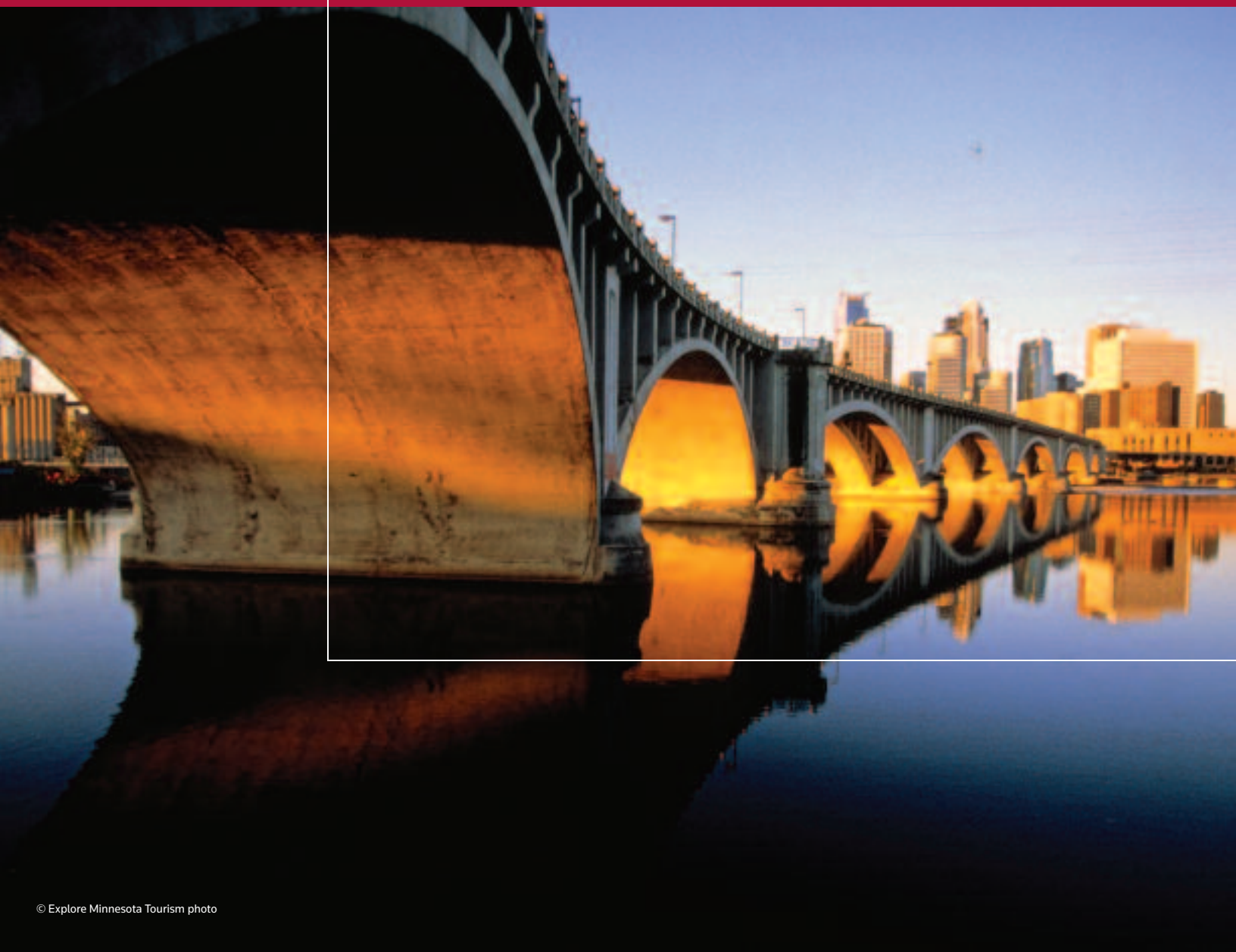
Ultra High-Speed Boradband Task Force

MINNESOTA
ULTRA HIGH-SPEED BROADBAND REPORT



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LETTER FROM THE CHAIR

LETTER FROM THE CHAIR

I don't pay bills online because it is quicker to write a check and mail it.
Judy Adamec, Otter Tail County, MN

Ms. Adamec's predicament is not unusual. Like her, thousands of residents across Minnesota lack functional access to what is, undoubtedly, the most meaningful technological development of our lifetimes.

If Ms. Adamec's connection doesn't allow her to pay bills online, she certainly will not be able to take advantage of online education, telemedicine, or telecommuting. These broadband-intensive applications (requiring, at a minimum, 10 Megabits per second, some up to 1 Gigabit per second, and all growing) give users the capability to perform remotely functions traditionally done in person, allowing services to reach more people, for a lower cost, and with a lower impact to the environment. These applications will become ubiquitous and essential in the next few years; without access to them, long-term economic success is unlikely.

Broadband access can bring more than economic progress to Minnesotans, including:

- improved health and safety to all communities
- online government services saving travel and time
- telemedicine allowing Minnesotans to remain in their homes as they age
- online education keeping rural communities vibrant and alive while giving residents access to experts and resources around the world.

"I don't pay bills online because it is quicker to write a check and mail it."

Judy Adamec, Otter Tail County, MN

Broadband access to the Internet has traditionally been thought of as a communication system. The Task Force recognizes that it also is a means of transportation. Our country and our state rely on dependable transportation systems. That's how we move goods, services and people using various methods, including airways, roadways, railways, seaways, bike paths and sidewalks. We also move items using the Internet – a new 21st Century piece of our transportation infrastructure. We access the Internet via reliable broadband service. Today, some systems such as roadways and airways are overburdened while others, such as railways and the Internet, are underutilized.

It is time for us to rebalance our transportation infrastructure. We need to move people, goods and services using the most effective and efficient way. For example, there is no reason to send a DVD of your favorite movie via airplane and truck when it can be sent via an ultra high-speed broadband connection directly to your home. And, is there any reason for everyone to go to work at exactly the same time every day? Why can't we stagger commuting times and allow workers to work at home? We can, but we must ensure workers are connected by reliable ultra high-speed broadband to the systems and tools at their office so they can work with the same efficiency at home as at work.

As you can see, if we rebalanced just those two items above, we'd move a number of vehicles off the road, remove some air freight from the airways and utilize more efficient and less energy dependent ultra high-speed broadband infrastructure to deliver goods and services. We at once can be more efficient, less costly, and greener. And, by removing vehicles and airplanes from peak

times, we reduce the need to overbuild these infrastructures for peak demand. Think of the added benefits. We would benefit workers who are able to work effectively at home, reduce our dependency on imported fossil fuels, and radically improve our environment.

The Minnesota Ultra High-Speed Broadband Task Force was convened in April 2008 to outline a path to ultra high-speed Internet access for all residents of the state by 2015. As chair, I have had the pleasure of leading a diverse and committed Task Force. For over a year and a half, we have met with experts to learn the issues, listened to the public to hear their concerns, researched solutions from other states and nations, and debated the best way to meet our state's needs.

The Minnesota Ultra High-Speed Broadband Task Force report sets ambitious goals for the state. In the following pages you will find a thorough description of our recommendations. Here are several highlights in summary:

- Minnesota should have **ubiquitous (every home and business in the state) high-speed broadband** coverage as soon as possible but **no later than 2015**.
- At a minimum, we recommend speeds of **10-20 Megabits per second (Mbps) (download) and 5-10 Mbps (upload)** for all residents of the state by 2015. Additionally, we recommend Minnesota should aspire to be:
  - In the **top 5 states** of the United States for overall **speed**
  - In the **top 5 states** for broadband **penetration**
  - In the **top 15** when compared to countries for **global broadband penetration**
- We outline **financial incentives** to support both the **supply and demand** sides of broadband.
- We make detailed recommendations for the **enhanced security and redundancy** of the existing infrastructure.
- We recommend the creation of a **Broadband Advisory Council for Minnesota (BACM)** to oversee the actions put forth in this report and to see that these objectives are achieved.
- We recommend that the **Federal Communications Commission (FCC) adopt a higher standard** for the definition of broadband. The current definition is 768 kilobits per second (Kbps).

I am very pleased with the Task Force's commitment to all Minnesota residents and businesses. While the varied compostion of the team ensured different and sometimes opposing points of view, we all worked hard and succeeded at achieving consensus. The results of that work make up the contents of this report.

With the support of the governor and the legislature, I hope Minnesota will take a great step forward by endorsing and putting our recommendations into action.

Respectfully submitted,

Rick King

Rick King
Chair

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

In April 2008, the leadership of the state of Minnesota took a giant step forward in its long-term planning by passing the law that created the Minnesota Ultra High-Speed Broadband Task Force[1]. The Task Force convened in August 2008 to outline a path to ultra high-speed Internet access for all residents of the state by 2015. Over a year and a half, our group of 23 diverse members met with experts to learn the issues, listened to the public, researched solutions from other states and nations, and debated the best way to meet our state's needs. We read. We studied. We heard presentations. We held meetings in the metro area and in greater Minnesota. All of these meetings, research and dialog culminated in this report.

We need to think of ultra high-speed broadband access both as a communication and transportation system, carrying massive amounts of electronic information for the 21st Century. We need to invest in it. It's good economics. Communities in which mass-market broadband was available experienced more rapid growth in employment, the number of businesses overall, and businesses in IT-intensive sectors, relative to comparable communities without broadband at that time.[2]

According to a recent statewide broadband mapping project, 94% of Minnesotans have access to broadband as defined by the FCC (currently 768 Kbps or more). While the Task Force supports the FCC's effort to update their definition, it also recognizes that technology has advanced considerably and that consumers are currently being offered broadband speeds as high as 50 Mbps, 65 times faster than the FCC definition. The Task Force has set a minimum of 10-20 Mbps by 2015.

The Minnesota Ultra High-Speed Broadband Task Force report sets ambitious goals for the state. In the following pages you will find a thorough description of our recommendations.

Our proposed actions will help Minnesota bring reliable, affordable and ubiquitous broadband service to all Minnesotans and will ensure they get the service options they need.

"Initiatives like the Minnesota Ultra High-Speed Broadband Task Force help move the country in the direction we need it to move: The infrastructure they promote will allow the American genius and innovation to ensure that we maintain our technological, economic and moral leadership while growing in a sustainable way."

Thomas Friedman

Minnesota native and New York Times *writer and journalist*

Identify a Minimum Level of Service

The Minnesota Ultra High-Speed Broadband Task Force recommends that any goal for a standard of broadband service in Minnesota be based on a basic level of functionality to every person in the state. We recommend the following minimum speeds for all residents of the state by 2015:

- 10-20 Mbps (download)
- 5-10 Mbps (upload)

In addition, the Task Force recommends that Minnesota aspire to be:

- In the top 5 states of the United States for overall broadband speed (download/upload)
- In the top 5 states of the United States for broadband penetration
- In the top 15 when compared to countries for global broadband penetration

1 On April 18, 2008, Governor Pawlenty signed a bill to enact the law to form the Minnesota Ultra High-Speed Broadband Task Force. See Appendix A for the full text of the passed bill.

2 See "Measuring Broadband's Economic Impact," a study conducted by MIT/Carnegie Mellon, **Itc.mit.edu/itel/docs/2005/MeasuringBB_EconImpact.pdf**

Regarding symmetrical service (i.e., equal upload and download speeds), certain applications require this to work properly. The Task Force concluded that many consumers asking for symmetrical service are in reality in need of faster upload speeds. When the upload need is met, consumers or businesses have a solution to their problem.

Identify the Policies and Actions Necessary to Achieve Ubiquitous Broadband

The goal for broadband is to have ubiquitous (100% of homes and businesses in the state) coverage as soon as possible and no later than 2015. As with roads, electricity, and telephony, broadband has become an economic and social necessity for all citizens of the state no matter where they are located.

The policies and actions necessary to achieve ubiquitous broadband span a wide range, both in terms of the people and entities who will have to collaborate to achieve that ubiquity as well as the nature of the work that they will have to do. The Task Force believes that it is critical to understand and address these actions as a whole. This collaborative approach is applicable to all actions that the Task Force is recommending, but is detailed here because achieving broadband ubiquity is both important and challenging to achieve. Conversely, if this collaboration can be put in place and help quickly achieve broadband ubiquity, the state will also have created a powerful engine to drive the implementation of other recommendations.

"Today more than 600,000 Americans earn part of their living by operating small businesses on eBay's auction platform, bringing jobs and opportunity to ... communities in both rural and urban America."

Julius Genachowski, FCC Chairman

Net Neutrality speech at The Brookings Institution, September 21, 2009

Minnesota cannot undertake alone all the actions required to achieve broadband ubiquity. What is required is a broad, and perhaps unique, collaboration between many stakeholders. The state has a variety of important roles to play, but so do the rest of the stakeholders. Balanced collaboration needs to be "baked in" right from the beginning.

Therefore the Minnesota Ultra High-Speed Broadband Task Force recommends the creation of a multi-stakeholder Broadband Advisory Council for Minnesota (BACM), with support from the appropriate agencies (e.g., Department of Commerce), to support the implementation of the recommendations that are outlined in this report. We provide many actionable steps the state can and should take.

Identify and/or Create Opportunities for Public and Private Sectors to Cooperate to Achieve the Goal of Ubiquitous Broadband

A successful relationship between the public sector (local, state, and federal government) and the private sector is critical in order to achieve ubiquitous high-speed broadband service in Minnesota. Both the public and private sectors have distinct, important roles in serving the communication needs of Minnesotans.

State government should lead the effort to accurately map the state to delineate the well-served, underserved, and unserved parts of Minnesota. Local providers, local units of government, or regional consortia, with their "feet-on-the-ground" knowledge of their areas, are important partners with the state to ensure the maps accurately reflect the service that is available. The Task Force believes any public-private partnership should follow the same clearly defined path, starting with accurate mapping of the state's broadband coverage. The governor should

designate one state agency to be responsible for maintaining the map, including a process for updating, verifying, and making it publicly available.

Local government entities (i.e., cities, counties, townships, school districts) and regional library consortia can form collaboratives to improve connectivity between them and/or combine their purchasing power in the aggregate. This level of connectivity can serve as the anchor tenant for existing service providers and be one way to encourage them to build out the existing network.

Budget issues and shrinking rural demographics are creating the need for different levels of government to share resources. This requires an increased use of broadband between these levels of government. Consortia should be formed to develop a clear understanding of needs and opportunities for collaboration.

On top of all this, government should encourage private sector providers to build out or upgrade their networks where necessary.

Evaluate Strategies, Financing, and Financial Incentives Used in Other States and Countries to Support Broadband Development

The Minnesota Ultra High-Speed Broadband Task Force has analyzed incentives used in other states and has included those that were most relevant in the key recommendations in the report. They include but are not limited to, funding sources, organizational changes, and financial incentives.

States across America provide tax incentives to spur deployment and adoption. Examples include sales or property tax exemptions for broadband equipment and income or sales tax credits to encourage access to broadband, location of facilities and telecommuting for employees. A detailed state-by-state listing of such incentives is set forth as Appendix D. Also in Appendix C are examples of state broadband funds, such as the California Emerging Technology Fund (funded by AT&T and Verizon merger approval funds) which can be tapped to accelerate the deployment and adoption of broadband in unserved and underserved areas.

On February 13, 2009, Congress passed the American Recovery and Reinvestment Act of 2009 (ARRA), which President Obama signed into law four days later. One component of the ARRA was a $7.2 billion appropriation accompanied by a direction to the Department of Agriculture's Rural Utilities Service (RUS) and the Department of Commerce's National Telecommunications and Information Administration (NTIA) to expand broadband access to unserved and underserved communities across the United States, increase jobs, spur investment in technology and infrastructure, and provide long-term economic benefits. The result is the RUS Broadband Initiatives Program (BIP) and the NTIA Broadband Technology Opportunities Program (BTOP). NTIA is also engaging in broadband mapping activity pursuant to the State Broadband Data and Development Grant Program that implements the joint purposes of the ARRA and the Broadband Data Improvement Act (BDIA).

Evaluate Security, Vulnerability, and Redundancy Actions Necessary to Ensure Reliability

The Minnesota Ultra High-Speed Broadband Task Force recommends these architectural enhancements to the way Internet is delivered in Minnesota:

- Provide a competitive advantage for the state.
- Strengthen businesses.
- Protect consumers and citizens.
- Promote the development and early adoption of advanced applications.

The Minnesota Ultra High-Speed Broadband Task Force recommends that the state undertake and fund a detailed study of this issue to determine the advisability and approach to addressing the goals and the detailed suggestions contained in this report.

The policies and actions necessary to move Minnesota to the front ranks of security, reliability, and redundancy rest on establishing a robust ongoing collaboration between a broad range of public, private, and citizen stakeholders.

Just as with achieving our other broadband goals, "steady leadership wins the race." Ensuring that the state has secure, reliable, redundant broadband infrastructure is not a one-time project but rather a long-term commitment of leadership talent to an ongoing program of vigilance and collaborative problem solving.

The Minnesota Ultra High-Speed Broadband Task Force recommends the leadership net be thrown as widely as possible. While the state must continue to play an active convening and enabling role, there is a need to continuously draw in leadership capability from all stakeholders.

Cost Estimate and Financial Strategies

A successful relationship between the public sector (local, state, and federal government) and the private sector is critical in order to achieve ubiquitous high-speed broadband service in Minnesota. Both the public and private sectors have distinct, important roles in serving the telecommunication needs of Minnesotans.

Over the past several decades Minnesota's telecommunications, cable and broadband providers have invested in excess of $8 billion in private capital to build out, upgrade and maintain networks that currently offer broadband services in Minnesota. In addition, through RUS loans and co-op financing other providers have invested over $50 million. Municipal entities have also raised and deployed about $35 million to offer such service.

The Minnesota Ultra High-Speed Broadband Task Force recommends that Minnesota:

- Initiate a study to develop a wide-ranging collaborative funding strategy to support the recommendations of this report. The study should be a creative exploration of a broad range of sources and uses of funds.
- Explore financial options such as tax incentives including property and sales tax credits and exemptions to further incentivize private capital investment. (See Appendix D for many examples from other states).

- Encourage and facilitate a variety of partnerships that increase the adoption and utilization of broadband. Partnerships may include local governments, education, health care, libraries, non-profits, providers and other institutions. Increased adoption will make additional private investments possible. (See Appendix E for examples of existing and proposed programs.)
- Encourage minimizing any unreasonable barriers to right of way or easement access and facilitate efficient cooperation related to open trenches and development. (See Recommendation 3.)
- Encourage appropriate utilization of available federal funding to support the deployment of broadband to unserved and underserved populations, as well as to encourage efforts to support broader public adoption of broadband services.

Identify Economic Development Opportunities

Access to high-speed broadband has been shown to enhance economic growth and performance. According to the report "Measuring Broadband's Economic Impact," prepared for the U.S. Department of Commerce, Economic Development Administration, "Communities in which mass-market broadband was available experienced more rapid growth in employment, the number of businesses overall, and businesses in IT-intensive sectors, relative to comparable communities without broadband." The report also states that the effect of broadband availability can be observed in higher property values.

High-speed broadband affords significant opportunities to encourage economic development. A region well served with high-speed connectivity encourages business growth for companies of all sizes. Cluster development occurs when infrastructure is in place to serve businesses that support or rely on related industry. The availability of high-speed broadband also provides an incentive for small and/or home-based businesses to locate and operate in well-served areas, reducing travel-related expenses and traffic congestion.

Rural Minnesota cities face unique economic development challenges. Often working on their own, rural cities have to expand their base by reaching beyond the city limits to serve as the hub of activity for geographical regions. In these areas, anchor tenants such as community colleges, health care centers, and libraries, can help justify the cost and effort of providing power and broadband for the community. To keep costs down, we advocate judicious planning. Plan once – develop coordinated broadband, electric-grid, energy retrofit projects – and dig once – coordinate construction projects, such as roads and electrical-grid improvements.

"(... we need to ...) ensure that Minnesota has a high speed broadband infrastructure that will ...

- *Attract new businesses, retain existing ones*
- *Create new job opportunities*
- *Encourage entrepreneurship with affordable broadband"*

Andrew Michael Cohill, Ph.D.
President, Design Nine, Inc.

Evaluate the Way Broadband Access Can Benefit Organizations and Institutions

By 2015, ultra high-speed broadband capabilities will be required to connect all parts of society, including the public sector, communities, citizens, and businesses. Each of these entities will need to have adequate access for e.emergency (multi-megabit connection to emergency responders and the National Guard), e.government (10 Gigabits per second (Gbps) network to large county seats), e.economic development, e.health, and e.learning (a multi-Gbps hub at major learning institutions).

The Minnesota Ultra High-Speed Broadband Task Force report details many of the current and future uses of ultra high-speed broadband capabilities and how various organizations and institutions will use it to provide benefits to the public. Increased capabilities will help drive creation of new applications benefiting all.

The Way Forward

In the following pages you will find a thorough description of our recommendations. The recommendations are actionable, but they also have to be flexible. While we have identified the speed goals as a bare minimum for all residents, dramatic increases in speed will be necessary for most users in the next few years as applications become more needed and prevalent.

The Minnesota Ultra High-Speed Broadband Task Force is committed to advocating and supporting the implementation of its recommendations. We feel that doing so will provide social and economic benefit to all Minnesota residents and businesses. We know that with the support of key stakeholders in the government and industry, the recommendations contained in this report will form the best possible foundation for the development of a new infrastructure in our state, which will in turn transform Minnesota and move it closer to the front of the race, both in the United States and in the world.

We look forward to your feedback and support.

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SECTION 1:

ULTRA HIGH-SPEED BROADBAND TASK FORCE VALUES

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This body of work represents the core consensus held by Task Force members. Arriving at such a consensus is never easy, as the composition of the Task Force was designed to ensure representation from a wide variety of public and private organizations and constituencies. These values, in alphabetical order, represent the agreed upon principles the Task Force based their recommendation upon:

- Advocate for cooperation between players
- Affordable and sustainable solutions
- Be technology neutral
- Bring service to the unserved
- Define a minimum broadband speed
- Foster partnerships between the public and private sectors
- Focus on increasing demand by educating and empowering consumers
- Increase demand in rural, unserved, and underserved areas
- Look forward, be proactive
- One size does not fit all
- Offer tiered service levels
- Provide high-quality, reliable broadband services
- Provide ubiquitous service
- Serve the public good
- Support economic development
- Support home-based businesses

SECTION 2:

HISTORY – WHERE WE'VE BEEN

SECTION 2: HISTORY – WHERE WE'VE BEEN

This section addresses the question "Where have we been?" when it comes to broadband in the state of Minnesota. Quoting the words of George Santayana (philosopher, essayist, poet, and novelist), "Those who cannot remember the past are condemned to repeat it," it is very important to understand the technology and initiatives that have preceded the work of the Task Force. Minnesota was once at the center of the computer industry. Control Data, Sperry, UNIVAC, Honeywell, and others had their headquarters in the state and formed the core of a vibrant technology community that was eventually eclipsed by the arrival of ever-smaller computers and the Internet. Minnesota was an early leader in developing Internet-based applications such as Gopher and the POP-3 email protocol.

"The U.S. Internet will grow 50-fold by 2015."

Bret Swanson and George Gilder

Article in The Wall Street Journal*, February 22, 2008*

Understanding this technical and business history may help frame the discussion regarding the future of the state in the worldwide information society. A number of reports produced by predecessors to this Task Force have been reviewed. The question "What should we do about broadband in Minnesota?" has been asked and answered a number of times before, and the Task Force has tried to summarize those answers (reports) in this section. Again, the results are mixed. The State was involved in the discussion early (the first major telecommunications report was issued by the Minnesota Telecommunications Council in 1985), but subsequent policy actions and results do not appear to have had a major impact. Several themes are repeated in most of the reports:

- Planning – Address the lack of a widely accepted broadband plan.
- Collaboration – Reduce the silo mentality and behavior of stakeholders.
- Leadership – Support leaders in the community, Legislature, and administration to advance the work.

Conditions today are not materially different from when these reports were written. The hope is this review of the past enabled the Task Force to address the issues in a way that does not consign this document to the same dusty shelves as previous reports. (See Appendix B for a detailed review of historical milestones.)

SECTION 3:

PRESENT – WHERE WE ARE TODAY

SECTION 3: PRESENT – WHERE WE ARE TODAY

What is Broadband?

In general, the term broadband refers to a network connection with high bandwidth. DSL and cable modems are examples of broadband communication. High-speed Internet connections that allow for transfers of information at rates far faster than those of dial-up modems also constitute broadband.

According to the FCC, the term broadband means 768 Kbps. According to the Task Force's definition, the minimum broadband speed should be 10-20 Mbps (download) and 5-10 Mbps (upload) for all residents of the state by 2015.

Primary Broadband Technologies in Use in Minnesota

For the most part, broadband networks have evolved from two existing networks: cable and telephone. Only in the last few years have new networks been deployed that are specifically built for the purpose and use of broadband. Various types of broadband are outlined below:

Cable: While the coaxial or cable plant was originally engineered and designed for the transmission of video to residential subscribers, there is a large available spectrum in traditional coaxial and hybrid fiber coaxial cable plant to support broadband requirements. In addition, newer compression technologies such as MPEG-4 have made it possible to fit a 20 Mbps video stream into 8 or 9 Mbps. Changes and upgrades to the underlying cable protocol, DOCSIS, which can increase speeds up to 150 Mbps and beyond, have provided additional bandwidth. Providers are transitioning to a protocol that will increase their ability to provide more symmetrical upload and download speeds, a key component as user-generated content increases.

Digital Subscriber Line (DSL): DSL uses existing telephone copper pairs and, with DSL coding techniques, gains additional bandwidth beyond the traditional 64 Kbps line rate. There have been many advances in DSL technology, some currently capable of providing service up to 40 Mbps and potentially more. While DSL speeds are very sensitive to distance – the further from the source, the lower the bandwidth – companies can extend their range by adding fiber to the copper network.

Fiber-to-the-Home (FTTH): "Fiber to the Home" is defined as a communications architecture in which the final connection to the subscriber's premises is optical fiber. The fiber optic communications path is terminated on or in the premise for the purpose of carrying communications to a single subscriber. To be classified as FTTH, the access fiber must cross the subscriber's premises boundary and terminate inside the premises, or on an external wall of the subscriber's premises, or not more than 2 meters from an external wall of the subscriber's premises. FTTH services may deliver just one application, but generally deliver several such as data, voice and video. Fiber optic cables are made of glass fiber that can carry data at speeds exceeding 2.5 Gbps to the home. FTTH services commonly offer a fleet of plans with differing speeds that are price dependent. At the lower end of the scale, a service plan might offer speeds of 10 Mbps. A more robust FTTH plan might offer data transfer speeds of over 100 Mbps.

Satellite: Satellite broadband is provided to the customer via geosynchronous satellite. Satellite broadband ground-based infrastructure includes remote equipment consisting of a small antenna and indoor unit. Gateways connect the satellite network to the ground based network. Except for gateway locations, satellite broadband is independent of ground based infrastructure such as conduits and towers. Satellite broadband provides ubiquitous coverage throughout the United States and is available to anyone with a clear view of the southern sky. There are some challenges to consumers in using satellite services, such as delay for certain services/applications (e.g., voice and videoconferencing).

Mobile and Fixed Wireless: Wireless broadband technologies include the 3G and 4G wireless/cellular networks (mobile) and the newer Wi-Fi/Wi-MAX technologies (fixed). Both services can provide freedom to users, as they are mobile. Mobile devices have become more feature-rich and capable, allowing users to access the Web, make and receive telephone calls, and share content. These technologies are also capable of long reach (up to 70km for Wi-MAX) and high data rates (100 Mbps). Challenges include interference and a decrease in bandwidth over distance. Because the networks are shared, consideration needs to be made to the load sharing versus quality of experience for the users.

Future: Technologies are always improving. DSL, cable, and wireless continue to expand their capabilities. Recently launched and next-generation satellites will offer significantly higher capacity and performance. A satellite system planned to enter service next year is designed to provide 10-30 Mbps aggregate bandwidth, though latency issues will continue to limit the usability of satellite for certain broadband applications. Wireless speeds will largely be constrained by network and spectrum availability. Fiber technologies hold practically unlimited capabilities.

"Currently, the consequences of being on the wrong side of the "digital divide" are modest. However, that is rapidly changing."

Jack Geller, PhD

University of Minnesota, Crookston

Task Force Member

Broadband Adoption: How Does Minnesota Compare?

Using the FCC's definition of broadband, 768 Kbps, over 93% of American households now have broadband available to them in one form or another. However, according to various data sources (see below), only two-thirds of American adults have adopted broadband at home. The differences in percentages between availability and adoption represent millions of American families who are "offline."

Minnesota's broadband adoption in the metro area rate is 57% and the rural broadband adoption rate is 39.4%, according to the Pew Internet and American Life Project. For comparison purposes, the FCC has compiled the following statistics regarding broadband adoption in the United States:

Figure 1 | **Broadband Adoption.**

Broadband adoption	Year	Data source	Methodology
63%	2009	Pew Internet and American Life	Based on a phone survey of American Households
63%	2008	Forester Research Group	Based on a mall survey of American and Canadian households and adults
64%	2009	Pike & Fischer	Based on subscriber counts from industry reported data
67%	2008	Nielsen	Based on Nielsen in-home media surveys of American households

Examining Disparities in Broadband Adoption

Broadband adoption is predicated on basic availability. Since 2001, the Center for Rural Policy and Development has conducted an annual survey of Greater Minnesota to identify and understand the adoption of computer and Internet technology, in particular, the adoption of broadband. According to The 2007 Minnesota Internet Survey[2], *Tracking the Progress of Broadband*, major findings include:

- Rural households subscribing to broadband increased 13 percentage points, from 39.7% at the end of 2006 to 52.3% at the end of 2007. Statewide, 57.8% of households reported subscribing to broadband, up from 49.0% at the end of 2006.
- 73% of rural Minnesota households reported owning at least one working computer, compared to 77.9% of metro Minnesota households.
- 68.2% of rural households maintained an Internet connection, compared to 74.4% of metro Minnesota households.
- From 2001 to 2005, computer and Internet adoption remained relatively flat, but from 2005 to 2007, the percentages of households owning computers and subscribing to an Internet connection have both increased noticeably.
- 94.3% of computer owners now have their computers connected to the Internet, the highest percentage yet. Broadband continues its steady rise.
- Although rural Minnesota is in general still behind the Twin Cities metro area in computer, Internet, and broadband adoption, that gap is closing. The 2007 data shows the smallest gap yet in all three technologies.
- The socio-demographic factors of age and income are still important determiners of who has computers, Internet and broadband. The older age groups and lower-income groups are still less likely to have computers, Internet or broadband, but they show continued growth in adoption each year.

3 http://www.mnsu.edu/ruralmn/pages/Publications/reports/2007telecomreport.pdf

The following figures show specific statistics in regards to computer ownership and Internet and broadband adoption.

Fig. 2 | **Center for Rural Policy and Development – The 2007 Minnesota Internet Survey Tracking the progress of broadband: Computer ownership, Internet connectivity and broadband adoption are still higher in the Twin Cities metro area, but the rest of Minnesota is closing the gap.**

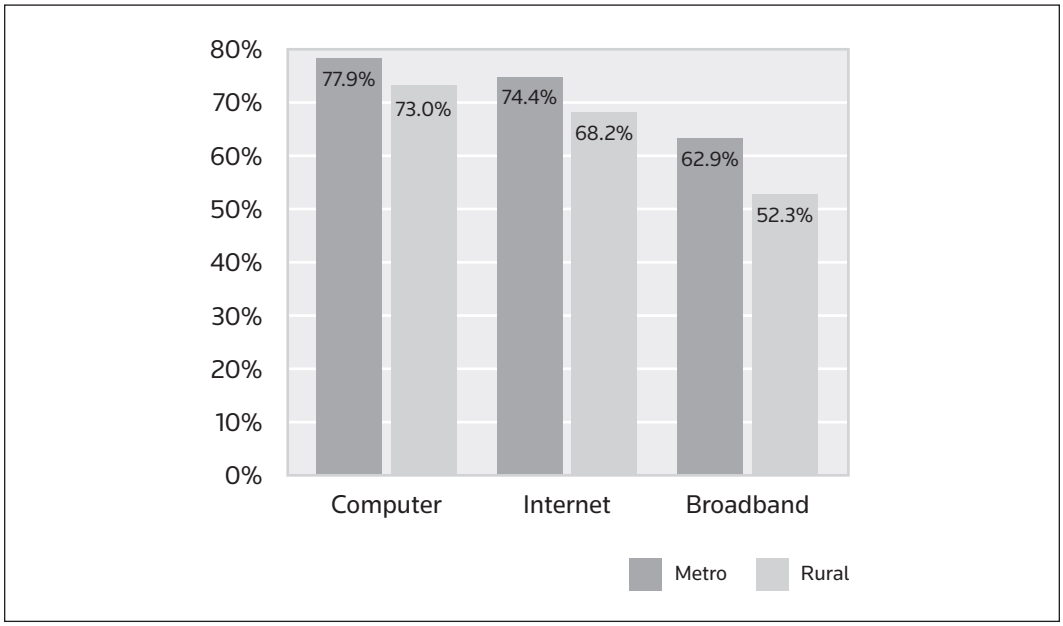


Fig. 3 | **Center for Rural Policy and Development – The 2007 Minnesota Internet Survey Tracking the progress of broadband: Age is still a leading predictor in the rate of computer ownership and Internet and broadband adoption, but each group shows a steady increase.**

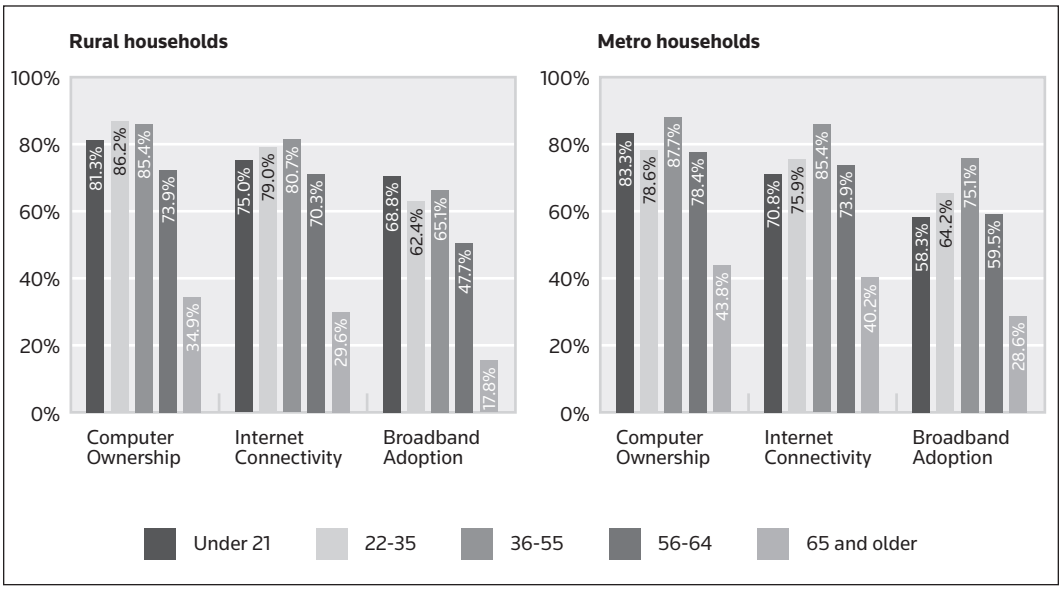
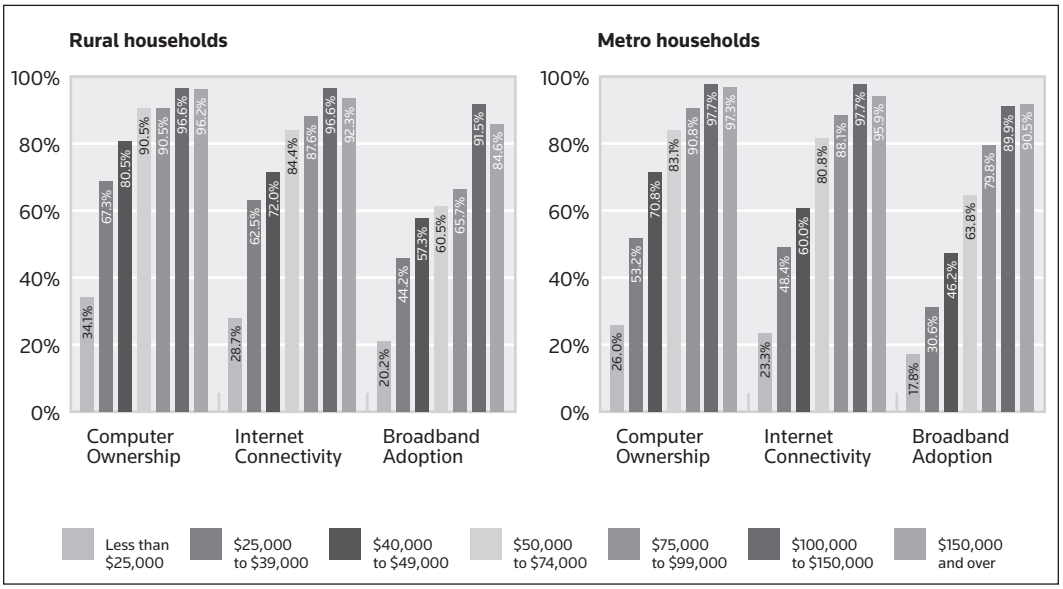


Fig. 4 | **Center for Rural Policy and Development – The 2007 Minnesota Internet Survey Tracking the progress of broadband: Income is another leading indicator affecting technology adoption.**



Broadband Availability and Speed Maps

In 2008, Minnesota enacted legislation that directed the commissioner of the Minnesota Department of Commerce to contract with a nonprofit organization to develop geographical information system maps displaying levels of broadband service by connection speed and type of technology used. The maps had to be integrated with demographic information to produce a comprehensive statewide inventory and mapping of existing broadband service and capability.

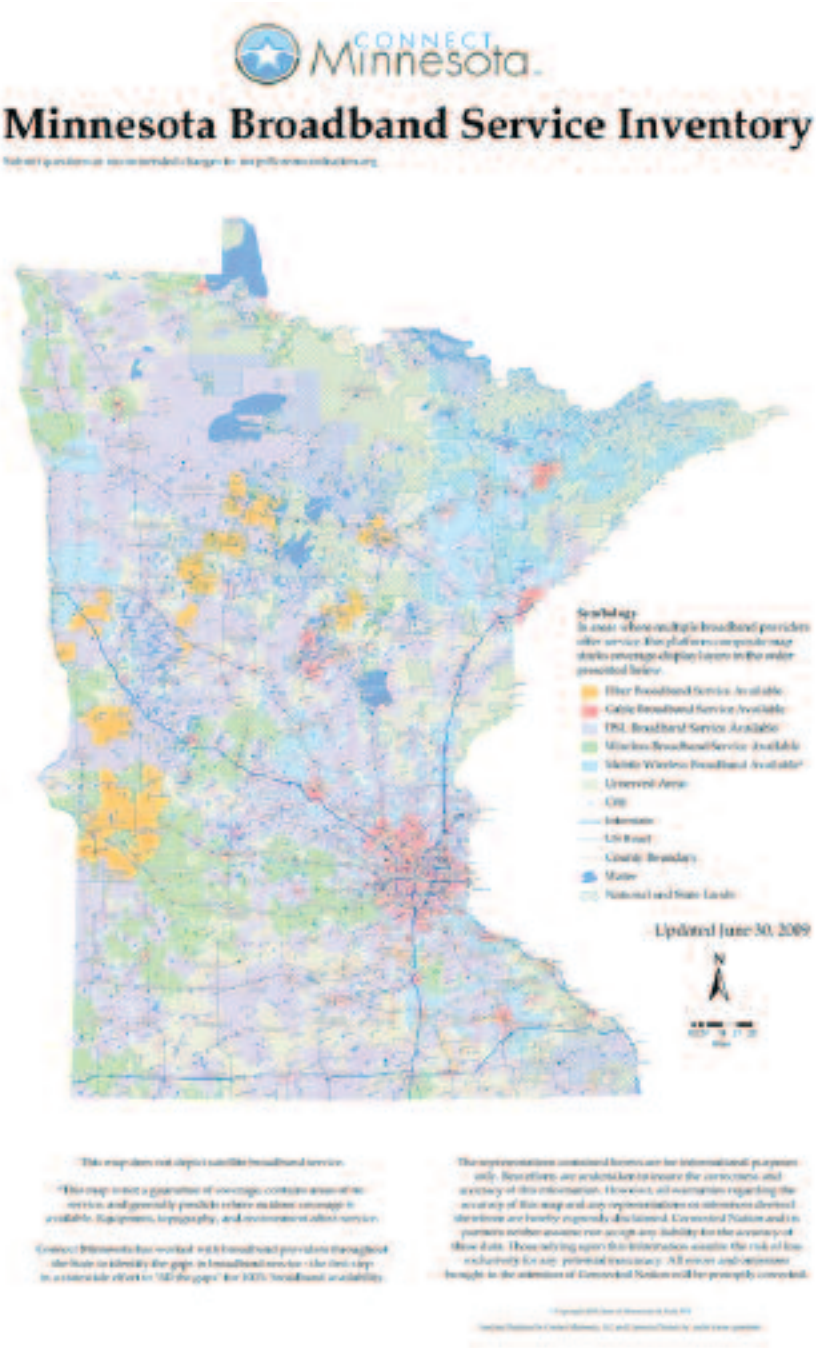
The data collected and maps produced needed to convey the following information:

1. Areas unserved by any broadband provider
2. Areas served by a single broadband provider
3. The location of towers used to transmit and receive broadband signals
4. Actual upstream and downstream transmission speeds at the county level of detail
5. Areas served by multiple broadband providers
6. The types of technology used to provide broadband service

Connected Nation was awarded the contract and formed ConnectMN as the vehicle to complete the project. ConnectMN gathered two types of information to create the first set of maps: areas served and technologies used. ConnectMN also set up a website (www.connectmn.org) to allow for citizen input, including the capability to allow Internet users to take a speed test. From this data, ConnectMN developed a second set of maps based on actual speeds observed and the locations of the hits to the website. That second set of maps reflects the speeds actually experienced by the consumer taking the speed test; they do not reflect the speeds offered by the provider.

ConnectMN sought input from stakeholders between the initial release of the report and when the final report was due on June 30, 2009. The final maps produced, based on provider-supplied data, showed 94% availability of broadband in the state of Minnsota. Because the state did not have a different definition for broadband at the time the study was commissioned, the current FCC definition of broadband, 768 Kbps download, was used as the benchmark for this portion of the mapping project.

Figure 5 | **Connected Nation: Broadband Service Inventory**



The Task Force was interested in determining how these availability percentages would change if the speed criterion were changed to reflect the speed goals proposed in this report. The information gathered from providers does not support such an analysis; it is the hope of the Task Force that subsequent studies will. A less rigorous approach to answering this question can be taken by reviewing the "consumer speed test" data that was also gathered by ConnectMN during this study. This data is much less reliable than the survey data gathered from providers; and it is based on "experienced speed" rather than available speed and also based on what the consumer chose to purchase rather than the maximum speed available to them. That said, this data still provides an indication of where we stand in terms of reaching our 2015 goals.

Based on statistically significant averages of consumer-initiated speed-tests:

- Zero counties currently meet or exceed the higher 2015 download speed target (20 Mbps).
- One county currently meets or exceeds the lower 2015 download speed target (10 Mbps) (Washington County at 12 Mbps).
- Zero counties currently meet or exceed the higher 2015 upload speed target (10 Mbps).
- Zero counties currently meet or exceed the lower 2015 upload speed target (5 Mbps).

Figure 6 | **Connected Nation: Average Residential Download Speed.**

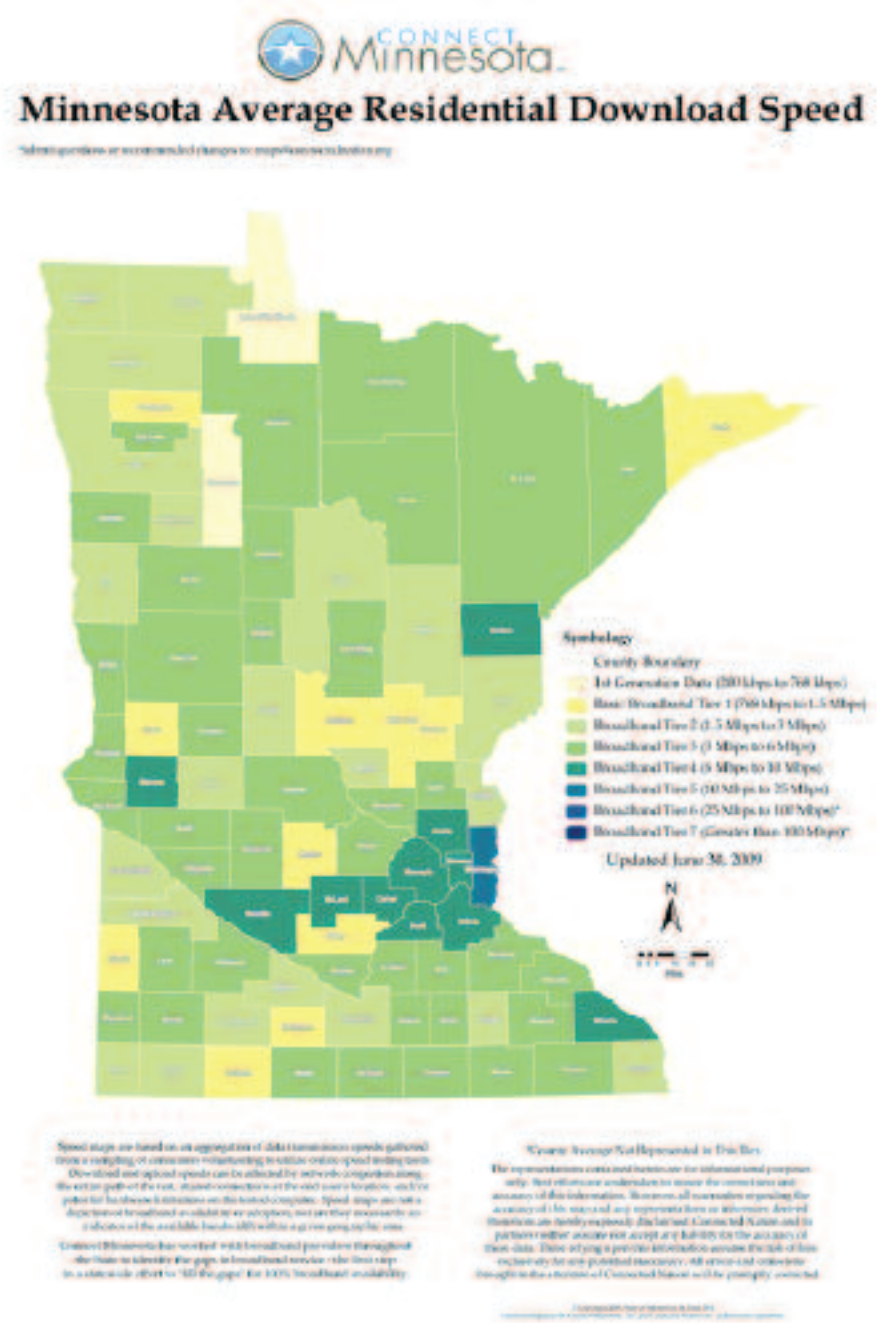
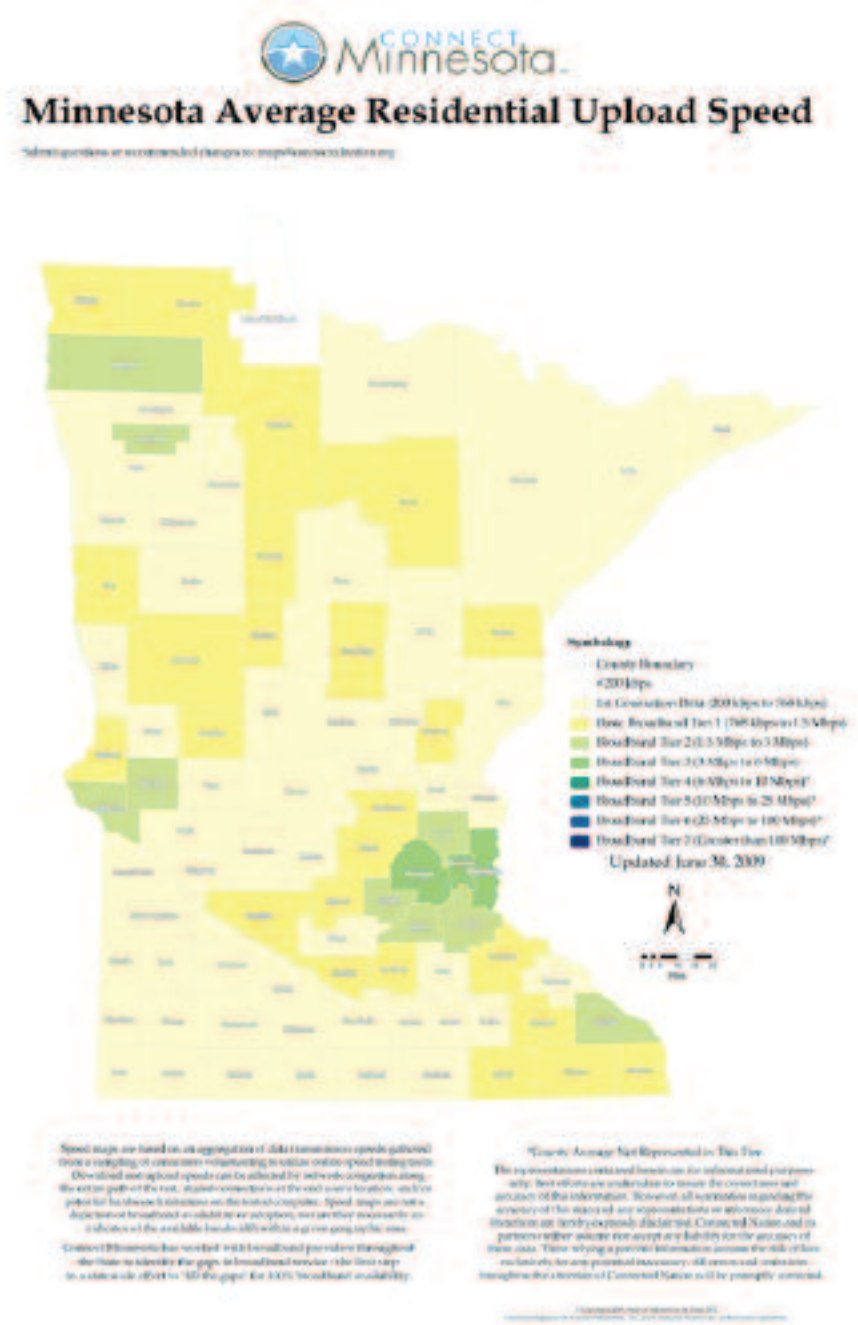


Figure 7 | **Connected Nation: Average Residential Upload Speed.**



In addition, the ConnectMN study showed a substantial disparity between counties with regard to broadband availability, with most counties clustering at the top of the availability range. However, several counties show substantially lower availability – most notably Cook County, at 37%, followed by Pine and Kanabec counties at 57% and 59%, respectively.

Minnesota County	Percentage of Broadband Availability	Down Average (MB)	Up Average (MB)
Cook	37	1.0	0.7
Pine	57	1.8	0.3
Kanabec	59	1.4	0.9
Aitkin	60	2.4	0.7
Mahnomen	68	2.1	0.4
Wabasha	70	4.1	0.7
Jackson	73	1.2	0.3
Redwood	74	5.6	0.7
Morrison	76	1.0	0.4
Waseca	79	5.2	0.6
Becker	80	3.4	0.5
Watonwan	80	1.5	0.4
Carlton	81	6.1	0.8
Cass	81	2.4	0.5
Clay	81	1.6	0.8
Lake	81	3.4	0.6
Pope	82	2.4	0.6
Winona	82	7.0	2.0
Isanti	83	3.7	0.6
Itasca	83	4.8	0.9
Cottonwood	84	1.6	0.3
Martin	84	3.7	0.5
Fillmore	85	5.2	0.8
Todd	85	2.3	0.4
Hubbard	86	4.6	1.1
Sibley	86	1.1	0.6
Le Sueur	87	5.5	1.0
Murray	87	3.3	0.5

Minnesota County	Percentage of Broadband Availability	Down Average (MB)	Up Average (MB)
Otter Tail	87	4.2	1.1
St. Louis	87	4.5	0.8
Big Stone	88	5.6	1.7
Mower	88	4.4	0.9
Steele	88	3.8	0.7
Wadena	88	3.7	1.0
Koochiching	89	4.2	0.6
Nicollet	89	5.1	1.1
Chisago	90	2.5	0.4
Dodge	90	2.9	0.5
Goodhue	90	3.9	0.8
Renville	90	6.3	0.8
Blue Earth	92	2.1	0.4
Freeborn	92	5.5	0.7
Houston	92	2.2	0.9
Meeker	92	1.5	0.4
Mille Lacs	92	1.5	0.4
Crow Wing	93	4.7	1.3
Nobles	93	2.7	0.4
Benton	94	2.0	0.5
Lake of the Woods	94	0.4	0.1
Marshall	94	2.1	1.5
Norman	94	3.9	0.8
Polk	94	2.2	0.7
Rice	94	4.7	0.7
Stearns	94	4.1	0.7
Faribault	95	3.8	0.7
Olmsted	95	5.7	1.5
Roseau	95	1.5	1.0
Traverse	95	5.3	0.9
Wilkin	95	3.6	0.4
Kandiyohi	96	4.3	0.7

Minnesota County	Percentage of Broadband Availability	Down Average (MB)	Up Average (MB)
Kittson	96	1.9	1.1
Pennington	96	1.1	0.4
Beltrami	97	3.8	1.1
Lincoln	97	0.9	0.4
Pipestone	97	5.8	0.6
Wright	97	4.1	1.2
Brown	98	1.8	0.7
Carver	98	6.1	1.7
Chippewa	98	4.1	0.6
Dakota	98	9.0	2.7
Douglas	98	3.4	0.8
Rock	98	2.8	0.3
Sherburne	98	3.8	0.8
Swift	98	4.9	0.7
Washington	98	12.0	4.2
Yellow Medicine	98	2.8	0.6
Anoka	99	9.0	2.9
Clearwater	99	0.7	0.4
Grant	99	1.1	0.7
Hennepin	99	8.8	3.0
Lac qui Parle	99	1.7	0.6
Lyon	99	4.7	0.5
McLeod	99	8.6	1.1
Ramsey	99	9.8	3.1
Red Lake	99	5.0	1.5
Scott	99	8.8	2.0
Stevens	99	6.1	2.0

In addition, ConnectMN has been very willing to provide information to the Task Force and work with its members in the creation of this report, which was outside the scope of their original task. The Task Force feels that the ConnectMN map was a good start at demonstrating the benefits of, and need for, accurate broadband mapping in Minnesota. Ideally, statistics on the values discussed in the Section 1 of this report will be gathered in the next round of mapping.

Demand Can Drive Investment

"If any entity in the value chain begins to do business electronically, companies up and down the value chain must follow suit, or risk being substituted."

Dr. Ravi Kalakota and Marcia Robinson

"e-Business –Roadmap for Success", Addison Wesley Longman, Inc., 1999.

As Connected Nation's inventory mapping for Minnesota shows, market forces have worked in developing Minnesota's broadband infrastructure. However, there is little macro-level research regarding levels of demand for broadband service in Minnesota. To the extent empirical evidence pertaining to demand exists, the data indicates there is not yet sufficient demand to support mass-market deployment of broadband speeds over 50 Mbps. The conclusion drawn given the data available to the Task Force is that where adequate demand exists for broadband services, the private sector has provided these services. The Task Force defines "adequate demand" to mean markets in which broadband service suppliers are providing services and earning a reasonable return on investment. The Connected Nation's map and inventory has shown that in certain areas the cost of providing service is too high, and/or the demand for service too low, to justify construction of facilities to serve those customers. In these areas, the market has behaved rationally; it is in these "unserved" areas that government intervention or assistance is required.

A paper by the Technology Policy Institute (TPI) cites a 2007 study by Parks Associates finding that 29% of U.S. households are not planning to subscribe to a broadband service for the following reasons:

- 3% said it was because Internet was not available to them.
- 7% cited affordability as the reason.
- 14% said they could not afford a computer.
- 44% said they did not want to have anything to do with the Internet.

TPI concluded that, from a policy perspective, spending large amounts of public money on infrastructure will not affect household penetration rates. Instead, policy makers should consider targeting subsidies toward low-income consumers who would subscribe if they could afford the service. Programs designed to provide computer access to low-income populations through public libraries or "community technology centers" also show potential.

Consumer Choice

Many residential and business consumers have several different choices among broadband providers in Minnesota, although the degree of choice available in the business market is probably much greater than it is in the residential market. According to the FCC, there are 98 broadband service providers in Minnesota, many of them acting in competition with each other. The market share between DSL, cable, and other broadband platforms is fairly evenly split, according to the FCC. The Task Force has received very little data on the Minnesota broadband business market, making this a potential for additional study.

Acknowledging That Price is a Function of Cost

Intermodal competition is resulting in price competition as well. Despite this good news, more competitors in the market will not always result in lower prices for consumers. One fundamental economic concept that policy makers tend to ignore is that price is a function of economic cost and profit (ROI) requirements. The cable and telecommunications industry has invested billions of dollars in plant and equipment over the past ten years in order to provide broadband services.

Where Other States Are Today

None of Minnesota's bordering states (North Dakota, South Dakota, Iowa, or Wisconsin) have published reports similar to this one; however those states have undertaken projects related to expanding broadband. Other states have created broadband reports and the Task Force has reviewed them all. Many of the 25 states the Task Force reviewed performed mapping and inventory of infrastructure as their first step. Minnesota has completed an initial round of mapping and is planning to take additional steps to understand broadband use and barriers to adoption.

According to World Speedtest.net, the following diagrams show the top ten download speeds in cities in Minnesota, North Dakota, South Dakota, Iowa, and Wisconsin.

Speedtest.net uses three key measurements to determine the overall quality and performance of an Internet connection:

1. Download speed: the speed at which data is sent from the Internet to a computer.
2. Upload speed: the speed at which data is sent from a computer to the Internet.
3. Ping (latency): the time it takes in milliseconds for a small piece of data to be sent from a computer to the Internet and back.

Figure 8 | **Speedtest.net: Minnesota Top 10 Cities.**

Figure 9 | **Speedtest.net: North Dakota Top 10 Cities.**

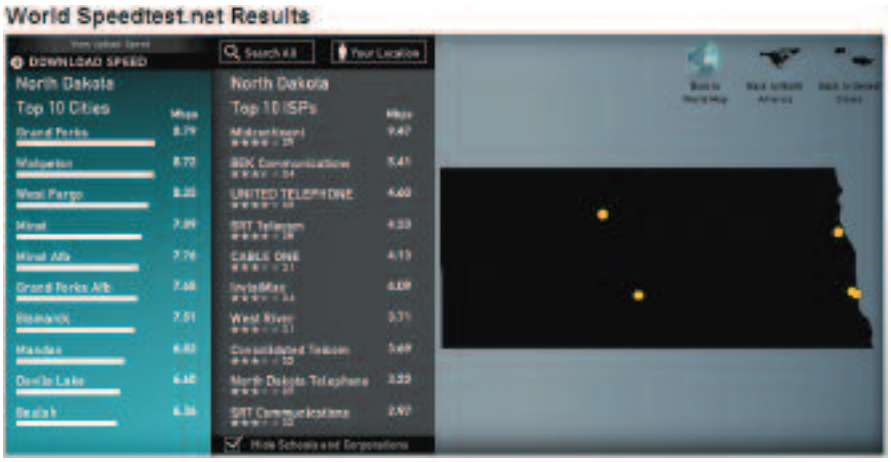


Figure 10 | **Speedtest.net: South Dakota Top 10 Cities.**

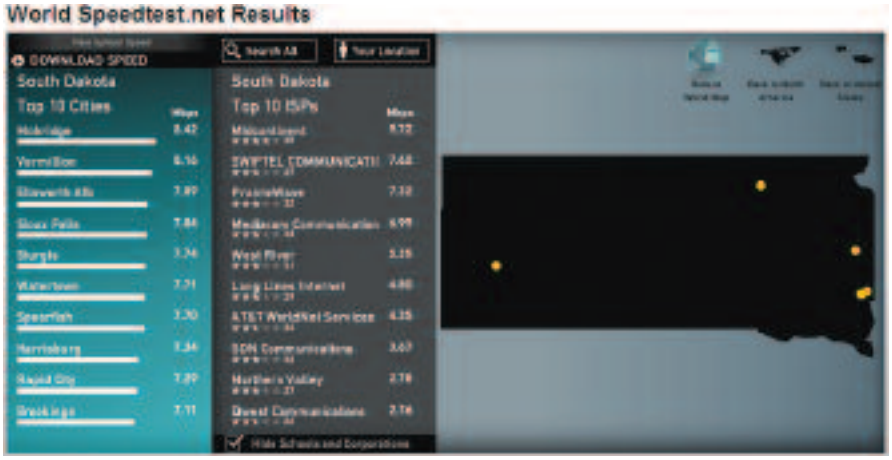


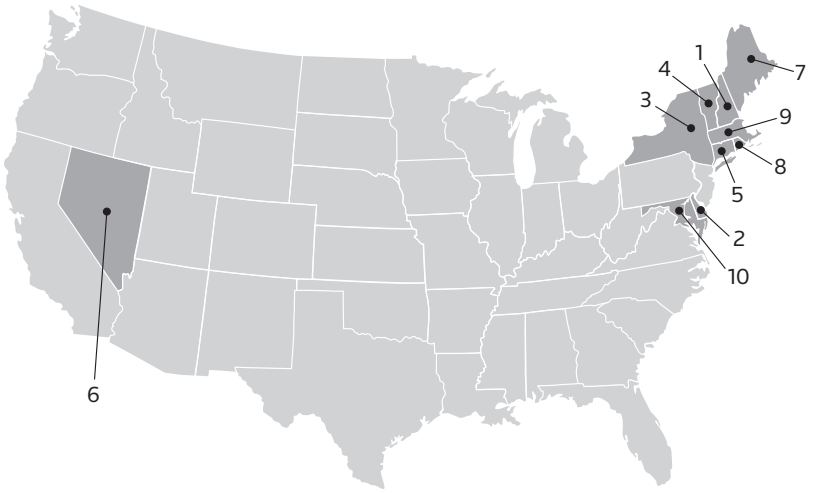
Figure 11 | **Speedtest.net: Iowa Top 10 Cities.**

Figure 12 | **Speedtest.net: Wisconsin Top 10 Cities.**

Broadband Leaders in the United States

The Task Force examined various sources to determine the broadband leaders within the United States in terms of overall broadband speed (download/upload) and broadband penetration. Based on the varying methods of collection and presentation the Task Force believes that multiple sources should continue to be examined on a regular basis. The statistics and rankings that the Task Force referenced to show leaders in the United States are depicted below.

Fig. 13 | **Akamai Technologies: High Broadband Connectivity, Fastest U.S. States. Minnesota's ranking in Q1 of 2009 is #23.**



	State	% above 5 Mbps	Q1-Q2 Change	YoY Change
1	New Hampshire	56%	-4.5%	+75%
2	Delaware	46%	-26.0%	-30%
3	New York	46%	-6.1%	+14%
4	Vermont	43%	-1.6%	+83%
5	Connecticut	39%	-5.2%	+12%
6	Nevada	37%	-19.0%	+11%
7	Maine	36%	-5.4%	+151%
8	Rhode Island	36%	-14.0%	-16%
9	Massachusetts	36%	-4.5%	+16%
10	Maryland	34%	+20.0%	+21%

Figure 14 | **Speed Matters - Q1 2009: Minnesota's Download Speed Ranking is #23.**

State	Number of Tests	Median Download Speed (Kbps)	Median Upload Speed (Kbps)	Download Speed Ranking
Delaware	639	9,906	2,310	1
Rhode Island	960	9,788	2,381	2
New Jersey	7,319	8,863	2,077	3
Massachusetts	6,467	8,645	2,163	4
New York	21,507	8,425	1,760	5
...				
Minnesota	5,510	5,436	1,486	23

Figure 15 | **Speed Matters - Q1 2009: Top 15 States in Regards to Download Speed.**

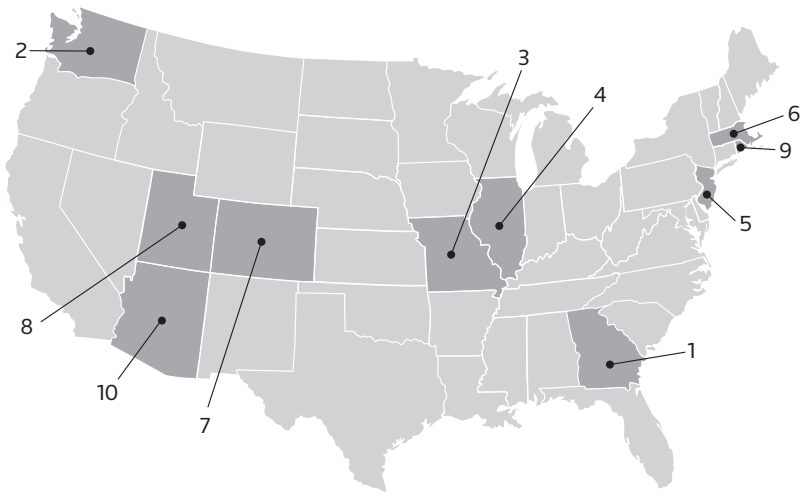
United States	Average Download Speed
1. Delaware	9.91 Mbps
2. Rhode Island	9.79 Mbps
3. New Jersey	8.86 Mbps
4. Massachusetts	8.65 Mbps
5. New York	8.43 Mbps
6. Maryland	8.26 Mbps
7. Virginia	7.91 Mbps
8. New Hampshire	7.17 Mbps
9. Connecticut	7.12 Mbps
10. District of Columbia	6.94 Mbps
11. California	6.64 Mbps
12. Georgia	6.49 Mbps
13. Pennsylvania	6.46 Mbps
14. Illinois	6.35 Mbps
15. Louisiana	6.26 Mbps

Broadband Penetration in the United States

The Leichtman Research Group's analysis of the Federal Communications Commission's (FCC) July 2009 report "High-Speed Services for Internet Access: Status as of June 30, 2008" found that:

- **Minnesota ranked 24th in residential broadband penetration** as of mid-2008. The greatest predictor of broadband adoption is household income. Minnesota ranked 14th in household income at that time.
- The top five states in residential broadband penetration as of mid-2008 were New Jersey, Connecticut, Maryland, Hawaii, and California.
- The bottom five states in residential broadband penetration were Mississippi, West Virginia, Alabama, New Mexico, and Montana.

Fig. 16 | **Akamai Technologies: Internet Penetration. Minnesota's ranking in Q1 of 2009 is #24 in the U.S., reaching to 0.35 unique IPs per capita.**

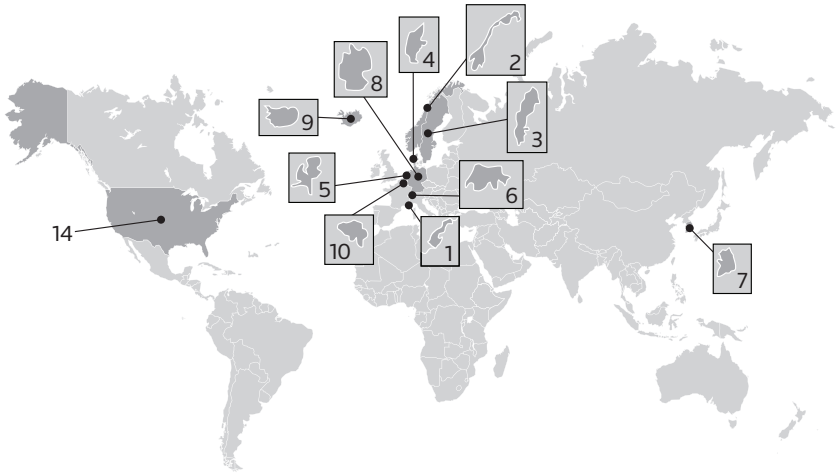


	State	Unique IP's Per Capita
1	Georgia	0.62
2	Washington	0.62
3	Missouri	0.57
4	Illinois	0.54
5	New Jersey	0.53
6	Massachusetts	0.51
7	Colorado	0.48
8	Utah	0.47
9	Rhode Island	0.46
10	Arizona	0.43

Broadband Leaders Worldwide

The Task Force examined various sources to determine who the world broadband leaders are in terms of global broadband penetration. The statistics and rankings that the Task Force referenced to show broadband leaders worldwide are depicted below.

Fig. 17 | **Akamai Technologies Q2 – 2009: Global Broadband Penetration. The United States is 14th.**



	Countries	Broadband IP's Per Capita
	Global	0.22
1	Monaco	0.44
2	Norway	0.39
3	Sweden	0.38
4	Denmark	0.38
5	Netherlands	0.37
6	Switzerland	0.36
7	South Korea	0.35
8	Germany	0.34
9	Iceland	0.32
10	Belgium	0.30
...		
14	United States	0.24

Fig. 18 | **Organisation for Economic Co-operation and Development: Broadband Penetration and GDP Per Capita.**

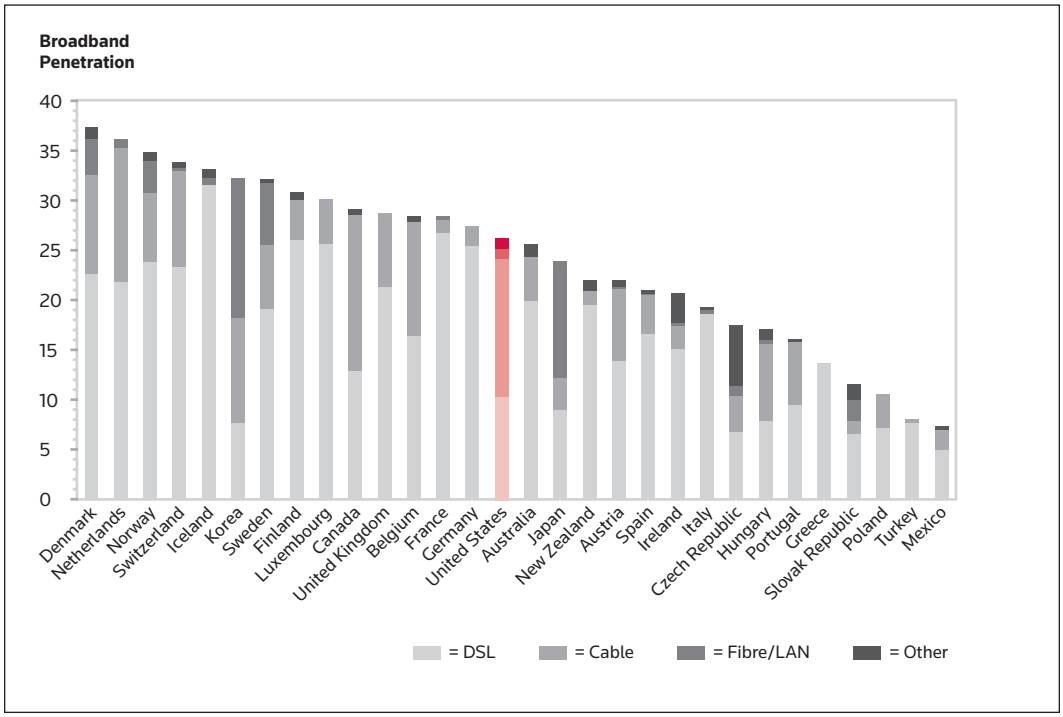


Figure 19 provides a summary of various penetration measures. The actual rank is shown along with providing the quintile it represents through shading: from light gray for first quintile to dark gray for fifth quintile. The ranking reflects a weighted aggregate quintile performance measure, reflecting an emphasis on fixed (60%) over mobile (40%), per-households (35%) over per 100 inhabitants (25%), and 3G (30%) over Wi-Fi (10%).

Figure 19 | **Source: OECD – Country Rankings on Various Penetration Measures.**

Country	Penetration per 100, OECD	Household penetration, OECD	3G penetration, GC	Wi-Fi hotspots per 100,000, Jwire	Weighted average ranking
1 South Korea	6	1	2	7	3.15
2 Iceland	5	2	4	27	5.85
3 Sweden	7	7	6	1	6.1
4 Denmark	1	4	18	10	8.05
5 Finland	8	9	8	15	9.05
6 Japan	17	5	1	29	9.2
7 Luxembourg	9	10	9	12	9.65
8 Norway	3	6	17	19	9.85
9 United Kingdom	11	11	10	3	9.9
10 Switzerland	4	13	15	2	10.25
11 Netherlands	2	3	25	13	10.35
12 Australia	16	17	3	17	12.55
13 Belgium	12	12	20	8	14
14 Germany	14	15	13	14	14.05
15 France	13	18	14	4	14.15
16 Canada	10	8	26	20	15.1
17 Unites States	15	14	19	9	15.25
18 Spain	20	19	7	16	15.35
19 Austria	19	16	12	18	15.75
20 New Zealand	18	20	11	11	15.9
21 Italy	22	27	5	21	18.55
22 Ireland	21	22	22	5	20.05
23 Portugal	25	23	23	6	21.8
24 Slovak Republic	27	26	16	25	23.15
25 Hungary	24	21	27	24	23.85
26 Czech Republic	23	25	24	23	24
27 Greece	26	28	21	22	24.8
28 Poland	28	24	28	28	26.6
29 Mexico	30	29	29	26	28.95
30 Turkey	29	30	30	30	29.75

Figure 20 | **The Information Technology & Innovation Foundation (ITIF): 2008 Broadband Rankings.**

Ranking	Nation	Score on Specific Broadband Measures			Composite Score
		Household Penetration (Subscribers per household)	Speed (Average download speed in Mbps)	Price (Lowest Monthly price per Mbps) (US $ purchasing power parity)	
1	South Korea	0.93	49.5	.037	15.92
2	Japan	0.55	63.6	0.13	15.05
3	Finland	0.61	21.7	0.42	12.20
4	Netherlands	0.77	8.8	1.90	11.77
5	France	0.54	17.6	0.33	11.59
6	Sweden	0.54	16.8	0.35	11.53
7	Denmark	0.76	4.6	1.65	11.44
8	Iceland	0.83	6.1	4.93	11.20
9	Norway	0.68	7.7	2.74	11.05
10	Switzerland	0.74	2.3	3.40	10.78
11	Canada	0.65	7.6	3.81	10.61
12	Australia	0.59	1.7	0.94	10.53
13	United Kingdom	0.55	2.6	1.24	10.30
14	Luxembourg	0.56	3.1	1.85	10.25
15	**United States**	0.57	4.9	2.83	10.25
16	Germany	0.47	6.0	1.10	10.17
17	Belgium	0.57	6.3	3.58	10.17
18	Portugal	0.44	8.1	1.24	10.15
19	New Zealand	0.42	2.5	1.05	9.68
20	Spain	0.49	1.2	2.27	9.68
21	Italy	0.41	4.2	1.97	9.54
22	Austria	0.45	7.2	4.48	9.37
23	Ireland	0.46	2.1	4.72	9.01
24	Greece	0.18	1.0	1.41	8.26
25	Hungary	0.29	3.3	4.67	8.22
26	Poland	0.23	7.9	6.47	7.83
27	Czech Republic	0.30	2.0	9.70	7.03
28	Slovak Repbulic	0.22	3.5	9.38	6.77
29	Turkey	0.23	2.0	15.75	5.25
30	Mexico	0.20	1.1	18.41	4.41
	Average	**0.51**	**9.2**	**3.77**	**10.00**

Figure 21 | **Strategy Analytics: Global Household Broadband Penetration Rankings (2008).**

Rank	Country	Household Penetration
1	South Korea	95%
2	Singapore	88%
3	Netherlands	85%
4	Denmark	82%
5	Taiwan	81%
6	Hong Kong	81%
7	Israel	77%
8	Switzerland	76%
9	Canada	76%
10	Norway	75%
11	Austrialia	72%
12	Finland	69%
13	France	66%
14	United Kingdom	67%
15	United Arab Emerites	65%
16	Japan	64%
17	Sweden	63%
18	Estonia	62%
19	Belgium	62%
20	United States of America	60%
21	Slovenia	58%
22	Germany	58%
23	Ireland	58%
24	Spain	57%
25	New Zealand	57%
26	Lithuania	51%
27	Italy	51%
28	Austria	50%
29	Portugal	40
30	Greece	39%
31	Turkey	37%
32	Hungary	34%
33	Slovakia	33%
34	Poland	32%
35	Argentina	31%
36	Romania	31%
37	Latvia	30%
38	Czech Republic	28%
39	Mexico	28%
40	Chile	27%
41	Croatia	23%
42	China	21%
43	Malaysia	21%
44	Venezuela	17%
45	Brazil	17%
46	Russia	14%
47	Bulgaria	13%
48	Peru	11%
49	Saudi Arabia	7%
50	Thailand	7%
51	Vietnam	7%
52	Phillippines	5%
53	Albania	5%
54	Ukraine	4%
55	Egypt	3%
56	India	2%
57	Indonesia	1%

Demographics

To understand economic development factors related to broadband penetration, the Task Force asked the Department of Employment and Economic Development (DEED) to overlay various demographic maps with the maps that Connected Nation produced. The following figures depict those results.

Figure 22 | **Broadband Service and 2001 – 2007 Job Growth.**

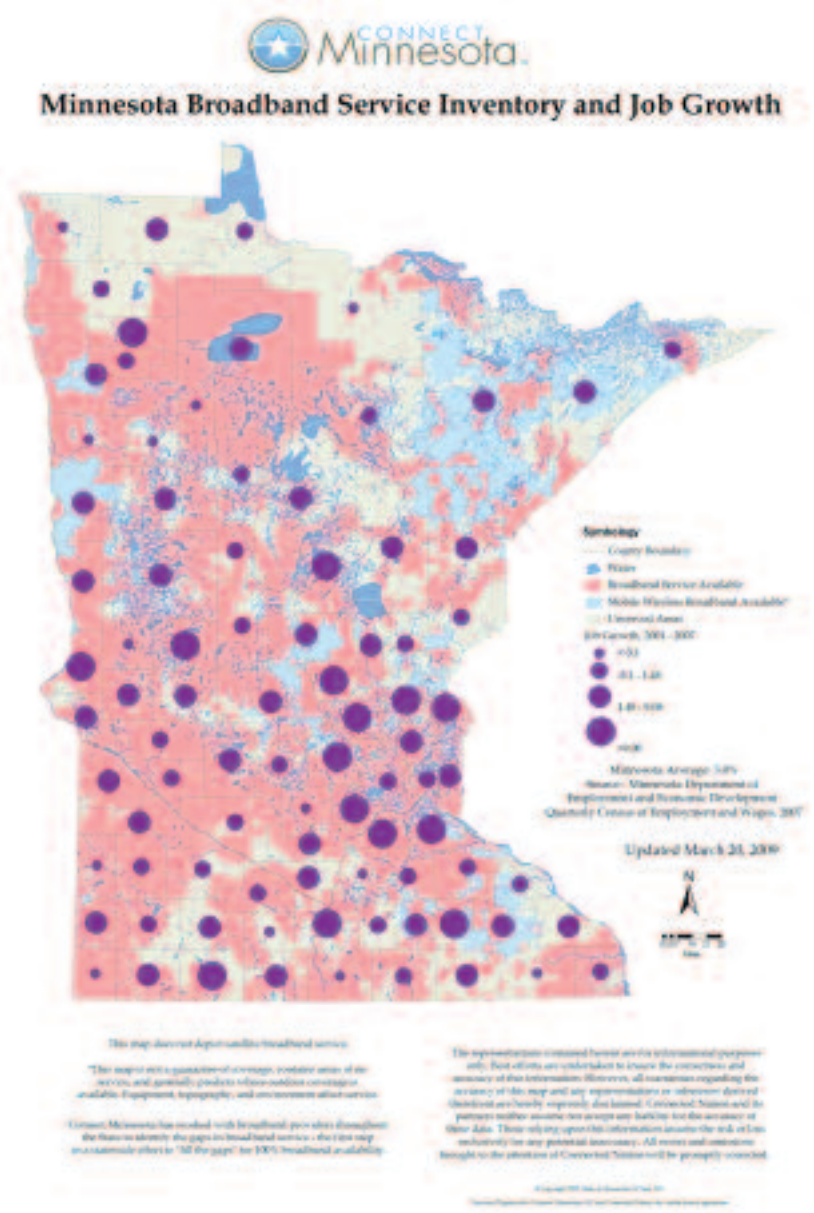


Figure 23 | **Broadband Service and 2001 – 2006 Non-farm Proprietor Growth.**

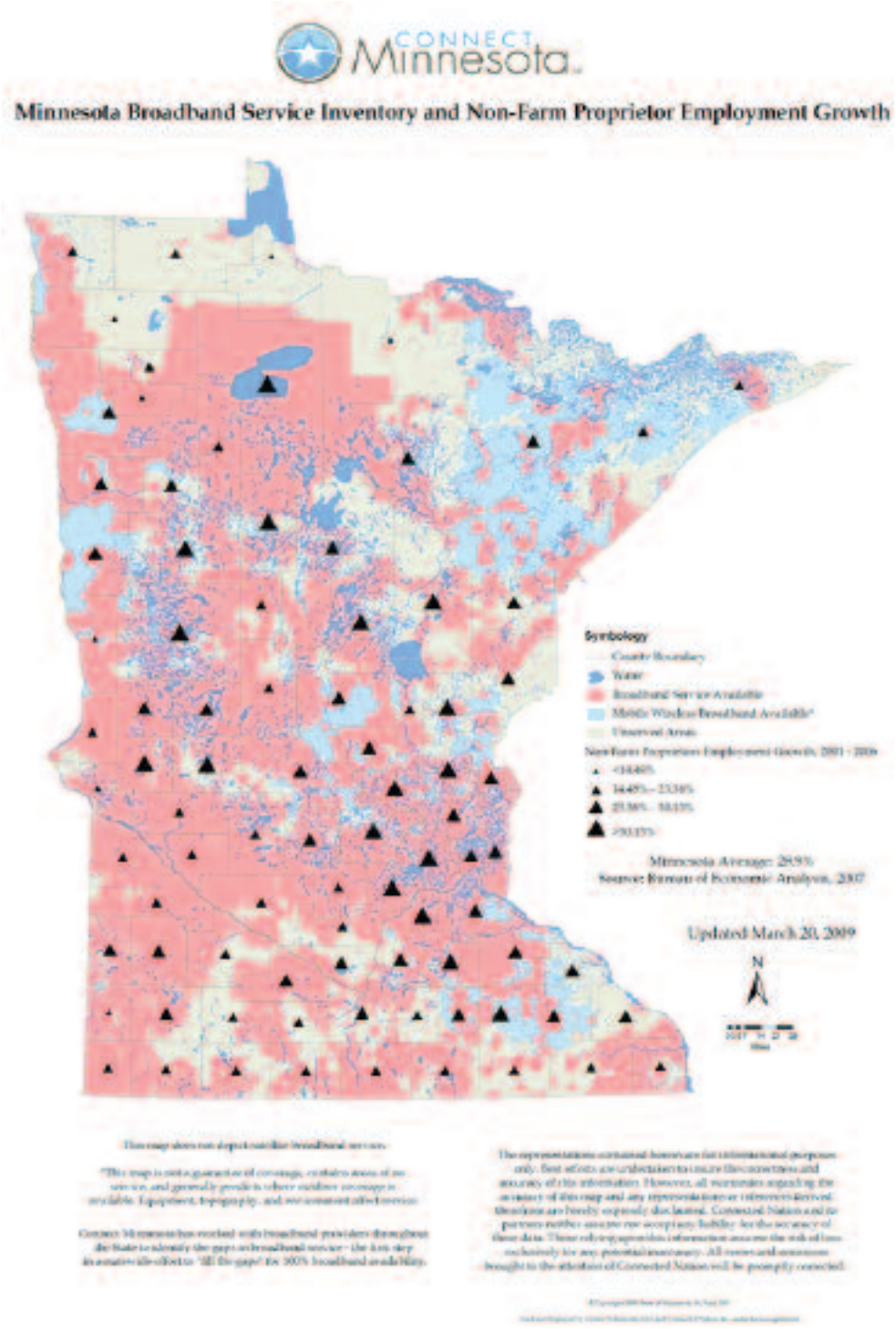


Figure 24 | **Broadband Service and 2008 Unemployment Rates.**

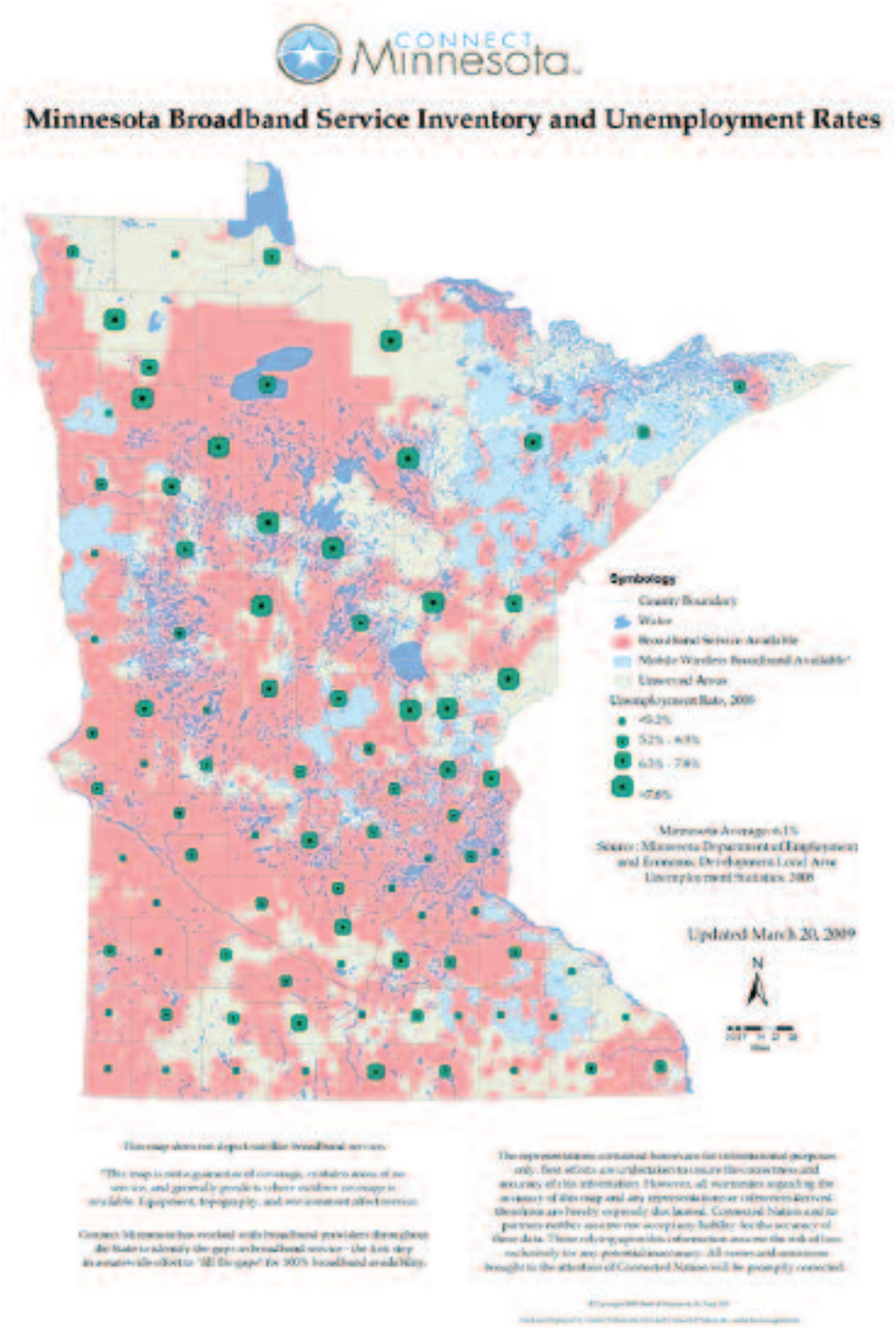


Figure 25 | **Broadband Service and Technological Jobs in 2000.**

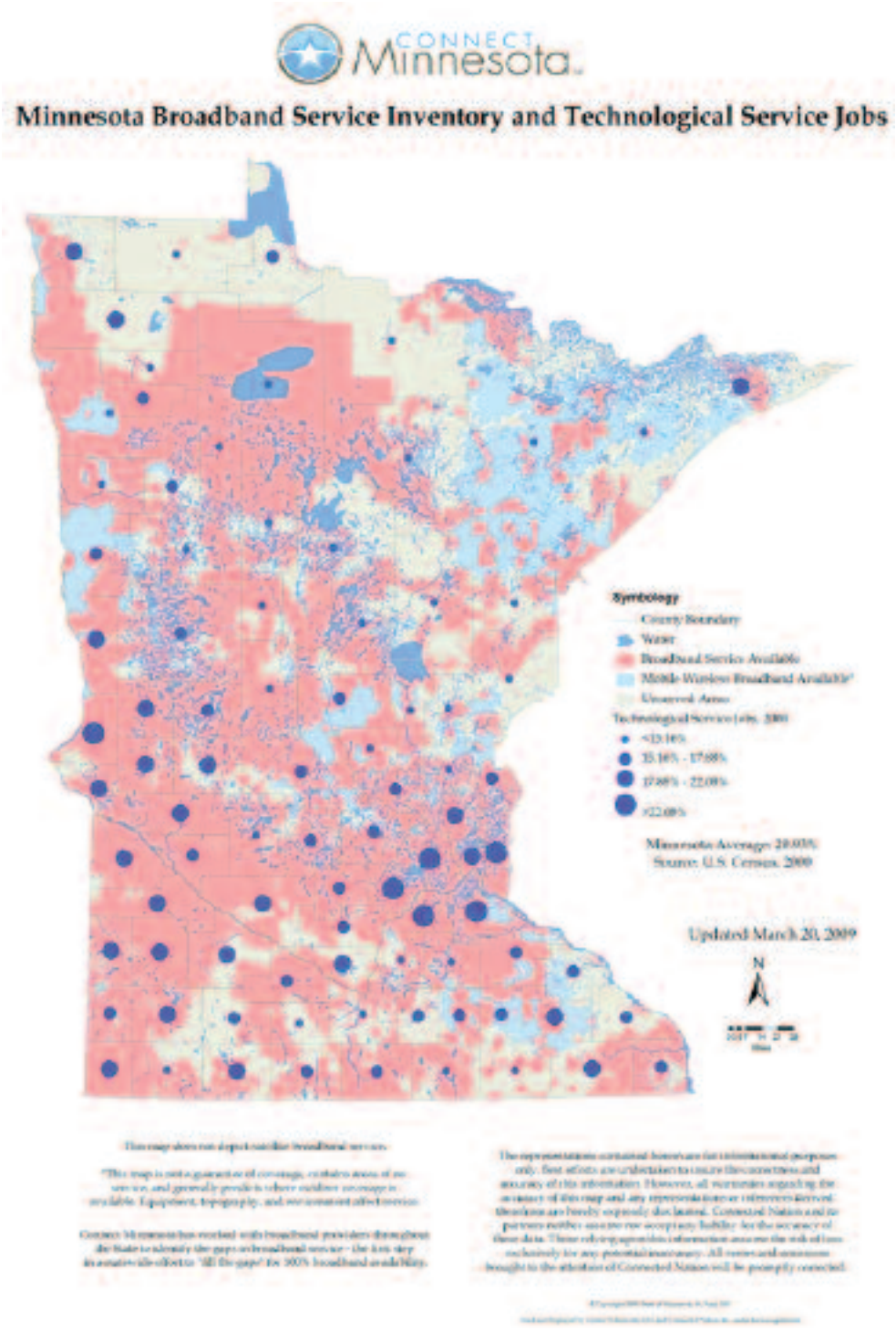


Figure 26 | **Broadband Service and Educational Attainment as of 2000.**

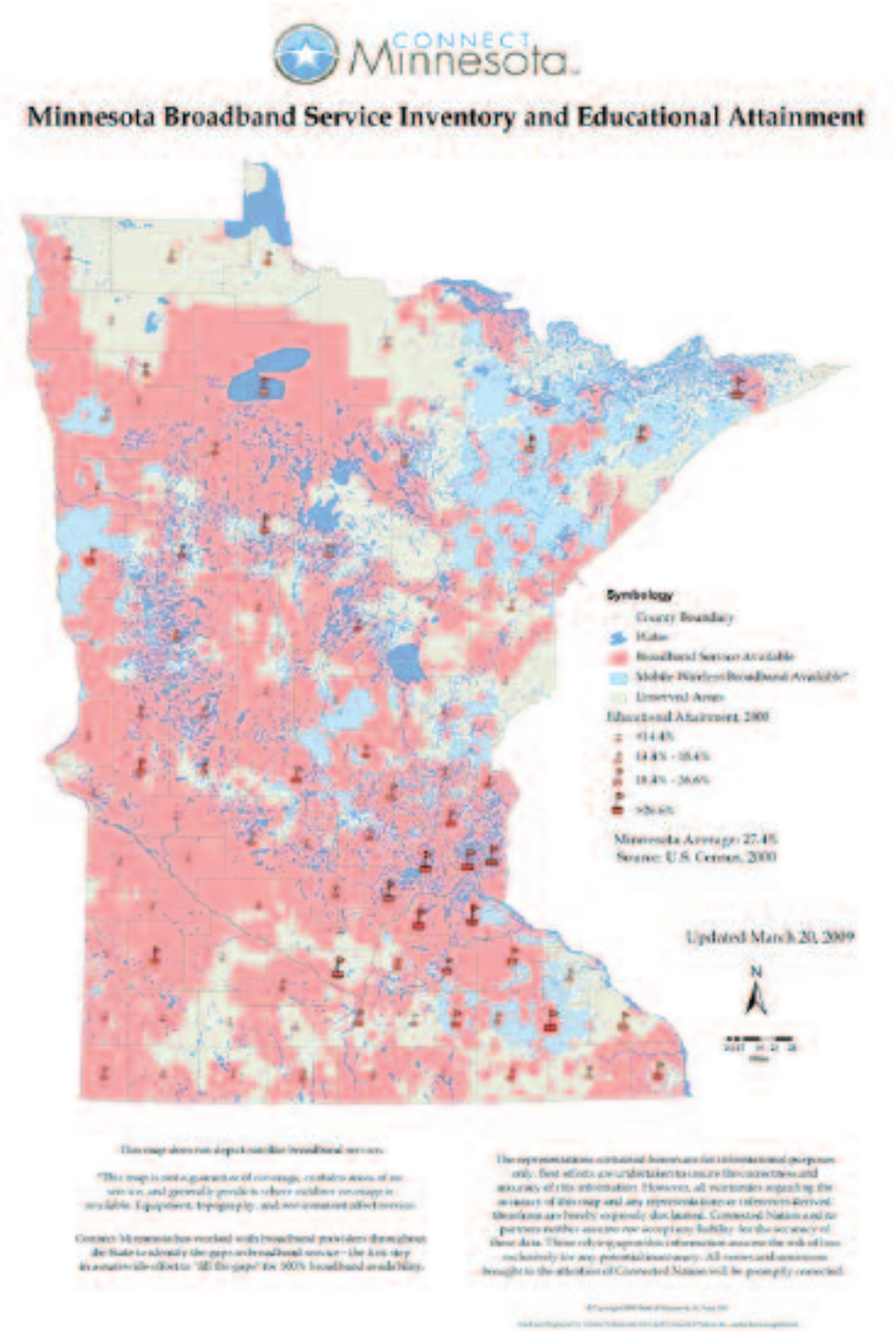
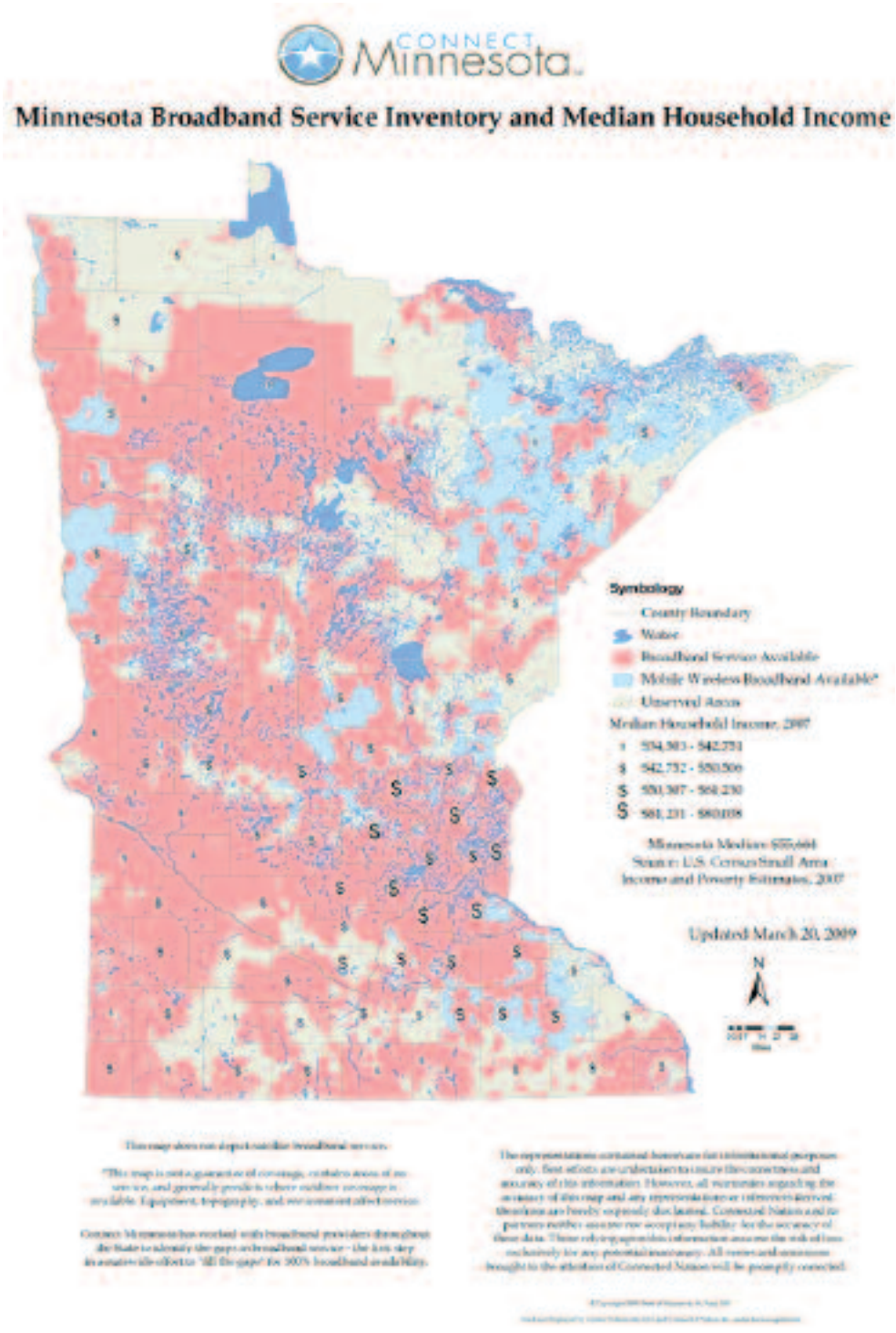


Figure 27 | **Broadband Service and Median Household Income.**



SECTION 4:

RECOMMENDATIONS – WHERE WE WANT TO BE

SECTION 4: RECOMMENDATIONS – WHERE WE WANT TO BE

The recommendations on the following pages reflect the convictions of the Minnesota Ultra High-Speed Broadband Task Force. They are detailed explanations of the eight recommendations introduced briefly in the Executive Summary. Full text of the legislative charge is located in Appendix A: Legislative Charge.

Recommendation 1: Identify the Level of Service

Base-level Standard of Service

Broadband is critical infrastructure for Minnesota's 21st Century advancement in education, health, public safety, research and innovation, economic diversification, and public services. Broadband service offerings should be fast enough to support all available applications that enable sufficient access to information, communication, business, education, healthcare, social interaction, and entertainment. To that end, the Task Force recommends that Minnesota establish both a minimum threshold of service and aspirational speed goals for all of Minnesota by 2015.

The Task Force recommends that any goal for a base-level standard of broadband service in Minnesota be predicated upon basic level of functionality available to every person in the state. We recommend the following minimum speeds:

- **10-20 Mbps** (download)
- **5-10 Mbps** (upload)

2015 Aspirational Goals for Speed and Penetration

The Minnesota Ultra High-Speed Broadband Task Force recommends these aspirational goals by 2015:

- **Minnesota will be in the top 5 states of the United States for overall broadband speed** (download/upload). Minnesota's current ranking is 23 according to Akamai.
- **Minnesota will be in the top 5 states of the United States for broadband penetration.** Minnesota's current ranking is 24 according to Akamai and Leichtman Research.
- In the top 15 when compared to countries for global broadband penetration.

By 2015, Minnesota citizens will use broadband to access:

- Government services[4]
- Security
- Distance education
- Interactive video
- Business
- Telemedicine
- Machine-to-machine applications

4 "All of the fishing licenses these days are sold over the Internet, so you have to have the capacity to access the DNR's web site." http://www.minnpost.com/stories/2009/10/05/12114/broadband_connectivity_is_a_big_issue_in_rural_and_remote_parts_of_minnesota.

As we work to achieve ubiquitous broadband, we also need to adopt and maintain a forward-looking vision that will position the state for global competitiveness.

To provide reference for the speeds that will be recommended later in this section, the table below shows the required upload and download ranges for various applications.

Upload & Download Speed Range	Applications	Uses in Minnesota
500 Kbps – 1 Mbps	Voice over IP SMS Basic Email Web Browsing (simple sites) Streaming Music (caching) Low Quality Video (highly compressed)	• Email • Basic Internet use, • NetMotion clients for general mobile laptop use • Satellite Connections at Command Vehicle
1 Mbps – 5 Mbps	Web Browsing (complex sites) Email (larger size attachments) Remote Surveillance IPTV-SD (1-3 channels) File Sharing (small/medium) Telecommuting (ordinary) Digital broadcast video (1 channel) Streaming Music	• Cisco VPN for remote connections • Clay County network connection in 2008 - 3 T1s (4.5 Mbps) • Home based medical and dental transcription (telecommuting ordinary)
5 Mbps – 10 Mbps	Telecommuting (converged services) File Sharing (large) IPTV-SD (multiple channels) Switched Digital Video Video on Demand SD Broadcast SD Video Video Streaming (2-3 channels) HD Video Downloading Low-Definition Telepresence Gaming Medical File Sharing (basic) Remote Diagnosis (basic) Remote Education Building Control and Management	• Minnesota Library Information Network (MnLINK) • Home-based customer service delivery (telecommuting converged services) • Online medical visit – basic (Low-Definition Telepresence)

Upload & Download Speed Range	Applications	Uses in Minnesota
10 Mbps – 100 Mbps	Telemedicine Educational Services Broadcast Video SD and some HD IPTV-HD Gaming (complex) Telecommuting (high-quality video) High-Quality Telepresence HD Surveillance Smart/Intelligent Building Control	100 Mbps Service Capacity **(Note: the list implies simultaneous use)** • Three channels of HDTV (18-20 MB/channel, uncompressed) **or** (2-4 MB/channel, compressed) • Voice telephone (multiple lines) • Radio, music, video downloads • Web surfing • Outgoing data – business servers, video streaming, videoconferencing[5] • Cisco's TelePresence requires 15 MB symmetrical[6] The Cisco TelePresence System 500 website Q & A indicates that bandwidth requirements "will depend upon the resolution (720p or 1080p) being used. Generally, between 2 and 3 Mbps per screen is used." • Wireless access points • LOGIS link to city, police, utility billing, financial connections via citrix farms, Internet connection
100 Mbps – 1 Gbps	HD Telemedicine Multiple Educational Services Broadcast Video Full HD Full IPTV Channel Support e.Government (small counties) Video on Demand HD Gaming (immersion) Remote Server Services for Telecommuting	• All local application on city network • LOGIS fiber connections to the State • Current Clay County network connection

5 Source: Broadband & Communities presentation by Andrew Michael Cohill, Ph.D. and Pres. Design Nine, Inc. on Feb. 19, 2009.
6 Source: The Exaflood presentation on Oct. 24, 2008 by Bret Swanson, Center for Global Innovation.

Upload & Download Speed Range	Applications	Uses in Minnesota
1 Gbps – 10 Gbps	Research Applications Telepresence (using uncompressed high-definition video streams) Live Event Digital Cinema Streaming e.Government (large counties) Telemedicine Remote Visualization and Virtual Reality Movement of Terabyte Datasets Remote Supercomputing	• Internet 2 • University of Minnesota R&D • MNSCU R&D • Private college R&D • Public service applications for large counties
10 Gbps – 100 Gbps	Supercomputer Center Interconnection Access to the Large Hadron Collider in Switzerland ESnet is receiving $62 million to build a 100 Gbps network for "big science" applications.	• University of Minnesota R&D • Internet2

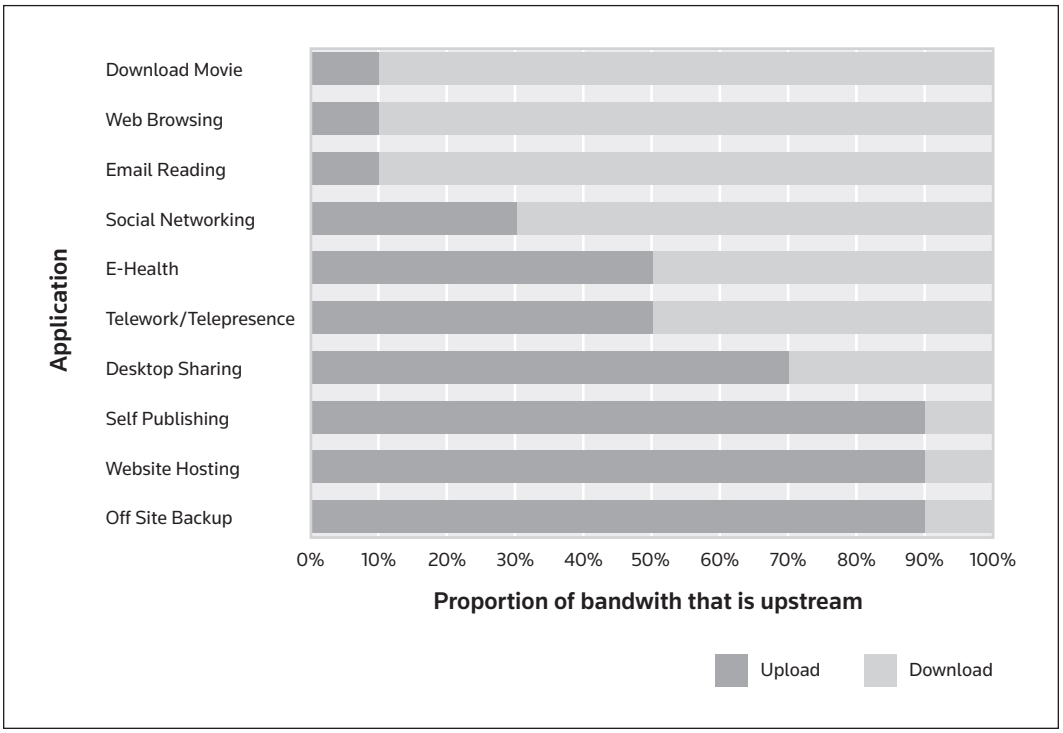
Our aspirational speed and penetration goals should be focused on the achievement of leading positions both nationally and globally in broadband speeds and penetration that are necessary today and tomorrow for Internet-based applications. Whether citizens are at home or work, leading positions in broadband speed and penetration drive innovation, efficiency, effectiveness, and satisfaction in people's daily lives. We are not seeking a leading speed position for the sake of speed, but to ensure our global competitiveness through access to broadband-based Internet applications in the areas of education, healthcare, commerce, economic development, and government services.

The Task Force believes that increasing broadband penetration (subscription or take rate) in Minnesota is a significant measure of ensuring national and global competitiveness and sustaining a high quality of life. Increasing broadband penetration in Minnesota is one of the most effective ways to increase our ranking globally.

Symmetrical Service

The Task Force heard from a variety of experts who believe certain applications require symmetrical speeds (i.e., equal upload and download speed) to work properly. Examples cited include telemedicine, telework, and distance education. The Task Force found that many consumers asking for symmetrical service are, in fact, in need of faster upload speeds. When the application upload need is met, whether the download speed is symmetrical or faster, consumers or businesses have a solution to their problems.

Fig. 28 | **Upload vs. Download Speed, Source: Task Force Research**



Recommendation 2: Policies and Actions Necessary to Achieve Ubiquitous Broadband

Ubiquitous Broadband Goal

The goal for broadband is to have ubiquitous (100% of homes and businesses in the state) coverage as soon as possible and no later than 2015. As with roads, electricity, and telephony, broadband has become an economic and social necessity for all citizens of the state no matter where they are located.

Introduction

"Another key aspect of an innovation ecosystem is ubiquitous and affordable broadband access throughout Minnesota. Broadband is as essential as oxygen to ensure a high quality of life and a globally competitive future for our citizens, businesses, and communities."

Kate Rubin, President

Minnesota High Tech Association

The policies and actions necessary to achieve ubiquitous broadband span a wide range, both in terms of the people and entities who will have to collaborate to achieve that ubiquity as well as the nature of the work that they will have to do. The Task Force believes that it is critical to understand and address these actions in their entirety.

This section describes the scope of this effort and the manner in which parts are related to one another. This collaborative approach is applicable to all actions that the Task Force is recommending, but is detailed here because achieving broadband ubiquity is both important and challenging to achieve. Conversely, if this collaboration can be put in place and help to quickly achieve broadband ubiquity, the state will also have created a powerful example to drive the implementation of other recommendations.

Minnesota cannot undertake all the actions required to achieve broadband ubiquity alone. What is required is a broad, and perhaps unique, collaboration between many stakeholders. The state has a variety of important roles to play, but so do the rest of the stakeholders and therefore this balanced collaboration needs to be "baked in" right from the beginning.

Following is a diagram that outlines the core activities and each of their corresponding detailed steps to accomplish a strong, sustainable, ubiquitous broadband service for Minnesota. The remaining portion of this section of the Task Force report provides further information regarding these activities and steps.

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Lead

Sustained, consistent leadership is crucial to accomplishing the state's broadband-ubiquity goals. Having this report become "shelfware" is one of the biggest fears of many Task Force members, and the quickest path to that outcome is to submit this report without describing the ongoing leadership that will be needed to ensure that recommendations are achieved.

Leadership will need to come from many places and in many forms. While the state must continue to play an active convening and enabling role, there is also a need to continue to draw in leadership from across all stakeholders. Thus, the Task Force recommends the formation of a fixed-term Broadband Advisory Council for Minnesota (BACM) from now until the end of 2015 (see Recommendation 4 for additional details).

This leadership function is comprised of three major parts:

- **Mobilize** communities and their human, technological and organizational resources.
- **Empower** people and organizations.
- **Manage** vision, goals, strategy, information, and actions.

These parts are described in the following sections.

Mobilize communities and their human, technological, and organizational resources

While addressing ubiquitous broadband is a statewide goal, it's an issue that will ultimately have to be addressed by each community. Thus, an important part of success hinges on helping communities understand what resources they have at hand, the resources they need, and how to develop good strategies to achieve their broadband goals.

Recommendations

1. Collect best-practice methodologies and tools, and make them available to communities that are mobilizing their local broadband efforts.
2. Identify current and planned broadband-mobilizing efforts across the state and make them aware of each other. Provide contact information and encourage collaboration.
3. Monitor and take advantage of any federal initiatives that promote broadband planning, coordination, or construction.
4. Identify and endorse an organization (or collaborative effort) that can provide an ongoing focal point and funding for these tools and activities.
5. Identify leaders and resource people with expertise in this area and share that list with communities in need of assistance.

Empower people and organizations

The Task Force has learned that there are two sides of the ubiquitous broadband coin: supply and demand. There is a big opportunity to increase demand by expanding digital literacy. This will increase demand for advanced broadband services that, in turn, will drive an increase in supply as the market responds to that demand. At the same time, there is an opportunity to increase the value of Minnesota's workforce by improving digital skills, skills that are becoming ever more important as we compete on a world-wide stage. This also increases demand for ubiquitous broadband services.

Minnesota Computers for Schools (MCFS) improves student success by transforming donated computer technology into greater educational opportunity for K-12 students in Minnesota. They have placed over 52,000 computers since 1997.

Recommendations

1. Support efforts to build Internet awareness and expand digital literacy by coordinating existing efforts (e.g. library programs) and leveraging existing capabilities (e.g. community education and community colleges).
2. Provide tax incentives for individuals, businesses, and organizations that build their digital literacy and skills.
3. Coordinate with jobs programs and ensure that there are digital literacy and skill-building components to each.
4. Support refurbished and recycled PC programs where effective in reducing cost.

Manage vision, goals, strategy, information, and actions

Bringing ubiquitous broadband to the state is a huge undertaking and it will happen much more quickly if the many efforts are well guided and coordinated. Additionally, it is critical that all stakeholders have a clear understanding of who is accountable for making this happen.

Recommendations

1. Sequence the support: unserved locations should receive the highest priority. Once priority locations have been identified, timing should favor ROI for the state and also favor locations with lower cost/location to deliver.
2. Pass legislation that forms a multi-stakeholder Broadband Advisory Council for Minnesota (BACM) with a five-year sunset which is tied to the Task Force recommendations (see Recommendation 4 for additional details).
3. Enable legislation (that forms the BACM) to establish clear expectations for meeting ubiquitous broadband goals.
4. Generate an annual report that describes the current status ("where we are now"), long- and short-range goals ("where we are going"), and action plans ("how we will get there") with regard to meeting our ubiquitous broadband goal. Review and make recommendations updating the state's definition of broadband and ultra high-speed broadband.
5. Ensure that there is tight coordination between the various state agencies that have an interest in broadband and the BACM.

Stimulate

Achieving ubiquitous broadband will require a real effort by many people and organizations and the Task Force would be remiss if it didn't describe ways to stimulate that activity. Minnesota has arrived at the place where pure market-based solutions are reaching their limit and progress beyond this point will require additional approaches. It is preferable to stimulate the market to complete the job, but options need to be provided for other approaches when market solutions aren't enough.

As with the other recommendations, this has to be a multi-stakeholder effort in order to be successful and the Task Force looks to the proposed BACM to make sure that these collaborations happen quickly.

Stimulating can come in many forms. This section of the recommendations describes three broad activities:

- **Coordinate** public and private activities that move the state toward ubiquitous broadband.
- **Build** facilities, infrastructure and content.
- **Incent** funding, demand and capabilities.

These activities are described in more detail in the sections that follow.

Coordinate public and private activities that move the state toward ubiquitous broadband

Much of the remaining work of achieving ubiquitous broadband will be easier if it is coordinated. Providers and communities (either geographic or communities of interest e.g., local governments, local chambers of commerce) need to leverage opportunities created by each other's projects. Businesses large and small will benefit from knowing where and when facilities will be added, or when they will become available. There is a real risk of slowing down progress and wasting private and public resources if these efforts aren't coordinated.

Coordination should not be limited to within the state. Indeed, the Task Force wishes to avoid the "not invented here" trap and coordinate Minnesota's efforts with those in neighboring states and across the country.

Recommendations

1. Identify and support new and existing consortia and partnerships needed to achieve ubiquitous broadband.
2. Dig once; coordinate infrastructure construction projects, such as roads and electrical grid improvements, with ubiquitous broadband projects.
3. Plan once; develop coordinated broadband, electric grid, and energy retrofit projects.
4. Include this coordination role in the charter of the proposed BACM, but set the expectation that the Council enlist the aid of public and private partners in doing this work.
5. Ensure that the BACM members are aware of and encouraged to attend conferences with similar statewide broadband councils.

"The Blandin Foundation appreciates the hard work and public mindedness required to reach consensus in this dynamic and complex area."

James J. Hoolihan

Prresident, The Blandin Foundation

Letter to the Task Force's chair, October 13, 2009

Build facilities, infrastructure, and content

Ultimately, achieving ubiquitous broadband requires building things – facilities, infrastructure, and content. Minnesota has accomplished a great deal through market-driven construction, yet unserved areas remain. Minnesota needs to stimulate actions that will finish the job in a way that also allows for future expansion.

There is also the need to build content as well as facilities if goals are to be met because, as the Task Force has learned, content drives demand and demand drives deployment. Thus, this section of the report also includes several content-building recommendations.

Recommendations

1. Initiate a study to develop a wide-ranging collaborative funding strategy to support the recommendations of this report.
2. Support the formation of procurement collaborations by government, educational institutions, and businesses to stimulate deployment of advanced last-mile and middle-mile infrastructure.
3. Assist providers with right-of-way issues arising during construction projects.
4. Explore collaborative strategies to expand broadband use through advanced applications such as e.government, telehealthcare and distance-learning.

Incent – funding, demand, and capabilities

Some actions needed to accomplish the ubiquitous broadband goal will require incentives. In some cases these incentives will have to be monetary, but this section also raises the possibility of non-monetary incentives (e.g., promotion and recognition) and provides some recommendations for consideration.

Recommendations

1. Initiate a study to determine the advisability of establishing a surcharge-funded Minnesota Broadband Fund.
2. Work toward expansion of the definition of the Federal Universal Service Fund to include broadband.
3. Publicize successful broadband initiatives in the state.
4. Identify other non-monetary incentives to achieve ubiquitous broadband.

Oversee

Oversight is required so that the state can determine where it stands, recognize and reward successes, and suggest changes when they are needed.

This portion of the recommendations is broken into three sections:

- Tracking resources (organizational, technology, human), connectivity, affordability, capacity, availability, and penetration.
- Evaluating progress, performance, benefits, technology, and cost.
- Rewarding positive action and regulating in the consumer's interest.

Track resources (organizational, technological, human), connectivity, affordability, capacity, availability, and penetration

It's clear that better information is required in order to guide policy and action if the state is to achieve its broadband goals. The Task Force recognized a strong need for reliable information during its policy discussions and wants to ensure that subsequent leaders will have access to the facts they need.

If Connected Nation is awarded funds through the State Broadband Data & Development Grant Program, the initial broadband maps will be maintained for at least two years. In addition, Connected Nation will conduct a statewide survey on broadband use and barriers to broadband adoption.

The following recommendations describe the information that is needed in order to understand the current situation and areas of need with regard to ubiquitous broadband.

Recommendations

1. Work through the National Telecommunications and Information Administration (NTIA) – State Broadband Data & Development Grant Program, identify ways to track:
   - Broadband availability (i.e., tiers of upload/download speeds) in each location (residential and business) consistent with the Task Force speed recommendations.
   - The number of individual and commercial broadband subscribers in the state, and the speed and cost of the services they buy.
   - Actual versus published/advertised broadband speeds available in each location.
   - Affordability (price per MB) in each location.
   - Actual vs. goal penetration/take-rate of various tiers of broadband service in each location.
2. Offer methods and templates to allow local communities and regions to track organizational, technological, and individual expert resources and needs, especially those related to ubiquitous broadband deployment.
3. Give as much of the data as possible in a public dataset (in addition to maps) that others can use in conjunction with their own data while at the same time preserving the privacy of the data that must remain confidential.
4. Provide the ability to independently verify the information that is gathered.
5. Generate a semi-annual status assessment of broadband development (percentage of households with broadband availability and penetration).
6. Provide updates to collected data and maps every six months.

Evaluate progress, performance, benefits, technology, and cost

It is not enough to simply measure activity; it is equally important to evaluate what the measures are saying and make suggestions regarding what changes are required in order to maintain forward momentum.

Recommendations

1. The BACM should identify expert resources that can be relied upon to assist them with their work as needed.
2. Establish a "working group" process that can allow formation of multi-stakeholder groups to assist the BACM as needed.
3. Establish opportunities for business and residential consumers to interact on an informational basis with the BACM.

Reward positive action that is in the consumer's interest

The Task Force feels that the most desirable course is to focus on rewarding success, especially at this early stage in the process of moving the state towards ubiquitous broadband. At this time there is too much to learn and too many avenues to explore to warrant a substantial change in the state's regulatory posture with regard to broadband deployment.

Recommendations

1. Maintain an up-to-date public-facing information "dashboard" describing progress towards reaching the state's ubiquitous broadband goals.
2. Maintain and promote an up-to-date list of broadband organizations and conferences.
3. Recognize and promote successful efforts.
4. Identify and monitor locations that are unserved or served by only one broadband provider.

Recommendation 3: Opportunities for Public and Private Sectors to Cooperate

A successful relationship between the public sector (local, state, and federal government) and the private sector broadband providers is critical in order to achieve ubiquitous high-speed broadband service in Minnesota. Both the public and private sectors have distinct, important roles in serving the communication needs of Minnesotans.

Government and Private Sector on Infrastructure

State government should lead the effort to accurately map the state to delineate the well-served, underserved, and unserved parts of Minnesota. Local providers, local units of government, or regional consortia, with their "feet-on-the-ground" knowledge of their areas, are important partners with the state to ensure the maps accurately reflect the service that is available. The Task Force believes any public-private partnership should follow the same clearly defined path, starting with accurate mapping of the state's broadband coverage. The governor should designate one state agency to be responsible for maintaining the map, including a process for updating, verifying, and making it publicly available.

Local government entities (i.e., cities, counties, townships, school districts) and regional library consortia can form collaboratives to improve connectivity between them and/or combine their purchasing power in the aggregate. This level of connectivity can serve as the anchor tenant for existing service providers and be one way to encourage them to build out the existing network.

Budget issues and shrinking rural demographics are creating the need for different levels of government to share resources. This requires an increased use of broadband between these levels of government. Consortia should be formed to develop a clear understanding of needs and opportunities for collaboration.

Government should encourage private sector providers to build out or upgrade their networks where necessary. This can be done by a variety of economic development tools and coordination, including:

1. Providing technical assistance to businesses interested in pursuing high-speed broadband deployment projects with items such as development and upgrade of business plans, securing public and private funding, and working through the financial packaging for the project that might include a combination of bank loans, foundation grants, government grants, and gap financing, such as revolving loan funds.
2. Providing financial incentives as appropriate (see Appendices C and D).
3. Encouraging public and private collaboration and sharing of information for the optimal use of public rights of way. It is also important to avoid Geographic Information System (GIS) duplication.
4. Positioning the state to be a location of choice for the beta testing and evaluation of new technologies that further enable or extend broadband, creating a climate of collaboration between manufacturers of these technologies, potential users of these technologies, and government and industry in Minnesota.

Government and Private Sector on Adoption

Programs such as Minnesota Computers for Schools are good examples of existing ideas that can be expanded to help increase broadband adoption. This is a program whose purpose is to provide affordable technology solutions to schools, teachers, and nonprofits that serve disadvantaged youth and those with special needs. It is a partnership that trains inmates at the Stillwater Correctional Facility to refurbish and upgrade computer hardware donated by businesses and then places the refurbished computers in Minnesota K-12 schools and educationally-based nonprofit organizations.

Education collaboratives are another good example of public/private partnerships. K-12 schools and public libraries formed collaboratives to purchase services from private providers to connect schools to the Learning Network of Minnesota. These collaboratives routinely put out requests for proposals (RFPs) to ensure they are getting the best pricing possible. This process also allows schools and libraries to update their technology on a regular basis.

Role of Government

Government has, or can have, a variety of roles to play with respect to broadband policy, broadband adoption, and consumer protection. Different levels of government (federal, state, local) have differing levels of jurisdiction and responsibility in the making of public policy regarding broadband.

Government plays an important planning and policy-making role with respect to establishing and achieving broadband goals. While it has regulatory authority too, it must also be recognized that actions the government takes or does not take have direct impacts on such things as time to market, the competitive playing field, and end-users paying for broadband services. In the final analysis, perhaps government's overarching responsibility is to ensure affordable, ubiquitous access to broadband for all those who want and need such services, while making sure our state and nation remain competitive in the global economy. Further, government has a responsibility to make sure that our critical broadband infrastructure is safe and secure.

As with the recommendations contained in other sections of this report, many of these recommendations have associated costs. Before moving forward with any specific recommendations, policy makers will need to evaluate the specific costs/benefits of the recommendations, particularly in light of declining government resources.

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Role of State Government

Because this is a state task force, greatest emphasis has been placed on actions the state can take to ensure broadband reaches everyone who wants it, on what lawmakers can do to encourage broadband deployment and adoption, and on installation of current and future broadband technologies. Some of these actions include:

Broadband Adoption. The Task Force agrees that increasing broadband adoption is vital to Minnesota's future success and the engagement of its citizens. There are two fundamental strategies policy makers should consider pursuing:

1. Government participation in general broadband education about the uses and applications available through broadband, including demographic populations who have had no prior training or exposure to the Internet.
2. A strategy aimed towards people who, for financial or other socioeconomic reasons, are not currently connected to the Internet. The Minnesota Department of Education, the Minnesota School Boards Association, and other appropriate stakeholders should be involved in discussions to determine an appropriate strategy. Such a strategy could include:
   a. A clearinghouse for industry's used computers not otherwise being resold or repurposed.
   b. A broadening of the Minnesota Computers for Schools program to also include families that cannot afford computers.
   c. The establishment of a low-income eligible threshold to obtain assistance defraying the cost of basic Internet service. The Task Force recommends using similar standards as already exist in Minnesota, such as total household income that does not exceed 135% of the Federal Poverty Guidelines.[7]

7 For instance, the MN Department of Commerce has the Telephone Assistance Plan (TAP) and the Low Income Home Energy Assistance Program (LIHEAP), which use the following guidelines: Total household income does not exceed 135% of the Federal Poverty Guidelines listed here; OR participation in one (or more) of these programs:
- Medicaid (Medical Assistance)
- Food support (Food Stamps)
- Supplemental Security Income (SSI)
- Federal Public Housing Assistance
- Low-Income Home Energy Assistance Program (LIHEAP)
- Temporary Assistance to Needy Families (TANF)
- Minnesota Family Investment Program (MFIP)
- National School Lunch Free Lunch Program (NSL)
- Bureau of Indian Affairs Program (Tribal TANF, Head Start Subsidy, NSL)

For simplicity's sake, the Task Force preferred the Federal Poverty Guidelines.

Broadband Safety and Security. Building on the work that was done post-9/11, and noting that we live in a world of potential terroristic acts and cyber attacks from organized foreign entities and domestic hackers, the Task Force believes it is essential that the appropriate agencies conduct a thorough review with the provider community to determine the security and redundancy of Minnesota's broadband infrastructure. This review should focus not just on public safety and law enforcement, but also on the provision of essential services such as electrical power, to gauge the potential impact that a widespread disruption of broadband services would have on commercial enterprise in Minnesota. Such a threat assessment should identify priorities and any special protections that may need to be enacted. See Recommendation 6: Evaluation of security, vulnerability, and redundancy for additional information.

Consumer Protections. The Task Force recommends that policy makers determine whether consumer protection gaps exist with respect to broadband services. In Minnesota, those roles are spread out over the Public Utilities Commission, the Department of Commerce, and the Attorney General's consumer protection division. Whether those efforts continue to be decentralized or not, state agencies should continue efforts to advocate on behalf of broadband consumers, especially those consumers in areas served by only one broadband provider.

Technical Improvements Leading to Greater Broadband Deployment.

1. Continue efforts in the essential task of keeping state broadband maps up-to-date.
2. Recommend further study of right-of-way issues involving a broad cross section of interested parties. Providers have an interest in expeditious approvals of right of way permits, while government is interested in protecting public safety in rights of way. Application approvals can be complex, particularly where relocates are involved concerning multiple providers, or multiple agencies or units of government. While the State of Minnesota has a comprehensive Right of Way law (MS 238.162 & MS238.163) that has served Minnesota well since the late 1990s, the Task Force recommends further study of this issue.
3. Recommend state building code officials consider home and multiple dwelling unit wiring standards to make sure the wiring of future homes and dwelling units are prepared to accommodate emerging "smart home" technology.
4. Work to develop best practice common code requirements that facilitate future broadband. Discussions should include industry, the League of Minnesota Cities and the Association of MN Counties.
5. Explore a process similar to or in addition to Gopher One Call for interested parties to know in advance of when trenches are going to be opened (for conduit or fiber installation) as a way to share costs and create efficiencies for installation.
6. Create legal authority for municipalities to mandate conduit installation on development applications as a condition for approval.

Other Potential State Government Actions to Further Broadband Competitiveness.

1. Determine if there is current university capacity (University of Minnesota and MnSCU) to conduct research into advanced generation broadband that would support the goals of this report.
2. Consider appropriate seed funding for projects which further Minnesota's broadband goals (once adopted by the Governor and Legislature.)

Role of Municipal Government

The Task Force has identified the following areas where municipal governments in the state could contribute to the objectives stated in this report.

1. Form public/private partnerships as needed to extend services to businesses and residents.
2. Engage the League of Minnesota Cities, the Association of Minnesota Counties, and the Minnesota High Tech Association in working with cities, counties, and industry to develop model zoning ordinance language that encourages wireless tower placement. Noting the difficulty of placing such towers because of "not in my back yard" reactions, encourage companies to work together or specifically provide for additional space on towers for later entrants.
3. Install conduit, as appropriate, along key local/county roadways that could be leased on a non-discriminatory basis for the provision of broadband service to homes or businesses.
4. Encourage the development of high-level collaborative broadband plans by bringing community stakeholders together. The organizations listed in #2 above and the BACM can assist municipalities in collecting and listing best practices. Recognizing that one size does not fit all and circumstances vary around the state, with respect to the municipal provision of broadband services, Minnesota has already defined a process for the provision of telecom services.[8]

8 This Task Force intends neither to inhibit nor to encourage the entry of qualified municipal entrants. Having obtained voter approval, as the statute allows, municipal providers shall be recognized as having equal standing to that of any other provider when it comes to other recommendations, including the ability to participate in any incentive programs that are developed.

Role of Federal Government

Noting efforts by countries such as Australia, Japan, Singapore, and France to have aggressive national broadband plans and strategies, the Minnesota Ultra High-Speed Broadband Task Force believes it is vital that U.S. policy makers develop a globally competitive, comprehensive, federal broadband policy. This work should build on the current work of the Federal Communications Commission (which is due to recommend a national broadband plan in February 2010).
The federal approach should include, but not be limited to, some of the following initiatives:

Potential Federal Initiatives:

1. Consider offering tax credits and other financing vehicles (See Appendix D) where appropriate, to encourage broadband deployment. Emphasis should be on a consistent basis of funding. Federal officials are encouraged to review and possibly repurpose allocations from the Universal Service Fund for building out broadband in high-cost areas.
2. Consider offering incentives for schools, community education entities, libraries, etc. to offer broadband adoption/education opportunities, and encourage programs to reduce the cost of home computers and Internet access for those who cannot afford them.
3. Consider requiring federal projects and federally funded projects to require conduit installation, where appropriate.
4. Establish and maintain standardized measurement criteria for annually measuring the nation's progress toward federal broadband policy goals, including available Internet speeds and Internet adoption and penetration.
5. Explore, along with business and industry, the development of a coordinated strategy and educational campaign to maximize the benefits of broadband use that will further stimulate broadband adoption.
6. Establish strategies for extending next generation broadband to job centers.

Recommendation 4: Establish the Broadband Advisory Council for Minnesota

The Task Force believes that sustained, consistent leadership will be needed to accomplish the state's broadband goals; and therefore recommends the formation of a fixed-term Broadband Advisory Council for Minnesota (BACM) from now until the end of 2015, which corresponds to the target date for many of the goals proposed in this report. The Task Force does not support a permanent BACM, nor does it support granting the BACM regulatory or fund-allocation authority. The focus of the BACM should be on collaboration and action – advising stakeholders as they take on their respective work.

Lawmakers should create a BACM housed in the Department of Commerce with terms and responsibilities set forth in statute, appropriate funding, and appropriate staff.

The Task Force recommends a council similar in composition to the current Task Force – consisting of representatives of an array of stakeholder interests. In addition, the BACM should include executive-branch representatives and legislative-branch representatives (or their designees). The Council should be appointed by the governor and the Legislature through the Open Appointments process. The BACM may consider forming working groups or advisory groups in order to broaden representation and expertise when needed.

Specifically, the BACM should, in addition to such other duties as the Legislature and the governor may assign, **advise and assist stakeholders and policy makers to:**

- Understand what needs to be done (based on broad input), and in what sequence.
- Identify and recommend legislative or policy ideas that further the broadband goals.
- Build coalitions and identify available resources from inside and outside state government to advance the goals outlined in this report.
- Ensure that activities are well defined before they are launched and that opportunities for collaboration are explored.
- Monitor and report progress towards the goals.
- Develop options to overcome obstacles as they arise.
- Resolve disputes and revise plans when circumstances change.
- Act as a sounding board for state policy makers wishing to make broadband improvements.

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Recommendation 5: Evaluation of Strategies, Financing, and Financial Incentives Used in Other States/Countries to Support Broadband Development and Cost Estimates

Recommendations:

1. Minnesota should initiate a study to develop a wide ranging collaborative funding strategy to support the recommendations of this report. The study should be a creative exploration of a broad range of sources and uses of funds.
2. Minnesota should explore financial options such as tax incentives including property and sales tax credits and exemptions to further provide incentive for private capital investment. (See Appendix D.)
3. Minnesota should encourage and facilitate a variety of partnerships that increase the adoption and utilization of broadband. Partnerships may include local governments, education, health care, libraries, non-profits, providers and a wide variety of other institutions. Increased adoption will make additional private investments possible. (See Appendix E for examples of existing and proposed programs.)
4. Minnesota should encourage minimizing any unreasonable barriers to right of way or easement access and facilitate efficient cooperation related to open trenches and development. (See Recommendation 3.)
5. Minnesota should encourage appropriate utilization of available federal funding to support the deployment of broadband to unserved and underserved populations, as well as to encourage efforts to support broader public adoption of broadband services.

Over $8 Billion Investment to Date

Over the past several decades Minnesota's telecommunications, cable and broadband providers have invested in excess of $8 billion in private capital to build out, upgrade and maintain networks that currently offer broadband services in Minnesota. In addition, through RUS loans and co-op financing other providers have invested over $50 million. Municipal entities have also raised and deployed about $35 million to offer such service.

Current Availability

Using the current FCC definition of 768k, provider data compiled by Connect Minnesota as of June 2009 showed that 94% of Minnesota households statewide had 768k (or greater) downstream broadband service available (excluding satellite based broadband). This means that about 97,282 Minnesota households were unserved by any wireline or wireless broadband provider, and upgrades will be required in some areas in order to meet the 2015 goals.

Based on the Task Force's definition of 10-20 Megabits per second (Mbps) (download) only 18% of Minnesota households have broadband available. This means that about 1,329,548 Minnesota households are underserved and therefore upgrades will also be needed to these households.

While the existing data shows where we are today, broadband availability data will continue to be compiled over at least the next five years under funding made available by the National Telecommunications and Information Administration through its State Broadband Data and Development Grant Program.

Characteristics and Cost Estimates of Various Broadband Technologies

As stated above, it is estimated that Minnesota has approximately 100,000 households who currently don't have access to the Internet. If one were to add cabins, second homes, RV parks, marinas, etc., the cost estimates outlined below will increase accordingly.

Sample Estimates

Wireless. Research published in *Business Week* August 3, 2009[9] shows that, starting with a national estimate of 40 million households unserved or underserved, using wireless as the technology to deliver broadband, the cost of achieving ubiquity in the U.S. would be approximately $1,500 per home.

Using the figure of $1500 per household to provide a "wireless overlay" Internet connection to the unserved homes in Minnesota, results in a cost of approximately $150,000,000. However the downside is that the download and upload speeds would be rather limited. The estimate does not include cost of PCs, other hardware, network maintenance or upgrades.

Wireline. If a wireline connection were made to each unserved home, the costs would increase significantly.

Several studies, detailed below, using a hybrid fiber and coaxial cable-based Docsis 3.0 network (HFC), a fiber and copper DSL network, or a fiber based RF over Glass, show similar cost results. The determining factor is the cost of installing the fiber and coax/copper in the unserved areas. There are many miles of plant and few homes. The DSL system had a slight cost saving in installation because it was able to use some existing copper plant but this was offset by the higher central office costs and the inability of the existing copper to carry high bandwidths for more than a short distance.

It is ultimately the low density of potential customers that drives up the cost of each technology. Based on an average of four homes per plant mile (derived from a sampling of plant mile densities experienced by the rural power cooperative), it is estimated that it would take 11,250 miles of plant to wire the unwired in Minnesota. Using a cost of $15,920 to build each plant mile[10] results in a total estimated cost of $178,304,000. Assuming a 60% take rate and a cost of $461 per customer in headend and in-home costs, an additional $12,447,000 would also be required.

9 http://www.businessweek.com/technology/content/aug2009/tc2009083_226117.htm.
10 Internal cost figures generated at Sjoberg's Inc. and also from analysis by Jaguar Communications.

Thus the total cost to wire the unserved areas with DSL or HFC would run about $190,751,000. These systems would be capable of delivering ultra high-speed Internet.[11]

Clearly, the type of network build-out being considered includes an element of cost, as evidenced by these high-level cost estimates for broadband technologies provided by Elert & Associates of Stillwater, MN:

> Costs to implement and operate broadband systems vary by population density as well as by the type of technology selected. In considering technologies that can support 20 Mbps downstream and 10 Mbps upstream, there are relatively few viable candidates. The technologies capable of delivering this type of capacity are fiber to the premise/fiber to the home (FTTP/FTTH) cable modem service utilizing DOCSIS 3 over hybrid fiber cable (HFC), VDSL2, and Wi-Fi 802.11g or 802.11n wireless.
>
> NOTE: with Wi-Fi it is not possible to guarantee a connection to every premise due to potential blockage by trees, terrain and buildings. In all cases, fiber or very high-capacity microwave would be required (and is assumed) in the middle mile (backhaul) to ensure the desired bandwidths.
>
> Assumptions: Costs are for initial installation only. Use of all fiber optic cabling for FTTP/FTTH; use of coaxial cable in the last ~500 feet in the case of HFC. Operating costs not included.

INITIAL cost per household or business passed

	FTTP/FTTH	Hybrid Fiber Coax (DOCSIS 3)	VDSL2	Wi-Fi 802.11g
Urban	$2,000	$500	(no basis data)	$150
Suburban	$4,000	$1,000	(no basis data)	$300
Rural	$12,000	$2,500	(no basis data)	$900

11 This is a similar cost as reflected in a Free Press article. According to an estimate by the Free Press in December of 2008, certainly the costs per home will be higher in rural areas because of the lower densities. A recent estimate by a rural Vermont FTTH company put the cost per rural home for FTTH at $2,900 ($1,100 to pass each rural home and $1,800 for the actual "hook up" of the home; rural FTTP is perfectly economical,' says Muni Fiber Veteran," Telephony Online, April 29, 2008). Of course, some rural homes are more "rural" than others, while some unserved homes lie in urbanized clusters inside rural areas. It is possible that some of the most extreme rural homes will not see FTTH, instead being served by a high-capacity wireless solution such as LTE. Considering all of these factors, we feel that a cost estimate range of $2,000-$5,000 per unserved home is a reasonable and conservative value. These estimates were further reflected in testimony submitted to the Task Force on August 21, 2009 by various providers. Mr. Daryl Ecker of Park Region Telephone stated that they had applied for Stimulus funding to build an area of unserved population. Their cost estimate was $3900 per household for a FTTH solution. Mr. Mark Birkholtz of Arvig Communications stated that they had applied for 2 Stimulus grants. The first was to fund an FTTH project in a rural unserved area. They project that it will cost $4300 per household to serve 315 homes. The second project involves rebuilding their telephone plant in Twin Valley to an FTTH in order to provide Internet. The estimated cost is $3000 per home in this rural town.

Further analysis of the cost-per-technology differential of the extension of various broadband technologies to unserved areas is contained in a letter the National Telecommunications Cooperative Association (NTCA) filed with the Federal Communications Commission on September 2, 2009, which provided analysis and cost comparisons for fiber-to-the-node (FTTN), fiber-to-the-home (FTTH) and fourth generation (4G) wireless technology.

NTCA concluded that using 4G wireless for broadband development in rural areas would be an appropriate method, especially if a network of towers and core network equipment already exist. However, if a full 4G network had to be deployed from the "ground up", NTCA found that it would be a more costly alternative than FTTN or FTTH.

Additionally the NTCA stated that a network strategy should be based on the long-term costs, potential services, and viability of a platform and that selecting the longest-term strategy is crucial. Primarily based on factors such as performance and operation costs over time, the NTCA concluded that FTTH was better than FTTN and a 4G network; they acknowledged that the initial construction cost was a significant disadvantage, and wireline providers could defray the initial cost via migration to FTTN and then FTTH.

For the single community used in the cost comparison (Gordon, NE an area of 1,370 sq. mi with a population of 503 residents), the NTCA found the total cost to build a FTTH network to be a total of $13,026,200[12].

The effect of geography on network cost was further examined as part of the ICT Regulation Toolkit, which contains a cost analysis for FTTH comparing deployment costs to rural, suburban and urban communities.

In the scenario presented, when establishing a new FTTH network, the dominant cost components include civil work, ducts and cables. The analysis shows that these components make up approximately 60% of the necessary capital expenditures needed to build a FTTH network. The cost of civil work and cables in the access segment escalates in the suburban and rural scenario, due to longer distances. Additionally, in rural settings, ducts and cables in the backbone segment result in a higher capital expenditure than the whole deployment cost of FTTH in urban settings. The analysis also highlights the need for optimization in network design as well as the effect of take-up rate on the cost per subscriber[13].

Further information regarding fiber deployment in rural areas is contained in an application for $52 million in ARRA funding by Cook County, Minnesota, to pass 5531 homes and business, which averages to $9,401 per premise. The 5,531 homes and businesses would be passed with 599 miles of fiber for an average of 9 homes per mile of fiber[14].

12 See full filing at: **https://portal.neca.org/portal/server.pt/gateway/PTARGS_0_0_307_206_0_43/http;/prodnet.www.neca.org/wawatch/wwpdf/92ntca2.pdf**.

13 **http://www.ictregulationtoolkit.org/en/Index.html**

14 Find the full Executive Summary for the Cook County Fiber Initiative at **http://www.ntia.doc.gov/broadbandgrants/applications/summaries/1902.pdf**.

The effect of anticipated take rate to network construction pricing is illustrated in an ex parte filing with the Federal Communications Commission by Jaguar Communications on September 24, 2009, which included cost estimates for providing FTTP deployments to six rural Minnesota communities including Blooming Prairie City, Blooming Prairie Twp., Summit Twp., Aurora Twp., Somerset Twp. and Credit River Twp. The estimates included a "high take-rate" (2,497 subscribers) scenario and a "low take-rate" (1877 subscribers) scenario. The "low take-rate" estimate is approximately $3,500.27 per subscriber and the "high take-rate" was $2,762.27 per subscriber.

Using these estimates to deploy FTTH systems in the unserved areas of Minnesota, the cost of serving all 100,000 unserved households would range between $290,000,000 and $450,000,000 (or $2,900 to $4,500 per household). These high costs are primarily the result of the very low population density in the remaining unserved areas.

If the State of Minnesota were to be rewired with fiber optic cable, the cost of doing so has been estimated by the Minnesota Telecom Alliance to cost $10 billion.

Increased Adoption is Key

Increasing adoption among those who already have the capability to receive broadband is not only good for individuals and society, it is also a key factor in facilitating the ability of providers to access further capital for additional deployment.

The Center for Rural Policy and Development has issued yearly "Minnesota Internet Survey" reports from 2001-2007 that track broadband adoption in Minnesota[15].

Broadband Adoption

	Minnesota	Rural	Seven-county Twin Cities area
2007	57.8%	52.3%	62.9%
2006	49.0%	39.7%	57.0%
2005	36.4%	27.4%	43.9%

15 The Surveys can be found at **www.mnsu.edu/ruralmn/research.php#technology**.

In explaining the broadband adoption rate in Minnesota and the differences between rural Minnesota and the Twin Cities, the report by the Center for Rural Policy and Development noted the following:

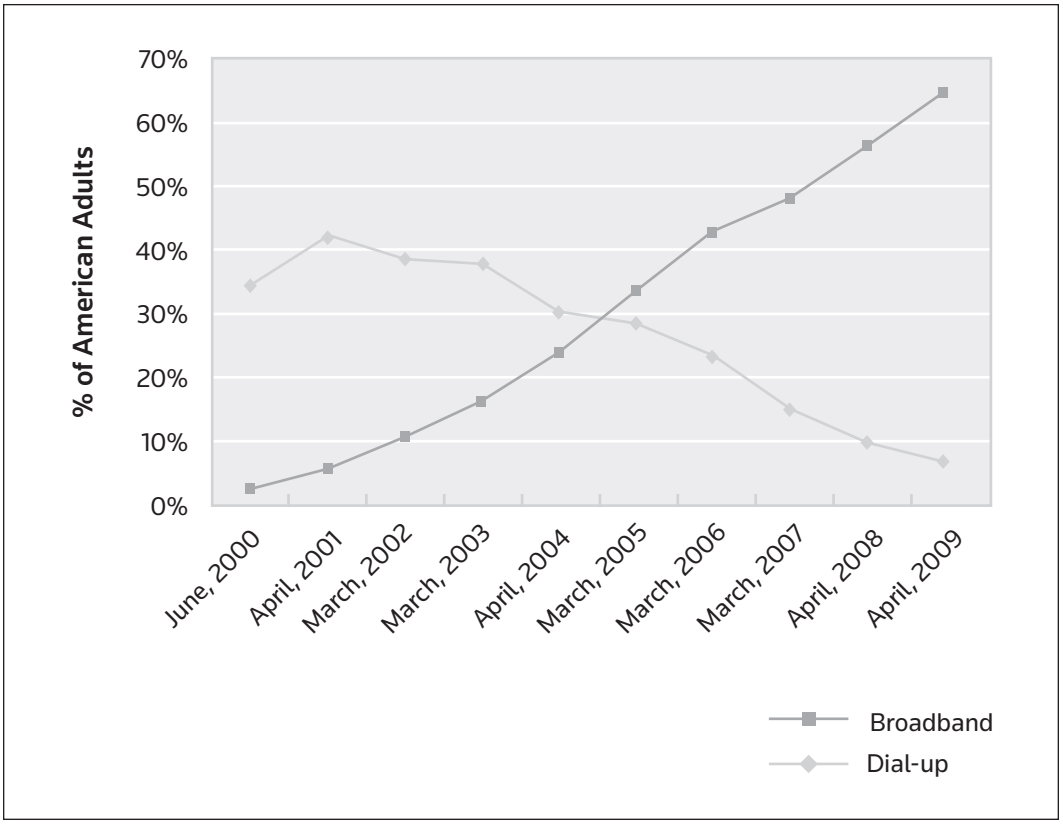
- Between 2001 and 2005, the number of households in rural Minnesota owning computers stayed nearly flat but showed a definite increase in 2006 and 2007, possibly due to the continuing decline in home computer prices and the increase in things to do on the Internet.
- Internet adoption in rural Minnesota moved in lockstep with computer ownership as one would expect and the number of households that own computers but do not subscribe to the Internet has shrunk.
- Rural Minnesota had lagged behind in broadband adoption, possibly due to the older average age of the population, lower average income, and the technical and financial issues of providing high-speed broadband to a population spread over comparatively greater distances than in the Twin Cities. However, the 2007 data showed the gap closing in all three areas surveyed: computer ownership, Internet adoption and broadband adoption.
- Both rural and metro areas have a higher rate of broadband adoption if there are school age children in the household.
- Availability is still an issue in rural areas for those who want broadband but are unable to get it, but only 6.6% of households with Internet said broadband was unavailable to them.
- Age and income are still the best indicators on whether a person has a computer, the Internet or broadband adoption. Adoption rates in the 65+ age group continue to increase as today's seniors are introduced to computers and those in the middle-age group bring their technology with them into the older age groups. Income is less easily addressed. Possibly computers and Internet access will never reach a price that everyone can afford. The survey results showed that there is growth in the lowest income groups and, in fact, a larger percentage of households in the lower income groups had computers and Internet access in the rural areas than in the metro area.

Another study, "Rural Businesses and the Internet: The Integration Continues"[16] assessed the adoption and utilization of the Internet among rural Minnesota businesses. General findings of the study, showed that 89.7% of rural businesses are now operating online compared to 65.5% in 2004. If a company is using a computer in its business (91.9% do) then the business almost certainly has at least one computer connected to the Internet. Today only 4.3% of those businesses connect to the Internet using a dial-up connection compared to 38.6% in 2004. Eighty-five percent of the respondents indicated that their connections speeds currently meet their needs; however, only 37% have confidence that the current connection speeds will adequately meet their needs in 24 months.

Although more recent state-specific information is unavailable, national surveys suggest that this past year has seen a marked increase in broadband adoption.An April 2009 survey by the Pew Research Center's Internet & American Life Project[17] shows that 63% of adult Americans now have broadband Internet connections at home, up from 55% in May, 2008.

16 www.umcedacenter.org
17 http://www.pewinternet.org/Reports/2009/10-Home-Broadband-Adoption-2009.aspx

Fig. 29 | **Trends in home internet access: broadband vs. dial-up: The percentage of adults who have broadband or dial-up, 2000-2009. Source: Pew Internet & American Life Project surveys.**



The Pew survey found that the greatest growth in broadband adoption in the past year has taken place among population subgroups which have below average usage rates. Among them:

- **Senior citizens:** Broadband usage among adults ages 65 or older grew from 19% in May, 2008 to 30% in April 2009.
- **Low-income Americans:** Two groups of low-income Americans saw strong broadband growth from 2008 to 2009.
  - Respondents living in households whose annual household income is less than $20,000 saw broadband adoption grow from 25% in 2008 to 35% in 2009.
  - Respondents living in households whose annual incomes are between $20,000 and $30,000 annually experienced a growth in broadband penetration from 42% to 53%.

Public-private-non-profit collaborative efforts can be developed and encouraged in order to increase the adoption and utilization of broadband. Such partnerships may include local governments, education, health care, libraries, non-profits, providers and a wide variety of other institutions. Increased adoption will make additional private investments possible[18].

Comcast recently submitted a list of ideas about how the Federal Communications Commission can address barriers to broadband adoption. In that filing, Comcast suggests the following:

- Fund initiatives around the nation to encourage broadband usage and digital literacy
- Promote public-private partnerships that help provide low cost computers to children who do not have them
- Recommend new tax credits and federal funding mechanisms to support broadband adoption
- Permit agencies to direct funds towards broadband-based services and programs
- Provide tax incentives for telework
- Fund the development of home energy efficiency measuring systems
- Increase funding for a national education awareness campaign
- Remove barriers to the practice of telemedicine
- Accurately address cybersecurity concerns[19]

State Tax and Other Financial Incentives Can Encourage Deployment and Adoption

States across this country provide tax incentives to spur deployment and adoption of broadband services. Examples include various sales or property tax exemptions for broadband equipment and income or sales tax credits to encourage access to broadband, location of facilities and employees telecommuting. A detailed state-by-state listing of such incentives is set forth as Appendix D. Also reflected in Appendix D are examples of state broadband funds, such as the California Emerging Technology Fund (funded by AT&T and Verizon merger approval funds) which can be tapped to deploy broadband in unserved areas.

Federal Stimulus Programs are Available to Spur Broadband Deployment and Adoption

American Recovery and Reinvestment Act of 2009 (ARRA)

On February 13, 2009, Congress passed the American Recovery and Reinvestment Act of 2009 (ARRA), which President Obama signed into law four days later. One component of the ARRA was a $7.2 billion appropriation accompanied by a direction to the Department of Agriculture's Rural Utilities Service (RUS) and the Department of Commerce's National Telecommunications Information Administration (NTIA) to expand broadband access to unserved and underserved communities across the U.S., increase jobs, spur investments in technology and infrastructure, and provide long-term economic benefits. The result is the RUS Broadband Initiatives Program (BIP) and the NTIA Broadband Technology Opportunities Program (BTOP). NTIA is also engaging in broadband mapping activity pursuant to the State Broadband Data and Development Grant Program that implements the joint purposes of the ARRA and the Broadband Data Improvement Act (BDIA).

18 Appendix H outlines many examples of existing and proposed broadband adoption and digital literacy programs.
19 See referenced letter at **https://portal.neca.org/portal/server.pt/gateway/PTARGS_0_0_307_206_0_43/http%3B/prodnet.www.neca.org/wawatch/wwpdf/924comcast.pdf**.

Broadband Initiatives Program (BIP)

The ARRA appropriates a total of $2.5 billion for RUS to distribute to BIP applicants for broadband infrastructure projects, through grants, loans and/or loan guarantees. To be eligible for BIP funding, an application must demonstrate that at least 75 percent of the proposed funded service area qualifies as a "rural area without sufficient access to broadband service to facilitate rural economic development." RUS has determined that to satisfy this benchmark, projects must serve at least 75 percent "unserved"[20] or "underserved"[21] "rural areas."[22]

Broadband Technology Opportunities Program (BTOP)

Funded at $4.7 billion, BTOP provides grants to support the deployment of broadband infrastructure in unserved and underserved areas, to enhance broadband capacity at public computer centers, and to encourage sustainable adoption of broadband service. Absent a waiver, awardees under BTOP will be required to provide matching funds of at least 20 percent toward the total eligible project cost (in-kind contributions may be counted toward the matching requirements in many circumstances). State Broadband Data and Development Grant Program is a competitive, merit-based matching grant program to provide grants for states, or their designees, to gather state-specific data on the availability, speed, and location of broadband services. The data the states collect and compile, including publicly available state-wide broadband maps, will also be used to develop a comprehensive, interactive national broadband map that NTIA is required by the ARRA to create and make publicly available by February 17, 2011.

The state should encourage appropriate private provider utilization of available federal funding to support the deployment of broadband to unserved and underserved populations, as well as to encourage efforts to support broader public adoption of broadband services.

20 An "unserved" area is defined as one composed of one or more contiguous census blocks, where at least 90 percent of households lack access to facilities-based, terrestrial broadband service, either fixed or mobile, at the minimum broadband transmission speed. A household has access to broadband service "if the household can readily subscribe to that service upon request." Satellite service is excluded from this definition.

21 An area may qualify as "underserved" for Last Mile projects if: 1) no more than 50 percent of the households in the proposed funded service area have access to facilities-based, terrestrial broadband service at greater than minimum broadband transmission speed; 2) no fixed or mobile broadband service provider advertises broadband transmission speeds of at least three megabits per second downstream in the proposed funded service area; or 3) the rate of broadband subscribership for the proposed funded service area is 40 percent of households or less. A proposed funded service area may qualify as underserved for Middle Mile projects if one interconnection point terminates in a proposed funded service area that qualifies as unserved or underserved for Last Mile projects.

22 A "rural" area is defined as "any area, as confirmed by the latest decennial census of the Bureau of the Census, which is not located within: 1. a city, town, or incorporated area that has a population of greater than 20,000 inhabitants; or 2. an urbanized area contiguous and adjacent to a city or town that has a population of greater than 50,000 inhabitants. For purposes of the definition of rural area, an urbanized area means a densely populated territory as defined in the latest decennial census of the U.S. Census Bureau.

Sources of Funds

Current examples of funding sources available to implement the deployment and adoption initiatives discussed in this report may include:

Federal Sources of Funds

- Federal Communications Commission
  - E-Rate
  - Rural Health Initiative
- Housing and Urban Development agencies
  - Block grants
- NTIA – BTOP
- Universal Service Fund
- USDA – RUS

State Sources of Funds

- General Fund
- Bonding
- Attorney General (telecomm fines and penalties)
- Economic development agencies
- Emergency management agencies
- Housing and community development agencies
- Tobacco settlement funds
- University of Minnesota and U of M Extension

County and Municipal Sources of Funds

- Economic development programs
- Emergency management agencies
- Housing and community development agencies
- Poverty agencies
- Bonding

Nonprofit-Sector Sources of Funds or Fund-raising Assistance

- Foundations (e.g.,)
  - Benton Foundation
  - Blandin Foundation
  - Library foundations
  - Minneapolis Foundation
  - Pew Charitable Trust
  - St. Paul Foundation
  - Wilder Foundation

- Charities (e.g.,)
  - Catholic Charities
  - Council of Churches
  - United Way
- Non-profit corporations (e.g.,)
  - Chambers of Commerce
  - MN Council of Foundations
  - MN Council of Nonprofits
  - MN League of Cities

Public/Private partnerships

Recommendation 6: Evaluation of Security, Vulnerability, and Redundancy Actions Necessary to Ensure Reliability

Goal

Distinguish Minnesota as a secure and reliable place to work, play, and innovate on the Internet. Positioning Minnesota in this way will:

- Provide a competitive advantage for the state.
- Strengthen businesses.
- Protect consumers and citizens.
- Promote the development and early adoption of advanced applications.

The Task Force recommends that the state undertake and fund a detailed study of this issue to determine the advisability and approach to addressing the following goals and the detailed suggestions contained below:

- Ensure that the middle-mile broadband infrastructure in the state has no "single points of failure" in the event of a disaster or attack.
- Ensure that there are multiple diverse high-capacity routes for "commodity" Internet traffic entering and leaving the state.
- Ensure redundancy for public safety. As high-speed broadband network becomes the medium for the communication and delivery of vital functions such as police, dispatch and ambulance services, phone service, and telemedicine services. Backup systems need to be available in the event of the failure of the primary broadband link. For example, in rural Minnesota the failure of the only fiber carrying these vital services to the remote and sparsely populated areas of the state, without a backup option, could result in major public safety concerns.
- Explore peering strategies and the degree to which they can contribute to our security and redundancy goals and reduce our vulnerability.
- Consider exchanging intra-state Internet traffic within the state. This may be a robust way to increase performance and reduce vulnerability by allowing the state to remain a fully functioning "island" in the event of attacks and disasters that happen elsewhere.
- Ensure that there are mechanisms to protect the confidentiality of sensitive information while still making it available to practitioners and policy-makers.

Introduction

The policies and actions necessary to move Minnesota to the front ranks of security, reliability, and redundancy rest fundamentally on establishing a robust ongoing collaboration between a broad range of public, private, and citizen stakeholders. This section of the report describes the scope of the effort, and the way the parts related to each other, while addressing this portion of our legislative mandate.

This approach is structured in the same way as the approach to achieving ubiquitous broadband, because these goals are similarly important to the success of the state, may have an even wider scope, and will be equally challenging to achieve.

Lead

Just as with achieving our other broadband goals, "steady leadership wins the race." Ensuring that the state has secure, reliable, redundant broadband infrastructure is not a one-time project but rather a long-term commitment of leadership talent to an ongoing program of vigilance and collaborative problem solving.

As with achieving our other goals, the Task Force recommends the leadership net be thrown as widely as possible. While the state must continue to play an active convening and enabling role, there is a need to continuously draw on leadership capabilities of all stakeholders.

This leadership function is comprised of three major parts:

- **Mobilize** communities and their human, technical and organizational resources
- **Empower** people and organizations
- **Manage** vision, goals, strategy, and actions.

Mobilize communities and their human, technical, and organizational resources

While working toward secure, redundant broadband as a statewide goal, it is a problem that will ultimately have to be addressed locally. Thus, an important part of its success hinges on security-aware consumers and organizations that understand what resources they have at hand, the resources they need, and the good strategies needed to make the most of these.

Recommendations:

1. Collect best-practice methodologies and tools, and make them available to consumers and organizations that are undertaking security and redundancy efforts.
2. Identify current and planned security and redundancy efforts across the state (such as the Chief Security Officer forum, InfraGuard, and the Center for Strategic Information Systems and Security), and make them available to each community. Strongly encourage collaboration.
3. Identify and endorse an organization (or collaborative) that can provide an ongoing focal point and funding for these tools and activities.
4. Identify technical and professional resources with expertise in this area and share that list with people and organizations in need of assistance.
5. Develop "what's in it for me?" materials to assist in recruiting and retaining public and private-sector participants.

"We cannot afford to discover successful cyber intrusions after-the-fact, accept disastrous losses, and then seek merely to contain them. It requires a broad alliance of departments, agencies, and industry leaders to focus on countering the threat, mitigating vulnerabilities, and enhancing resiliency in order to preserve our national security, national economy, and public welfare."

Dennis Blair, Director of National Intelligence

Hearing on "Annual Threat Assessment of the Intelligence Community" for the Senate Select Committee on Intelligence

February 12, 2009

Empower people and organizations

Much of the work of securing the Internet depends on informed and educated consumers. At the same time, there is an opportunity to increase the value of Minnesota's workforce by improving Internet security skills, skills that are becoming ever more important as we defend our citizens, businesses and online assets from ever-increasing attacks. Indeed, a recently released report[23] from the Partnership for Public Service and Booz Allen Hamilton says, "Our federal government will be unable to combat these threats without a more **coordinated, sustained** effort to increase cybersecurity expertise in the federal workforce." The same can be said for private and public-sector organizations here in Minnesota.

Recommendations:

1. Support efforts to build cybersecurity awareness and skills by coordinating existing efforts (e.g., library programs) and leveraging existing capabilities (e.g., community education, community and technical colleges, and Minnesota's university systems).
2. Provide tax incentives for individuals and organizations that undertake to increase their security skills, assist with helping to reduce the vulnerability of our Internet infrastructure or build out facilities that increase redundancy.
3. Coordinate with jobs programs and encourage the addition of cybersecurity components to each.

Manage vision, goals, strategy, and actions

Bringing secure, redundant, reliable broadband to everyone in the state is a large undertaking, but it will happen much more quickly if the many efforts are well guided and coordinated. In addition, it's very important that all stakeholders have a clear understanding of who is accountable for making this happen.

Recommendations:

1. Include cybersecurity, vulnerability, and redundancy in the remittance of the proposed multi-stakeholder BACM housed in the Department of Commerce to guide the leadership, stimulus and oversight functions outlined in this report.
2. Generate an annual report (perhaps building on this report) that describes the current status ("where we are now"), long- and short-range goals ("where we are going"), and action plans ("how we will get there") with regard to meeting our cybersecurity and redundancy goals.

23 http://ourpublicservice.org/OPS/publications/download.php?id=135

Stimulate

Security, vulnerability, and redundancy are, at their core, issues of "readiness." The focus needs to be on the things that need to happen in order to get ready. Collectively, the state needs to make sure those ongoing, ever more refined, preparations are happening quickly and effectively.

As with the other recommendations, this has to be a multi-stakeholder effort in order to be successful and, the Task Force proposes the creation of the BACM to make sure that these collaborations happen in a timely manner.

Stimulating can come in many forms. This section of the recommendations describes three broad activities:

- **Coordinate** public and private activities that move the state toward secure, reliable and robust broadband
- **Build** facilities, infrastructure and content
- **Incent** funding, demand, and capabilities.

"It's now clear that this cyber threat is one of the most serious economic and national security challenges we face as a nation. It's also clear that we're not as prepared as we should be, as a government or as a country."

President Barack Obama

May 29, 2009

Coordinate public and private activities that move the state toward more secure, redundant broadband

Much of the work of achieving the state's broadband security and redundancy goals will be easier if it is coordinated. Providers and their large customers need to leverage opportunities created by each other's projects. Businesses large and small will benefit from knowing where and when secure, redundant facilities will be added or will become available. Smooth coordination is crucial to becoming more nimble in responding to cyber threats and disasters as well as deploying preventative capabilities.

Coordination should not be limited to within the state. Indeed, the Task Force wishes to avoid the "not invented here" trap and coordinate Minnesota's security, vulnerability, and redundancy efforts with those in neighboring states, across the country, and worldwide.

Recommendations:

1. Identify and support new and existing consortia and partnerships needed to advance these security, vulnerability, and redundancy goals.
2. Plan once; then develop coordinated broadband, electric grid, and energy reliability/ redundancy projects.
3. Dig once; coordinate infrastructure construction projects, such as roads and electrical grid improvements with broadband projects aimed at increasing redundancy and reducing vulnerability.
4. Include this coordination role in the charter of the proposed BACM, but set the expectation that the Council aggressively enlist the ongoing aid of public and private partners (both individuals and organizations) in doing this work.
5. Ensure that the BACM members are aware of and encouraged to attend conferences with similar statewide broadband security councils.

Build facilities, infrastructure, and content

Ultimately achieving secure, less-vulnerable, redundant broadband is about building things: facilities, infrastructure, systems, and response teams, to name a few. The day has passed when the Internet was a discretionary product offered by purely market-driven communications providers. Today, the Internet is an economic and social necessity that is rapidly becoming indispensable to Minnesota's citizens and organizations. While there are strong market forces driving providers towards some of the goals we describe, there is a need to stimulate collaboration, shared infrastructure and services that no single provider could justify or undertake on its own. Minnesota needs to stimulate actions that will fill those gaps in a way that also provides for future improvement as security, vulnerability, and redundancy needs inevitably increase – while maintaining the state as a welcoming place for innovative providers to do business.

There is also the need to build education and training capabilities if goals are to be met because, as many know, awareness drives demand and demand drives deployment. Thus, this section of the report also includes several content-building recommendations.

Recommendations:

1. Initiate a study to develop a wide-ranging collaborative funding strategy to support the recommendations of this report.
2. Support the formation of procurement collaborations by government, educational institutions, and businesses to stimulate deployment of advanced last-mile and middle-mile infrastructure.
3. Promote service-provider collaboration to deliver on the redundancy and reliability goals.
4. Encourage municipalities and regions interested in building broadband networks to participate in incentive programs where their projects could reduce vulnerability and increase redundancy.

Incent – funding, demand, and capabilities

Some actions needed to accomplish security, vulnerability, and redundancy goals will require incentives. In some cases these incentives will have to be monetary, but this section also raises the possibility of nonmonetary incentives (e.g., promotion and recognition) and provides some recommendations to get that started.

Recommendations:

1. Publicize successful security, vulnerability, and redundancy initiatives in the state.
2. Identify other nonmonetary incentives to undertake the actions needed to achieve these goals.

Oversee

Oversight is required so that the state can determine where it stands, determine whether it is on course, recognize and reward successes, and suggest changes when they are needed.

The challenge in this area is found in the competing needs for better information and measurement versus the equally compelling need to protect that information from people and organizations wishing to do harm. The Task Force hopes that the leaders of these initiatives can strike a balance between these competing needs, while recognizing that today the tendency by almost every stakeholder leans too far toward keeping information closely held.

This portion of the recommendations is broken into three sections:

- Track resources (organizational, technical, human) and capability
- Evaluate progress, performance, benefits, technology, and cost
- Reward success and encourage further efforts.

Track resources (organizational, technological, human) and capability

It is clear that better information is required in order to guide policy and action if the state is to achieve its broadband goals. The Task Force was hampered by the lack of reliable information during many of its policy discussions and wants to ensure that subsequent leaders will not face similar hurdles.

The following recommendations describe the information that is needed in order to understand the current situation and areas of need with regard to security, vulnerability, and redundancy.

Recommendations:

1. Develop and implement a mechanism to maintain the confidentiality of sensitive or proprietary information gathered to advance the security, reliability and redundancy of broadband in the state. The Task Force wants to acknowledge that much of the information described below would be detrimental if it were to find its way into public view. At the same time, not collecting and sharing this information between responsible stakeholders is detrimental to achieving our goals.

2. Working through the National Telecommunications and Information Administration (NTIA) – State Broadband Data & Development Grant Program, identify ways to track:
   - Broadband availability – with an eye toward redundancy.
   - Maintain an up-to-date inventory of those locations that have only one physical or logical path to the Internet.
   - Maintain an up-to-date inventory of those locations that are connected to the Internet backbone through a single point of failure.
3. Provide methods and templates to allow local communities and regions to track organizational, technical, and individual-expert, cybersecurity resources and needs.
4. Provide as much data as possible in a public dataset (in addition to maps) that others can use in conjunction with their own data – while at the same time preserving the privacy of the data that must remain confidential.
5. Provide the ability to independently verify the information that is gathered.
6. Generate a semiannual status assessment of security, vulnerability and redundancy.
7. Provide updates to collected data and maps every six months.

Evaluate progress, performance, benefits, technology, and cost

It is not enough to simply measure activity. It is equally important to evaluate what the measures are saying and make suggestions as to what changes are required in order to maintain forward momentum.

Recommendations:

1. The BACM should identify expert staff resources that can be relied upon to assist them with their work as needed. These experts could sometimes be under nondisclosure agreements, when they are required to maintain confidentiality.
2. Establish a working group process to allow formation of multi-stakeholder groups to assist the BACM as needed. Some of these working groups could be managed with very stringent information-disclosure restrictions, which could be helpful given the sensitive nature of some of the information required to address security and redundancy goals.
3. Establish opportunities whereby business and residential consumers can interact on an informational basis with the BACM.

Reward positive action

The Task Force believes that the most desirable course is to focus on rewarding success; especially at early stages in the process of moving the state towards secure, reliable, redundant broadband. However, the Task Force recognizes that circumstances may arise in the future that might best be addressed with rule making, standards setting, or regulation.

Recommendations:

1. Maintain up-to-date, public-facing information "dashboard" describing progress towards reaching the state's security, reliability, and redundancy goals.
2. Maintain and promote an up-to-date list of cybersecurity and broadband-reliability organizations and conferences.
3. Recognize and promote successful efforts.

Recommendation 7: Economic Development Opportunities

Access to high-speed broadband has been shown to enhance economic growth and performance. According to the report "Measuring Broadband's Economic Impact," prepared for the U.S. Department of Commerce, Economic Development Administration, "communities in which mass-market broadband was available experienced more rapid growth in employment, the number of businesses overall, and businesses in IT-intensive sectors, relative to comparable communities without broadband." The report also states that the effect of broadband availability can be observed in higher property values.

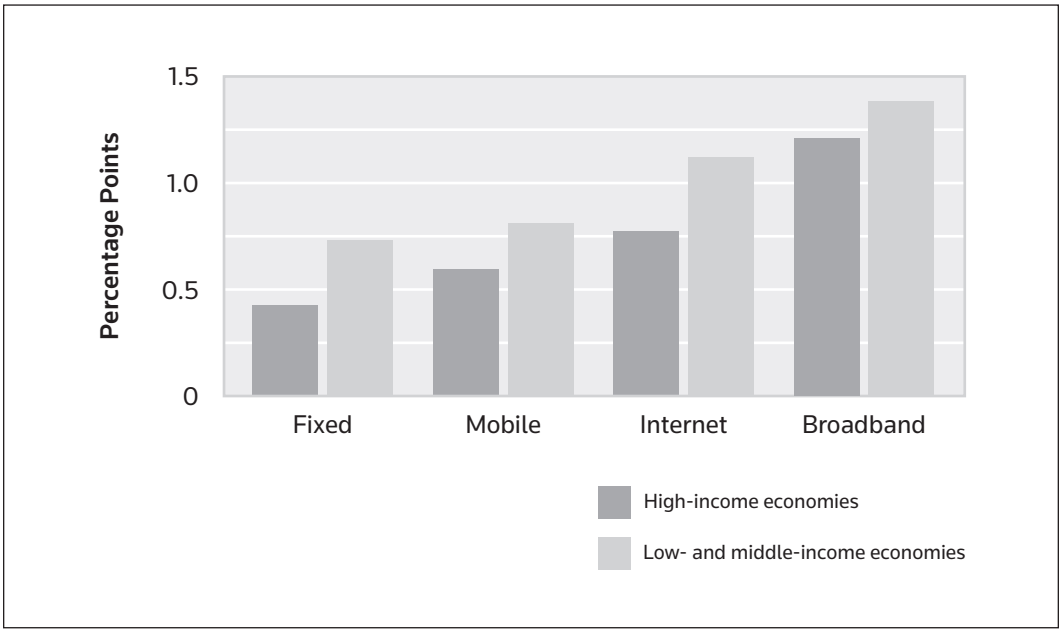
High-speed broadband affords significant opportunities to encourage economic development. A region well served with high-speed connectivity encourages business growth for companies of all sizes. Cluster development occurs when infrastructure is in place to serve businesses that support or rely on related industry. The availability of high-speed broadband also provides an incentive for small and/or home-based businesses to locate and operate in well-served areas, reducing travel-related expenses and traffic congestion.

Figure 30 on the next page shows a July 2009 report from the World Bank on information and communications technologies calculates that every 10 additional broadband subscribers out of every 100 inhabitants are correlated in high income countries with GDP growth increases of 1.21%, while the correlation was even more pronounced for low- and middle-income countries, at 1.38%. The y-axis represents the percentage-point increase in economic growth per 10-percentage point increase in telecommunications penetration. All results are statistically significant at the 1% level except for those for broadband in developing countries, which are significant at the 10% level.

Rural Minnesota cities face unique economic development challenges. Often working on their own, rural cities have to expand their base by reaching beyond the city limits, serving as the hub of activity for geographical regions. In these areas, anchor tenants such as community colleges, health care centers, and libraries, can help justify the cost and effort of providing power and broadband for the community. To keep costs down, we advocate judicious planning. Plan once – develop coordinated broadband, electric-grid, energy retrofit projects; and dig once – coordinate construction projects, such as roads and electrical-grid improvements.

The Task Force believes that the Legislature should consider public/private partnership models in making funding available for technology training, production, and adoption in communities at the margins of technology (i.e., rural, low-income, immigrant, senior populations, and communities of color). Demand for broadband can be stimulated by increasing digital literacy and requiring an adoption component of all broadband projects funded.

Fig. 30 | **Source: World Bank, 2009 – Growth effects of Information and Communication Technologies**



Affordable, fast, and easy access to the Internet can strengthen educational and health services, local business, citizen and civic engagement, access to information, and delivery of government services. Digital knowledge and skills enable people to use and shape the Internet to meet their needs. Minnesota's government, community organizations, and private sector entities should support and promote free or low-cost training. Minnesota should fund digital and media literacy as a component of public education, and support education in libraries, YMCAs, and public housing community centers.

To remain competitive with other states and the rest of the world, Minnesota must make a long-term commitment to developing and maintaining ultra high-speed broadband capability. In today's competitive business environment, the availability of high-speed broadband infrastructure is key to a community's and state's ability to attract and keep new businesses and industries. Access to high-speed broadband can help level the playing field for rural areas by creating opportunities for businesses, job growth, and telecommuting.

Recommendation 8: Evaluation of fhe Benefits of Broadband Access to Organizations and Institutions

By 2015, ultra high-speed broadband capabilities will be necessary not only to connect the public sector and communities, but also citizens and businesses. Each of these entities will need to have adequate access for e.emergency, e.government, e.economic development, e.health, and e.learning.

The paragraphs below take a closer look at each of these areas, and how they will benefit from broadband.

e.emergency

Minnesota's public safety and emergency response organizations need broadband so they can rapidly share information between public health, safety, and emergency responder entities and private entities. Broadband is also required for cybersecurity, 24/7 availability, fault protection, and to support seamless disaster management between branches and levels of government, as well as to expand capacity and connectivity for the Public Safety and Homeland Security Networks of Minnesota.

The Task Force believes that it is necessary to ensure a network connection to every public sector emergency responder facility (i.e., sheriff, police and fire, PCA, public health locations) as well as each of the 63 National Guard armories and training centers.

e.government

Minnesota's health, welfare, and public service delivery needs require high-speed connectivity across all branches and levels of government. High-speed connectivity is necessary to make needed improvements for connectivity to and between government facilities, citizens, and businesses, including adding or improving capabilities for remote services for civic and citizen engagement, sharing information among governmental agencies, and providing infrastructure for alternative service delivery models (telecommuting, neighborhood service centers, communication and collaboration between units of government). In addition to high speed, the state information infrastructure must provide for confidentiality, fault protection, and cost efficiency. (See Role of Government)

e.economic development

Minnesota's need to stay competitive in a global economy requires citizens and businesses, including home-based businesses, to have cost-effective, high-speed broadband connectivity. Examples include: access to global markets, the need to share and move information between locations, the need to provide employee telecommuting and business opportunities (which will result in lower costs and increased retention). (See Recommendation 7: Economic Development Opportunities)

e.health

The Task Force's broadband recommendations will enable Minnesota to continue as a leader in providing high-quality, cost-effective, accessible healthcare.

Access: Many Minnesota citizens would benefit from having reasonably priced high-speed Internet available to their organizations and homes. The lack or high cost of high-speed broadband can prevent a hospital, clinic, or senior care center from offering many existing technologies. Consumers, in particular those who live outside population centers or who are homebound, could take advantage of home healthcare applications for remotely monitoring and sharing their blood pressure, glucose readings, or heart rates with their provider. People across the state could take advantage of the coming e-care visits; capabilities coming onto the market for virtual Web video delivery experience for many common consultative and some diagnostic activities; and avoid the time, travel, hassle, expense, and exposure of visiting a clinic. People can telecommute for a variety of business functions (e.g., coders, billers, transcriptionists), and when it may be necessary to provide socially distant working conditions in the case of an epidemic situation. Additionally, providers and consumers would be able to access and share medical information to ensure accurate information is available when needed.

Extending Quality Services: High-speed broadband provides organizations the opportunity to offer advanced specialty services through telehealth applications such as the eICU, telepsychiatry, and teleradiology. These and other similar applications bring highly trained specialists to communities that cannot otherwise offer these services locally. As a result, patients are treated earlier in their disease process and can remain in their community.

Cost: Everyone is experiencing the growing cost of healthcare. As baby boomers age, healthcare costs are projected to increase far above what the current model can support. Telehealth and e-care Web video delivery services, which require high-speed broadband, can support the changes that are needed in the current healthcare delivery system. For example, by providing high-speed broadband access to every home, the current healthcare model can change for many. How? Home monitoring and home healthcare applications can prevent acute illness that drives costs up, and assist in daily maintenance of many conditions at much less cost than expensive office visits. In addition, having people leave their homes and communities to seek distant specialty care is extremely costly. Patients as well as family members must often take time off work and be away from home when they need to travel for care that is not offered locally.

"'Telehomemonitoring' is a lifeline to keep people with fragile health at home longer."

Stuart M. Speedie, Ph.D.

Institute for Health Informatics

University of Minnesota

e.learning

Minnesota's education community, made up of K-12 schools, higher education institutions and public libraries, needs an open network infrastructure that allows interconnectivity, connections to each other and access to Internet2. At the same time, e.learning applications require security, capacity, availability, and world-wide connectivity.

Many of these technologies and applications are not available to Minnesota's educational community. They need available expandable bandwidth, additional computer workstations, intranets, increased wireless access and support personnel to offer these opportunities to students, adult learners, and citizens of Minnesota in order to participate in the global educational arena. For many students and members of the general public, Minnesota's educational community is the first point of formal and structured access to the world of technology. Equipping and supporting schools and libraries is fundamental to the establishment of Minnesota as a global leader.

This advanced capability is necessary for the following:

- Student Web-based learning systems
- Data-driven decision-making systems with a Minnesota orientation
- Instructional management systems for tracking and accountability
- Electronic video-streamed and Web-based curriculum resources
- Student access to educators, counselors, and student services
- Shared interactive television including telepresence, hybrid online/video, and online courses and instructional resources
- High-stakes testing and assessment with various data collection devices
- Secure student information storage, transfer, and reporting with common protocols
- Access to reference and research resources
- Network bandwidth traffic analysis and management
- Library Web-based resource and information systems
- Cost effective Voice over Internet Protocol (VoIP) applications
- Internet2
- Seamless data and video connectivity between K-12 schools, higher education and public libraries and to state agencies, cities, and counties to allow for exchange, use, and delivery of resources and services.
- Internet access necessary for schoolwork after hours
- Locally-proctored online tests
- K-12 and higher education online classes for both distance students and students without home access to the Internet
- ELM (Electronic Library for Minnesota) databases
- Parent and student access to school information and records outside of school hours, including those without Internet access at home or those with dial-only access

In addition, Minnesota's K-12 schools, higher education institutions, and public libraries need increased and, readily expandable bandwidth to provide life-long learners:

- Access to online library catalogs for both in-house and web-based use
- Interlibrary loan and resource sharing across the state through the MnLINK database
- Internet access and research assistance.
- Access to hundreds of electronic databases and thousands of e-books

Finally, Minnesota's educational community needs sufficient bandwidth and public access computer workstations to provide Internet access to the digitally disadvantaged. Increased capabilities would be used to::

- Provide Internet access to thousands of Minnesota citizens
- Provide high-speed stable access to those who live in underserved dial only areas
- Assist beginners in computer use basics and Internet usage
- Assist the unemployed in filling out forms and filing claims
- Assist the unemployed in resume writing and job searches
- Provide email access to those without other means of attaining an account

The Task Force believes that K-12 schools, higher education and public libraries should receive bandwidth on an as-needed basis, with continued funding by the state of Minnesota and the federal e-rate program. Also the Task Force believes that K-12 schools and public libraries should continue to fund interior wiring and network hardware, computer workstations and training for the public through local funds.

SECTION 5:
CONCLUSION

SECTION 5: CONCLUSION

In public policy, as in life, it is rare to find yourself in a position to truly make a difference.

Being a member of this Task Force has been one of those rare opportunities. We all realized, from the first meeting, that by being on this team we had a chance to influence the game. We are privileged to be in a position to bring to Governor Pawlenty, the legislature, and the general public a set of ideas and plans that will impact how we think and act about broadband in Minnesota.

A good broadband infrastructure *really* can make a difference for our state. Not only will it provide new economic opportunities; it will also position Minnesota to take the lead in other areas of life, some of which we might not know about today. Much of the innovation that will happen over the next few decades will have the Internet as a foundation. Having a ubiquitous ultra high-speed infrastructure will allow our businesses to compete, our entrepreneurs to invent, and our people to thrive. We can make Minnesota a more vibrant and more innovative place to live.

With the issuance of this report, the job is not done. It just begins anew. The recommendations in our report are only as good as their implementation. It is critical for all parties involved to ensure that there is follow-through and that the momentum continues behind these initiatives. Much effort and study is still needed.

We would like to encourage you, the reader, to make every effort to support the objectives outlined in this report. Together, we can make Minnesota all it deserves to be.

APPENDICES

APPENDIX A – LEGISLATIVE CHARGE

S.F. No. 1918, 3rd Engrossment - 2007-2008th Legislative Session (2007-2008)

A bill for an act

relating to telecommunications; creating the Ultra High-Speed Broadband Task Force.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF MINNESOTA:

Section 1. **ULTRA HIGH-SPEED BROADBAND GOAL TASK FORCE.**

Subdivision 1. **Establishment; membership.** (a) The governor shall convene an Ultra High-Speed Broadband Task Force to make recommendations to the governor and the legislature regarding the creation of a state ultra high-speed broadband goal and a plan to implement that goal.

(b) The Ultra High-Speed Broadband Task Force consists of:

(1) one member representing higher educational systems, one member representing regional public libraries, and one member representing K-12 institutions or consortia;

(2) one member representing health care institutions located in the metropolitan area, and one member representing health care institutions located in rural areas;

(3) three members appointed by the governor representing telephone companies, one of whom shall represent telephone companies with 50,000 or fewer subscribers located outside the metropolitan area;

(4) one member representing cable communications systems providers located in the metropolitan area, and one member representing cable communications systems providers located in rural areas;

(5) one member representing wireless service providers;

(6) one member representing metropolitan area Minnesota counties, and one member representing rural area Minnesota counties;

(7) two members representing Minnesota cities, including one member representing metropolitan area cities, and one member representing rural area Minnesota cities;

(8) four citizen-at-large members representing Internet users, equally divided between business and residential users;

(9) one member representing a labor organization representing communications workers;

(10) the commissioner of commerce or the commissioner's designee;

(11) the commissioner of employment and economic development or the commissioner's designee; and

(12) one representative from the Office of Enterprise Technology.

For the purposes of this paragraph, "metropolitan area" means the counties of Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington, and "rural area" means an area outside of the metropolitan area.

(c) The governor shall appoint the members described in paragraph (b), clauses (1) to (9), and shall designate one of the citizen-at-large members to serve as chair of the task force who shall convene the first meeting after all members have been appointed.

(d) The Department of Commerce shall provide logistical and administrative support to the task force.

(e) By November 1, 2009, the task force shall submit a report to the governor and the chairs and ranking minority members of the senate and house committees with primary jurisdiction over telecommunications policy containing recommendations, including possible legislation, for the development of a comprehensive statewide plan designed to achieve a state ultra high-speed broadband goal that the task force considers appropriate. The report must include, at a minimum:

(1) identification of the level of broadband service, including connection speeds for sending and receiving data, that is reasonably needed by all citizens by 2015;

(2) a description of the policies and actions necessary to achieve the goal established in clause (1), including the elimination of obstacles to investment and the identification of areas in the state that currently lack infrastructure necessary to support broadband service;

(3) a description of the opportunities for the public and private sectors to cooperate to achieve the goal;

(4) an evaluation of strategies, financing methods, and financial incentives used in other states and countries to support the deployment of high-speed broadband;

(5) an evaluation and recommendation of the security, vulnerability, and redundancy actions necessary to ensure the reliability of high-speed broadband;

S.F. No. 1918, 3rd Engrossment - 2007-2008th Legislative Session (2007-2008)

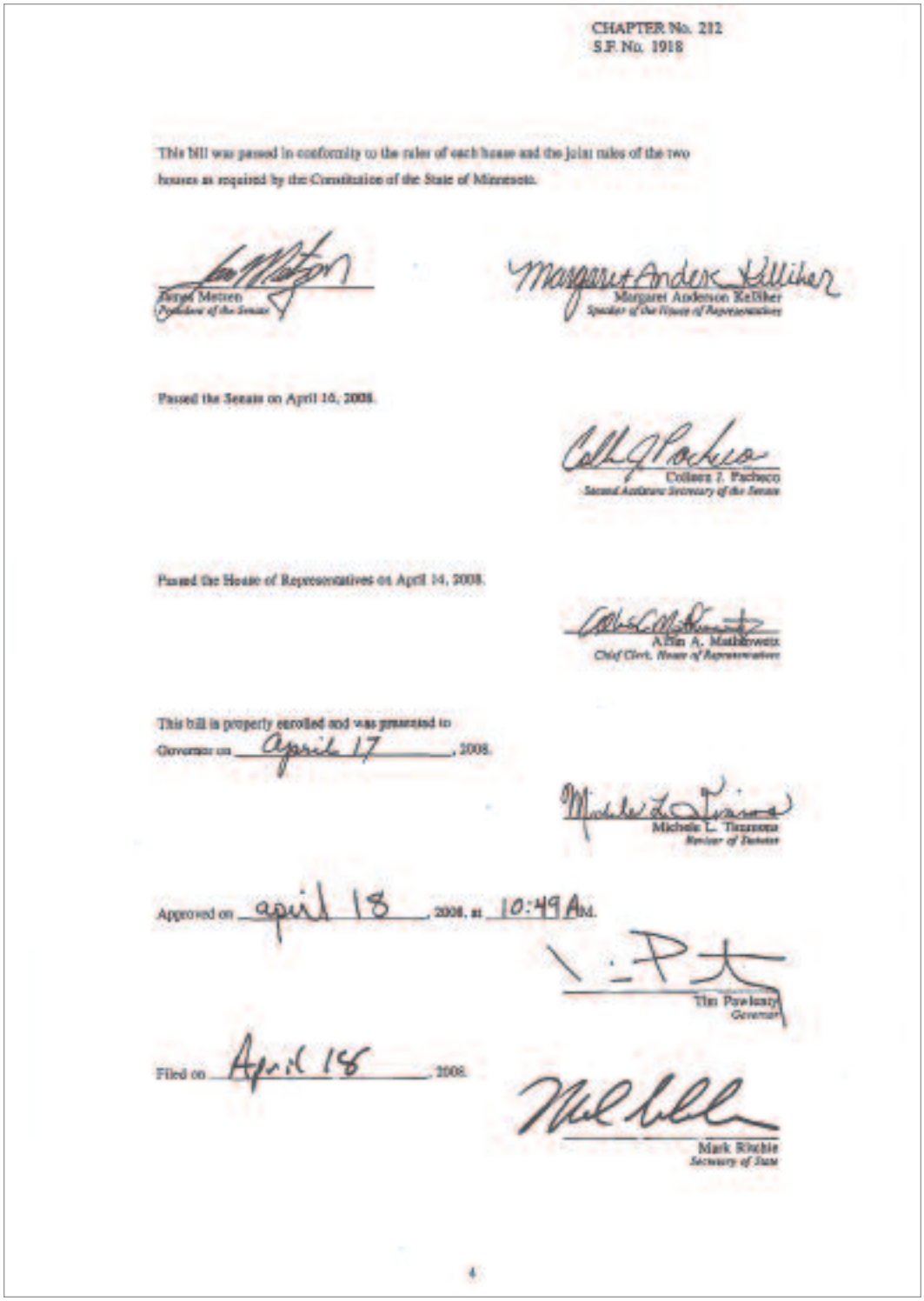
(6) an estimate of the costs of reaching the broadband goal, including capital costs, and identification of who will bear those costs;

(7) a description of economic development opportunities made possible by the wide dissemination of high-speed broadband; and

(8) an evaluation of how access to high-speed broadband can benefit educational institutions, healthcare institutions, community-based organizations, and government institutions.

Subd. 2. **Expiration.** This section expires March 1, 2010.

EFFECTIVE DATE. This section is effective the day following final enactment.



CHAPTER No. 212
S.F. No. 1918

This bill was passed in conformity to the rules of each house and the joint rules of the two houses as required by the Constitution of the State of Minnesota.

Lawrence Pogemiller
President of the Senate

Margaret Anderson Kelliher
Speaker of the House of Representatives

Passed the Senate on April 16, 2008.

Colleen J. Pacheco
Second Assistant Secretary of the Senate

Passed the House of Representatives on April 14, 2008.

Allan A. Mathiowetz
Chief Clerk, House of Representatives

This bill is properly enrolled and was presented to Governor on April 17, 2008.

Michele L. Timmons
Revisor of Statutes

Approved on April 18, 2008, at 10:49 AM.

Tim Pawlenty
Governor

Filed on April 18, 2008.

Mark Ritchie
Secretary of State

APPENDIX B – HISTORICAL MILESTONES

This appendix has been organized into the following sections:

- State Milestones
- Technology Catalysts
- National Drivers
- In-State Broadband Initiatives
- Municipal Broadband Initiatives

Each section chronologically documents events that have taken place at the state and national levels. These events were taken into consideration by the Task Force in the preparation of this report.

State Milestones

1988 MRNet formed as an academic/commercial collaborative statewide service.

First Internet service to the state via a 56K point-to-point line to the NSFNet backbone hub at the University of Illinois at Urbana-Champaign.

1989 First National Science Foundation (NSF) funding for higher education connectivity.

1990 MRNet builds a statewide network connecting many outstate educational organizations. A few outstate ISPs are also hooked in at the remote hub sites.

1991 MRNet connection to the Internet backbone upgraded to a T1 connection.

1992 Joint MRNet/University of Minnesota connection to CICNet Chicago via multi-T1; 1992-1995 launched.

1993 Commercial Internet begins rapid growth.

The first statewide dial-up service, InforMNs (Internet for Minnesota Schools) was deployed.

1994 Arrival of independent ISPs. The first independent ISPs popped into existence, using the low cost and ubiquitous presence of MRNet's infrastructure.

Independent Telco entry into rural Internet.

1995 Launched joint MRNet/University of Minnesota connection to MCI Chicago via 45 Mb DS3.

Growth of the commercial Internet. The transition from R&D to commercial use (NSF NAP/RA/vBNS solicitation, et al.).

1996 Independent ISPs (VISI and gofast.net) add non-MRNet DS3 connections to national backbone networks.

1997 gofast.net (local ISP) and Continental Cablevision (Roseville) collaborate on first Internet access delivered over cable in the state.

gofast.net (local ISP) delivers first wireless Internet access.

1998 MNET initiated. MNET rapidly extended access to the public sector all over the state.

Local ISPs VISI and gofast.net deliver first DSL Internet access.

Northern Lights GigaPoP established. The University of Minnesota established a regional connecting point to Internet2 to serve the regions research and education community.

Technology Catalysts

1990 The RS/6000 AIX-based workstation was introduced by IBM. The RS/6000 legitimized the Unix workstation in business environments. Businesses began buying the workstations and giving them to their IT departments to figure out. IT staff went looking for Unix information and found that it was all on the Internet; businesses soon began connecting to the Internet in significant numbers.

The Gopher protocol and original Gopher viewer application was developed at the University of Minnesota.

1993 The Mosaic browser for the World Wide Web protocol was released.

U.S. West launches a statewide frame relay service. Eventually this service was priced on a distance-insensitive uniform basis statewide. This enabled many outstate organizations to be connected to the MRNet outstate hubs in Moorhead, St. Cloud, Duluth, and Rochester at prices comparable to those in the Twin Cities.

National Drivers

1986 NSFNET goes online and connects the supercomputer centers at 56,000 bits per second – the speed of a typical computer modem today. A variety of regional research and education networks, supported in part by NSF, were connected to the NSFNET backbone, thus extending the Internet's reach throughout the United States.

1993 NSF begins transition to commercial providers. Commercial firms note the popularity and effectiveness of the growing Internet and build their own networks. The Internet architecture created in 1993 remains, for the most part, in place today.

1995 The NSFNET backbone is decommissioned.

1996 Telecommunications Act of 1996 opens up the landscape for the growth of competitive local exchange carriers and competitive providers and opened the landscape for the expansion of wireless.

1999 Major telco and cable entry (e.g., AT&T, Sprint, MCI, Baby Bells, Cox, Time Warner) into Internet service occurs.

2003 FCC ruling exempting the telcos from the requirement to share broadband network elements.

In-State Broadband Initiatives and Reports[24]

1985 First major telecommunications report from the Minnesota Telecommunications Council.

1989 Citizens League Report: "Wiring Minnesota: New State Goals for Telecommunications."

1990 The Minnesota Telefutures Study Group is established by the Public Utilities Commission (PUC). to view the PUC order that resulted from the report.

1993 The Learning Network of Minnesota (LNM) is established by the Minnesota Legislature to provide a statewide, high-speed telecommunications highway designed to enable higher education institutions to provide courses through distance learning.

1995 The LNM is expanded to establish links to connect K-12 public schools and public libraries with the existing higher education network.

The Minnesota Rural Telecommunications Conference resulted in a report, "A Shared Vision for Minnesota."

1999 The Ventura administration issues its Telecommunications Strategic Plan.[25]

2000 The Regional Library Telecommunications Aid (RLTA) program is launched.

2001 The Legislature provides funding for school district and public library telecommunications access through separate funding streams.

2003 The Blandin Foundation[26] launches its website. To date, the results are as follows:

- Supported ongoing policy discussion and relationship building at the Strategy Board level, including the adoption of a Broadband Vision with supporting Principles
- Approved 39 community-driven broadband market development and implementation grants in 33 communities that positively impacted broadband adoption
- An initial $352,500 investment by the Blandin Foundation has leveraged an additional grant from the state of Minnesota for $250,000, plus at least $627,300 in matching funds from the communities, for total new investment in broadband capacity of over $1,229,800.
- Built community leadership capacity through conferences, videoconferences and webinars, Web resources, and onsite technical assistance
- Stimulated, through grant making, investments in FTTP networks and telehealth and distance education broadband-based applications

24 Reports can be found at **http://www.ultra-high-speed-mn.org/CM/Custom84.asp**.
25 **www.utilityregulation.com/content/reports/MNstrategicplan.pdf**
26 **http://broadband.blandinfoundation.org**

Municipal Broadband Initiatives

2004 Eagan Technology Task Force completes their initial report.[27] Go to to view the report.

The city of Buffalo built a network supporting more than 100 business and residential users

The city of Chaska launched municipal Wi-Fi for use by business, public services, and the residential population.

2005 The city of Windom lays a fiber network. The network runs entirely through underground conduit and passes 2,000 homes and 300 businesses.

2007 The Broadband Advisory Committee completes their report on the future of broadband in St. Paul.[28]

The City of Minneapolis has wireless municipal broadband service operated by US Internet.

27 www.ci.eagan.mn.us /upload/images/webmaster/report.pdf
28 www.stpaul.gov/DocumentView.aspx?DID=3821

APPENDIX C – BROADBAND DEPLOYMENT AND ADOPTION INCENTIVE PROGRAMS BY STATE

State	2007 GSP ($m)	Population (2008)	Program	Type	Definition/Description	Citation	Source of Funds	Allocation of Funds
Alabama	165,796	4,661,900	ACCESS		Promotes distance learning.		Act #2005-173 was passed by the Alabama Legislature to appropriate initial funds to develop and begin the ACCESS. For 2006, a federal grant from the Appalachian Regional Commission (ARC) provided additional funding.	24 high schools funded so far.
Alabama			Tax incentive	Tax Rate Reduction	A reduced tax rate applies to certain equipment used in broadcasting by broadcasting companies, cable television companies, and television and radio stations. The reduced tax rate is part of the provisions pertaining to machinery and equipment used in manufacturing, processing and certain utility activities.	AL Code Sec. 40-23-1(a)(10) Sec. 40-23-2(3) Sec. 40-23-4(46) Sec. 40-23-60(5) Sec. 40-23-61(b) Sec. 40-23-62(35)		
Alaska	44,517	686,293	Rural Alaska Broadband Internet Access Grant Program	Grants	Grant funds to acquire and install equipment, facilities, and systems to provide local broadband Internet access in qualifying communities in rural Alaska.		$15 million in federal grants were awarded to the RCA and Commerce.	Grant recipients are required to match awards with cash or in-kind contributions equal to at least 25% of the total project cost
Arizona			Instructional Technology Systems Grants Fund	Grants	Legislative appropriations, gifts, grants and donations to be administered by the Arizona Department of Education (ADE) Fund in FY 2007-08 to the ADE	$10,000,000 is appropriated from the state General		
Arizona			E-Learning Pilot Program	Infrastructure	The three-year E-Learning Pilot Program was established, along with the E-Learning Fund, to help up to ten schools to achieve academic and motivational gains based on the state and national average.		The Fund received an appropriation of $3,000,000 in FY 2006-07 to the ADE for the Pilot Program	

State	2007 GSP ($m)	Population (2008)	Program	Type	Definition/Description	Citation	Source of Funds	Allocation of Funds
Arizona			Tax incentive	Exemption	(1) Sales tax exemption for tangible personal property sold to persons engaged in business classified under for the telecommunications classification. (2) Sales tax exemption Machinery & Equipment used by direct broadcast satellite television or data transmission facility.	(1) AZ Rev. Stat. § 42-5061(B)(3) (2) Ariz. Rev. Stat. § 42-5061(B)(16)		
Arkansas	95,371	2,855,390	Arkansas technology infrastructure fund	Grants	The creation of an Arkansas Technology Infrastructure Fund makes money available to state agencies and institutions of higher education for information technology projects. Intends to accelerate the implementation of electronic government to provide citizens services in a more cost effective and efficient manner.		Savings that accrue to state agencies from reductions in the cost of providing services to citizens as a result of employing technology will be deposited in this fund.	
California	1,812,968	36,756,666	California Advanced Services Fund	Grants	Promote broadband services in unserved areas of California.		0.25% all-end-user surcharge on intrastate telecom. (Sunsets 2011)	$100M in grants to companies to promote BB in unserved areas.
California			California Emerging Technology Fund	Grants	A non-profit corporation established pursuant to requirements from the California Public Utilities Commission in approving the mergers of SBC-AT&T and Verizon-MCI.		AT&T and Verizon will contribute a total of $60 million over 5 years (per merger approvals).	
California			California Tele-connect Fund	Discounts	Provides 50% discount on selected telecommunications services to qualifying schools, libraries, government-owned and operated hospitals and health clinics, and community based organizations.		0.79% surcharge on all end-users of intrastate telecommunications services.	
Colorado	236,324	4,939,456	Colorado Multi-use Network	Infrastructure	Public/private partnership with Qwest to build a high-speed fiber-optic network for the State of Colorado. Focus on rural areas. The original requirements of that were toprovide at least 20MB of connectivity in each of the State's county seats. In practice, the smaller and more remote counties have received less (10 MB).		Funded partially through the Colorado Digital-Divide Elimination Fund (CDEF), a 23% bill surcharge	The estimated cost for the proposed network is: Capital: $13.5 million (One time cost). Operating: $13 million annually.[1]

[1] http://www.nitc.state.ne.us/nitc/network/Documents/Summaries/Colorado_MNT_summary.pdf

State	2007 GSP ($m)	Population (2008)	Program	Type	Definition/Description	Citation	Source of Funds	Allocation of Funds
Colorado			Rural Technology Enterprise Zone Income Tax Credit	Infrastructure	Promote the development of the infrastructure needed to promote Internet access in rural areas.		N/A	Any taxpayer that makes a qualified capital investment in technology infrastructure in Rural Technology Enterprise Zones may claim an income tax credit of 10% of the total investment made Credit claimed shall not exceed $100,000 per year
Connecticut	216,266	3,501,252	N/A	N/A	N/A	N/A	N/A	N/A
Delaware	60,118	873,092	N/A	N/A	N/A	N/A	N/A	N/A
District of Columbia	93,819	591,833	Tax incentive	Exemption	A limited exemption is provided for property purchased by a toll or wireless telecommunication company. Further, property purchased by a utility or public-service company for use or consumption in furnishing a commodity or service is exempt from tax if thecompany is subject to a gross receipts, mileage, or toll telecommunicationstax covering that commodity or service.	Sec. 47-2005(5) Sec. 47-2206	N/A	N/A
Florida	734,519	18,328,340	Florida statute § 220.183	Tax Credits	Provides income tax credits to broadband providers for any project designed to increase a community's access to broadband facilities.		N/A	Credit of 50 percent of a "community contribution" against any tax due for a taxable year. Max. $200,000 in annual tax credits.
Florida			Tax incentive	Exemption	The rental of poles, conduits, fixtures, and similar improvements located on public or private streets or rights-of-way occupied or used by a utility or provider of communications services for utility or communications or television purposes is not subject to tax. Separate exemption also applies to property, wherever located, on which the following are placed: towers,	Sec. 212.08(5)(b)(1) &(2)&(5)(n) Sec. 212.031 Sec. 212.05(1)(f)		

State	2007 GSP ($m)	Population (2008)	Program	Type	Definition/Description	Citation	Source of Funds	Allocation of Funds
					antennas, cables, accessory structures, or equipment, not including switching equipment, used in the provision of mobile communications services. In addition, towers used in the provision of mobile communications services, are considered to be fixtures.			
Florida			Tax incentive	Credit	(1) Qualified Target Industry Refund (2) Business Property Located in Enterprise Zone	(1) Fla. Stat. Ann. § 2 (2) Fla. Stat. Ann. § 212		
Georgia	396,504	9,685,744	Georgia Tax Code	Tax Credit	Tax credit of to employees who participate in programs that encourage telecommuting, which increases the demand for broadband in all communities.		N/A	Up to $1,200 per employee.
Hawaii	61,532	1,288,198	Hawaii Revenue Statute § 235-110.51	Tax Credit	Costs may be deducted if the building's telecommunications facilities are upgraded to high-speed telecommunications systems that can provide Internet access, direct satellite communications access, and videoconferencing facilities.		N/A	Up to 4 % of a commercial building's renovations costs.
Idaho	51,149	1,523,816	Broadband Tax Credit	Tax Credit	For qualified equipment and infrastructure.		N/A	3% for up to $750k
Idaho			Idaho Rural Broadband Investment Program	Grants	Provides matching funds for rural BB investment plans		appropriations	$5M in 2007
Illinois	609,570	12,901,563	Program to foster elimination of digital divide	Grants	Grants to public and private organizations seeking to reduce digital divide.		Voluntary donation on telephone bills.	
Illinois			School Technology Revolving Loan Program	Low-cost loans	Loans to school districts to fund technology investments, including networks.		From School Infrastructure fund.	3yr, 2% rate. Since 1999, over $74 million (523 loans) has been loaned to eligible school districts.

State	2007 GSP ($m)	Population (2008)	Program	Type	Definition/Description	Citation	Source of Funds	Allocation of Funds
Indiana	246,439	6,376,792	Tax incentive	State Gross Retail Tax Exemption	Central office equipment, station equipment or apparatus, station connection, wiring, or large private branch exchanges Mobile telecommunications switching office equipment and radio or microwave transmitting equipment, including, towers and antennae are also exempt. National, regional, or local headend or similar facility equipment operated by a person furnishing video services, cable radio services, satellite television or radio services, or Internet access services.	IC 6-2.5-5.13		N/A
Iowa	129,026	3,002,555	Iowa broadband initiative	Infrastructure	Promote broadband deployment in underserved areas		Allows carriers to implement a $2 surcharge to residential and business telephone lines in order to subsidize broadband deployment.	
Kansas	117,305	2,802,134	N/A	N/A	N/A		N/A	N/A
Kentucky	154,184	4,269,245	N/A	N/A	N/A		N/A	N/A
Louisiana	216,146	4,410,796	Tax incentive	Credit	Enterprise Zone Rebate	LA Rev. Stat. Ann. § 51:1787(A) (1)(a)(i)(bb)	N/A	N/A
Maine	48,108	1,316,456	Connect ME Authority	Grants, Loans and others	Reviews proposals for projects that extend broadband to underserved areas. Funds grants, loans and other investments.		Funded through a 0.25% surcharge on all communications services and a one-time $2.5M cash contribution from Verizon.	Has awarded $2.5M in direct grants.
Maine			Maine Learning Technology Initiative	Infrastructure	Promotes technology in education.		Funded through the Maine Learning Technology Endowment: $30M initial funding in 2001.	Not specified.

State	2007 GSP ($m)	Population (2008)	Program	Type	Definition/Description	Citation	Source of Funds	Allocation of Funds
Maryland	268,685	5,633,597	Maryland Broadband Cooperative	Infrastructure	Public/private partnership to promote economic development through the deployment of technology supporting infrastructures.		Receives funding through the Maryland Rural Broadband Coordination Board	
Maryland			Rural Broadband Assistance Fund	Other	A Board will review and approve the disbursement of funds from the Rural Broadband Assistance Fund, and through cooperation with other public, private, and nonprofit entities, it will obtain further resources for establishing broadband communication services in rural and underserved areas in Maryland.		2008 and 2009 budgets include $4M for The RBAF	
Maryland			Rural Broadband Communication Services Act	Infrastructure	Project to deploy fiber-optic backbone lines to rural counties. Private sector completes last mile.			2006: $10M for a three-year project.
Maryland			Tax incentive	Credit	Corporate Income Tax Credit for Property Tax Paid by Telecom Companies /telecomm/	Md. Code Ann. Tax-Gen. See also: http://business .maryo/taxcredit		
Massachusetts	351,514	6,497,967	Massachusetts Broadband Initiatives	Direct investment	Bridge digital divide by investing in infrastructure.		$40M raised through Bond Financing	
Massachusetts			Tax incentive	Exemption	Sales of machinery, or replacement parts thereof, used directly and exclusively in the operation of commercial radio broadcasting or television transmission are not subject to tax.	Ch. 64H, Sec. 1 Ch. 64H, Sec. 6(i), (r), (s), (ww)		
Michigan	381,963	10,003,422	Metropolitan Extension Telecommunications Rights-of-Way Oversight Authority	Admin	Assists providers in cutting through red tape to deploy telecomm infrastructure. Responsible for public right-of-way matters with municipalities, to assess fees on telecommunication providers with facilities in public rights-of-way within a municipality in a metropolitan area, and to make payments to municipalities that have "opted in"		Allowed to recover the costs of rights-of-way use by the providers. Currently, 100% of fees assessed on providers are paid out to municipalities.	In 2008, fees invoiced and collected from providers exceeded $21 million.

State	2007 GSP ($m)	Population (2008)	Program	Type	Definition/Description	Citation	Source of Funds	Allocation of Funds
Michigan			Tax incentive	Exemption	Machinery and Equipment @ 90%: Purchases of machinery and equipment for use or consumption in rendering any combination of taxable communications services are exempt from sales/use tax. The exemption is limited to tangible personal property which is located on the premises of the subscriber and to central office equipment or wireless equipment which is directly used or consumed in transmitting, receiving, or switching, or in the monitoring of switching of a two-way interactive communication. It is presumed that no more than 90 percent of the purchase price of eligible equipment is used for exempt purposes. Therefore, the exemption only applies to 90 percent of the purchase price of the exempt property. The exemption does not apply to distribution equipment such as cable or wire facilities.	Mich. Comp. Laws Ann. §§ 205.54v, 205.94q.		
Minnesota	254,970	5,220,393	Tax incentive	Exemption	Telecommunications machinery and equipment is exempt from sales tax by statute. "Telecommunications machinery and equipment" includes machinery, equipment, and fixtures such as computers, transformers, amplifiers, routers, bridges, repeaters, multiplexers, and other items performing comparable functions, utilized in receiving, initiating, amplifying, processing, transmitting, retransmitting, recording, switching, or monitoring telecommunications services.	Sec. 289A.40, Subd. 5 Sec. 297A.61, Subd. 24 Sec. 297A.68, Subd. 5(d)(11)&35		N/A
Minnesota			Tax incentive	Exemption	Cable television services are specifically taxable by statute as telecommunications services. As such, cable television distributors generally qualify for the telecommunications, cable television, or direct satellite machinery and equipment exemption if they sell telecommunications, cable television, or direct satellite services at retail. However, wire, cable, fiber, poles, or			

State	2007 GSP ($m)	Population (2008)	Program	Type	Definition/Description	Citation	Source of Funds	Allocation of Funds
					conduits are specifically excluded from the definition of "telecommunications equipment" and are therefore taxable. These materials are incorporated into real property when installed and are subject to tax at the time of purchase by the contractor who installs the equipment. Additionally, effective August 1, 2005, these items, as well as all other telecommunications equipment, were specifically excluded from the definition of capital equipment and are, therefore, not eligible for the capital equipment refund available to manufacturers.			
Mississippi	88,546	2,938,618	Mississippi Broadband Technology Development Act	Tax Credit	Tax breaks for providers deploying infrastructure in rural areas.		N/A	From 2003 to 2013. Tax credits range from 5 to 15% of the cost of the equipment is covered by the incentive. Sales tax exemptions range from 50 to 100%. The credits and exemptions can be used for a total of 10 years.
Mississippi			Tax incentive	Exemption	No general exemption: No exemption exists for purchases of telephone, mobile telephone or telegraph equipment. All such equipment is subject to tax at the normal retail rate. Yes for broadband: However, effective until July 1, 2013, an exemption exists for equipment used in the deployment of broadband technologies subject to certain requirements (see Sec. 27-65-101(3)(b)-(c), as amended by Senate Bill 3026). "Equipment used in the deployment of broadband technologies" means any equipment capable of being used for or in connection with the transmission of	Sec. 27-65 101(3) Sec. 27-65-17		

State	2007 GSP ($m)	Population (2008)	Program	Type	Definition/Description	Citation	Source of Funds	Allocation of Funds
					information at a rate, prior to taking into account the effects of any signal degradation, that is not less than three hundred eighty-four (384) kilobits per second in at least one direction, including, but not limited to, asynchronous transfer mode switches, digital subscriber line access multiplexers, routers, servers, multiplexers, fiber optics and related equipment.			
Missouri	229,470	5,911,605	N/A	Tax Credit	Tax Credits to entities opening in or relocating to an economically distressed community. A tax credit that offers incentives for organizations to relocate can have a beneficial effect on the demand for access to service in that community.		N/A	40% per year per entity for a period of three years for high-speed telecommunications equipment costs incurred while opening or relocating a business facility.
Missouri			Tax incentive	Exemption	Until July 1, 2013, an exemption exists for equipment used in the deployment of broadband technologies subject to certain requirements (see Sec. 27-65-101 (3)(b)-(c), as amended by Senate Bill 3026). "Equipment used in the deployment of broadband technologies" means any equipment capable of being used for or in connection with the transmission of information at a rate, prior to taking into account the effects of any signal degradation, that is not less than three hundred eighty-four (384) kilobits per second in at least one direction, including, but not limited to, asynchronous transfer mode switches, digital subscriber line access multiplexers, routers, servers, multiplexers, fiber optics and related equipment.	('1) Mo. Rev. Stat. § 144.030(2)(4) & (5). Southwestern Bell Telephone Company v. Director of Revenue, 182 S.W.3d. 226 (Mo. 2005). ('2) Sec. 144.020.1(1)&(8) Sec. 144.054(3) Sec. 144.610(1) Sec. 144.811		

State	2007 GSP ($m)	Population (2008)	Program	Type	Definition/Description	Citation	Source of Funds	Allocation of Funds
Montana	34,253	967,440	Advanced Telecommu-nications Tax Credit	Tax Credits	Tax incentives for telecommunications carriers to deploy advanced telecommunications services and fund infrastructure improvements.		N/A	Started in 1999. 20% tax credit
Nebraska	80,093	1,783,432	N/A	N/A	N/A		N/A	N/A
Nevada	127,213	2,600,167	N/A	N/A	N/A		N/A	N/A
New Hampshire	57,341	1,315,809	N/A	N/A	N/A		N/A	N/A
New Jersey	465,484	8,682,661	Tax incentive	Exemption	(1) Commercial broadcasting machinery and equipment Receipts from the sale of tangible personal property for use directly in the production of film or video for sale are exempt from sales/ use tax. The exemption applies to all tangible personal property including motor vehicles, replacement parts without regard to useful life, tools, and supplies but does not apply to property when the use is incidental to film or video production. Receipts from installing, maintaining, servicing, or repairing tangible personal property that is directly used or consumed in the production of film or video for sale are also exempt.	(1) NJ Rev. Stat. § 54:32B-8.13(e) (2) N.J. Rev. Stat. § 54:32B-8.13(c)		N/A
New Jersey					(2) Telecommunications machinery and equipment Sales of telephones, telephone lines, cables, central office equipment or station apparatus, or other machinery, equipment or apparatus, or comparable telegraph equipment to a service provider subject to the jurisdiction of the Board of Public Utilities or the Federal Communications Commission, for use directly and primarily in receiving at destination or initiating, transmitting and switching telephone, telegraph or interactive telecommunications service for sale to the general public.			

State	2007 GSP ($m)	Population (2008)	Program	Type	Definition/Description	Citation	Source of Funds	Allocation of Funds
New Jersey			Tax incentive	Credit	Enterprise Zone Sales Tax Incentives	NJ Rev. Stat. § 52:27H-79.		
New Mexico	76,178	1,984,356	N/A	N/A	N/A		N/A	N/A
New York	1,103,024	19,490,297	New York State Council for Universal Broadband	Grants	Awards grants for the development of broadband. Administered by the state's CIO		New York State Legislature appropriation.	$5M in grants in 07-08 $7.5M budgeted for 08-09
New York			Tax incentive	Exemption	(1) Telecommunications Equipment (2) Equipment Used to Provide Internet Access (3) Equipment Used in an Internet Data Center	(1 & 2) NY Tax Law § 115(a)(12-a) (3) NY Tax Law § 1115 (a)(37)		
New York			Tax incentive	Credit	Empire Zones	NY Tax Law § 14		
North Carolina	399,446	9,222,414	e-NC North Carolina	Other	Central authority for all things broadband in North Carolina	Commerce, non-profits, etc...Initial funding of $30M in 2000.	Various sources: NC General Assembly, U.S. Dept of	
North Carolina			Tax incentive	Exemption	(1) Purchases of towers, antennas, and other broadcasting equipment and parts and accessories attached to the equipment by a cable service provider (2) Telecommunications Equipment (3) Business Equipment Used in an Internet Data Center	(1) N.C. Gen. Stat. § 105-164.13(5d); North Carolina Sales and Use Tax Technical Bulletin 20-2. (2) N.C. Gen. Stat. § 105-164.13(5b); North Carolina Sales and Use Tax Technical Bulletin 21-1; 21-2. 3) N.C. Gen. Stat. § 105-164.13(55).		
North Dakota	27,725	641,481	N/A	N/A	N/A		N/A	N/A
Ohio	466,309	11,485,910	Tax incentive	Exemption	Communications Equipment (but excludes Internet) There is an exemption for sales to a telecommunications service vendor of tangible personal property and services used directly and primarily in transmitting, receiving, switching, or recording any interactive, two-way	Ohio Rev. Code Ann. § 5739.02(B)(34).		N/A

State	2007 GSP ($m)	Population (2008)	Program	Type	Definition/Description	Citation	Source of Funds	Allocation of Funds
					electromagnetic communications (including voice, image, data, and information) through the use of any medium including (but not limited to) poles, wires, cables, switching equipment, computers, and record storage devices and media. BUT: This exemption does not apply to equipment used to provide Internet services.			
Oklahoma	139,323	3,642,361	N/A	N/A	N/A		N/A	N/A
Oregon	158,223	3,790,060	Oregon Broadband Tax Credit	Infrastructure	To deploy advanced telecommunication facilities	N/A		Up to 20% of cost of deployment.
Pennsylvania	531,110	12,448,279	Ben Franklin Technology Development Authority	Grants	Provides grants to businesses and communities		Not specified	$52M budget (2007)
Pennsylvania			Broadband outreach and aggregation fund	Grants and Programs	Outreach programs concerning broadband services as well as providing seed grants to aggregate customer demand in communities with no service. Grant program designed to help communities aggregate the demand for broadband service and require local telephone companies to respond to the new demand for services in a more timely fashion.		Funds provided via assessments levied against the participating Incumbent Local Exchange Carriers. Amount will fluctuate and is capped at $5 million per year	06-07 12 grants, $1.8M
Pennsylvania			Tax incentive	Exemption	(1) A processing exemption is provided for tangible personal property purchased by a licensed commercial or educational station, including cable television operators. The property must be used directly and predominantly (more than 50%) in the broadcasting of radio or television programs. (2) An exemption from sales and use tax is provided for tangible personal property used directly and predominantly in rendering a public utility service. As a result, where telecom-munication equipment is purchased for use in rendering a public utility service, such equipment may be purchased exempt from tax.	(1) Sec. 201(d)(12), (k)(8)(D), (o)(4)(B)(iv) (2) PA. State. Sec. 201(c), (d), (k)(8), (m), (o)(4)(B) Pennsylvania Regulation Sec. 32.34		

State	2007 GSP ($m)	Population (2008)	Program	Type	Definition/Description	Citation	Source of Funds	Allocation of Funds
Rhode Island	46,900	1,050,788	N/A	N/A	N/A		N/A	N/A
South Carolina	152,830	4,479,800	South Carolina Rural Infrastructure Fund	Loans	Provides loans and other financial assistance to municipalities, counties assistance to municipalities, counties and others to improve infrastructure, including telecomm.		Not Specified	Not Specified
South Carolina			Tax incentive	Exemption	(1) All supplies, technical equipment, machinery, and electricity sold to cable television systems (2) High Technology Computer Equipment Exemption	(1) S.C. Code Ann. § 12-36-2120(26). (2) S.C. Code Ann. § 12-36-2120(65)		
South Dakota	33,934	804,194	N/A	N/A	N/A		N/A	N/A
Tennessee	243,869	6,214,888	N/A	N/A	N/A			N/A
Texas	1,141,965	24,326,974	Telecommunications Infrastructure Fund (TIF)	Grants	Supports deployment and use of advanced telecommunications in public institutions		1.25% tax on telecommunication services.	$1.5 billion grant program created in 1996.
Texas			Tax incentive	Credit	Enterprise Zone Refund	TX Tax Code Ann. § 151.429		
Utah	105,658	2,736,424	Rural Broadband Service Fund	Grants	Expands broadband across rural areas		"The fund shall be funded by monies appropriated to the fund by the Legislature"	$1M (2007)
Utah			Tax incentive	Exemption	Purchases or leases by telecommunications service providers of telecommunications equipment, machinery, and software with a useful life of one year or more are exempt from Utah sales and use tax. Included in the exemption are: (1) telecommunications enabling or facilitating equipment, machinery, or software; (2) telecommunications equipment, machinery, or software required for 911 service; (3) telecommunications maintenance or repair equipment, machinery, or software; (4) telecommunications switching or routing equipment,	Sec. 59-12-102(99)-(103) - Effective Until January 1, 2009 Sec. 59-12-102(110)-(112)&(114)-(116) - Sec. 59-12-104(64) - Effective Until January 1, 2009 Sec. 59-12-104(61) - Effective January 1, 2009		

State	2007 GSP ($m)	Population (2008)	Program	Type	Definition/Description	Citation	Source of Funds	Allocation of Funds
					machinery, or software, and; (5) telecommunications transmission equipment, machinery, or software.			
Vermont	24,543	621,270	Vermont Telecommunications Authority	Grants and others	Grants, Loans and other financial backing to build broadband service. Infrastructure will be owned by the state and leased to service providers.		Funded through state backed Bonds, capped at $40M.	
Virginia	382,964	7,769,089	Advanced Communications Assistance Fund	Loans/ Grants	Provides loans and grants for the purpose of connecting underserved localities to broadband.		"Funds (...)appropriated by the General Assembly and any gifts, grants, or donations from public or private source"	Not Specified
Virginia			Virginia Broadband Infrastructure Loan Fund	Loans	Money in the Fund will be used exclusively for the financing of broadband infrastructure projects undertaken by a local government. Priority for will be given to projects that provide cost savings, serve two or more local governments, or are in unserved areas.		Not specified	Not Specified in bill.
Virginia			Tax incentive	Exemption	Amplification, Transmission and Distribution Equipment Used by Cable Television Systems There is an exemption available for broadcasting equipment and towers used by commercial radio and television companies, wired or land based wireless cable television systems, common carriers or video programmers using an open video system or other video platform provided by telephone common carriers. In addition, amplification, transmission and distribution equipment used by wired or land based wireless cable television systems or open video systems or other video systems provided by telephone common carriers are also exempt. In addition, an exemption is available for equipment used in the production or distribution of Internet-access services, by providers of Internet service. This	VA Code Sec. 58.1-400.1 Sec. 58.1-602 Sec. 58.1-609.3 Sec. 58.1-609.6(2)		

State	2007 GSP ($m)	Population (2008)	Program	Type	Definition/Description	Citation	Source of Funds	Allocation of Funds
					equipment is defined in part as computer and communications equipment, and software used for storing, processing and retrieving end-user subscribers' requests.			
Washington	311,270	6,549,224	N/A	N/A	N/A			N/A
West Virginia	57,711	1,814,468	West Virginia Broadband Deployment Council	Grants	Administers the Broadband Deployment Fund, which distributes grants for broadband deployment and use.		Legislative appropriations, gifts and others	Not specified.
West Virginia			Tax incentive	Exemption	Purchases of property or services by a person engaged in West Virginia in the business of providing communication services are exempt from tax if the property or service purchased is directly used or consumed in the activity of communications. Effective July 1, 2007, a refundable sales tax exemption is available for a contractor's purchases of materials, services, machinery, or supplies that are directly used or consumed in the construction, alteration, improvement, or repair of a new or existing structure or building, if the purchaser of the contractor's services would have been entitled to claim the refundable exemption if it purchased the services, machinery, supplies or materials directly itself. This includes sales of services, machinery, supplies and materials directly used in the activities of manufacturing and communication.	WV Code Sec. 11-15-2 Sec. 11-15-3 Sec. 11-15-8 Sec. 11-15-8d Sec. 11-15-9 Sec. 11-15-9e Sec. 11-15A-2 Sec 11-15A-3		
Wisconsin	232,293	5,627,967	Education Telecommunications Access Program	Infrastructure	Subsidizes access to broadband for K-12 schools, libraries and colleges.		Not specified	Not specified.
Wisconsin			Tax incentive	Exemption	Broadband Internet Equipment Exemption	WI Stat. § 77.54(48)		
Wyoming	31,514	532,668	N/A	N/A	N/A		N/A	N/A

APPENDIX D – TELECOMMUNICATIONS, BROADBAND AND COMMUNICATIONS EQUIPMENT EXCEMPTIONS AND CREDITS

State	Exemption	Citation	Credit	Citation
Alabama	A reduced tax rate applies to certain equipment used in broadcasting by broadcasting companies, cable television companies, and television and radio stations. The reduced tax rate is part of the provisions pertaining to machinery and equipment used in manufacturing, processing and certain utility activities.	AL Code Sec. 40-23-1(a)(10) Sec. 40-23-2(3) Sec. 40-23-4(46) Sec. 40-23-60(5) Sec. 40-23-61(b) Sec. 40-23-62(35)		
Arizona	(1) Tangible personal property sold to persons engaged in business classified under the telecommunications classification. (2) Machinery & Equipment used by direct broadcast satellite television or data transmission facility.	(1) Ariz. Rev. Stat. § 42-5061(B)(3) (2) Ariz. Rev. Stat. § 42-5061(B)(16)	N/A	N/A
California	N/A	N/A	N/A	N/A
Colorado	N/A	N/A	N/A	N/A
Connecticut	An exemption is provided for sales to a community antenna television (cable) company of equipment that is used to provide telecommunications, high-speed data transmission or broad-band Internet services which offer the capability to transmit information at a rate that is not less than two hundred kilobits per second in at least one direction.	Ct. Code Sec. 12-412(34), (44)&(112) Reg. Sec. 12-412(34)-1(c)(9)		
District of Columbia	Yes: A limited exemption is provided for property purchased by a toll or wireless telecommunication company. Yes: Further, property purchased by a utility or public-service company for use or consumption in furnishing a commodity or service is exempt from tax if the company is subject to a gross receipts, mileage, or toll telecommunications tax covering that commodity or service	Sec. 47-2005(5) Sec. 47-2206		
Florida	Yes: The rental of poles, conduits, fixtures, and similar improvements located on public or private streets or rights-of-way occupied or used by a utility or provider of communications services for utility or communications or television purposes is not subject to tax. Another exemption also applies to property, wherever located, on which the following are placed: towers, antennas, cables, accessory structures, or equipment, not including switching equipment, used in the provision of mobile communications services. In addition, towers used in the provision of mobile communications services, are considered to be fixtures.	Sec.212.08(5)(b)(1)&(2)&(5)(n) Sec. 212.031 Sec. 212.05(1)(f)	(1) Qualified Target Industry Refund (2) Business Property Located in Enterprise Zone.	(1) Fla. Stat. Ann. § 288.106. (2) Fla. Stat. Ann. § 212.08(5)(h).
Hawaii	N/A	N/A	N/A	N/A
Illinois	N/A	N/A	N/A	N/A

State	Exemption	Citation	Credit	Citation
Indiana	**Yes:** Central office equipment, station equipment or apparatus, station connection, wiring, or large private branch exchanges Mobile telecommunications switching office equipment and radio or microwave transmitting equipment, including, towers and antennae are also exempt. **Yes:** National, regional, or local headend or similar facility equipment operated by a person furnishing video services, cable radio services, satellite television or radio services, or Internet access services.	IC 6-2.5-5-13		
Kansas	N/A	N/A	N/A	N/A
Louisiana	N/A	N/A	Enterprise Zone Rebate.	La. Rev. Stat. Ann. § 51:1787(A)(1)(a)(i)(bb).
Maine	N/A	N/A	N/A	N/A
Maryland	N/A	N/A	Corporate Income Tax Credit for Property Tax Paid by Telecom Companies	Md. Code Ann. Tax-Gen. § 10-708. See also: http://business.marylandtaxes.com/taxinfo/Tax credit/telecomm/default.asp
Massachusetts	**Telecom: No.** **Broadcast & Cable: Yes.** Sales of machinery, or replacement parts thereof, used directly and exclusively in the operation of commercial radio broadcasting or television transmission are not subject to tax.	Ch. 64H, Sec. 1 Ch. 64H, Sec. 6(i), (r), (s), (ww)	N/A	N/A
Michigan	**Yes:** Machinery and Equipment @ 90%: Purchases of machinery and equipment for use or consumption in rendering any combination of taxable communications services are exempt from sales/use tax. The exemption is limited to tangible personal property which is located on the premises of the subscriber and to central office equipment or wireless equipment which is directly used or consumed in transmitting, receiving, or switching, or in the monitoring of switching of a two-way interactive communication. It is presumed that no more than 90 percent of the purchase price of eligible equipment is used for exempt purposes. Therefore, the exemption only applies to 90 percent of the purchase price of the exempt property. **No:** The exemption does not apply to distribution equipment such as cable or wire facilities.	Mich. Comp. Laws Ann. §§ 205.54v, 205.94q.	N/A	N/A
Minnesota	**Yes for telecom office equipment:** Telecommunications machinery and equipment is exempt by statute. "Telecommunications machinery and equipment" includes machinery, equipment, and fixtures such as computers, transformers, amplifiers, routers, bridges, repeaters, multiplexers, and other items performing comparable functions, utilized in receiving, initiating, amplifying, processing, transmitting, retransmitting, recording, switching, or monitoring telecommunications services.	Sec. 289A.40, Subd. 5 Sec. 297A.61, Subd. 24 Sec. 297A.68, Subd. 5(d)(11)&35		

State	Exemption	Citation	Credit	Citation
	Cable television services are specifically taxable by statute as telecommunications services. As such, cable television distributors generally qualify for the telecommunications, cable television, or direct satellite machinery and equipment exemption if they sell telecommunications, cable television, or direct satellite services at retail. **No for cable wires poles etc:** Wire, cable, fiber, poles, or conduits are specifically excluded from the definition of "telecommunications equipment" and are therefore taxable. These materials are incorporated into real property when installed and are subject to tax at the time of purchase by the contractor who installs the equipment. Additionally, effective August 1, 2005, these items, as well as all other telecommunications equipment, are specifically excluded from the definition of capital equipment and are, therefore, not eligible for the capital equipment refund available to manufacturers.			
Mississippi	**No general exemption:** No exemption exists for purchases of telephone, mobile telephone or telegraph equipment. All such equipment is subject to tax at the normal retail rate **Yes for broadband:** However, effective until July 1, 2013, an exemption exists for equipment used in the deployment of broadband technologies subject to certain requirements (see Sec. 27-65-101(3)(b)-(c), as amended by Senate Bill 3026). "Equipment used in the deployment of broadband technologies" means any equipment capable of being used for or in connection with the transmission of information at a rate, prior to taking into account the effects of any signal degradation, that is not less than three hundred eighty-four (384) kilobits per second in at least one direction, including, but not limited to, asynchronous transfer mode switches, digital subscriber line access multiplexers, routers, servers, multiplexers, fiber optics and related equipment.	Sec. 27-65 101(3) Sec. 27-65-17		
Missouri	**Yes for broadband:** However, effective until July 1, 2013, an exemption exists for equipment used in the deployment of broadband technologies subject to certain requirements (see Sec. 27-65-101(3)(b)-(c), as amended by Senate Bill 3026). "Equipment used in the deployment of broadband technologies" means any equipment capable of being used for or in connection with the transmission of information at a rate, prior to taking into account the effects of any signal degradation, that is not less than three hundred eighty-four (384) kilobits per second in at least one direction, including, but not limited to, asynchronous transfer mode switches, digital subscriber line access multiplexers, routers, servers, multiplexers, fiber optics and related equipment.	('1) Mo. Rev. Stat. § 144.030(2)(4) & (5). *Southwestern Bell Telephone Company v. Director of Revenue*, 182 S.W.3d. 226 (Mo. 2005). ('2) Sec. 144.020.1(1)&(8) Sec. 144.054(3) Sec. 144.610(1) Sec. 144.811	N/A	N/A
New Jersery	(1) Commercial broadcasting machinery and equipment Receipts from the sale of tangible personal property for use directly in the production of film or video for sale are exempt from sales/use tax. The exemption applies to all tangible personal property including motor vehicles, replacement parts without regard to useful life, tools, and supplies but does not apply to property when the use is incidental to film or video production. Receipts from installing, maintaining, servicing, or repairing tangible personal property that is directly used or consumed in the production of film or video for sale are also exempt.	(1) N.J. Rev. Stat. § 54:32B-8.13(e).	Enterprise Zone Sales Tax Incentives	N.J. Rev. Stat. § 52:27H-79.

State	Exemption	Citation	Credit	Citation
	(2) Telecommunications machinery and equipment Sales of telephones, telephone lines, cables, central office equipment or station apparatus, or other machinery, equipment or apparatus, or comparable telegraph equipment to a service provider subject to the jurisdiction of the Board of Public Utilities or the Federal Communications Commission, for use directly and primarily in receiving at destination or initiating, transmitting and switching telephone, telegraph or interactive telecommunications service for sale to the general public.	(2) N.J. Rev. Stat. § 54:32B-8.13(c).		
New York	(1) Telecommunications Equipment	(1) N.Y. Tax Law § 1115(a)(12-a).	Empire Zones	N.Y. Tax Law § 14.
	(2) Equipment Used to Provide Internet Access	(2) N.Y. Tax Law § 1115(a)(12-a).		
	(3) Equipment Used in an Internet Data Center	(3) N.Y. Tax Law § 1115(a)(37).		
North Carolina	(1) Purchases of towers, antennas, and other broadcasting equipment and parts and accessories attached to the equipment by a cable service provider	(1) N.C. Gen. Stat. § 105-164.13(5d); North Carolina Sales and Use Tax Technical Bulletin 20-2.	N/A	N/A
	(2) Telecommunications Equipment	(2) N.C. Gen. Stat. § 105-164.13(5b); North Carolina Sales and Use Tax Technical Bulletin 21-1; 21-2.		
	(3) Business Equipment Used in an Internet Data Center	(3) N.C. Gen. Stat. § 105-164.13(55).		
Ohio	Communications Equipment (but excludes Internet) There is an exemption for sales to a telecommunications service vendor of tangible personal property and services used directly and primarily in transmitting, receiving, switching, or recording any interactive, two-way electromagnetic communications (including voice, image, data, and information) through the use of any medium including (but not limited to) poles, wires, cables, switching equipment, computers, and record storage devices and media. BUT: This exemption does not apply to equipment used to provide Internet services.	Ohio Rev. Code Ann. § 5739.02(B)(34).	N/A	N/A
Oregon	No Sales Tax	N/A	No Sales Tax	N/A
Pennsylvania	(1) A processing exemption is provided for tangible personal property purchased by a licensed commercial or educational station, including cable television operators. The property must be used directly and predominantly (more than 50%) in the broadcasting of radio or television programs.	('1) Sec. 201(d)(12), (k)(8)(D), (o)(4)(B)(iv)		
	(2) An exemption from sales and use tax is provided for tangible personal property used directly and predominantly in rendering a public utility service. As a result, where telecommunication equipment is purchased for use in rendering a public utility service, such equipment may be purchased exempt from tax.	('2) PA. State. Sec. 201(c), (d), (k)(8), (m), (o)(4)(B) Pennsylvania Regulation Sec. 32.34		
Rhode Island	N/A	N/A	N/A	N/A
South Carolina	(1) All supplies, technical equipment, machinery, and electricity sold to cable television systems	(1) S.C. Code Ann. § 12-36-2120(26).		
	(2) High Technology Computer Equipment Exemption	(2) S.C. Code Ann. § 12-36-2120(65)		

State	Exemption	Citation	Credit	Citation
Tennessee	N/A	N/A	N/A	N/A
Texas	N/A	N/A	Enterprise Zone Refund	Tex. Tax Code Ann. § 151.429.
Utah	Purchases or leases by telecommunications service providers of telecommunications equipment, machinery, and software with a useful life of one year or more are exempt from Utah sales and use tax. Included in the exemption are: (1) telecommunications enabling or facilitating equipment, machinery, or software; (2) telecommunications equipment, machinery, or software required for 911 service; (3) telecommunications maintenance or repair equipment, machinery, or software; (4) telecommunications switching or routing equipment, machinery, or software, and; (5) telecommunications transmission equipment, machinery, or software.	Sec. 59-12-102(99)-(103) - Effective Until January 1, 2009 - Sec. 59-12-102(110)-(112)&(114)-(116) - Effective January 1, 2009 - Sec. 59-12-104(64) - Effective Until January 1, 2009 Sec. 59-12-104(61) - Effective January 1, 2009		
Virginia	Amplification, Transmission and Distribution Equipment Used by Cable Television Systems There is an exemption available for broadcasting equipment and towers used by commercial radio and television companies, wired or land based wireless cable television systems, common carriers or video programmers using an open video system or other video platform provided by telephone common carriers. In addition, amplification, transmission and distribution equipment used by wired or land based wireless cable television systems or open video systems or other video systems provided by telephone common carriers are also exempt. In addition, an exemption is available for equipment used in the production or distribution of Internet-access services, by providers of Internet service. This equipment is defined in part as computer and communications equipment, and software used for storing, processing and retrieving end-user subscribers' requests.	VA Code Sec. 58.1-400.1 Sec. 58.1-602 Sec. 58.1-609.3 Sec. 58.1-609.6(2)	N/A	N/A
Washington	N/A	N/A	N/A	N/A
West Virginia	Purchases of property or services by a person engaged in West Virginia in the business of providing communication services are exempt from tax if the property or service purchased is directly used or consumed in the activity of communications. Effective July 1, 2007, a refundable sales tax exemption is available for a contractor's purchases of materials, services, machinery, or supplies that are directly used or consumed in the construction, alteration, improvement, or repair of a new or existing structure or building, if the purchaser of the contractor's services would have been entitled to claim the refundable exemption if it purchased the services, machinery, supplies or materials directly itself. This includes sales of services, machinery, supplies and materials directly used in the activities of manufacturing and communication.	West VA. Code Sec. 11-15-2 Sec. 11-15-3 Sec. 11-15-8 Sec. 11-15-8d Sec. 11-15-9 Sec. 11-15-9e Sec. 11-15A-2 Sec. 11-15A-3		
Wisconsin	Broadband Internet Equipment Exemption.	Wis. Stat. § 77.54(48).	N/A	N/A

APPENDIX E – PUBLIC - PRIVATE - NONPROFIT COLLABORATIVE BROADBAND ADOPTION/ DIGITAL LITERACY PROGRAMS

Program Name	Description	Link
Arts & Business Council, Tech Connectors (Philadelphia, PA)	Comcast partnered with the Arts and Business Council, to support the Technology Connectors program, which facilitates partnerships between area cultural organizations and the business community (primarily with technology sector firms) that allows them to benefit from technology planning and consulting; also provides necessary skills training.	
Blandin Foundation	The Blandin Foundation helps communities optimize their use of broadband-based technologies to improve their economic competitiveness in a global economy. To date, the results are as follows: • Supported ongoing policy discussion and relationship building at the Strategy Board level, including the adoption of a Broadband Vision with supporting Principles. • Supported ongoing promotion and discussion on broadband to a wider audience though annual broadband conferences and the Blandin on Broadband blog. • Approved 39 community-driven broadband market development and implementation grants in 33 communities that positively impacted broadband adoption. • An initial $352,500 investment by Blandin Foundation has leveraged an additional grant from the state of Minnesota for $250,000 plus at least $627,300 in matching funds from the communities for total new investment in broadband capacity of over $1,229,800. • Built community leadership capacity through conferences, videoconferences and webinars, web resources and onsite technical assistance. • Stimulated, through grant-making, investments in FTTP networks and tele-health and distance education broadband-based applications.	http://broadband.blandinfoundation.org http://blandinonbroadband.org
Breakthrough St. Paul (St. Paul, MN)	Comcast supports the organization Breakthrough Saint Paul, through their "Breakthrough Anywhere" laptop program. A five-month pilot project currently serving 20 10th grade Saint Paul Public School (SPPS) students, the project could expand to serve 200 SPPS students in grades 9 through12 each year. Comcast makes this program possible by offering free home Internet service to each participating student. Breakthrough Saint Paul provides each student with a personal laptop, free home Internet through Comcast, online curriculum, and a personal instructor. Each week, students complete an assignment relating to online research, summer planning, college research, or financial literacy. They also practice typing and check-in regularly with their teacher on Skype. Once a month, students attend an in-person workshop to review the past month and look ahead to the next.	
Boys & Girls Clubs of Greater New Bedford (New Bedford, MA)	Comcast provided funding that allowed clubs to expand offer software and hardware offerings in existing computer labs involving more children in safe and productive online activities.	
Boys & Girls Club of Taunton (Taunton, MA)	Donated 70 computers and funding that will allow club to reopen computer lab for drop-in members.	
Comcast Community Partners Program (MN)	In February, 2009 Comcast launched Comcast Community Partners, a new signature community program that provides eligible non-profit organizations with discounted Comcast Business Services including Comcast Business Class Internet, TV and Voice services. The Comcast Community Partners discount program is available to non-profit organizations that reside in Comcast-serviceable areas and that demonstrate status as an IRS 501 c (3) non-profit and sign up for Comcast Business Class Internet and Comcast Business Class TV.	

Program Name	Description	Link
Computers for Youth	Computers for Youth (CFY), a national non-profit organization, helps low-income children perform at higher levels in school by improving their learning environment at home. CFY partners with public schools in high poverty areas to improve the educational resources available in children's homes, enhance parent-child interaction around learning, and help teachers connect classroom learning with the home. CFY's Take IT Home program works directly with schools in low-income communities to improve the home learning environment of their students. Families are offered: • A free computer - designed as a home learning center. Participating families keep the home learning center • Engaging educational software titles - in English, math, social studies and science. • Internet access - at a reduced rate, where available • Family Learning Workshops - teach parents and children how to use their CFY home learning center to strengthen core academic skills.	www.computersforyouth.org
Common Sense Media (Proposed Program - BTOP)	Common Sense Media, a nonprofit leader on issues surrounding youth and media, proposes to create community-based programs in digital media education, including training, content, and the development and distribution of additional tools to help make American families more "digital media literate." Common Sense Media's strategy focuses on three core elements: 1. Development and Dissemination of Digital Literacy Curricular Materials developed in collaboration with partner school districts and communities around the country and with input from leading American educators and senior officials of the Dept. of Education. 2. Training and Education Programs for Teachers and Parents across the U.S based on the latest in digital literacy research and expertise. 3. A Coordinated Public Education Campaign – developed in partnership with One Economy – to highlight the benefits of safe broadband adoption and digital literacy for America's families and schools.	www.commonsensemedia.org
Connected Nation	**eCommunity Strategies**: Connected Nation's state affiliates (currently active in Kentucky, Tennessee, and Ohio) coordinate eCommunity Strategies designed to help communities effectively and efficiently leverage technology by helping them quantify its existing use of technology as well as identify best practices and the best means of acquiring new technology. They do so by facilitating local eCommunity Technology Teams comprised of high-level representatives from nine different sectors (Healthcare, K-12 education, Higher education, Business and industry, Agriculture, Libraries, Community-based organizations, Tourism, recreation, and parks, and Government). These Teams then develop a technology expansion plan that provides detailed analysis of the best means of deploying new and available technology within the relevant locale. **Computer Ownership**: Connected Nation's state programs also incorporate initiatives to facilitate computer ownership and broadband use in low-income and unconnected homes with an emphasis on providing access to computers by students. These programs are state-specific and operate under the titles Every Citizen Online, Every Child Online, and Computers 4 Kids.	www.connectednation.org
Digital Harmony Project (Tallahassee, FL)	Comcast partnered with the Digital Harmony Project in a program that provided every incoming sixth grader at a designated Middle School with a new three-year warranty desktop computer, free Internet access and online academic curriculum training on core class curriculum.	
Don Moyer (Boys & Girls Club in Champaign, IL)	Comcast partnered with the Boys and Girls Club to upgrade the Teen Computer Center, which plays a key role in the club's educational and career development program. The Center serves youth (ages 13 - 18) and provides access to technology to help the students improve their academic skills and become more prepared for college and/or the workforce.	

Program Name	Description	Link
Elevate Miami	The City of Miami launched a comprehensive Digital Inclusion program: Elevate Miami. The program's goal is to prepare the community to participate and compete in the new digital society and digital economy by assisting citizens in becoming more comfortable with and adaptable to new technologies through training (computer usage fundamentals, Internet and web usage, financial fundamentals, better health through the Internet, etc.) and affordable technology packages (Internet access, hardware, software, financing, etc.) for residents. Elevate Miami offers a variety of programs that address the digital divide among all age groups: 1. Children - Monitored computer lab hours provided in City of Miami ePark facilities with a focus on Internet and computer safety, Email and homework assistance 2. Adults (18 to 55) - Monitored computer lab hours provided in City of Miami ePark facilities and free computer classes located at various ePark Technology Learning Centers 3. Seniors (age 55 and above) - Monitored computer lab hours provided in City of Miami ePark and eSenior facilities along with free computer classes designed specifically with seniors in mind. 4. Small Businesses - Assistance provided in building the capacity of technology use among small businesses including how to design websites and use the latest Microsoft Accounting software.	www.elevatemiami.com
eVermont (Proposed Program - BTOP)	eVermont, a BTOP-funded broadband adoption program proposed by the Vermont Council on Rural Development, plans to provide facilitation, technical assistance and funding to selected rural communities to systematically answer their needs and stimulate broadband usage in a variety of ways determined by local leadership. Each community will develop its own plan. eVermont plans to provide support activities including: • Building or improving municipal web sites • Providing direct business consultation services to improve business efficiency and expand web based marketing, commerce and profitability • Providing new computer workstations to the town library • Building local community or neighborhood on-line networks • Delivering new notebook computers to the families of middle school children who receive school lunch assistance • Involving youth in leadership to build community connection and expand the use of web based tools for a variety of community and business uses. • Providing teacher training and curriculum development assistance to spur Internet usage in and out of school • Providing consultation and training to improve municipal delivery of services, communications between working committees, and expanding the use of web-based tools to facilitate community engagement and advance local initiatives • Building community calendars, local business directories, buy local maps, sports schedules, and a variety of locally-driven new applications • Expanding tele-medicine opportunities • Providing new computer based services to connect seniors with their families	www.evermont.org
FocusHOPE, Detroit, MI	In Detroit, Comcast partnered to support an information technology training program providing computer job training and technology education; will work with the Foundation to develop program materials; also supports student loan program to meet financial assistance needs for students in the program; program goal is to help participants gain economic self-sufficiency and boost self-esteem.	

Program Name	Description	Link
One Economy (Digital Connectors)	One Economy works to increase broadband demand and adoption by making broadband more accessible, offering digital literacy training and creating and distributing relevant content. Programmatic efforts include: **Access Services:** One Economy consults with low-income property owners to develop options to deploy affordable broadband into the property; markets adoption programs to targeted demographics in the program location; designs, facilitates, and in some cases manages hardware purchase programs for low-income people to acquire computers for home usage; works with financing partners to extend microloans to facilitate these purchases. **Digital Literacy/Digital Connectors:** The Digital Connectors program hires youth between the ages of 14 and 21 who are trained on a full development curriculum with a community service mandate to support the digital literacy/adoption needs of a designated community. In addition to the skills they gain they receive financial stipends and earn a computer for their work. One Economy operates some programs directly and has also established chapters and affiliates in many communities. **Content and Online Applications:** One Economy offers an array of online programming through its media sites designed to increase the relevance of broadband to low-income communities.	www.one-economy.com
National Urban Technology Center ("Urban Tech")	The National Urban Technology Center (Urban Tech) prepares residents in low-income communities across the country to participate in the information age by building technology centers to access computer training and web-based products for job training, health care and financial literacy, and life skills for at-risk youth. Since 1995, Urban Tech has established over 700 technology centers. Urban Tech's flagship program, SeedTech, works with community-based organizations to establish state-of-the-art Computer Training Centers. Partner organizations are provided with turn-key facilities, backed by Urban Tech's training, source materials and support. Each center provides jobs for local community residents that Urban Tech trains and certifies as instructors. These participants in turn provide computer job training for other residents. Urban Tech's Youth Leadership Academy (YLA) is a comprehensive web-based program for building life skills. The NY State Department of Education integrated the YLA program into its core curriculum. The Interactive Training Network (iTN), developed in partnership with the U.S. Department of Justice, offers online access to curriculum and courseware, shared resources, webinars and other material.	www.urbantech.org
League of United Latin American Citizens (LULAC)	LULAC, the oldest and largest Latino civil rights organization in the United States, operates 57 community technology centers in low-income Hispanic communities throughout the country to provide free high-speed Internet access and computer-related training to students, parents, and low income individuals.	www.lulac.org
SeniorNet	SeniorNet operates over 90 Learning Centers across the country including in "underserved urban" communities and Native American communities. The centers offer computer classes and services specifically designed for adults 50 and older.	www.seniornet.org
One Laptop per Child	One Laptop per Child (OLPC) is a nonprofit organization dedicated to creating educational opportunities for the world's poorest children by providing them with rugged, low-cost, low-power, connected laptops with content and software designed to facilitate learning. OLPC has developed a durable, inexpensive laptop (currently approx. $180-$205 per unit), designated the XO, and works to distribute them to disadvantaged children worldwide. In the United States, the primary distribution of XO laptops is in the City of Birmingham, Alabama. In 2008 the City purchased 15,000 laptops to give to all public school students in the first through fifth grades (a program it renewed this year, ordering an additional 3,000 laptops).	www.laptop.org/en/

Program Name	Description	Link
Urban League, Detroit, MI	Comcast worked with the Detroit Urban League to do technology and computer upgrades to the Urban League's education, employment and youth development programs. Improvements will strengthen curriculum, access, and link their programs to other sites and resources.	
Project Home, Honickman Center, Philadelphia, PA	**The Honickman Learning Center and Comcast Technology Labs opened its doors January 2004** and is the centerpiece of Project H.O.M.E.'s revitalization strategy for the St. Elizabeth's/Diamond Street section of North Central Philadelphia. The 38,000-square-foot, three-story center is technologically loaded with the most progressive hardware and software systems for education and learning—the largest and most advanced learning facility to serve low-income populations in Philadelphia.	

APPENDIX F – GLOSSARY

3G (3rd Generation) Wireless: A family of standards for mobile telecommunications defined by the International Telecommunication Union. 3G allows simultaneous use of speech and data services and higher data rates (up to 14.0 Mbps on the downlink and 5.8 Mbps on the uplink with high-speed Packet Access.

4G (4th Generation) Wireless: Expected to offer higher speeds and automatic roaming to Wi-Fi, satellite and other wireless networks. 4G technology roll-outs will most likely start in the 2010-2012 timeframe.

ARRA (American Recovery and Reinvestment Act of 2009): An economic stimulus package enacted by the 111th United States Congress in February 2009. The Act of Congress was based largely on proposals made by President Barack Obama and was intended to provide a stimulus to the U.S. economy in the wake of the economic downturn.

Bandwidth: Used in common parlance as a measure of the speed of a network connection. It is measured in Kbps (kilobits per second) or Mbps (megabits per second). Typical modem speeds are 28.8 Kbps and 56 Kbps.

Bandwidth divide: Dataquest – "In 2012, 12.4 million households (9% of the regional total) will have broadband of more than 50 Mbps." This means that a "bandwidth divide" will open up in North America, especially compared with some Asia/Pacific countries.

Broadband: An advanced communications system capable of providing high-speed transmissions of services such as voice, video, and data over the Internet and other networks. Transmission is provided by a wide range of technologies including digital subscriber line and fiber-optic cable, coaxial cable, wireless technology, and satellite.

BACM (Broadband Advisory Council for Minnesota): The council The Task Force is recommending be created to oversee future of broadband development in Minnesota.

BIP (Broadband Initiatives Program): The purpose of the program is to make loans and grants available for the purpose of facilitating broadband deployment in rural communities.

BTOP (Broadband Technology Opportunities Program): Funded at $4.7 billion, BTOP provides grants to support the deployment of broadband infrastructure in unserved and underserved areas, to enhance broadband capacity at public computer centers, and to encourage sustainable adoption of broadband service.

Cable Modem: This piece of hardware allows digital cable signals to be used to connect computers to high-speed Internet services provided by cable companies. The modem is connected to the cable outlet and to the computer.

Cybersecurity: A branch of technology known as information security as applied to computers and networks.

DOCSIS (Data-Over-Cable-Services-Interface-Specification): An equipment standard developed by the cable television industry which defines requirements for cable modems and cable modem termination systems that enable broadband Internet access. The advanced version enables

Internet speeds in excess of 50 Mbps. Comcast is offering 50 x 5 Mbps service to customers in Minneapolis/St. Paul, the fastest speed available of any Comcast market in the country. DOCSIS 3.0 is already being tested in labs to provide download speeds of up to 320 Mbps.

DSL (Digital Subscriber Line): Refers to one type of high-speed Internet access which uses existing phone lines to transfer data. The technology utilizes frequencies along the phone line that are not used with voice communication so that DSL users can access the Internet and talk via the telephone at the same time.

e.Commerce: Selling products or services online. The two major forms of e-commerce are B2B (business-to-business) and B2C (business-to-consumer).

e.Health: Healthcare practice that is supported by electronic processes and communication.

e.Government: the use of technology by government to interact with citizens, improve services and streamline operations. Source: e-Texas

FCC (Federal Communications Commission): An independent United States government agency. The FCC was established by the Communications Act of 1934 and is charged with regulating interstate and international communications by radio, television, wire, satellite and cable. The FCC's jurisdiction covers the 50 states, the District of Columbia, and U.S. possessions.

FTTN (Fiber to the Node): A telecommunication architecture based on fiber-optic cables run to a cabinet serving a neighborhood.

FTTH (Fiber to the Home): Fiber reaches the boundary of the living space, such as a box on the outside wall of a home.Gbps (Gigabit per second): A unit of data transfer equal to 1,000,000,000 bits per second.

Gopher: From about 1992 to 1996, an Internet application in which hierarchically-organized text files could be brought from servers all over the world to a viewer on your computer

Headend: A central control device, within cable television systems, that provides centralized functions such as remodulation.

High-speed access: A broadband Internet connection that transmits data such as e-mail and Web pages much faster than so-called "dial-up" services. The most common high-speed access services are DSL, cable modems, T-1 and T-3 lines, DBS, and fixed wireless.

HTML (Hypertext Markup Language): A web page markup language that specifies how the content will be displayed.

HTTP (Hypertext Transfer Protocol): The way HTML Web pages are transferred from the Web server to the Web browser.

HFC (hybrid fiber cable): A telecommunications technology in which optical fiber cable and coaxial cable are used in different portions of a network to carry broadband content (such as video, data, and voice).

InfraGuard: A collaborative effort between the FBI and the private sector to share information and resources in an effort to better protect the nation's critical infrastructure

Internet: A global system of interconnected computer networks that use the standardized Internet Protocol Suite (TCP/IP) to serve billions of users worldwide.

Internet2: The foremost U.S. advanced networking consortium in the U.S. Led by the research and education community since 1996, Internet2 promotes the missions of its members by providing both leading-edge network capabilities and unique partnership opportunities that together facilitate the development, deployment and use of revolutionary Internet technologies. Source: www.internet2.edu.

Kbps (Kilobits per second): A unit of data transfer equal to 1,000 bits per second.

ISP (Internet Service Provider): Makes an Internet connection available to customers. Some ISPs provide cable modem access, DSL access, and modem access. Also called an access provider.

LAN (Local Area Network): A linked system of computers, printers, and file servers that serve a company or office at a single location. Latency: Refers to the amount of time it takes to transfer data from one point to another. Latency should not be confused with bandwidth. Highways can be used as a real-world example of the difference between bandwidth and latency. The number of lanes in a highway can be considered the bandwidth, and the amount of time it takes to get from one city to another city is the latency. In some cases, increasing the number of lanes will decrease the latency, but it will only work up to a certain point.

Last mile: The final leg of a cable TV, telephone or other telecommunications network that ends in the user's household. The last mile can be a copper wire, fiber-optic line or a wireless link.

LNM (Learning Network of Minnesota): established in 1993 by the Minnesota Legislature to provide a statewide high-speed telecommunications highway for distance learning in higher education.

LTE (Long Term Evolution): The last step toward the 4th generation of radio technologies designed to increase the capacity and speed of mobile telephone networks.

MDU (Multiple dwelling units): a classification of housing where multiple separate housing units for residential inhabitants are contained within one building.

Mbps (Megabit per second): A unit of data transfer equal to 1,000,000 bits per second.

Modem: A shortened version of Modulator-Demodulator and refers to a device that is used to allow computers to communicate with one another over the phone line or through a cable network.

MPEG-4: A patented collection of methods defining compression of audio and visual digital data.

NTCA (National Telecommunications Cooperative Association): A Non-profit association representing small and rural telephone cooperatives and commercial companies.

NTIA (National Telecommunications and Information Administration): An agency in the U.S. Department of Commerce that serves as the executive branch agency principally responsible for advising the President on telecommunications and information policies.

OECD (Organisation for Economic Co-Operation and Development): An international organisation of 30 countries that accept the principles of representative democracy and free-market economy

Peering: Voluntary interconnection of administratively separate Internet networks for the purpose of exchanging traffic between the customers of each network.

POP3 (Post Office Protocol 3): is the most recent version of a standard protocol for receiving e-mail.

Protocol: In computer terms, a formal and precise definition of what kind of information is transferred and how it is transferred between two or more parties. HTTP is an example of a protocol.

Proxy: With respect to the Web, an intermediate computer between the Web server and the end user's Web browser. A classic use of a proxy is to cache Web pages for multiple users.

PSTN (Public Switched Telephone Network): The traditional system of telephone lines that the majority of businesses and consumers currently use for voice communication.

Quintile: One of the four quintiles that divide the units of a frequency distribution into five classes each containing the fifth (20%) of the total number of units such that the values corresponding to the units in one class are less than the first quintile, those in a second class are greater than the first quintile and less than the second quintile, and so on throughout.

ROI (Return on Investment): A performance measure used to evaluate the efficiency of an investment or to compare the efficiency of a number of different investments.

RUS (Rural Utilities Service): is an agency of the United States Department of Agriculture (USDA), charged with providing public utilities (electricity, telephone, water, sewer) to rural areas in the United States via public-private partnerships

Server: A centralized repository of information or other resources. Clients send requests to a server. The most common example of a server is the Web server.

Smart home: A home or building, usually a new one, that is equipped with special structured wiring to enable occupants to remotely control or program an array of automated home electronic devices by entering a single command.

SMS (Short Message Service): A communication service standardized in the Global System for Mobile communications system, using standardized communication protocols allowing the interchange of short text messages between mobile telephone devices. Also know as text messaging.

T-1: Technically refers a piece of hardware needed for a network connection, commonly used to refer to a type of Internet connection provided by telephone companies. T-1 lines transfer data at 1.5 megabits per second, and are typically leased by ISPs and by businesses.

T-3: A very high-speed network connection in which data is transmitted at a speed of 45 mbps.

Telecommuting: Using information and communications technologies to perform work away from the traditional office at alternate worksites.

Telepresence: A set of technologies which allow a person to feel as if they were present, to give the appearance that they were present, or to have an effect, at a location other than their true location.

TPI (Technology Policy Institute): A group or an institution organized for intensive research and solving of problems in the areas of technology. Unserved: refers to geographic areas, defined by census tract, where there is noprovider offering service

Underserved: A demographic measurement which describes those consumers who are unable to subscribe to an Internet service because of factors such as the absence of computer ownership, lack of training, income limitations, employment issues or other demonstrable need.

VDSL2 (Very High-Speed Digital Subscriber Line 2): An access technology that exploits the existing infrastructure of copper wires that were originally deployed for plain old telephone service.

VoIP (Voice over Internet Protocol): Technology that allows for voice communication over a broadband connection.

WAN (Wide Area Network): A computer network that covers a broad area (i.e., any network whose communications links cross metropolitan, regional, or national boundaries).

Web server: A server that delivers Web pages upon request. Examples of Web servers include Apache and IIS.

Wi-Fi (Wireless Fidelity): Wi-Fi enabled devices link together without cables to form wireless local area networks

Wi-MAX (Worldwide Interoperability for Microwave Access): A telecommunications technology that provides wireless transmission of data using a variety of transmission modes, from point-to-multipoint links to portable and fully mobile Internet access.

Wireline: A term associated with a network or terminal that uses metallic wire conductors (and/or optical fibers) for telecommunications

XML (Extensible Markup Language): A standard created by W3C for specifying information formats. It is similar to HTML, but XML can be extended for use in any domain.

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October 30, 2009

Respectfully Submitted,

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Some photos in this report were provided courtesy of Explore Minnesota Tourism.