Guidelines for Development of a Strategic Plan for Accessibility to Broadband Services in Connecticut

December 2011

A Report By

The Connecticut Academy of Science and Engineering

For the

Connecticut Office of Consumer Counsel and
Connecticut Public Utilities Regulatory Authority, Department of Energy and Environmental Protection

Guidelines for Development of a Strategic Plan for Accessibility to Broadband Services in Connecticut

A Report By

The Connecticut Academy of Science and Engineering

Origin of Inquiry:	The Connecticut Office of Consumer Counsel and The Connecticut Public Utilities Control Regulatory Authority, Department of Energy and Environmental Protection
Date Inquiry Established:	July 27, 2010
Date Response Released:	December 30, 2011

This study was initiated at the request of the Connecticut Office of Consumer Counsel and the Public Utilities Control Regulatory Authority, Department of Energy and Environmental Protection (known as the Department of Public Utility Control until June 30, 2011) and the on July 27, 2010. The project was conducted by an Academy Study Committee with the support of staff of the Connecticut Economic Resource Center serving as the study management team. The content of this report lies within the province of the Academy's Communication and Information Systems Technical Board. The report has been reviewed by Academy Members Peter G. Cable, PhD and Frederick J. Leonberger. Martha Sherman, the Academy's Managing Editor, edited the report. The report is hereby released with the approval of the Academy Council.

Richard H. Strauss
Executive Director

MEMBERS OF THE STUDY COMMITTEE ON GUIDELINES FOR THE DEVELOPMENT OF A STRATEGIC PLAN FOR ACCESSIBILITY TO BROADBAND SERIVCES IN CONNECTICUT

Rajeev Bansal, PhD (*Academy Member*)
Professor & Head
Dept. of Electrical & Computer Engineering
University of Connecticut

Jon Carroll
Assistant Vice President
Enterprise IT Operations
University of Connecticut Health Center

Richard C. Cole
President & CEO (ret.)
CT Academy for Education

Niloy K. Dutta, PhD (*Academy Member*)
Professor of Physics
University of Connecticut

John Filchak
Executive Director
Northeast Council of Governments

Phillip Gardner, PhD (*Academy Member*)
Chair, Study Committee
Coherent Inc. (ret.)

Christine Horrigan
Representative
League of Women Voters of Connecticut

Matt Miller, PhD
Consultant

Krishna R. Pattipati, PhD (*Academy Member*)
Professor of Electrical and Computer Engineering
University of Connecticut

Ken Rosen, PhD (*Academy Member*)
President, General Aero-Sciences Consultants, LLC
Vice President of Research & Engineering and
Advanced Programs (ret.)
Sikorsky Aircraft

Guy Rovezzi
President
The Community Foundation of Northwest CT

Rich Rowlenson
Retired Vice President & General Counsel
Frontline Wireless, LLC

Martin Seifert
President
Nufern, Inc.

Kendall F. Wiggin
State Librarian
Connecticut State Library

Shengli Zhou, PhD (*Academy Member*)
Associate Professor
Dept. of Electrical and Computer Engineering
University of Connecticut

RESEARCH TEAM

STUDY MANAGEMENT TEAM

Connecticut Economic Resource Center
Alissa K. DeJonge (CASE Study Manager)
Michelle Riordan-Nold, Research Consultant
Robert W. Santy, President

ACADEMY PROJECT STAFF

Richard H. Strauss, Executive Director
Bruce Carlson, Associate Project Manager
Terri Clark, Associate Director
Ann G. Bertini, Assistant Director for Programs

TABLE OF CONTENTS

EXECUTIVE SUMMARY

STUDY PURPOSE AND METHODOLOGY

The State of Connecticut received funding from the federal government to create a Strategic Plan for Accessibility to and Adoption of Broadband Services in Connecticut. This funding came from the US National Telecommunications and Information Administration (NTIA) pursuant to a January 13, 2010, competitive, merit-based matching grant through the State Broadband Data Program of the American Recovery and Reinvestment Act (ARRA) and the Broadband Data Improvement Act.

The Department of Public Utility Control (as of July 1, 2011 the Public Utilities Regulatory Authority "PURA"), in association with the Office of Consumer Counsel, Office of the Governor, and Office of Policy and Management, contracted with the Connecticut Academy of Science and Engineering (CASE) in August 2010 for the purposes of providing guidance—input and suggestions—for the state to use in its formulation of the state's strategic plan.

The term broadband commonly refers to high-speed Internet access that is always on and faster than the traditional dial-up access. Broadband service provides higher speeds of data transmission allowing more content to be carried through the transmission "pipeline." Another feature of broadband is that it does not block phone lines and does not require reconnecting after logging off.

The following are the goals and objectives of the state's strategic plan that were identified in the state's original project proposal to NTIA.

- ➢ The objective of all policies and implementation strategies adopted by the state in the next several years should lead to the creation of a broadband network that provides all communications services, including interactive, information, and entertainment services.
- ➢ The strategic plan must address the long-term sustainability of the expanded broadband access, recognizing that budgets rise and fall over time, and that technology always presents a moving target, changing the players as well as the basic methods of broadband accessibility.
- ➢ The strategic plan should provide for a flexible process for keeping abreast of the changing environment for broadband accessibility into the future.

A variety of study methods were used to gather data and information including:

- input from broadband experts at committee meetings;
- research on leading state and country broadband programs and initiatives;
- surveys of consumers and businesses;
- focus groups that were conducted throughout the state; and
- integration of the state mapping project findings into the final report.

This research formed the basis for the development of study findings. The findings were then used by the CASE Study Committee to formulate study recommendations that can help guide the state's strategic plan.

BRIEF STATEMENT OF PRIMARY CONCLUSIONS

By improving communication and the flow of information and social interaction, broadband facilitates job creation, reduces miles driven and fossil fuels consumed, expands consumer choice, and improves competition for goods and services. Broadband enables advancements in health care, public safety, energy, government performance, education, economic development, workforce development, and transportation—encompassing almost every aspect of life.

Through the research, the CASE Study Committee found that even though the state has benefited from broadband infrastructure investments by the private and public sectors, Connecticut lacks coordination among broadband policy makers and does not have clearly defined broadband goals. In researching other states and nations, one common thread that was evident among broadband leaders was a need for a clearly defined goal and actionable steps to achieve that goal.

The state needs a broadband strategic plan that establishes goals and objectives, continues the initiatives already underway in the state, leverages public and private investments, and incorporates the following:

1. As the first step, Connecticut needs to create a sustainable mechanism for communication among existing broadband policy makers. In addition, progress needs to be continually monitored through the development and implementation of quantifiable metrics so that Connecticut remains competitive in retaining and attracting residents and businesses.
2. Although Connecticut has enjoyed relatively high adoption rates, those in households with low incomes may fail to adopt broadband for several reasons, including having set a lower priority for the value of using the Internet; the expense of the technology, including hardware, to access broadband; and a perception that broadband service itself is unaffordable relative to other household expenses.
3. Lack of digital literacy among some residents is another barrier to broadband adoption.
4. Without streamlined pole attachment and cell-tower siting processes, competition and investment in newer broadband infrastructure will likely be inhibited.
5. A fiber network spans the state, including rural areas, but the full potential of this network has not been realized.
6. State policies that facilitate making broadband technologies accessible to all residents will be an engine of growth for the state.

SUMMARY OF FINDINGS AND RECOMMENDATIONS

Broadband can be described as the electricity of the 21st century; it is a major driver of the global economy. Broadband has enabled innovations across all aspects of the economy, throughout many sectors and industries. Given the role broadband plays in increasing economic competitiveness, it merits significant attention from state policy makers. This will ensure that the state is a global leader in broadband networking capacity that can support the applications of tomorrow, enhancing personal and economic growth and educational attainment.

Through the investment of millions of dollars in broadband infrastructure by private providers, Connecticut enjoys nearly ubiquitous broadband service coverage. The coverage makes Connecticut one of the most "wired" states in the country and among the leaders in the world. However, for Connecticut to maintain its status as a leader in broadband access and adoption, the state needs to maintain and develop policies to promote continued investment in ever-advancing broadband capability and capacity. The state needs to be proactive in this area since other states and countries are also installing fiber-optic technology for widespread residential and business use.

In addition, the demand for mobile devices continues to rise, which increases the need for expanded and faster wireless networks.

Through the research and interviews with other state leaders on broadband policy, it is evident that Connecticut policy makers have not given broadband access and adoption the degree of attention and resources as have other states. On the other hand, Connecticut has not needed to make broadband policy a priority since most state residents and businesses have access to broadband that meets their needs today. In order to remain competitive, Connecticut must focus resources to ensure that the state's residents and businesses continually have the best broadband infrastructure and service, and adoption rates increase. To the extent that the private entities have not addressed access and adoption issues, the state government has an obligation to its citizens and businesses to make every effort possible to provide ubiquitous service at reasonable prices. The study recommendations are focused on five main areas that warrant state attention:

- state organization,
- establishing goals and progress metrics,
- adoption of broadband,
- pole attachment and cell tower siting processes, and
- infrastructure and access.

State Organization

FINDINGS: As shown in Figure ES-1, with current responsibilities for broadband policy disbursed through multiple public state entities[1], the state lacks a formal communications structure that can monitor and promote broadband policy. This lack of coordination has led to missed opportunities for enhancing broadband infrastructure and programs, as well as for federal and other funding. For example, without a mechanism for cross-agency broadband collaboration, highway projects that involve digging up state roads could result in missed opportunities for installing fiber networks.

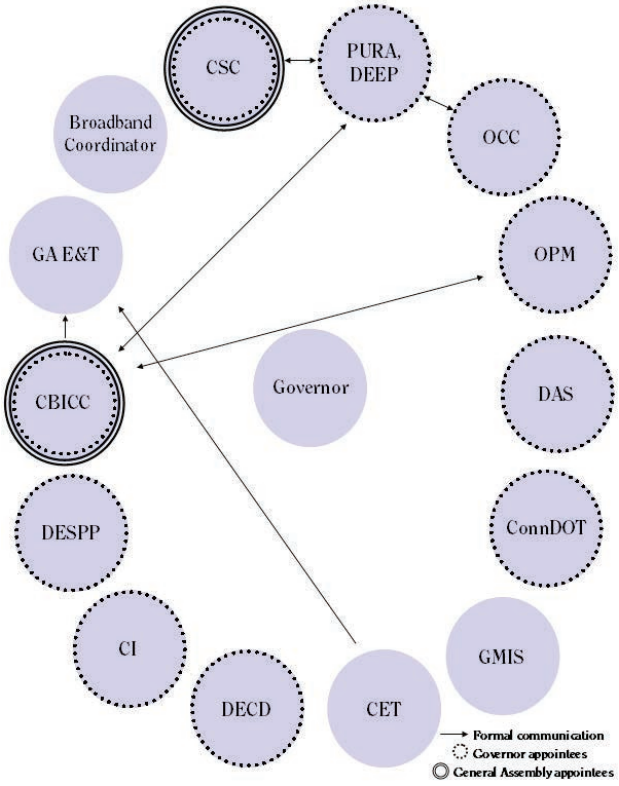


FIGURE ES-1: CURRENT COMMUNICATION AMONG BROADBAND POLICY MAKERS AND COORDINATING AGENCIES

RECOMMENDATIONS: With limited state and federal dollars expected to be available for projects, the state needs to ensure that consideration of broadband infrastructure expansion is factored into all state infrastructure projects including roadway and utility improvements. Therefore, it is recommended that a formal communication structure for developing and sustaining broadband policy, strategy and promotion, in the form of a broadband cabinet, be created to enhance economic development and leadership opportunities for Connecticut.

Since this does not represent creating a new entity, but rather coordinating existing entities, it is not anticipated that significant additional state funding will be needed to support this function. However, if the cabinet decides to move forward with some or all of the recommendations outlined in this report, additional funding or legislation may be required for implementation.

By working within the existing entities in the state that focus on broadband policy, this proposed coordination structure, the broadband cabinet, seeks to create a link between all the entities and ensure strong coordination and communication (see Figure ES-2 for an example of entities to be included in the cabinet and others with links to broadband issues). The broadband cabinet creates a comprehensive process, shared by the legislative and administrative branches

[1] CBICC: Connecticut Broadband Internet Coordinating Council; CET: Commission for Education Technology; CI: Connecticut Innovations; ConnDOT: Connecticut Department of Transportation; CSC: Connecticut Siting Council; DAS: Department of Administrative Services; DECD: Department of Economic and Community Development; DEEP: Department of Energy and Environmental Protection; DESPP: Department of Emergency Services and Public Protection; GA E&T: Energy and Technology Committee, General Assembly; GMIS: Government Management Information Sciences; OCC: Office of Consumer Counsel; OPM: Office of Policy and Management; PURA: Public Utilities Regulatory Authority, DEEP

of government, to deliberate, develop and monitor effectiveness of broadband policy.

The state's **broadband coordinator** would be responsible for developing and advancing the state's strategic broadband plan, continuing data collection/mapping of statewide broadband access and applying for federal funding. Sustaining these efforts that were started with federal funding will be vital to advancing state and federal public policy goals. With the proposed structure, the broadband coordinator will also:

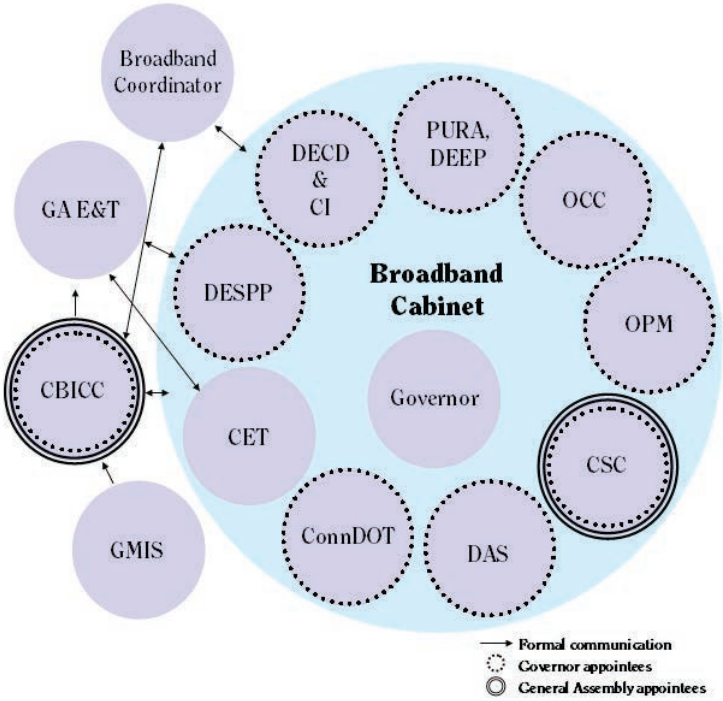


FIGURE ES-2: INCREASING COMMUNICATION AMONG EXISTING POLICY MAKERS IN CONNECTICUT

- develop the annual broadband report in consultation with and on behalf of the proposed broadband cabinet
- staff the proposed broadband cabinet as needed
- serve as an ex officio member of Connecticut Broadband Internet Coordinating Council (CBICC) (legislative action is needed for this role to be fulfilled)
- coordinate communications between the legislative function (CBICC) and the executive function (broadband cabinet)

The **proposed broadband cabinet** would be composed of existing state agency leaders who can have an impact on broadband policy development. Figure ES-2 includes the agencies that are primarily involved in broadband policy issues currently, although additional agency leaders may be added. The cabinet, which could be created through an executive order or state statute, will coordinate state activities that relate to broadband and issue an annual broadband report that will consider issues such as:

- Setting progress goals that can be continually benchmarked over time, including comparing advertised speeds offered by providers versus actual speeds being recorded by speed tests of residents and businesses.
- Encouraging the integration of broadband issues into other statewide strategic plans.
- Having mechanisms to maintain a sustainable, long-term effort.
- Periodically reviewing the broadband vision for the state and ensuring that the minimum standard for all citizens and businesses remains globally competitive.

- Developing and maintaining the broadband website and dashboards that measure progress.
- Reviewing the leadership, vision, mission, goals, sustainability, and management structure of the Connecticut Education Network (CEN) to plan for the possible future demand from its open access network.
- Building upon and integrating the statewide plan with the national broadband plan.
- Ensuring the sustainability of broadband efforts through policies.
- Monitoring federal funding opportunities.
- Communicating progress to the public and policy makers by continually updating and making available timely broadband benchmarking and mapping information.
- Promoting the development of state e-government efforts.
- Advocating for broadband improvements at the national level. An example involves expanding the use of unlicensed bandwidth spectrum for applications such as Wi-Fi that increase the utility of broadband. Another example involves allowing Connecticut to be a recipient of funding from the Connect America Fund even though there are no areas in Connecticut with a federal rural designation.
- Reviewing Internet security and privacy issues that may impact residents or businesses.
- Reviewing emergency events regarding preparedness, disaster recovery and service restoration for lessons learned; determining if there are ways to enhance broadband system reliability and resiliency.

The **CBICC** continues to act as legislatively mandated; that is, to monitor trends in the state's efforts to develop statewide, world-class communications infrastructure and to issue reports to the General Assembly about technology.[2] In addition to its current role, the CBICC provides an advisory role to the broadband cabinet by reviewing and commenting on the annual broadband report. An amendment to the CBICC-enabling legislation will be required to name additional ex officio members of the CBICC. These additional members should include the broadband coordinator to facilitate policy discussions, as well as a member of the Connecticut Government Management Information Sciences (GMIS) Users Group to provide municipal perspectives on state issues within the broadband policy arena.

Broadband Goals and Progress Metrics

FINDINGS: Connecticut not only lacks coordination among decision-making entities for broadband policy but it also does not have a clearly defined broadband goal. One common thread that was evident among broadband leaders in other states and nations was a need for a clearly defined goal and actionable steps to achieve that goal. Goals help guide policy decisions and create a defined end point to identify level of achievement.

[2] See Connecticut General Statutes § 4d-100(a) which provides the empowering statutory authority granted to the CBICC.

RECOMMENDATIONS: It is recommended that the following broadband vision statement be integrated into Connecticut's strategic plan and serve as a guide for future recommendations and action steps:

Broadband technology is an enabler that significantly advances the ability of Connecticut's residents, organizations and businesses to communicate, learn, work, create, consume, access services, and recreate, therefore participating competitively in the global economy. Connecticut residents, organizations and businesses will have access to affordable broadband service that meets their current and future needs. To this end, the State shall adopt and promote the policies and programs needed to achieve affordable, ubiquitous access and adoption of broadband services sufficient to enable today's applications and the applications of tomorrow.

In addition, it is recommended that the following action steps be taken by the proposed broadband cabinet to ensure both that the highest performance broadband infrastructure as is practical is offered, and that a base level of broadband access is available across the state:

- Determine a minimum standard for all Connecticut citizens and businesses to access broadband, such as the ability to email, browse the web and conduct basic transactions on government and other websites. The minimum standard for Connecticut should be at least the national standard set forth in the National Broadband Plan.[3]
- The proposed broadband cabinet should also consider setting goals to make Connecticut stand out as a global broadband leader, such as the goals set forth by the state of North Carolina as well as by other countries.[4]
- Publish the minimum standard and other goals on www.ct.gov/broadband.
- Routinely monitor and upgrade the minimum standard and other goals as needed.
- Monitor broadband metrics to assure Connecticut is globally competitive and communicate these attributes as an economic development tool.

Adoption of Broadband

FINDINGS: Unlike other parts of the country where access to broadband is an issue, in Connecticut broadband adoption presents a greater challenge for some residents. As the consumer survey results of this study indicate, fewer urban respondents access the computer at home and this was statistically different than the respondents from rural and suburban towns. Urban respondents are also less likely to use the Internet, a statistically significant finding at a time when more transactions are conducted online, such as applying for a job or accessing government forms for services. Both in Connecticut and nationwide, a smartphone with its wireless connection can be an alternative to a typical broadband connection with a computer. In recent studies, as well as from the findings of this study, use of a smartphone is often adopted when the up-front cost of the typical connection is an issue.

Furthermore, state government has not fully realized the potential of broadband capabilities in e-government interactions with citizens and businesses. Several reports that rank the states'

[3] http://www.broadband.gov/plan/2-goals-for-a-high-performance-america/

[4] See page 33 of report for details.

adoption of technology have placed Connecticut at the bottom. For example, the Center for Digital Government, a national research institute on informational technology policies and best practices in state and local government, gave Connecticut a B- in 2010 based on using technology to streamline operations and improve service delivery.

In addition, even though the CEN reaches at least one school in every municipality, not every school utilizes its full capabilities either through teacher instruction or student use, which further perpetuates the digital divide in the state, and inhibits adoption.

RECOMMENDATIONS: Therefore the following recommendations should be reviewed by the proposed broadband cabinet and implemented through legislation if necessary:

- Find ways to address both the cost of broadband service and to increase digital literacy in populations not currently using broadband service in order to increase adoption rates, thereby decreasing the growing "digital divide." For example, advocate at the national level that the Universal Service Fund (currently a surcharge on all telephone bills), which has now been made available to broadband providers who offer reduced rates for broadband service to low-income residents in rural areas, be expanded to include states such as Connecticut that do not have designated rural areas, but have unserved areas where the market does not support broadband provider investment. This could also include a special rate for wireless Internet users for this same group of residents.
- Consider establishing a statewide pilot program designed to assist low-income residents with the cost of broadband service, such as the issuance of data vouchers, if the Universal Service Fund is not made available to broadband service.
- Consider mobilizing state agencies to embrace broadband use throughout their business activities as a way to advance e-government efforts.
- Increase awareness of the CEN to teachers and students not yet taking advantage of the current system as a way to promote broadband adoption to reduce the educational digital divide.
- Facilitate the development of public-private partnerships between nonprofits that are educating residents in the use of broadband and gifting computers, with providers that offer reduced-price broadband services to low-income residents (e.g., Comcast "Internet Essentials Program" and FCC "Connect-to-Compete"). These partner relationships can jointly promote programs that increase adoption with low-income residents. Once the Lifeline/Linkup federal program funding (through the Universal Service Fund) is expanded to broadband services, the nonprofit-provider partnerships may be able to receive additional funding to expand efforts and offer alternatives such as less expensive mobile devices. These public-private partnerships should focus on urban households where there is a lower rate of adoption. Examples of existing programs that could be expanded include:
    - Concepts for Adaptive Learning (CfAL), based in New Haven, targets underserved parents of students at urban public schools; provides software that adapts teaching methods to each student's learning style; and works with teachers to adopt technology in the classroom. The program for parents first provides technology training and then installs computers and computer-related equipment in the home.

- One Economy engages youth in major cities throughout the United States to provide technology training and support to their peers and neighbors by becoming a Digital Connector. The youth first receive training and then serve as volunteers in their community.

Pole Attachment and Cell Tower Siting Processes

FINDINGS: Current trends in broadband indicate that the future will continually demand broadband access at higher speeds with greater reliability, reduced latency and enhanced security. In addition, the demand for mobile devices continues to rise, which increases the need for expanded and faster wireless networks.

Connecticut was fortunate that providers were willing to make the infrastructure investments in the state in the early phase of broadband availability to meet consumer demand, and state policies should continue to promote an environment where Connecticut remains an attractive market for providers to invest in communications innovation. Improvements in broadband capacity frequently require the deployment of new infrastructure, and the state regulatory system has not kept pace with the changes. Two hurdles faced by companies wanting to enter or expand in the broadband market include pole attachment and cell tower siting processes.

In 2008, the Department of Public Utility Control (DPUC, now PURA) established fixed time intervals for pole owners to issue licenses to third party attachers, regulated the completion of make-ready work, and imposed other limitations on the pole owners' management of telecommunication infrastructure.[5] However, telecommunications providers continue to face obstacles in trying to deploy facilities and fiber on poles. For example, pole owners have 90 days to issue licenses to third party attachers. However, deadlines are often not met and recourse is rarely taken.[6] In addition, if a customer wants service in less than 90 days, accommodations are rarely made.

Other states have established laws as a way to streamline the process and allow for competition in the market. They have done this through allowing temporary pole attachments and shortening the time frame in which the work must be completed.

Furthermore, as experienced by the power outages during the 2011 October Nor'easter, many of Connecticut's poles were damaged and confusion over ownership created delays in repairs.[7] A streamlined process would provide greater security for Connecticut's power and telecommunications services through a more responsive management system that in turn would enhance the state's emergency preparedness.

In addition, in some areas of Connecticut, the siting of cell towers can be a challenge. Tower siting issues in towns are often due to opposition of town residents for aesthetic or other reasons even before the proposed tower siting is brought to the Connecticut Siting Council for approval.

---

[5] DPUC Docket Number: 07-02-13, DPUC Review of the State's Public Service Company Utility Pole Make-Ready Procedures - Phase I, 4/30/2008

[6] DPUC Docket Number: 11-03-07, Investigation into the Appointment of a Third Party Statewide Utility Telephone Pole Administrator for the State of Connecticut

[7] PURA Docket Number: 11-09-09, PURA Investigation of Public Service Companies' Response to 2011 Storms, 12/6/11.

However, this prevents access to broadband for residents and also creates public safety issues with residents not having a reliable way to communicate.

Removing the major barriers to pole attachment and cell tower siting processes will help open up competition and allow companies to invest in new broadband infrastructure which will enhance Connecticut's competitiveness.

RECOMMENDATIONS: Therefore, it is recommended that the following action steps be reviewed by the proposed broadband cabinet and implemented through legislation if necessary:

- Develop a streamlined process for pole access to allow Connecticut to be seen as a business- friendly state with a competitive broadband market. A representative within PURA with pole administration duties should have the authority to keep pole access schedules on track, allow for temporary pole attachments when warranted by customer needs, and impose penalties if the timelines are not met. In addition to assuring fair policies for the companies seeking access to poles that they do not own, the pole administrator within PURA will work to assure that the state remains an attractive place for continued investment by the companies that currently own the poles. Enabling legislation that will allow for this single pole administrator function within PURA will reduce the need to open dockets and carry forth with litigation when there are disputes over the time needed for pole access.
- In areas where cell tower siting is an issue, consider the use of newer technologies to bring wireless access to areas that are currently not served.
- In connection with the Connecticut Siting Council, review and seek amendments to any federal or state statutes that may facilitate the location of additional cell towers in order to increase public safety and emergency operations efforts.
- Explore the use of leasing space on state-owned equipment, buildings, or land (e.g., fire towers, telecommunications towers, public safety towers and state forests) for the deployment of wireless-based broadband equipment to expedite the deployment of broadband networks.

Broadband Infrastructure and Access

FINDINGS: The majority of the state's residential and business customers are accessing the Internet through a broadband infrastructure which includes coaxial cable, hybrid fiber coaxial cable (HFC) and DSL. Through the ARRA, many states received federal funding to install the latest technology, including fiber-to-the-home or node, which has the capability to deliver broadband at speeds multiple times faster than traditional cable, HFC or DSL. In addition, providers continue to invest in advanced networks in the state where there is an expected return on their investments.

However, in some areas of the state, broadband access is not available. In these areas where the providers have not provided service, the state may consider strategies to address this market issue so that all citizens and businesses have some broadband service. (See Appendix H for maps of Connecticut broadband access.)

How is Connecticut positioned to meet the bandwidth demands of tomorrow? In addition to the private investments already occurring in the state, Connecticut received almost $94 million in ARRA funding to install additional fiber that expands the Connecticut Education Network (CEN) into rural areas of the state and is being used to connect public safety facilities in towns to an enhanced 911 system. The original shared core infrastructure and fiber of the CEN were funded through state bonding, with no federal e-rate funding. The portion of the CEN that used e-rate[8] funding included AT&T's OPT-E-MAN® circuits (a switched Ethernet service that connects LANs within the same metropolitan area with flexible bandwidth options), frame and DSL.

Furthermore, the fiber network and subsequent upgrades do not use e-rate funding, but instead were funded through ARRA funding, which places no use restrictions on this network and requires open access. In addition, fiber networks are being installed in neighboring states (e.g., MassBroadband 123), which may provide an opportunity to create regional networks, particularly along the I-91 and I-95 corridors. An expanded network would support regional economic development efforts.

RECOMMENDATIONS: Therefore, the following recommendations should be reviewed by the proposed broadband cabinet and implemented through legislation if necessary:

- Explore the feasibility of expanding the CEN to additional municipal buildings, including public safety and first responder facilities. Assess which municipal buildings, in addition to the libraries and schools already on the CEN, are in close proximity to the CEN and could be easily linked up, thereby increasing the number of public spaces with fiber-optic broadband access. Examples of successful public-private partnerships that can guide Connecticut's efforts include Axcess Ontario in New York (see Appendix G for more information).
- Municipalities can explore the feasibility of connecting to the fiber networks in the state through any provider, although the costs to do so may be prohibitive.

In areas of the state that are underserved or unserved by broadband, even after the CEN is fully built out using the federal funding, consider ways to fund broadband expansion projects. A revolving loan fund that would leverage public funds and make loans to private companies that invest in broadband infrastructure could be established similar to state infrastructure banks established for transportation.[9] There have also been proposals at the national level to create a National Infrastructure Development Bank. The national proposal, most recently championed by Representative Rosa DeLauro in the 111th Congress, was to create a stand-alone entity that would make loans or loan guarantees to leverage private dollars for infrastructure projects. Projects would be selected based on merit and demonstrated need. Therefore, Connecticut should assess how an infrastructure bank could work in expanding the reach of the fiber broadband infrastructure to areas throughout the state. In addition, tax incentives to providers that build out in unserved areas could be considered.

[8] E-rate is the common name for the Universal Service Fund for Schools and Libraries, established by section 254 of the federal Telecommunications Act of 1996. The E-Rate program is administered by the Universal Service Administrative Company (USAC) under the direction of the Federal Communications Commission and provides discounts to K-12 schools and libraries to obtain affordable telecommunications and Internet access for educational purposes. E-rate funding stipulates that the money can only be used for "educational purposes."

[9] State Infrastructure Banks (SIB) were authorized in 1995 as a part of the National Highway Designation Act (NHS) to help accelerate needed mobility improvements through a variety of financial assistance options made to local entities through state transportation departments.

CONCLUDING REMARKS

Given that broadband technology is an enabler that significantly advances the ability of Connecticut's residents, organizations and businesses to communicate, learn, work, create, consume, access services, and recreate, it merits serious state attention. The recommendation regarding creating formal communication among existing policy makers places greater emphasis on broadband policy with the development of the broadband cabinet. This will help increase communication and coordination between state agency leaders who can impact broadband policy. The establishment of a broadband goal provides direction for policy makers and helps establish Connecticut as a broadband leader.

In order to be a global leader in broadband capacity, Connecticut must ensure that the state maintains a competitive environment for broadband providers and remains attractive for continued investment. Streamlining the pole attachment and cell tower siting processes will ease the burden for providers in the market. Furthermore, since open access to the CEN is required as part of receiving ARRA funding, review the leadership, vision, mission, goals, sustainability, and management structure of the CEN so that it may adapt to the possible future demands on the fiber network.

Finally, although Connecticut does have some of the highest broadband access rates in the nation, there are segments of the population that lack broadband connections due to factors such as lack of interest or understanding of the need for an Internet connection as well as the cost of technology and broadband service. Therefore, it is hoped that the proposed recommendations will increase access rates by leveraging existing resources and working within the existing infrastructure of nonprofits and organizations that assist low-income residents.

I. INTRODUCTION

The State of Connecticut received funding from the federal government to create a *Strategic Plan for Accessibility to and Adoption of Broadband Services in Connecticut.* This funding came from the US National Telecommunications and Information Administration (NTIA) pursuant to a January 13, 2010 competitive, merit-based matching grant through the State Broadband Data Program of the American Recovery and Reinvestment Act (ARRA) and the Broadband Data Improvement Act. The development of the plan is being undertaken concurrently with, and utilizing information provided under, a separate contract for the purpose of developing state-level broadband maps.

In addition to the $2.8 million for broadband mapping project, the state received $500,000 for the purpose of developing the strategic plan to identify public policy goals needed to support the National Broadband Plan's goal of universal connectivity to high-speed broadband for all citizens and communities.

The Department of Public Utility Control (as of July 1, 2011 the Public Utilities Regulatory Authority "PURA") in association with the Office of Consumer Counsel, Office of the Governor, and Office of Policy and Management, contracted with the Connecticut Academy of Science and Engineering (CASE) in August 2010 for the purposes of providing guidance—input and suggestions—for the state to use in its formulation of the state's strategic plan.

The following are the goals and objectives of the state's strategic plan that were identified in the state's original project proposal to NTIA.

- ➢ The objective of all policies and implementation strategies adopted by the state in the next several years should lead to the creation of a broadband network that provides all communications services, including interactive, information, and entertainment services.
- ➢ The strategic plan must address the long-term sustainability of the expanded broadband access, recognizing that budgets rise and fall over time, and that technology always presents a moving target, changing the players as well as the basic methods of broadband accessibility.
- ➢ The strategic plan should provide for a flexible process for keeping abreast of the changing environment for broadband accessibility into the future.

This information was used as guidance to structure tasks, as follows, that were undertaken to inform the CASE Study Committee on various issues for the purpose of developing suggestions for the state to consider in creating the strategic plan.

- **Communications with Program Manager:** Detailed discussions between the state's Program Manager (William L. Vallée, State Broadband Policy and Programs Coordinator) and the CASE Study Committee and Project Management Team were held to develop approaches to address and resolve issues relating to universal and enhanced accessibility to broadband in Connecticut. The Program Manager participated in CASE Study Committee meetings and other meetings, including focus group sessions, to be directly informed from ongoing research, guest presenters, and Study Committee discussions.

- **Guest Presentations**: To become informed on advances in broadband technology, legal issues and adoption trends, etc., the Study Committee heard from representatives of the telecommunications industry, research organizations and academia, the education sector, state and municipal government officials and others. For a complete list of guest presenters see Appendix A.
- **Best Practices Review:** The Study Committee and the Project Management Team selected specific states and countries to be examined for two-phase best practices review. The first phase of the review involved Internet research on programs and initiatives of each state/country identified for review and a Phase 1 report was developed for Study Committee review. The Phase 1 process resulted in the selection of states that were targeted for more detailed Phase 2 research and analysis. This process involved phone interviews with broadband policy leaders in the selected states who were identified as leaders in broadband adoption and access programs/strategies. These states included: Kentucky, Maine, Maryland, Massachusetts, North Carolina, Vermont, and Virginia. The states/countries that were reviewed in the Internet-only research included: Colorado, New Jersey, Rhode Island, Washington, Finland, Japan, South Korea, Australia, Germany, United Kingdom, and Chattanooga, TN. A summary of the Best Practices Review is included in the report.
- **Survey and Stakeholder Interview Outreach**
    - **Public Usage Survey:** Telephone surveys were developed by the Project Management Team with guidance from the Study Committee to assess broadband use among Connecticut businesses regarding business use of broadband and consumers regarding broadband use in the home. The surveys were completed in November and December 2010. A summary of the survey results is included in the report, with the full survey analysis provided in Appendices D and E.
    - **Focus Group Sessions:** A framework of questions for focus group sessions was developed. Fourteen focus group sessions including a total of over 100 participants were conducted by the CASE Project Management Team in several regions of the state to gather information from a variety of broadband users and non-users regarding their use of broadband services and needs for the future.
    - **Integration of State Mapping Project Information:** The team from state broadband mapping consultant Applied Geographics, Inc. (AppGeo) briefed the Study Committee throughout the CASE study on both methods and findings from the state's broadband mapping project. The information provided by AppGeo was taken into consideration in the development of the study's findings and recommendations. In addition, the Study Committee also provided input to AppGeo in the development of several broadband information dashboards for use by the general public, businesses and policy makers that will be available on the state's broadband project website.
    - **Final Report and Briefing:** A final report was developed by the Project Management Team and reviewed by the Study Committee. All data and information gathered in the study process was considered in the development of the study's findings and recommendations. This process involved some follow-up research and Study Committee deliberations to verify and finalize the study's

findings and recommendations. A Briefing of the final report was provided to the project sponsors.

The report is intended to provide guidance to the state's Program Manager for the development of the state's *Strategic Plan for Accessibility to and Adoption of Broadband Services In Connecticut.* The CASE Project Management Team and Study Committee will review the state's draft Strategic Plan and will assist the Program Manager and other state agencies, as appropriate, in presenting the Strategic Plan to the state's citizens/businesses.

II. UNDERSTANDING BROADBAND

WHAT IS BROADBAND?

The term broadband commonly refers to high-speed Internet access that is always on and faster than the traditional dial-up access. Broadband service provides higher speeds of data transmission allowing more content to be carried through the transmission "pipeline." Another feature of broadband is that it does not block phone lines and does not require reconnecting after logging off.

Broadband provides access to the highest quality Internet services—streaming media, VoIP (Internet phone), gaming, and interactive services. Many of these current and newly-developing services require the transfer of large amounts of data that may not be technically feasible with dial-up service. Therefore, broadband service has become increasingly necessary to access the full range of services and opportunities that the Internet can offer.

Types of Broadband

There are a number of options for deploying broadband infrastructure throughout an area. Some options are currently used more frequently than others. Technical characteristics influence the extent of the deployment as well as the ability of a provider to access local rights-of-way, telephone and electric poles, and wireless-tower sites.

Broadband is the common term to describe high speed Internet; however, there are multiple ways to access the Internet. Fixed technology connections include DSL, cable modem, and T-1 or fiber optic, whereas mobile wireless connections mean the device can access the Internet without a wire connection. A few of the technologies that enable high-speed Internet connections are described in detail below. Also provided in Table 1 below, for each type of broadband, are advertised speeds and the actual speeds experienced by consumers nationally.

For a visual representation of the network that connects broadband users with the Internet, refer to Appendix I.

Table 1: Advertised and Actual Speeds by Type of Broadband

Technology	Advertised mean download speed (Mbps)	Actual average download speed (Mbps)
DSL	2.5	2.0
Cable	9.2	5.5
FTTP	13.9	7.7
Fixed Wireless	1.3	0.7
Satellite	1.3	0.7
Source: FCC, "Broadband Performance," OBI Technical Paper No. 4.—Exhibit 15 and 17		

Digital subscriber line (DSL) is a wireline transmission technology that transmits data over traditional copper telephone lines already installed to homes and businesses. The copper wires have sufficient bandwidth to deliver both voice and data. DSL-based broadband provides transmission speeds ranging from several hundred Kbps to millions of bits per second (Mbps). The availability and speed of DSL service may depend on the distance from the connection point to the closest telephone company facility. In 2009, the national average actual DSL download speed experienced by consumers was 2 Mbps.[10]

Cable modem service enables cable operators to provide broadband using the same coaxial cables that deliver pictures and sound to television. Most cable modems are external devices that have two connections: one to the cable wall outlet, the other to a computer. Subscribers can access their cable modem service by simply turning on their computers, without dialing up to an ISP. Transmission speeds vary depending on the type of cable modem, cable network, and number of customers sending or receiving data. In 2009, the national average actual cable modem download speed experienced by consumers was 5.5 Mbps.[11]

Fiber to the premise (FTTP) provides a high-speed, wire-based alternative to traditional cable and telephone networks. Fiber-optic technology converts electrical signals carrying data to light and sends the light through transparent glass fibers about the diameter of a human hair. Since fiber is thinner than copper wire, it allows more lines to go over the same cable. Fiber transmits data at speeds that far exceed current DSL or cable modem speeds, typically by tens or even hundreds of Mbps. The actual speed varies depending on a variety of factors, such as how close to the point of connection the service provider brings the fiber and how the service provider configures the service, including the amount of bandwidth used. The same fiber providing broadband can also simultaneously deliver voice (VoIP) and video services, including video-on-demand. FTTP deployment is currently concentrated in urban and suburban communities[12] since the cost of deployment is high in rural and less densely populated areas. In 2009, the national average actual download speed from fiber-to-the-premise experienced by consumers was 7.7 Mbps.[13]

Wireless broadband connects a home or business to the Internet using a radio link between the customer's location and the service provider's facility. Wireless broadband can be mobile or fixed. Wireless technologies using longer-range directional equipment provide broadband service in remote or sparsely populated areas where DSL or cable modem service is not necessarily available and/or would be costly to provide. Speeds are generally slower than DSL and cable modem and usually require an external antenna. In 2009, the national actual average wireless download speed experienced by consumers was 0.7 Mbps.[14]

- Wireless fidelity (Wi-Fi)-enabled wireless devices, such as laptop computers, can send and receive data from any location within signal reach of a Wi-Fi-equipped access point. Because Wi-Fi hot spots operate in unlicensed spectrum, interference can be a problem.

[10] FCC, "Broadband Performance," OBI Technical Paper No. 4.

[11] ibid.

[12] General Accountability Office, "Telecommunications: Broadband Deployment Is Extensive throughout the United States, but It Is Difficult to Assess the Extent of Deployment Gaps in Rural Areas," May 2006, http://www.gao.gov/products/GAO-06-426

[13] FCC, "Broadband Performance," OBI Technical Paper No. 4.

[14] ibid.

- With Worldwide Interoperability for Microwave Access (WiMAX) service, the signal can pass through buildings, trees, or other obstructions with non-line-of-sight service. Because of its greater capabilities in terms of distance and speed, WiMAX can extend wireless broadband to less densely populated communities and into older buildings where wired solutions may be more expensive to deploy. Potential concerns include spectrum availability, interference, and the ability of manufacturers' equipment to support broadband applications.

Satellite broadband is another form of wireless broadband, and is also useful for serving remote or sparsely populated areas. Just as satellites orbiting the earth provide necessary links for telephone and television service, they can also provide links for broadband.

Downstream and upstream speeds for satellite broadband depend on several factors including the provider and service package purchased, the consumer's line of sight to the orbiting satellite, and the weather. Typically a consumer can expect a download speed of about 500 Kbps and an upload speed of about 80 Kbps. These speeds may be slower than DSL and cable modem, but they are about 10 times faster than the download speed with dial-up Internet access. Consumers need a clear view of the southern sky to be able to receive transmission from the satellites. Service can be disrupted in extreme weather conditions. In 2009, the national actual average satellite download speed experienced by consumers was 0.7 Mbps.[15]

Broadband over Powerlines (BPL) is a technology that allows voice and data to be transmitted over the existing low- and medium-voltage electric power distribution network. BPL speeds are comparable to DSL and cable modem speeds. BPL can be provided to homes using existing electrical connections with a modem plugged into an outlet; it does not require a phone, cable, or satellite, BPL is an emerging technology that is available in very limited areas. It has significant potential because power lines are installed virtually everywhere, alleviating the need to build new broadband facilities for every customer. However, a number of prototypes in various locations across the United States have been canceled due to interference and safety concerns.[16] For example, BPL can emit signals that interfere with other users of the spectrum, such as amateur radio and public safety equipment. In addition, due to the age or condition of the electric network, providers in some areas would be unable to transmit Internet data at high speeds.

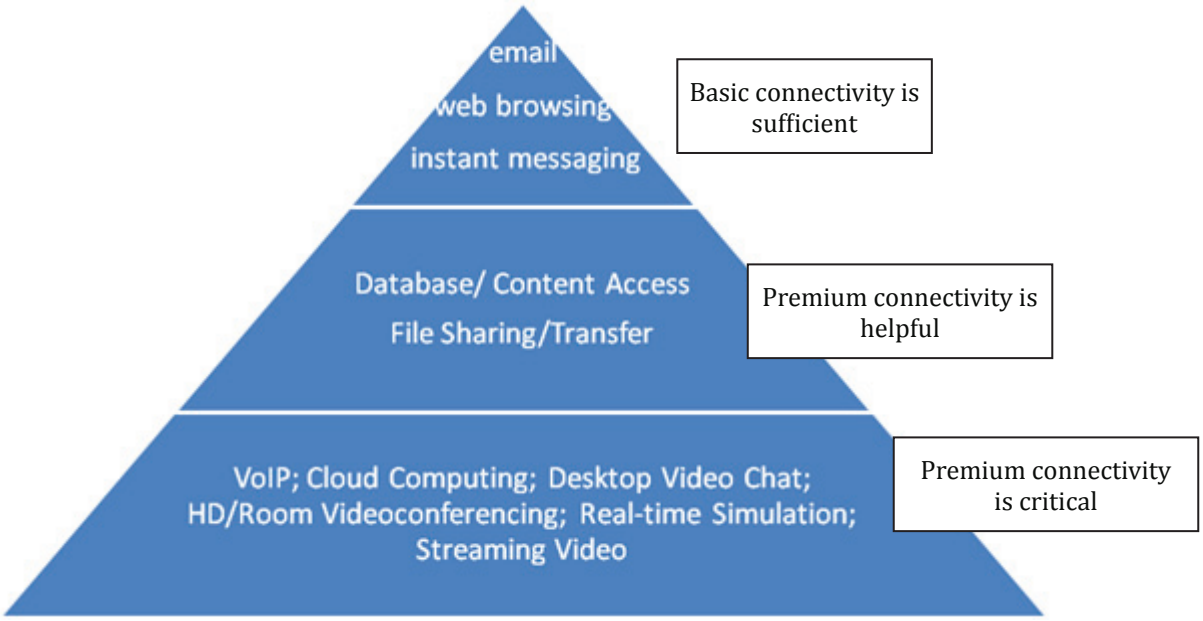
Speed Requirements for Broadband Activity

Different online activities such as emailing and video conferencing require different download and upload speeds. Figure 1 and Table 2 outline different uses for broadband and the service requirements and current download speeds that the activities require.

[15] FCC, "Broadband Performance," OBI Technical Paper No. 4.

[16] http://www.ncs.gov/library/tech_bulletins/2007/tib_07-01.pdf

FIGURE 1: DESIRED CONNECTIVITY BY BROADBAND ACTIVITY



Source: modified from Bill & Melinda Gates Foundation recommendations to the FCC

TABLE 2: DOWNLOAD SPEED DEMANDS BY CONTENT AND APPLICATION, 2010

Actual Download Speed Demands (Mbps) by Different Content and Application Types		
Content Type	**Example of Applications/content providers**	**Actual download speed demands (Mbps)**
Basic download (or upload) usage	Email, web browsing, government websites	0.1 – 0.3
Large download (or upload) usage	iTunes, advanced web browsing, social networking, medical records	0.5 – 5+
Streamed audio	PBS, Rhapsody	0.1-0.3
SD-quality streamed video	Streamed classroom lectures; Hulu	1-5
HD-quality streamed video HDTV; HD streamed university lecture 5-10+		
Voice over the Internet (VOIP)	Skype, Vonage	0.1-0.3 symmetrical
Video conference and VOIP	Lower definition telemedicine	0.6-1.0 symmetrical
Internet Protocol TV	IPTV	1-5+ symmetrical
2-way advanced video interaction	Real-time interactive experiences and gaming	2-5+ symmetrical
Enhanced video teleconferencing (HD quality or similar	Video teleconference; TeleLearning; HD Telemedicine (diagnostic imaging)	5-10+ symmetrical
Source: Modified from FCC , "Broadband Performance," OBI Technical Paper No. 4, page 9.		

REGULATION OF BROADBAND

Although the broadband market is not regulated, because of permitting and zoning rules, government often has a significant role in network construction. Government also regulates how broadband providers can use existing private infrastructure such as utility poles and conduits.

In Connecticut, most entities, including broadband service provider companies, must file with PURA for a certificate of public convenience and necessity (CPCN) for statutory authority to gain access to public rights-of-way to install the necessary broadband infrastructure. For companies seeking to install infrastructure on utility poles, a CPCN is required to gain access from pole owners. In Connecticut, nearly all poles are jointly owned by an electric utility and a telecommunications company. Gaining access to the poles requires a company to submit separate applications to each pole owner.

As noted in the National Broadband Plan, the "make-ready" process of gaining access to the poles can result in significant costs and delay the building or upgrading of broadband networks.[17] "Make-ready" work frequently involves moving wires attached to a pole to ensure proper spacing according to electrical safety codes. This process requires coordination between the utility that owns the pole and the other firms that have attached to the pole. Each attaching party is responsible for moving its wires and equipment. Delays in the process can result from existing attachers' inaction to move the equipment and wires to accommodate a new attacher.

WHY IS BROADBAND IMPORTANT FOR CONNECTICUT?

Broadband has revolutionized the way services are provided and business is conducted. It drives innovation, progress, and prosperity for all residents. By improving communication and the flow of information, broadband facilitates job creation, decreases health-care costs, reduces miles driven and fossil fuels consumed, expands consumer choice, and improves competition. Broadband encompasses almost every aspect of life.

Possessing digital literacy skills is an essential competency necessary for professional advancement and personal prosperity. Those who do not have access to the Internet are at a disadvantage in the academic arena and the labor market. For example, 80% of all Fortune 500 companies only accept applications online.[18] In addition, more government services, including Medicare applications, are moving online, requiring digital literacy.

In an online poll measuring the importance to consumers who currently have broadband connections, 85% of those polled said they would give up eating out, designer coffee, and cable TV before their cell phone and Internet service—demonstrating that once people have access to broadband, it becomes more of a necessity than a luxury.[19]

Broadband enables advancements in health care, public safety, energy, government performance, education, economic development, workforce development, and transportation.

[17] The National Broadband Plan Chapter 6.

[18] Taleo Research - http://www.taleo.com/research/articles/talent/don-miss-the-next-strategicturn-115.html

[19] National Foundation for Credit Counseling online poll of 3,148 individuals conducted June 1-30, 2011.

Below are just a few examples of the advancements possible with access to broadband.

Health care: Access to broadband increases the ability to use electronic medical records, wireless medical devices, and capacity to collect and analyze patient information. Broadband can provide real-time data to providers, allowing for faster diagnosing and treatment, thus improving patient care. Electronic medical records can reduce redundant treatment, eliminate time-intensive paperwork, and expand research and data capabilities. In addition, broadband can enable doctors to remotely assist patients who cannot make it to the office.

Public Safety: Broadband can enable a system where first responders nationwide can communicate with each other via public safety wireless communication devices. For example, a firefighter arriving at a scene could instantly check police communications and data transmissions such as building maps with a PDA or laptop—possibilities not currently available with just radios. In addition, the state has signed a $14.2 million contract that will allow nearly a dozen criminal justice agencies in Connecticut to share information.[20] Broadband could enable the real-time tracking of offenders and maintain accurate and reliable information that further promotes public safety.

Energy: Smart Grid technology, enabled by broadband, provides consumers with real-time energy consumption data, increasing the likelihood of energy conservation. Smart Grid implementation can revolutionize the way people live and function with the appliances and technologies in their homes. For example, mobile devices could enable individuals to control their heat and lights remotely. Also, Smart Grid technologies provide opportunities for improved management of the electricity transmission and distribution system.

Government Performance: Broadband facilitates the delivery of e-government services and applications, providing government with more opportunities to communicate with its constituents. The ability for government to offer more services online increases the efficiency and accessibility for all residents with access to the Internet. With the state facing structural budget deficits, offering more services online is one way for government to reduce the cost of providing services to the public.

Education: As the content grows on the Internet, more teachers are assigning homework that requires access to the Internet—and using the Internet to enhance and add dimensions to traditional learning techniques at all levels of instruction. For example, students can now participate in virtual high school classes. This allows students to take classes not offered at their high school and to learn at their own speed. The Internet also enables parents to more easily communicate with teachers and to view grades, progress reports, and other student evaluation information.

Economic Development: Broadband enables towns, regions, and states to develop, attract, retain, and expand job-creating businesses and institutions. It enables new business growth and the expansion of existing businesses into new markets.

Workforce Development: Broadband-enabled job-training can customize training so it reaches the broadest group of people at a lower cost and with greater flexibility than the traditional model of training classes. Broadband enables a workforce system to provide individuals with training and career help in a more flexible and cost-effective manner.

[20] Computer Network Will Connect Justice Agencies, *Hartford Courant,* September 20, 2011.

Transportation: Broadband enables technologies that can alleviate congestion, enhance road safety, and reduce the environmental impact of transportation. For example, in South Korea, wireless sensors help monitor the health of bridges.[21] This changes the model from an engineer inspecting a bridge on-site and then reporting back, to using data collected remotely to monitor the condition of a bridge continuously. Another example of the possibilities with broadband is in San Francisco, where a mobile network is used to deploy a smart parking system that allows users to locate open parking spots or pay for parking using a mobile phone.[22] Broadband also enables telecommuting, reducing traffic congestion during peak hours and reducing pollution.

[21] Andes, Scott and Daniel Castro, "Opportunities and Innovations in the Mobile Broadband Economy, " Information technology & Innovation Foundation, September 14, 2010.

[22] ibid.

III. BROADBAND TODAY

This section of the report examines recent efforts aimed at expanding broadband access and use, both at the national and state levels. The first part of this section looks at recent national efforts regarding broadband policy; how the United States compares with other countries in terms of broadband infrastructure and use; research published by the Pew Internet and American Life Project, a project of the Pew Research Center (Pew Internet) on national trends in the use of broadband; and finally, explores broadband policy in other states. The second part of this section examines Connecticut's efforts at expanding broadband access; how the state compares to other states; recent maps of broadband speed and coverage in Connecticut; results on consumer and business surveys regarding broadband use; results from focus groups conducted in the state; and finally, the challenges in expanding broadband access and adoption.

But first, an overview of the history of broadband use. The Internet and the development of broadband for wide use by the public occurred in the mid- to late-1990s. Dial-up access became available to many residents across the country when early services such as CompuServe and America Online (AOL) began offering service. Terms such as web browsers, operating systems and e-commerce were discussed and the products were utilized. Fears about Y2K brought about a surge in IT investment followed by the dot com stock market crash (2000-2002). The first web logs (blogs) became prominent. This first wave of Internet and broadband development is noteworthy because it increased the ease with which people could create content.

The second wave, roughly between 2000 and 2005, can be described as a time of "content explosion." Broadband at that time was not much faster than dial-up speeds, although it was always on and available rather than having to log in to it. Search engines during this time gained in popularity, as did user-generated content (UGC).

The third wave, taking place between 2005 and 2010, can be noted as a time of increased social networking and mobile access. Broadband speeds increased (1-5 Mbps versus 200 Kbps during second wave) and with faster speeds came more complex social platforms such as Facebook. Twitter also expanded rapidly during this time, as did mobile access of broadband services.[23]

RECENT NATIONAL BROADBAND EFFORTS

In 2009, the ARRA provided the Department of Commerce's National Telecommunications and Information Administration (NTIA) and the US Department of Agriculture's Rural Utilities Services (RUS) with $7.2 billion to expand access to broadband services in the United States. Of these funds, $4.7 billion was provided to NTIA and $2.5 billion to RUS.

Federal funding was allocated to projects that promoted one of the following missions: the expansion or improvement of broadband infrastructure; establishment of public computing

[23] Kevin Werbach, Technology Analyst, Associate Professor of Legal Studies and Business Ethics
The Wharton School, University of Pennsylvania, Presentation to CASE Broadband Study Committee, 4/1/11.

centers; increasing usage and adoption, particularly in vulnerable populations; and state data and development programs.

The NTIA administered two programs utilizing the ARRA funding: the Broadband Technology Opportunities Program (BTOP) and the State Broadband Data and Development Program. The BTOP issued two rounds of awards, one starting at the end of 2009 and another in the fall of 2010. The BTOP had three project categories under which awards were issued: Comprehensive Community Infrastructure; Public Computing Centers; and Sustainable Broadband Adoption.

The federal funding that was allocated to RUS supported grants and loan/grant combinations to facilitate broadband infrastructure projects in rural areas via the Broadband Initiatives Program (BIP). BIP funding solely focused on rural areas as defined by the US Bureau of Census.[24]

In addition to the grants issued as part of the federal broadband initiative, the Federal Communications Commission was tasked with developing a national broadband plan. In March 2010, the National Broadband Plan[25] was released. The plan describes four ways in which the government can influence the broadband ecosystem. The four ways include:

1. establishing competition policies;
2. ensuring efficient allocation and use of government-owned assets;
3. creating incentives for universal availability and adoption of broadband;
4. updating policies and setting standards and aligning incentives to maximize use for national priorities

As for establishing competition policies, federal policy makers, including those at the FCC, have tools to encourage competition in the broadband markets of network services, devices, applications and content. Some of the tasks highlighted in the national broadband plan include

- publishing information on broadband pricing;
- developing disclosure requirements for providers regarding pricing and performance;
- allocating additional spectrum;
- updating rules for wireless backhaul spectrum;
- expediting action on data roaming;
- fostering a competitive video set-top box market;
- clarifying the Congressional mandate allowing state and local entities to provide broadband;
- ensuring consumer privacy.

[24] Any area 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 Bureau of the Census.

[25] http://www.broadband.gov/plan/

The second way in which federal government can influence the broadband markets, through ensuring efficient allocation and use of government-owned assets, includes establishing policies for the deployment of broadband networks through the use of spectrum, poles, conduits, rooftops and rights-of-way. In addition, the federal government finances infrastructure projects to encourage the deployment of broadband infrastructure and lower barriers to competitive entry.

Creating incentives for universal availability and adoption of broadband, the third aspect of the national broadband plan, involves three elements to ensure all Americans have the opportunity to benefit from the use of broadband. These are

1. access to broadband service with sufficient capabilities;
2. the ability to afford broadband;
3. the opportunity to develop digital literacy skills.

These elements will be advanced by the newly created Connect America Fund, which will eventually replace the Universal Service Fund. In addition, the new fund will create a Mobility Fund to ensure that states have sufficient 3G wireless coverage; reform intercarrier compensation to eliminate per-minute charges; create mechanisms that ensure affordability for low-income Americans; expand Lifeline and Link-Up programs by allowing subsidies to be used for broadband; license a block of spectrum for a low-cost service; and launch a National Digital Literacy Corps to break down adoption barriers.

The fourth major thrust of the national broadband plan involves updating policies, setting standards, and aligning incentives to maximize use for national priorities. The plan includes recommendations designed to increase use, private sector investment, and innovation within six sectors. Below is a list of the sectors and why broadband is important:

- Health care - Broadband improves the quality and lowers the cost of health care through health IT and improved data capture and use, which will enable clearer understanding of effective treatments and processes.
- Education - Broadband enables improvements in public education through e-learning and online content, which can provide personalized learning for students. In addition, broadband facilitates the flow of information, allowing teachers, parents and schools to make better decisions tied to students' needs and abilities.
- Energy and the environment - Broadband plays a major role in the transition to a clean energy economy. America can use these innovations to reduce carbon pollution, improve energy efficiency and lessen dependence on foreign oil.
- Economic opportunity - Broadband expands access to jobs and training, supports entrepreneurship and small business growth, and strengthens community development efforts.
- Government performance and civic engagement - Within government, broadband drives greater efficiency and effectiveness in service delivery and internal operations. It can also improve the quantity and quality of civic engagement by providing a platform for meaningful engagement with representatives and agencies. Through its own use of

broadband, government can support local efforts to deploy broadband, particularly in unserved communities.

- Public safety and homeland security - Broadband improves public safety and homeland security by allowing first responders to send and receive video and data, by ensuring Americans can access emergency services and by improving the way Americans are notified about emergencies.

Appendix C lists the major long-term goals as prescribed in the plan as well as the role of the government in implementing the goals.

United States Compared to Other Countries

Although the United States led the way in the development of high-speed Internet, the country now trails other countries in terms of access, adoption rates, and broadband speed. Several studies published recently have ranked countries throughout the world on the quality of broadband and the use of broadband to enhance competitiveness.

Table 3 shows the challenge confronting the United States if it is to keep pace with other developed nations when it comes to broadband adoption rates, speed, and price.

TABLE 3: BROADBAND AVAILABILITY, SPEED, AND COST:
UNITED STATES VERSUS SELECTED COUNTRIES

Comparison of Broadband availability, speed and cost: United States versus Select Countries				
Ranking	**Country**	**Household penetration**	**Speed** (Avg download speed Mbps)	**Price** (lowest monthly price per Mbps) (US $ purchasing power parity)
1	South Korea	0.93	49.5	0.37
2	Japan	0.55	63.6	0.13
3	Finland	0.61	21.7	0.42
15	US	0.57	4.9	2.83
Source: ITIF May 2008				

Another report, published in September 2010, sponsored by CISCO and issued by Oxford University, assessed the quality of broadband connections around the globe. Broadband quality was evaluated by scoring download speeds, upload speeds, and latency. South Korea was the clear leader in broadband quality with the United States ranking 15th. Furthermore, the United States was not listed as one of the fourteen countries prepared for the Internet 'applications of tomorrow' (examples include high-definition Internet TV and high-quality video communications services). In 2008, one country was prepared for the "applications of tomorrow" and in three years, 13 more countries were added to the list. However, the United States was listed with eighteen other countries as "comfortably enjoying today's applications" (examples include social networking, low-definition video streaming, basic video-conferencing, small file sharing).[26]

[26] Oxford University and Cisco, "Broadband Quality Score III: A global study of broadband quality," September 2010.

Finally, another study, which assessed broadband in terms of enhancing competitiveness, shows the United States ranking in the top five. For the past ten years, the Networked Readiness Index has been measuring the degree to which countries across the globe leverage information and communication technologies (ICT) for enhanced competitiveness. The measures comprising the index fall into three areas: the friendliness of the country's market, regulatory and infrastructure environments to innovate; readiness of businesses, individuals, and government to adopt broadband; and finally, the actual usage of broadband by government, businesses, and individuals. The United States ranked 5th overall (a drop of two rankings from the 2008-09 index) with Sweden as the leader.[27]

National Broadband Research

Many organizations within the United States have been tracking the progress of broadband adoption and uses. Most notably, the Pew Internet has been studying the social impact of the Internet since March 2000. It has become the main resource for national surveys on Internet adoption and use. The following list summarizes the major findings from recent Pew surveys on home broadband access, broadband use by household income, broadband and phone use, and broadband use with respect to race and ethnicity.

- *Home Broadband Access* - In August 2010, Pew Internet released the results of its home broadband adoption survey, which it has been conducting for the past ten years. The findings from the survey showed that the adoption of home broadband Internet access slowed from the previous year. While most demographic groups experienced flat-to-modest broadband adoption growth, African Americans experienced 22% year-over-year broadband adoption growth. For example, in 2009, 65% of whites and 46% of African Americans were broadband users and in 2010, 67% of whites and 56% of African Americans were broadband users.
- *Broadband Use by Household Income* - In a separate survey, the Pew Internet looked at household broadband use by income levels. Results from a November 2010 survey find that higher-income households are different from other Americans in terms of their technology ownership and use.[28] In fact, 95% of households earning over $75,000 use the Internet at least occasionally, compared with only 70% of those earning less than $75,000.[29] In addition, the higher-income households are more likely than those in lower-income households to own a variety of technology devices such as desktop and laptop computers, iPods or MP3 players, e-book readers, and tablet computers.[30]
- *Broadband and Phone Use*- As broadband continues to evolve, new uses become mainstream in our daily living. In 2011, a phone survey conducted by Pew Internet found that almost a quarter (24%) of Internet users have placed phone calls online with 5% of Internet users placing an online call on any given day.[31] What is interesting about this finding was in 2007 a similar survey found only 8% of Internet users had placed calls online—an increase of 16% in four years.

[27] World Economic Forum, The Global Information Technology Report 2010-2011, http://www.weforum.org/issues/global-information-technology

[28] "Use of the Internet in Higher-Income Households," Pew Research Center, November 24, 2010.

[29] ibid.

[30] ibid.

[31] http://www.pewInternet.org/Reports/2011/13--Internet-phone-calls--Skype.aspx

- *Broadband Use with Respect to Race and Ethnicity*- Since 2000, when Pew Internet first began surveying households regarding Internet use, the proportion of Internet users who are African American or Hispanic has doubled— from 11% to 21%. However, African Americans are less likely than whites to go online and also less likely to own a desktop computer—51% of African Americans compared with 65% of whites.

  On the other hand, English-speaking Hispanics are almost identical to whites in terms of their Internet and home broadband use. However, foreign-born and Spanish-dominant Hispanics dramatically trail both whites and native, English-speaking Hispanics in home broadband and Internet use. Based on the 2009 National Survey of Hispanics, Pew Internet found that language proficiency is one of the most powerful predictors of Internet use, even when controlling for other demographic factors. For example, 85% of native-born Hispanics ages 16 and older go online, but only about half (51%) of foreign-born Hispanics do.[32]

  However, when looking at mobile technology use, the survey data reveal a different trend. In fact, African Americans and English-speaking Hispanics are more likely than whites to own a cell phone. In addition, minority adults use a much wider range of their cell phones' capabilities than do white cell phone owners. For example, 70% of all African American and English-speaking Hispanics use text messaging whereas only just over half of whites do. Other uses for which African Americans and Hispanics are more likely to use their mobile devices when compared to whites include: emailing, playing games, recording and watching videos, and using the Internet.[33]

The phone surveys that were conducted in Connecticut in support of this research included questions that mirrored the Pew surveys so that comparisons with the national averages can be made. The results of Connecticut's surveys are summarized later in the report.

RECENT CONNECTICUT BROADBAND EFFORTS

Prior to the federal initiative to expand broadband access and adoption, Connecticut state policy makers realized the importance of broadband access for state residents and businesses. The state launched two initiatives: the development of the Connecticut Education Network (CEN) and creation of a Broadband Coordinating Council, both of which are described in more detail below. More recent efforts include the Legislative Program Review and Investigations Committee's recent report examining Connecticut's e-government efforts and Connecticut's applications for BTOP funding.

Connecticut Education Network

In 2000, Connecticut's education technology program was established by statute to achieve statewide technology goals which included the creation of the Connecticut Education Network (CEN). The CEN provides at least one school and library within each town with a high-speed Internet connection. Connections were available in all K-12 school districts at the start of the 2005-2006 school year. By statute, the CEN is limited to providing Internet access and video, voice, and data transmissions.

[32] Livingston, Gretchen, "The Latino Digital Divide: The Native Born versus The Foreign Born," Pew Hispanic Center, July 28, 2010.

[33] Smith, Aaron, "Mobile Access 2010," PewInternet & American Life Project, July 7, 2010.

The network was built using fiber-optic connections that operate at speeds 1,000 times faster than a home broadband connection.[34] The Connecticut Department of Information Technology (as of July 1, 2011 the Department of Administrative Services Bureau of Enterprise Systems and Technology), and the University of Connecticut provide project management, network architecture, and operational support.

Currently there are 220 fiber sites throughout the state and with the ARRA federal funding, an additional 120 sites will be added in northwestern and northeastern Connecticut as well as some points along the shoreline and in the Colchester area. Through the CEN, fiber broadband has been installed in rural areas of the state that are not served otherwise. The CEN currently allows users other than libraries and K-12 educational institutions access to their network (currently mostly colleges and universities) but they must first connect to the network through a provider.

The network is built so that each site has double redundancy with two distinct connections; therefore, if one fiber is accidentally cut, the users on the network do not lose service, unlike typical networks where outages occur if the one line is cut or disabled. The benefit of this redundancy was apparent during Winter Storm Alfred in late October 2011. Approximately six sites noted fiber problems following the massive power outages; however, only one site was without service.

In addition, for the network sites that use fiber, the CEN is able to meet its customers' bandwidth needs without increasing costs. With the fiber connection, the network operator can activate additional fiber and go from 1 gigabit to 10 gigabits if necessary. However, for the clients connecting through DSL and OPT-E-MAN® circuits (the latter is a switched Ethernet service that connects LANs within the same metropolitan area with flexible bandwidth options), the network operator must pay the third party provider extra to increase bandwidth. Furthermore, the fiber network offers customers 10 to 100 times the performance level for the same dollar as the traditional DSL connection.

The original shared core infrastructure and fiber were funded through state bonding, with no federal e-rate funding. This freed CEN from restrictions that e-rate dollars would have imposed, such as separating funding from higher education and K-12 sites, as well as limiting access to only schools and libraries on the core of the network. The K-12 and library-only segments of the network were partially funded with federal e-rate funding and restricted to schools and library use only. Today, CEN has no restrictions on use of the network, except when the network contracts with AT&T's OPT-E-MAN, frame, and DSL service that was e-rate funded, in which case use is restricted to schools and libraries. When the CEN is complete with the BTOP grant, approximately 12 sites will still utilize AT&T's OPT-E-MAN service for connection to the network. The network will continue to contract with AT& T OPT-E-MAN as needed to connect those still not served through the core network due to cost or availability.

Due to the requirement of the federal ARRA funding for open access, it is possible for:

- A provider to connect to the CEN network, and then serve as a provider to businesses and citizens, as no restrictions apply to access to the CEN *(except for the parts of the system that are e-rate funded).*

[34] http://cen.ct.gov/cen/cwp/view.asp?a=2401&q=384690

- Businesses and citizens to connect directly to the CEN network by agreement—monthly fee plus installation *(except for the parts of the system that received e-rate funding).*
- Municipalities to connect directly to the CEN network by agreement—monthly fee plus installation *(except for the parts of the system that received e-rate funding).*
- Businesses and citizens to connect directly to the fiber network—separate from the CEN on additional system capacity directly through agreement with the owner of the fiber network.

Connecticut Broadband Internet Coordinating Council (CBICC)

The Connecticut Broadband Internet Coordinating Council (CBICC) was established by statute as a result of legislative interest and based on the recommendations in a December 2006 study by the Connecticut Academy of Science and Engineering entitled, "Advanced Communications Technology." As required by Connecticut General Statutes § 4d-100(a)(a), the council "shall include representatives from both the private and public sectors." As of June 2011, the composition of the council includes: four representatives from the telecommunications industry, one representative from a university, one representative from a law firm, an independent consultant, a CIO from a town, an independent business person, and a member from the Office of Consumer Counsel (OCC). After its enabling legislation in 2007, the CBICC has met on a quarterly basis since July 2008.

The council is responsible for monitoring trends and developments in the state's efforts to develop a statewide world-class communications infrastructure; and issue any reports it deems necessary to the General Assembly's Energy and Technology Committee.

In April 2009, in accordance with Public Act No. 07-254, the CBICC provided the governor with four principles to consider when determining which projects should be submitted to the National Telecommunications and Information Administration (NTIA) for funding under the ARRA. The four principles included: invest in broadband mapping; promote broadband construction to unserved areas; promote broadband demand-side initiatives; and obtain funding for CBICC.[35] To date, the CBICC has not received or been designated for any funding. In March 2010, the CBICC submitted a report to the Energy and Technology Committee of the Connecticut General Assembly updating the committee on the council's activities as well as providing recommendations from a subcommittee of the council. In summary, the Council emphasized the importance of broadband service for Connecticut's economic success and recommended the creation of a statewide, comprehensive broadband plan to guide future state action on promoting broadband capacity and usage.

Legislative Efforts

In 2010 the Program Review and Investigations Committee studied state e-government efforts. The Committee concluded that "Connecticut's governance structure for planning, developing, and implementing e-governance is ineffective.[36]" In addition, there is no mechanism in place to

[35] CBICC Letter to Governor, 4/9/09

[36] Connecticut Legislative Program Review and Investigations Committee, "Assessment of Connecticut's Implementation of e-Government," December 2010.

guide e-government projects; instead they are implemented by individual state agencies, which results in an online presence modeled after the structure of government rather than tailored to the customer or state resident.

The committee made several recommendations to improve the state's website design and content so that it has a more customer-centered focus. In particular, the committee recommended establishing an e-government board to identify business and customer service needs and develop strategies for the state's CIO. The committee also recommended creating a strategic plan specifically for e-government services. A bill was raised in the 2011 legislative session to implement the recommendations from the report; it was put on the Senate calendar, and then recommitted back to the Program Review Committee where no further action was taken.

Today's Broadband Policy Landscape in Connecticut

The major groups of stakeholders that influence the state's broadband policy, either through strategy or with operational activities, are detailed in Figure 2. Prior to the federal ARRA funding, the role of the broadband coordinator did not exist. As shown in the figure, responsibilities are dispersed among several agencies and entities. In the figure, the arrows represent formal communication linkages; the double-lined solid circle represents organizations with legislative appointees, and the dotted lined circles represent organizations with gubernatorial appointments. As seen below, few formal lines of communication exist between the state's broadband policy makers.

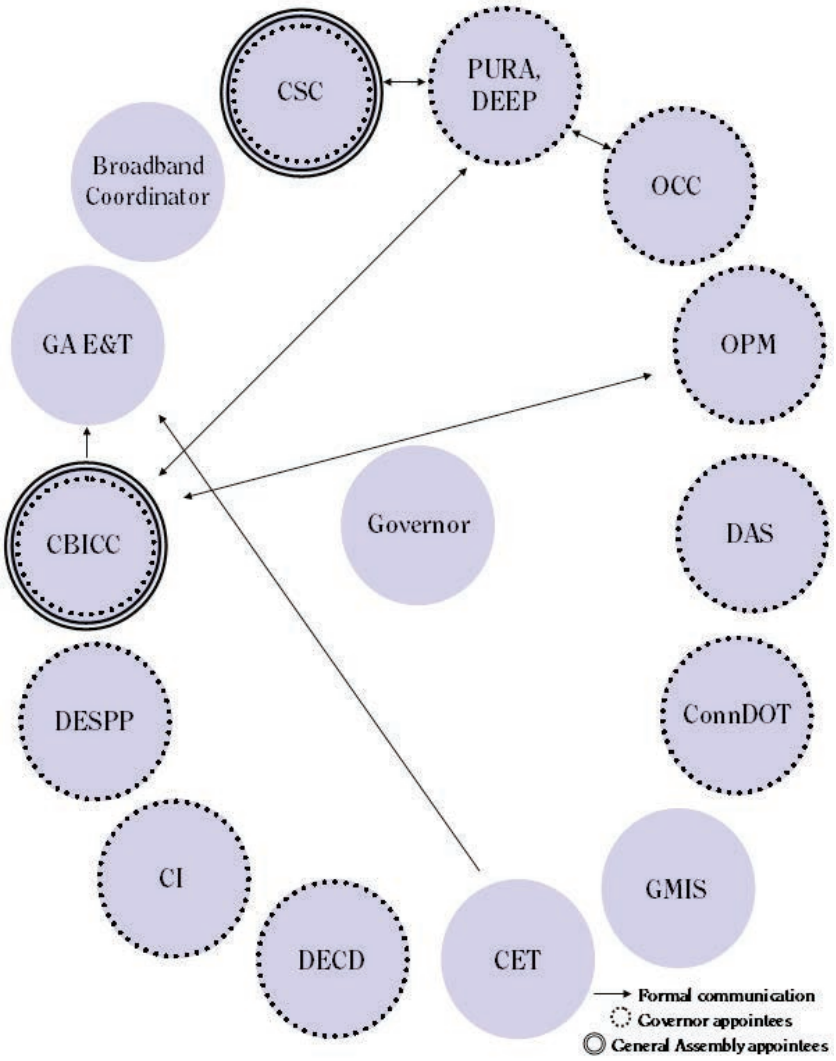


FIGURE 2: CURRENT COMMUNICATION AMONG BROADBAND POLICY MAKERS AND COORDINATING AGENCIES

The governor appoints all agency commissioners, along with two of the 10 CBICC members. The CBICC, as described earlier, monitors trends in the state's efforts to develop a world-class communications infrastructure, and issues reports as needed to the General Assembly's Energy & Technology Committee (GA E&T). The Broadband Coordinator[37] is responsible for writing the state's strategic broadband plan and applying for federal broadband funding, and is an appointed member of the CBICC. Two ex officio members of the CBICC include representatives from the Office of Policy and Management (OPM) and PURA. OCC advocates for all utility ratepayers in addition to participating as a party in all PURA dockets. The Connecticut Siting Council (CSC) oversees the siting of public utility facilities. The Chief Information Officer of the Bureau of Enterprise Systems and Technology, Department of Administrative Services (DAS), is

[37] In order to receive ARRA broadband funding, the federal funding conditions required that each of the 56 sovereign recipients (50 states, 5 territories or possessions, and Washington DC) had to create the broadband coordinator position not only to provide a single point of contact on broadband matters, but to facilitate a planning process for broadband issues on a sustained basis.

responsible for the operational responsibilities for Connecticut's state technology infrastructure. The monitoring of the Connecticut Education Network, along with setting standards in technology competency and reporting about trends in educational technology to the General Assembly, is under the purview of the Connecticut Commission for Education Technology (CET). The Department of Emergency Services and Public Protection (DESPP) coordinates emergency preparedness and planning and administers the public safety data network, including E911.

The Connecticut Government Management Information Sciences (GMIS) Users Group is a chapter of the international organization. Its purpose is to provide an opportunity municipal CIOs to network, exchange ideas, and coordinate solutions involving information technology and broadband.

Additional agencies and organizations that consider broadband issues within their purview include:

- Department of Economic and Community Development (DECD), which strives to strengthen innovation in the state
- Department of Transportation (ConnDOT), which works with utilities on various infrastructure projects and provides funding support for telecommuting programs
- Office of Policy and Management (OPM), which develops the state budget and policy initiatives on behalf of the governor
- Connecticut Innovations (CI), which provides strategic capital to high-tech industries including those within the information technology sector

Formal links of communication include reports written by the CBICC and CET for the General Assembly. As a nature of their missions, PURA and OCC interact closely together, as does DECD and CI. Representatives from both PURA and OPM are ex officio members of the CBICC.

Connecticut BTOP Project

Connecticut is fortunate when compared to other states in that private providers have invested millions of dollars in broadband infrastructure that traverses the state. The federal government's initiative to expand access to broadband across the United States placed a priority on areas without broadband infrastructure. Although multiple projects were submitted by the state as well as by private entities to the federal government for funding under the Broadband Technology Opportunities Program (BTOP) project, the state government was the only Connecticut-based recipient of a BTOP grant to improve the CEN infrastructure and E-911 service. This funding was in addition to the Broadband Data Improvement Act (BDIA) grant to aid the state with broadband data collection and mapping and development of a strategic plan for increasing access to and adoption of broadband services. This section of the report examines both the projects for which Connecticut received funding and those projects that were not awarded funding.

Under the BTOP, Connecticut was the recipient of $93.8 million in federal BTOP dollars to increase broadband infrastructure as well as a $3.8 million BDIA federal grant to complete a broadband mapping project, develop a strategic plan, and establish a state-level broadband office to coordinate broadband policy and programs. No awards were granted to the state to expand or create Public Computer Centers.

The infrastructure award—known as the Access Connecticut project—was granted to the Connecticut Department of Information Technology, in partnership with other state agencies, to significantly upgrade and expand Connecticut's existing broadband infrastructure in order to improve public safety and educational services across the state.

The Access Connecticut project has three components. First, the project plans to deploy over 5,500 miles of new fiber infrastructure, including 113 hub sites in predominantly underserved areas. Second, it will work with the Connecticut Public Safety Services Data Network to integrate a statewide data network at more than 540 public safety facilities that serve more than 25,000 first responders. Third, the project plans to engage the Connecticut Education Network to bring broadband service to educational institutions and libraries at speeds up to 1 Gbps.

Access Connecticut also proposes to:

- Prepare the state for its transition to Next Generation 911 functionality, improving connectivity to the FBI's National Crime Information Center (NCIC) system and a wide array of security applications.
- Directly connect approximately 660 anchor institutions, including 543 public safety entities, 83 K-12 schools, 29 libraries, four government facilities, and two community colleges.
- Enhance access for educational institutions to Internet2 and the iCONN state and regional education networks to facilitate distance learning, research, and collaboration.

Connecticut had 13 applications for BTOP grants that did not receive funding. Below is a list of the projects that were not funded:

1. Department of Information Technology – Infrastructure, $110 million (rejected in Round 1 and then awarded $93 million in Round 2)
2. Yale New Haven Health Services Corporation – Sustainable Broadband, $1 million – Remote Emergency Access for Children in Community Hospitals
3. Town of Manchester – Infrastructure, $18.9 million – CT Municipal Net
4. Town of Manchester – Public Computing Center, $0.4 million – CT Municipal Net
5. Town of Manchester – Sustainable Adoption, $0.1 million - CT Municipal Net
6. Housing Authority of the City of New Haven – Public Computing Center, $0.4 million – Eastview Public Computer Lab
7. Housing Authority of the City of New Haven – Public Computing Center, $2.5 million – West Rock Learning Center
8. City of Hartford – Infrastructure, $6.5 million – Connect Hartford (Round 1)
9. West Hartford Public Library – Public Computing Center, $0.1 million – Bishops Corner Branch
10. Stamford Hospital – Sustainable Broadband Adoption, $2.8 million – Broadband Adoption and Telehealth Monitoring for Older Adults

11. Town of Glastonbury – Infrastructure, $1.9 million – CT East of the River Fiber Connect
12. City of Hartford – Infrastructure, $6.2 million – Connecting Hartford (Round 2)
13. Alphastar America, Inc. – Infrastructure, $12.1 million – Building the First Statewide Broadband Telehealth Network in Connecticut

However, Connecticut is included in two Sustainable Broadband Adoption awards that will impact many states in the nation. The first project, Project Endeavor, is focused on expanding broadband services for people who are deaf and hard of hearing. The second project, 21st Century Information and Support Ecosystem: Make It Easy Where You Are, will provide training and computer access to residents of affordable and public housing developments. Connecticut also will be impacted by the Infrastructure grant to the University Corporation for Advanced Internet Development which will connect 30 existing research and education networks.

Although policy makers often view Connecticut as not faring well in the funding that was awarded by the federal government, the tables below compare Connecticut's funding levels to the other states examined in this report. Table 4 displays the award amounts for each category under the BTOP grant and also the amounts for the BIP grants which were awarded to rural areas—for which Connecticut does not qualify. As shown in Table 5, Connecticut's federal awards on a per capita and per household measure were among the highest.

TABLE 4: FEDERAL AWARDS FOR SELECTED STATES

	BTOP							BIP for rural areas	
	Infrastructure		Computing Centers		Sustainable Adoption		Data & Development		
	#	$ amount	#	$ amount	#	$ amount	$ amount	#	$ amount
Washington	3	$166.1	2	$5.5	3	$3.1	$7.3	8	$62.4
North Carolina	3	$120.7	4	$2.6	1	$2	$6.6	9	$146.7
Maryland	1	$115.2	2	$1.1	0	$0	$4.8	3	$63.2
Colorado	2	$112.8	2	$2.4	0	$0	$5.4	10	$59.6
Connecticut	1	$93.8	0	$0	0	$0	$3.8	n/a	n/a
Massachusetts	3	$80.1	2	$2.6	2	$5.1	$6.2	1	$0.5
Rhode Island	1	$19.2	1	$1.2	0	$0	$4.5	n/a	n/a
Maine	1	$25.4	1	$1.4	1	$1.4	$5.0	3	$9.4
Vermont	3	$46.8	0	$0	1	$2.5	$3.5	2	$122.4
Kentucky	1	$0.5	3	$2.5	1	$1.4	$5.3	12	$305.4

$ in millions

National Infrastructure and Sustainable Adoption awards not included in the table.
BIP—Broadband Initiatives Program

Source: BTOP funding from BroadbandUSA website (www2.ntia.doc.gov); BIP awards from December 27,2010 RUS Quarterly ARRA Report

TABLE 5: PER CAPITA AND PER HOUSEHOLD BTOP FUNDING

State	BTOP Awards	Total BTOP funding	2010 Population	2010 # of Households	Per capita BTOP Funding	Per Household BTOP Funding
Washington	9	$182.0	6,724,540	2,620,076	$27.07	$69.46
North Carolina	9	$131.9	9,535,483	3,745,155	$13.83	$35.22
Maryland	4	$121.1	5,773,552	2,156,411	$20.97	$56.16
Colorado	5	$120.6	5,029,196	1,972,868	$23.98	$61.13
Connecticut	2	$97.6	3,574,097	1,371,087	$27.31	$71.18
Massachusetts	8	$94.0	6,547,629	2,547,075	$14.36	$36.91
Rhode Island	3	$24.9	1,052,567	413,600	$23.66	$60.20
Maine	4	$33.2	1,328,361	557,219	$24.99	$59.58
Vermont	5	$52.8	625,741	256,442	$84.38	$205.89
Kentucky	6	$9.7	4,339,367	1,719,965	$2.24	$5.64

BTOP funding totals include multi-state projects but not national awards.

Sources: Population and household (occupied housing units) data from the 2010 US Census; BTOP funding from BroadbandUSA website (www2.ntia.doc.gov) and Appendix A from BTOP Feb 2011 Quarterly Report

Broadband Measures: Connecticut Compared to Other States and Countries

Connecticut fared well in terms of the federal dollars awarded for broadband projects but how does the broadband service in the state compare to other states and countries? Various organizations that conduct research on broadband service and availability provide rankings and data that compare states and countries on measures such as: speed, coverage, and percent of households with broadband. When comparing Connecticut's current average connection speeds to other states in the nation, Connecticut ranks in the top ten for various measurements.

Each year the Wireline Competition Bureau of the FCC publishes a report based on information provided in the FCC Form 477 that is submitted to the FCC by telecom providers. Table 6 shows that as of June 30, 2010, Connecticut had a greater percentage of residential fixed connections at the national target speed than the United States and New York but not as high as Massachusetts.

TABLE 6: RESIDENTIAL BROADBAND FIXED CONNECTIONS - STATE COMPARISON

As of June 30, 2010	CT	MA	NY	United States
% Residential household fixed connections using National Target—3 mbps down and 768 up	46%	64%	43%	33%
% Residential household fixed connections—200 kbps in at least one direction	75%	76%	71%	64%

Source: "Internet Access Services: Status as of June 30, 2010," Industry Analysis and Technology Division of Wireline Competition Bureau, March 2011. http://transition.fcc.gov/Daily_Releases/Daily_Business/2011/db0520/DOC-305296A1.pdf

Akamai, an Internet content delivery company that manages a globally distributed network of servers and handles 15-30% of web traffic, publishes a quarterly report based on the data

they collect.[38] In the most recent report issued for the first quarter of 2011, Connecticut ranked sixth in the nation in terms of average connection speed. Delaware was the number one state with an average speed of 7.5 Mbps and Connecticut's average connection speed was 5.9 Mbps. Connecticut's average speed increased by 6.3% from the previous quarter and 7.8% from the previous year as shown in Table 7.

Table 7: Average Measured Connection Speed, Top 5 States—First Quarter 2011

State	Q1 '11 Avg Mbps	Quarter over Quarter Change	Year over Year Change
Delaware	7.5	3.5%	-0.7%
Rhode Island	6.8	-1.1%	18%
Wisconsin	6.0	7.7%	16%
New Hampshire	6.0	2.5%	2.4%
Connecticut	5.9	6.3%	7.8%
Source: Akamai, "State of the Internet," Volume 4, Number 1,1st Quarter 2011.			

Akamai's report also looks at average speeds globally and when looking at Connecticut's average speed compared to other countries as shown in Table 8, Connecticut ranked 10th in the first quarter of 2011. However, Connecticut's average speed is approximately 2.5 times slower than the leading nation- South Korea.

Table 8: Connecticut Average Speed Compared to Leading Countries

Rank	Country	Q1 '11 Avg Mbps
1	South Korea	14.4
2	Hong Kong	9.2
3	Japan	8.1
4	Netherlands	7.5
5	Romania	6.6
6	Czech Republic	6.5
7	Latvia	6.3
8	Switzerland	6.2
9	Belgium	6.1
10	*Connecticut*	5.9
11	Ireland	5.6
...		
15	United States	5.3
Source: Akamai, "State of the Internet," Volume 4, Number 1,1st Quarter 2011.		

[38] www.akamai.com

In May 2011, the FCC published its second *International Broadband Data Report* which provides comparative data on the extent of international broadband service capability, based on the best data sources available at the time. The FCC's analysis shows a positive correlation between broadband adoption and income, population size, and population density. These factors help explain why Connecticut ranks 7th in terms of the percent of households with broadband when compared to other developed nations, as shown in Table 9.

Table 9: Percent of Households with Broadband - Connecticut compared to other OECD Countries

Rank	Country	% of households with broadband
1	Korea	84
2	Sweden	79
3	Norway	78
4	Netherlands	77
5	Denmark	76
6	Finland	74
7	*Connecticut*	70
8	United Kingdom	69
…		
	United States	63

-Ranks 40 countries for which information was available

-States that ranked higher than Connecticut include: Massachusetts, New Hampshire, New Jersey, Utah, Washington, and Alaska

Source: FCC International Broadband Data Report, Second Report DA 11-732, May 20, 2011 (data from 2009 OECD)

In terms of Connecticut's actual speeds compiled from residents using the speed test on the state's broadband website[39] between July 1, 2010, and August 31, 2011:

- Wireline average speeds of 9.15 Mbps down and 2.40 Mbps up
- Wireless average user speeds of 22 Mpbs down and 1.67 Mbps up
    - Wireless just using cellular connection of 1.50 Mbps down and .78 Mbps up
    - Wireless just using a Wi-Fi connection of 6.24 Mbps down and 2.33 Mbps up

[39] http://connecticutbroadband.appgeo.com/speedtest.aspx; averages calculated by Applied Geographics

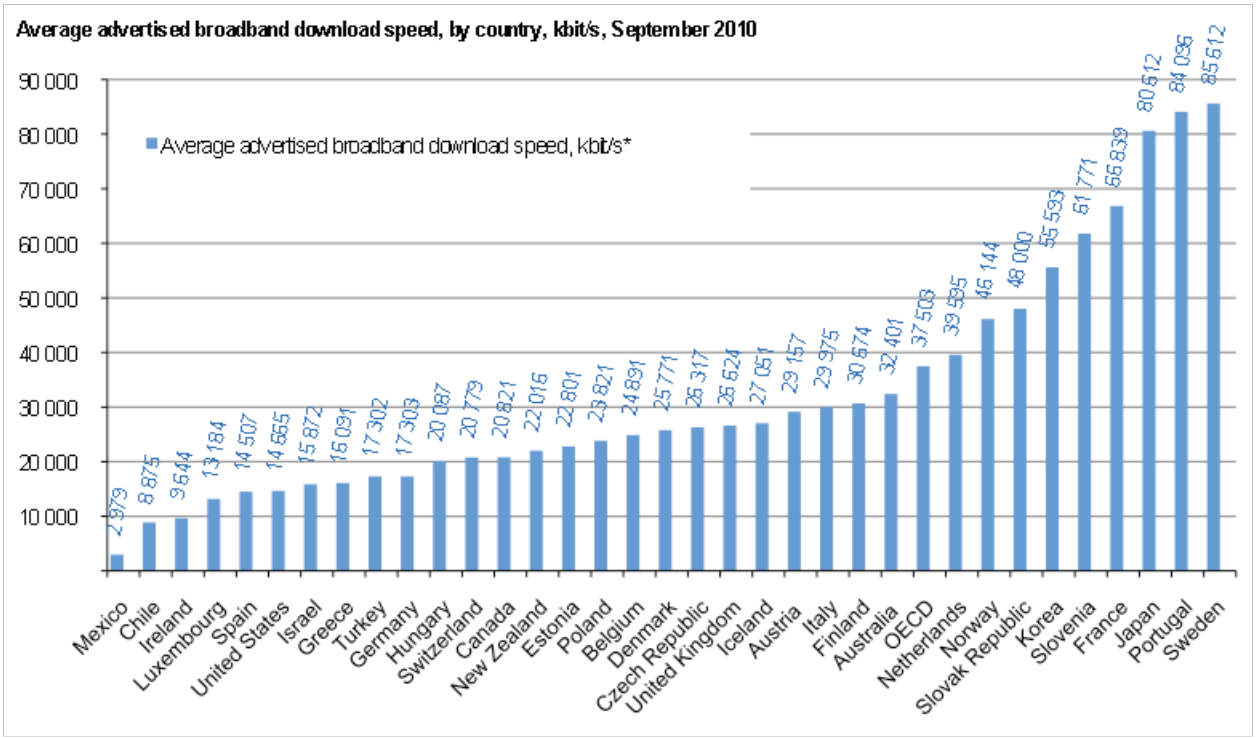


FIGURE 3: CONNECTICUT – A GLOBAL BROADBAND COMPETITOR

SOURCE: OECD BROADBAND PORTAL (OECD.ORG/STI/ICT/BROADBAND); 1MBPS=1,000KBIT/S

SUMMARY OF CONSUMER SURVEY RESULTS

As mentioned earlier in this report, the research team conducted surveys of Connecticut residents that mirrored the survey conducted by the Pew Internet. During the months of November and December 2010, a telephone survey was conducted among a random sampling of Connecticut residents at least 18 years old. 400 surveys were completed and evenly distributed by population density (rural, average, urban)[40] and phone type (landline, cell). This section of the report summarizes the results from the survey, with all the results provided in Appendix D.

The findings from the consumer survey indicate that a large percentage of Connecticut residents use the computer and the Internet. In fact, 89% of respondents use a computer, which is 12 percentage points higher than the national average. In Connecticut, fewer urban respondents access the computer at home and it was statistically different than the respondents from rural and average towns. Urban respondents are also less likely to use the Internet, which was also statistically significant.

The most common way for consumers to connect to the Internet is through cable modem, followed by DSL; FIOS and T-1 were not mentioned by any of the respondents. The use of cable Internet was 12 percentage points higher than the national average. On the other hand, a higher

[40] Rural defined as less than 325 people per square mile; average defined as 325-2,700 people per square mile; and urban defined as more than 2,700 people per square mile.

percentage of Americans use wireless connections than in Connecticut. Most respondents (43%) pay between $21 and $40 a month for their Internet service.

Connecticut consumers seem to be pleased with their service. When asked whether they would like faster service, almost three-quarters of the respondents said no. More than half of the respondents who want faster service indicated that price was the reason for not upgrading. While these respondents have access to broadband, they opt not to adopt the service due to cost concerns.

Cell phone ownership is also high in Connecticut, with 9 out of 10 respondents owning a cell phone. About one-quarter of the respondents who own a cell phone receive all their calls on a cell phone, with almost a third of cell phone owners receiving all or almost all their calls on a home phone.

Four out of ten respondents felt expanding affordable broadband service should be a priority for the state and federal government. These results mirror the national findings. However, fewer respondents in Connecticut felt it should not be done than in the national survey results: 13% versus 26%. Respondents with an associate's degree or higher were also more likely to feel expanding broadband service should be a priority for the government, either state or federal.

Respondents were provided with a list of activities to determine if not having broadband access at home was a disadvantage to conducting certain activities that are possible due to the availability of the Internet. In all the activities mentioned, more than half of the respondents felt it was either a major or minor disadvantage not to have Internet access.

Although, telecommuting is mentioned more often as an increasing trend, the results from the survey indicate it is still only a small percentage of workers in the state who telecommute. More than three-quarters of the respondents never telecommute with only 6% frequently telecommuting.[41] Higher-income households were more likely to telecommute than lower-income households. For example, 22 of the 23 households earning less than $49,999 never telecommute, whereas 57% of households earning more than $150,000 telecommute frequently. This trend is similar to the national trend, which found that over 75% of those telecommuting earn more than $65,000, putting them in the 80th percentile for income relative to the total workforce.[42]

When compared to the rest of the nation, Connecticut has a smaller percentage of its population not using computers or the Internet. In Connecticut, 13% of survey respondents indicated they either do not use a computer or do not use the Internet; this compares to 21% nationally. The highest level of educational attainment of almost half of those not using a computer was a high school diploma or GED.

[41] Based on total statewide employment, it is estimated there were more than 158,000 telecommuters in Connecticut in 2007, compared to an estimated 85,260 in December 2001, which equates to an 86% increase. (Telecommute Connecticut, Connecticut Embraces Practice of Telecommuting, March 2007)

[42] Lister, Kate and Tom Harnish, "The State of Telework in the U.S.," Telework Research Network, June 2011.

SUMMARY OF BUSINESS SURVEY RESULTS

During the months of November and December 2010, a telephone survey was conducted among a random sampling of Connecticut business service decision makers. 400 surveys were completed and evenly distributed by population density (rural, average, urban). This section of the report summarizes the results from the survey, with all the results in Appendix E.

85% of businesses surveyed use computers with 100% of businesses from the manufacturing, finance and insurance, real estate, and government sectors using computers. The industry sectors with the lowest percentage of computer use were the accommodation and food services sector (65%) and the agriculture, fishing, forestry, and mining industry sector (60%). Of the businesses with computers, 75% stated that all the computers in their businesses can connect to the Internet. Only five respondents indicated that none of the computers in their business can connect to the Internet.

Most businesses access the Internet from desktop computers (95%) with laptops as the next most common device (41%). Over 70% of businesses said either they would not be purchasing devices in the next six months or were not sure what they would purchase.

In contrast to the consumer findings, more businesses connect to the Internet through a DSL connection (56%) as opposed to a cable modem (30%). There was also no statistical difference between urban and rural respondents as to the type of connection they use. The majority of businesses are happy with the reliability and speed of their service, with more expressing concern over speed than reliability.

All businesses with 25 or more employees use email and 97% of businesses with less than 24 employees use email. Of all the businesses surveyed, three-fifths have a website but only a third sell products and services online.

Similar to the consumer findings, 8 out of 10 business respondents do not support telecommuting. There was a statistical difference between the ”support” and ”do not support” categories for businesses with 1 to 9 employees and 10 to 24 employees. A higher percentage of businesses with 1 to 9 employees compared to businesses with 10 to 24 employees ”do not support” telecommuting. This indicates that size of the business factors into the decision to allow telecommuting. In addition, the professional and technical professions and finance and insurance industries showed greater support for telecommuting than other industries.

Of the businesses that either do not have computers (60), do not have the Internet (5), or do not email (9), only six expressed an interest in using the Internet or email. The main reason given for not using the Internet or email is that they just aren’t interested.

Similar to the consumer findings, businesses felt favorably towards either the federal or state government expanding affordable high-speed Internet access to everyone. Half felt it should be a priority for the federal government and more than half of businesses feel it should be a priority of the state government.

SUMMARY OF FOCUS GROUPS

A total of 14 focus group sessions were conducted by the CASE Project Management Team to gather information from a variety of broadband users and non-users regarding their use of broadband services and needs for the future. Focus groups were geographically dispersed throughout the regions of the state—in northwestern, southwestern, eastern and central Connecticut. Additional focus groups were held to capture the opinions of youth and parents who have not adopted broadband in their homes. The focus group sessions were conducted from February through April 2011; approximately 114 people attended the sessions. A cross section of people attended the sessions including librarians, a State Representative, hospital leaders, business leaders, chief information officers and other information technology personnel, representatives from k-12 and higher education, community organization leaders and volunteers, town government representatives, economic development leaders, and the general public.

Below is a summary of the major findings from the focus groups based on the general themes that were discussed in each of the sessions. In addition, differences that were unique to a particular area of the state are also noted. The full results from the focus groups can be found in Appendix F.

Universal Access

In general, most participants felt that everyone should have access to broadband and that it is a necessity in order for individuals to be successful and for the state to stay competitive in a global economy. However, there was less agreement about how it should be paid for. Fast, reliable broadband service is critical for businesses. If Connecticut positions itself as a leader in broadband service, it would give the state a national and global competitive advantage.

Some participants also likened broadband to a utility such as electricity. Some people felt that regulation of broadband may be needed in order to remove the roadblocks for ensuring universal access, and to bring service to areas where providers have not yet built infrastructure. In addition, many participants felt that if the state and federal governments continue to expand their e-government services and mandate the use of the Internet for certain transactions, then government also has an obligation to ensure universal access.

Most people experience broadband through a device and not through the supporting infrastructure associated with the device, so they may not be aware of how decisions about infrastructure or potential government policies are made.

Municipal Government

Since Connecticut is divided into town governments, the role of municipalities in expanding broadband was also discussed. Municipalities vary in their level of service, with some still using dial-up service. Often town buildings are not connected with each other but instead each facility has its own connection. Additionally, participants felt that municipalities need to cooperate, rather than compete, with each other, and that it could be beneficial to have them connected. Public safety was often cited as a key area of municipal cooperation that could be enhanced through greater broadband access. Access to the E-911 and Connecticut Education Network

(CEN) networks seems like a natural answer to expanding municipal use of broadband services to improve e-government. However, overcoming competition among towns will be a real challenge because of the state's overreliance on property taxes, which causes towns to compete for the next big tax generator.

Libraries

Libraries are often viewed as a means for ensuring universal access. According to the State Librarian's office, there are 165 principal public libraries in the state with 240 total, including library branches. There was some agreement among participants that libraries are not the final solution for universal access. During the economic downturn, libraries have seen increased use of public terminals, and are playing a key role in providing free broadband access to job seekers and others who cannot afford home broadband service. On the other hand, since libraries are a public space it is not realistic for people to do all that is needed on a public computer. Furthermore, there are time limits placed on public access computers in some libraries and not everyone has the means to travel to the nearest library. In addition, the student participants expressed discomfort with using the public library facilities. However, while there are limitations, libraries still do serve as an important access point and contribute to the solution for enabling universal access.

Schools

In addition to libraries, schools were another possible solution mentioned as a way to offer universal access. PC centers within schools are often not used on weekends and after school hours and therefore could provide a space for public use or training classes. In addition, since schools are connected to the CEN, they often have faster broadband connections than typical home connections. However, a funding source for maintaining, monitoring, and operating PC centers in schools for public use beyond regular school hours would need to be secured as such funding most probably would not be available through school budgets.

Education

Many participants, including the youth participants, felt that students who do not have broadband at home are at a disadvantage to their peers. This may create the potential for widening the achievement gap and could have a negative impact on students' learning experience and achievement. This is particularly true since teachers are assuming students have access to the Internet when they are assigning homework and other related school work.

Business

Broadband has become a game changer in nearly all aspects of the business world. Businesses need robust, redundant and secure broadband networks and are requiring greater bandwidth in order to share documents and complete business transactions.

Cost of service was mentioned as a concern for the business participants. DSL is often chosen over cable since it is less expensive and a more cost-effective solution for small organizations.

However, service quality is sometimes an issue. Also, bundling of telephone, broadband and cable services by providers requires analysis by businesses to evaluate the options for the services that are needed.

Some participants are already experiencing the need for greater broadband speed at home and at work. Engineering firms using computer assisted design (CAD) would benefit from speeds higher than 1.5 Mbps upload and 10 Mbps download. Radiology practices also need increased bandwidth.

For the business representatives that participated, telecommuting was common among their employees with most firms having formal policies. For example, at Nestlé, headquartered in Stamford, CT, telecommuting is seen as an added employee benefit. They have 500-600 salespeople who work from home and a call center with agents who take calls at home. For companies based in Stamford, for example, telecommuting allows employees to live in places that are more affordable than Stamford. However, security was mentioned as the major issue with telecommuting. Additionally, it was noted that some employees do not have reliable broadband service at home, which makes telecommuting difficult.

Cloud computing[43] is also being used more frequently and is a way for organizations to maximize resources and be cost effective. However, the increase in cloud computing requires increased focus on security.

Health care

The challenge for the health-care industry moving to e-records is that more bandwidth and higher speed broadband connections will be required. Security also becomes a major issue. Private doctors' offices may not be able to afford the level of broadband service that is needed to stay current in the evolving industry.

Student Non-adopters

Cost was the key reason mentioned by the youth for not having a computer and broadband at home. Students without access at home rely on school computers and libraries but feel they are at a disadvantage to those with computers and broadband at home. Students who have smartphones with Internet access use their phones for school-related activities (emailing teachers, tracking assignments, doing homework, and online research). Computers in schools are critical for students who do not have broadband access at home.

Parent Non-adopters

Although participants agreed that broadband service is worth paying for, cost was the main reason participants did not have a computer or broadband in the home. Paying for a computer and the monthly cost for broadband service is a burden for many non-adopting households. Parent participants indicated that they access computers and the Internet from the following locations: library, work, school, a neighbor's house, or a relative's house. It was pointed out

[43] See "Appendix B: Broadband Glossary" for definition

that access at a hub (like a PC center or library) is not sufficient for people who do not have transportation or cannot leave home for health reasons or lack of childcare. In addition, public libraries often have waiting lists and time limits for computer use.

Geographic Differences

Participants from eastern Connecticut mentioned that some areas of the region do not have broadband access and a few areas have spotty cell phone coverage.

Participants from northwestern Connecticut noted that there are some areas where only dial-up service is available and there are even areas in the region without cell phone coverage. However, in areas that do not have wireless coverage, there is a tension between those who oppose the installation of cell phone towers for aesthetic purposes and those who want coverage for safety and security purposes. When libraries were discussed as an option to ensure universal access to broadband service, participants mentioned that many libraries do not have extended hours and are geographically far apart; therefore, libraries could not be the only solution to achieve this goal for this region of the state.

However, in southwestern Connecticut, access to broadband service is not an issue. In fact, participants were not even aware that some parts of the state do not have broadband coverage. The concern expressed by participants from this region is that residents require even faster and more robust service for both household and business use. Residential service can inhibit some residents from telecommuting because of concerns about security or service reliability.

Summary of Findings

Participants from all across the state felt that access to broadband is a necessity to remain competitive in this economy. Fast and reliable broadband is crucial for business competitiveness. Being a leader in this area could give Connecticut a global competitive advantage. In addition, as the demand and use of broadband services increases, security will become increasingly important.

In general, participants felt that there is a role for the government in increasing access to broadband and that regulation of the industry is probably needed. The demand for more secure, faster, reliable broadband services is the way of the future for both business and household needs.

However, as government moves more services online, the government has a responsibility to ensure greater access to the Internet. Since there are time restrictions and accessibility issues, libraries and computer hubs cannot be the only solution to ensuring universal access. In addition to having publicly accessible Internet, the state should also look into programs that subsidize the cost of the Internet for low-income households.

Summary of Broadband Mapping

A component of the ARRA grant included funding to map broadband coverage throughout the state. PURA commissioned Applied Geographics to meet the mapping requirements. The

maps display broadband advertised speed, number of providers, and wireless coverage and a summary of the findings is provided below (see Appendix H for a visual representation of the mapping findings).

Advertised Speed[44]

As of June 30, 2011, portions of all towns in Connecticut had advertised broadband download speeds of 6 Mbps. Furthermore, portions of all towns except four (Killingly, Plainfield, Sterling, and Putnam) had advertised download speeds of 10 Mbps. When looking at advertised download speeds of 100 Mbps or greater as of June 30, 2011, only towns in Fairfield County, portions of Litchfield County, and a few sections of towns outside those counties had service at these speeds. The highest speeds of 1 Gbps or greater only exists in a few sections of towns in lower Fairfield County, and also in a ring[45] running through the towns of Danbury, Bethel, Newtown, Southbury, Roxbury, Bridgewater, New Milford, and Sherman. If the National Broadband Plan goal of actual download speeds of 100 Mbps by 2020 for 100 million homes included Connecticut, more than half of the state would need improved service to achieve the goal.

Number of Providers

As of June 30, 2011, all towns in Connecticut were nominally serviced by at least one provider. However, there are sections of towns that are not serviced by any provider: for example, portions of Old Lyme, Portland, Salisbury, Voluntown, and Colebrook.

Land Area Coverage

Connecticut is fortunate in that virtually the entire state had access to wireless service as of June 30, 2011. The areas with the greatest access, which includes five or more wireless providers, are coastal Fairfield County and the towns along the I-91 corridor. The areas with the least amount of coverage, where only one provider offers service, include portions of northwestern Connecticut.

The following provides a list of the land area in Connecticut covered by various broadband and DSL technologies as reported by providers. As expected, wireless and wireline cover nearly all of the state, while satellite covers the entire state. DSL and cable services are available to more than three-quarters of the land area in the state, while fiber is not accessible to most.

[44] The term "advertised speed" generally refers to the speed ISPs use to advertise and market a particular broadband service. Generally ISPs do not expressly guarantee advertised speeds, but rather may describe an advertised speed as an "up to" speed, suggesting that consumers can expect to experience performance up to the advertised speed, with actual performance varying upon network conditions and other factors.

[45] Some of the fiber that has been installed across Connecticut is essentially "private" direct connections, such as the "ring" described which was built by Verizon for the sole use of IBM out of Armonk, NY to connect regional offices.

- % of Connecticut Land Area served by Satellite 100.0%
- % of Connecticut Land Area served by Terrestrial Wireless 98.8%
- % of Connecticut Land Area served by some form of Wireline 96.0%
- % of Connecticut Land Area served by DSL 83.2%
- % of Connecticut Land Area served by Cable 82.1%
- % of Connecticut Land Area served by Fiber 4.5%[46]

[46] Applied Geographics, Data as of June 30, 2011. Data does not include the CEN fiber network.

IV. BROADBAND TOMORROW

Connecticut's Broadband Strategic Plan is expected to account for the current uses of broadband but also for the future possibilities. This section of the report describes some of the factors that need to be accounted for when thinking about the future of broadband in Connecticut.

As noted in the previous section, 1995-2000 brought about the first wave of publicly available broadband through dial-up access. The period between 2000 and 2005 was marked by a substantial amount of content being generated and Internet searches becoming prevalent. The third wave, from 2005 to 2010, was marked by the increased use of social networking and mobile access. Currently in the fourth wave, broadband is widely available yet not universal, with some access speeds ramping up to 10-50 Mbps and a 4G wireless network. Videos are increasingly popular—for instance, 35 hours of YouTube videos are uploaded every minute and Netflix has 20 million customers (2001-2011). Online gaming is now multi-player and businesses are using video developments such as video conferencing and multi-party videos to conduct day-to-day operations.

This demand for more complex functions is creating a need for greater broadband capacity. And what is forecast for the fifth wave during the second half of this decade? Experts expect a transition from existing business models so that voice will be integrated on a data network, and new electronic distribution networks will emerge. In addition, the focus will not necessarily be on increasing capacity and speed, but rather on reducing latency and increasing security and reliability. Integration will also be important, particularly with the advent of foursquare and Google Latitude.[47]

IMPACT OF DEMOGRAPHIC PROJECTIONS / CHANGES

As noted previously from the Pew Internet survey findings, different racial and ethnic groups access and use the Internet in different ways. For example, language proficiency among the Hispanic population is one of the most powerful predictors of Internet use, even when controlling for other demographic factors. In addition, African Americans and English-speaking Latinos are more likely to own a cell phone than whites. Therefore, when developing broadband policies for the state, future demographic projections must be taken into account.

Between the 2000 and 2010 Census as shown in Table 10, the Hispanic population in Connecticut grew by almost 50%. All racial groups experienced a growth in population except whites. If these trends continue, as is predicted, racial minority and ethnic groups will comprise a larger percentage of the population than in the past. Since the current trend is for racial minority groups to use more wireless devices, Connecticut could see a larger demand for wireless in the future.

[47] Kevin Werbach, Technology Analyst, Associate Professor of Legal Studies and Business Ethics
The Wharton School, University of Pennsylvania, Presentation to CASE Broadband Study Committee, 4/1/11.

TABLE 10: CONNECTICUT DEMOGRAPHIC CHANGES 2000 TO 2010

	2000 Census	2010 Census	% Change (00-10)	% of 2010 Population
Total Population	3,405,565	3,574,097	4.9%	
White	2,780,355	2,772,410	-0.3%	77.6%
Black	309,843	362,296	16.9%	10.1%
Asian	82,313	135,565	64.7%	3.8%
Am Indian	9,639	11,256	16.8%	0.3%
Some other race	148,567	199,894	39.4%	5.6%
Two or more races	74,848	92,676	23.8%	2.6%
Hispanic	320,323	479,087	49.6%	13.4%
Not Hispanic	3,085,242	3,095,010	0.3%	86.6%
Source: US Census				

GROWTH IN WIRELESS AND WIRELINE BROADBAND

The number of US consumers with broadband access on their mobile devices has grown from 3 million in 2006 to 73 million in 2008.[48] Cisco recently reported that in 2010, global mobile data traffic grew 2.6 fold, nearly tripling for the third year in a row. [49] In addition, global mobile broadband quality has improved significantly, with 10% of mobile broadband users already enjoying experiences that are of similar quality to those with fixed-line broadband.[50] Furthermore, a May 2010 survey by Pew Internet found that 59% of adult Americans go online wirelessly using a laptop or cell phone. In August 2011, the most recent Pew Internet survey found that 83% of Americans own a cell phone and a third of American adults own a smartphone.[51]

With the rapid increase in the adoption of wireless devices, the data indicates that accessing the Internet through wireless devices will continue to become the norm. In a paper written by Kevin Werbach titled, "Radio Revolution: The Coming Age of Unlicensed Wireless," he predicts that we are just at the cusp of wireless possibilities and that innovations of smart wireless devices that impact every aspect of our lives are yet to come.

Werbach discusses a dynamic wireless environment, as opposed to the current static environment, where more than one service can occupy the same spectrum. Currently, spectrum is allocated by the FCC and users are "licensed" to use the spectrum to provide a particular service and only that service. However, in a dynamic environment, wireless devices would be able to utilize unused spectrum and more than one service could occupy the same spectrum in the same place at the same time. Werbach is predicting that wireless is the next "Internet of the air, in some ways more powerful than the Internet of the wires."[52]

[48] "US Broadband Ranking: Does it Matter?," PC WORLD, June 5, 2009.

[49] Cisco, "Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2010--2015," February 1, 2011.

[50] Oxford University and Cisco, "Broadband Quality Score III: A global study of broadband quality," September 2010.

[51] Smith, Aaron, "Americans and Their Cell Phones," PewInternet, August 15, 2011.

[52] Werbach, Kevin, "Radio Revolution: The Coming Age of Unlicensed Wireless," New America Foundation.

The potential capabilities and needs for broadband in the future are difficult to predict and limitless. Cloud computing is another transformation occurring that is enabled by broadband. With the introduction of cloud computing, some predict that the information technology industry is on the cusp of a major paradigm shift. Forrester Research predicts that by 2016 personal cloud computing will be a $12 billion market.[53] However, security of data and information will be in the forefront of any major shifts to cloud computing. As demand for wireless increases, so will the demand on the wireline broadband system. The majority of Connecticut residents and businesses access the Internet through a wireline connection –DSL, cable, or fiber optic.[54] Furthermore, the growth in the demand for wireless also requires a backhaul system that can accommodate the increased capacity and speed. Wireless networks are only "wireless" from the customer's device to the nearest cell or antenna site. The signals are backhauled from the antenna sites to the metro networks generally by wireline, which are increasingly fiber-optic networks (generally 1Gbps today).

With many nations leading the United States in terms of broadband speed and use, what will be required in the future can be gleaned from those leading nations. Broadband consumption patterns are diverging, from a basic household using the web for browsing, social networking, and instant messaging, requiring over 2 Mbps and consuming about 20 GB per month, to a smart and connected home using the web for high-definition video communication, high-definition entertainment, tele-education or telemedicine, home security and others services and commanding at a minimum 20 Mbps with a consumption of 500 GB per month.[55]

WHAT IT MEANS FOR CONNECTICUT

The trend shows that the future will continually demand more broadband access at higher speeds, with greater reliability and enhanced security. The Internet has evolved from simple email and web browsing to social networking and enhanced gaming and video to cloud computing, with the next generation of applications yet to be imagined. In order to respond to the broadband needs of the future, Connecticut must create flexible and responsive policies.

Several states are preparing for the increase in broadband demand and ensuring a competitive position. In addition, many countries have invested in broadband infrastructure and have rapidly increased adoption rates. In order to glean the best practices from the leaders in broadband policy, the research team examined the particular states and countries that are ready or preparing for the broadband applications of tomorrow.

Most of the information was gathered through Internet research. However for the states that appeared to be leaders in broadband adoption and access rates, the research team conducted phone interviews of the leaders within those particular states who are responsible for broadband policy.

Research was conducted on the following states and countries: Kentucky, North Carolina, Vermont, Colorado, Maryland, Maine, Massachusetts, Rhode Island, Washington, New

[53] Gillett, Frank, "The Personal Cloud: Transforming Personal Computing, Mobile, and Web Markets," June 6, 2011.

[54] "Internet Access Services: Status as of June 30, 2010," Industry Analysis and Technology Division of Wireline Competition Bureau, March 2011.

[55] Oxford University and Cisco, "Broadband Quality Score III: A global study of broadband quality," September 2010.

Jersey, Japan, South Korea, Finland, Australia, Germany, United Kingdom, and Chattanooga, Tennessee.

SUMMARY OF FINDINGS: BEST PRACTICES RESEARCH

The following are the findings and themes (with additional information in Appendix G) from both the Internet research and interviews with state leaders. These findings can help guide Connecticut's strategic broadband planning initiative.

Broadband is not the last step in the process: once you determine adoption and availability, you need to show what opportunities exist if broadband service had more robust capabilities. States, communities, and local leaders need to be asking how broadband can help us do our jobs better.

Methods for expanding broadband:

- Establish task force with public and private stakeholders to evaluate current situation and explore policy options. In developing a strategy, include economic development specialists, high-tech companies, health-care providers, local governments, and leverage expertise in the universities.
- Use of tax incentives to encourage investment in infrastructure
- Encourage private investment by having states create dedicated funding streams
- Engage local communities to increase grassroots demand for broadband

State governments that have actively pursued infrastructure expansion programs followed one of these three models:

1. Encourage the private sector to deploy high-capacity infrastructure by creating a statewide public service network connecting all levels of government, education, and health care (i.e., Colorado)
2. Strong executive leadership that creates a broadband authority with powers and duties either through executive order or legislation (i.e., Vermont)
3. Public-private partnership coordinating organization (i.e., Kentucky)

Partnerships

- In order to successfully map state broadband availability, providers must be partners in the project. Since the data is not mandated to be made public, the providers really have the most accurate information on price, availability, and adoption.
- A few state governments have established nonprofits to provide broadband to other non-profits (colleges, schools) by bundling their purchasing to make the rates more competitive.

First step in planning is to set a goal

- Establishing a goal and then actionable steps seem to be the first step for success. Table 11 lists a few examples of goals that have been established by other countries and states.

TABLE 11: BROADBAND GOALS

State or Country	Goal
United States	By 2020, at least 100 million US homes should have affordable access to actual download speeds of at least 100 megabits per second and actual upload speeds of at least 50 megabits per second.
Finland	By 2015, the goal is to have optical fiber or cable network permitting 100-megabit connection available to everyone.
Australia	By 2020, rank in the top five OECD countries in portion of households that connect to broadband at home; top five OECD countries in relation to portion of businesses using online opportunities to drive productivity, expand customer base, and enable jobs growth; the majority of Australians will have access to smart technology to better manage their energy use (3 of the 8 goals).
North Carolina	Access: By 2012, broadband infrastructure of at least 5 Mbps symmetrical service will be available to all North Carolina households and businesses through deployment of a variety of technologies. Also by 2012, ubiquitous mobile telecommunication services for voice and high-speed data will be available throughout the state. Bandwidth: By 2018, high-capacity broadband infrastructure of at least 100 Mbps symmetrical service will be universally available to homes and businesses.

State structure

- Most state governments have quasi-public entities responsible for broadband policy development and implementation.
- Many state offices have only one or two employees working on broadband issues.

State role

- Serve as enablers and advocates.
- Provide a clearinghouse of ideas and best practices; a resource for funding availability; and tools to assist local leaders.
- Support both providers and communities/regions.

- Delegate some of the policy planning to local authorities or e-champions because not all can be performed at the state level; a "cookie cutter approach" cannot be applied to all areas, especially rural versus urban regions. Therefore, empower local governments, in addition to economic development agencies and chambers of commerce, to drive the policy and action, and to integrate with broader statewide planning.
- Partner with one or more universities for expertise and to assist with research and for tracking progress (Virginia and North Carolina serve as examples).

Local level structure/role

- Leaders and drivers of broadband initiatives.
- Find a local government champion(s) to drive e-government applications.
- Each region (varies by state—many of the states in this report are divided into counties) within a state should develop its own broadband plan and integrate it into the general planning efforts– Virginia has a community toolkit of assessing broadband needs that is often mentioned as a "best practice" (see page 133).

Planning

- When developing plans, focus on two or three initiatives each year to accomplish.
- Make sure the tasks are specific and measurable.
- If plans are too broad, they will not get implemented.
- It is not just about having and using broadband. Work backwards from the uses—what are the needs? Broadband should not be viewed as a stand-alone policy priority. Rather it needs to be an integral part of economic development, health care, education and transportation policy planning, among others. This requires a more holistic view of broadband rather than an isolated initiative. The question should be, "How can broadband help us do our jobs better? How can broadband retain more high quality jobs in Connecticut? How can broadband bring more high quality jobs to Connecticut?" For example, this is how we use or will use broadband, and then figure out the best way to get to that endpoint.
- Focus on both demand and supply when creating a plan.
- Mapping is not the last step in the process. Once availability is identified, adoption will follow when it can be shown what opportunities exist if broadband had more robust capabilities.

Increasing demand

- When towns/counties/regional planning organizations decide that broadband is an important initiative and is needed in that particular locality, it creates demand for services, and sends a signal to providers. Providers then see this and will start to offer services and change priorities to meet the needs that are in demand.

- To encourage adoption of broadband among residents, nations have enacted policies that include promoting broadband in education, establishing digital literacy programs, and migrating government services and content to the Internet (e-government).
- Libraries are a great resource. They are seeking ways to remain relevant and are safe, friendly places for seniors as well as those who do not have access at home or at work. As tablet use is expected to grow over the next few years, libraries can also play an important role in offering this as a resource. A few libraries in Connecticut already provide access to e-books and also lend out e-book readers.

Supply

- Wireless service is becoming more popular and there is a need at the local and state level to encourage and influence policies for access to wireless (such as pole attachments, cell towers, and other infrastructure).

Economic development

- States are approaching broadband as not just a consumer service but as a platform for all activities, especially economic development (see Vermont and North Carolina for examples).
- When businesses are negotiating for building contracts, they are focusing more on high-speed broadband availability and service as opposed to the traditional water and sewer services (which are assumed to be existing utilities). As more businesses move out of the metro areas due to costs, high-speed broadband access has become a major issue. In addition, with more employees telecommuting, broadband access is starting to become a higher priority for businesses (see Maryland).

Challenges

- Increasing access into rural areas.
- Fiber is nearby but is not going to homes.
- Providing enough technical assistance to increase adoption—North Carolina is trying to develop more public/private partnerships to overcome this challenge.
- Determining future needs and technology requirements and then setting the "right" goals.
- Increasing competition.
- Funding the initiatives when federal funding to support programs is no longer available.

V. FINDINGS AND RECOMMENDATIONS

Broadband can be described as the electricity of the 21st century: it is a major driver of the global economy. Broadband has enabled innovations across all aspects of the economy, throughout many sectors and industries. Increasingly, residents and businesses feel broadband is not just a luxury but a necessity to everyday life and daily business.

Through the investment of millions of dollars in broadband infrastructure by private providers, Connecticut enjoys nearly ubiquitous broadband service coverage. The coverage makes Connecticut one of the most "wired" states in the country and among the leaders in the world. However, for Connecticut to maintain its status as a leader in broadband access and adoption, the state needs to maintain and develop policies to promote continued investment in ever-advancing broadband capability and capacity. The state needs to be proactive in this area since other states and countries are also installing fiber-optic technology for widespread residential and business use. In addition, the demand for mobile devices continues to rise, which increases the need for expanded and faster wireless networks.

Connecticut's broadband system is meeting today's needs, but are we ready for tomorrow?

Given the role broadband plays in increasing competitiveness, creating jobs, increasing business growth and business location decisions, and supporting education at all levels, it merits significant attention from state policy makers to ensure the state is a national and global leader in broadband networking capacity that can support the applications of tomorrow, enhancing personal and economic growth and educational attainment.

As demand for wireless increases, so will the demand on the wireline broadband system. Furthermore, the growth in the demand for wireless also requires a backhaul system that can accommodate the increased capacity and speed. Therefore, in order to meet the increasing demands of wireless and other business and residential uses of broadband, Connecticut's policy makers must ensure that the wireline infrastructure through which broadband is deployed continues to add capacity.

With many nations leading the United States in terms of broadband speed and use, what will be required in the future can be gleaned from those leading nations. Broadband consumption patterns are diverging, from a basic household—using the web for browsing, social networking, and instant messaging—requiring over 2 Mbps and consuming about 20 GB per month, to a smart and connected home—using the web for high definition video communication, high definition entertainment, tele-education or telemedicine, home security and others—commanding at a minimum 20 Mbps and a consumption of 500 GB per month.[56]

Through the research, the CASE Study Committee found that Connecticut lacks coordination among broadband policy makers and does not have clearly defined broadband goals. In researching other states and nations, one common thread that was evident among broadband leaders was a need for a clearly defined goal and actionable steps to achieve that goal.

[56] Oxford University and Cisco, "Broadband Quality Score III: A global study of broadband quality," September 2010.

The state needs a broadband strategic plan that establishes goals and objectives, continues the initiatives already underway in the state, leverages public and private investments, and incorporates the following:

1. As the first step, Connecticut needs to create a sustainable mechanism for communication among existing broadband policy makers. In addition, progress needs to be continually monitored through the development and implementation of quantifiable metrics so that Connecticut remains competitive in retaining and attracting residents and businesses.
2. Although Connecticut has enjoyed relatively high adoption rates, those in households with low incomes may fail to adopt broadband for several reasons, including having set a lower priority for the value of using the Internet; the expense of the technology, including hardware, to access broadband; and a perception that broadband service itself is unaffordable relative to other household expenses
3. Lack of digital literacy among some residents is another barrier to broadband adoption
4. Without streamlined pole attachment and cell-tower siting processes, competition and investment in newer broadband infrastructure will likely be inhibited.
5. A fiber network spans the state, including rural areas, but the full potential of this network has not been realized.
6. State policies that facilitate making broadband technologies accessible to all residents will be an engine of growth for the state.

STATE ORGANIZATION

Findings

Through the research and interviews with other state leaders on broadband policy, it was evident that Connecticut policy makers have not given broadband access and adoption the degree of attention and resources as have other states. On the other hand, Connecticut has not needed to make broadband policy a priority since most state residents and businesses have access to broadband. With the federal focus on broadband access and adoption that has enabled all states to improve their infrastructure, many states are installing fiber-optic infrastructure that has multiple times the capacity of what is currently available to residents and businesses in Connecticut. Other countries are also investing in the newest technologies. In order to remain competitive, Connecticut policy makers must focus resources on ensuring the state has the best broadband infrastructure and service, and adoption rates increase.

Currently, a number of state agencies, offices and entities have responsibility for broadband policy in the state (see Figure 2 for a visual representation). Formal links of communication include reports written by the CBICC and CET for the General Assembly. As a nature of their missions, PURA and OCC interact closely together, as does DECD and CI. Representatives from both PURA and OPM are ex officio members of the CBICC.

With current responsibilities for broadband policy disbursed through multiple public state entities, the state lacks a formal communications structure that can monitor and promote broadband policy. This lack of coordination has led to missed opportunities for enhancing broadband infrastructure and programs as well as for federal and other funding. For example, without a mechanism for cross-agency broadband collaboration, highway projects that involve digging up state roads could result in missed opportunities for installing fiber networks.

With the thrust to make more state services available online and to require more transactions online, state government has an obligation to ensure that residents of Connecticut have access to broadband. In order to fulfill this public obligation, the state needs to ensure communication and coordination among its agencies and branches of government.

Recommendations

With limited state and federal dollars expected to be available for projects, it is recommended that the state needs to ensure that consideration of broadband infrastructure expansion is factored into all state infrastructure projects. Therefore, it is recommended that by working within the existing entities in the state that focus on broadband policy, this proposal, in the form of creation of a broadband cabinet, seeks to create a link between all the entities and ensure strong coordination and communication (see Figure 4 for an example of entities to be included in the cabinet and others with links to broadband issues). These policy makers will continue their efforts to sustain broadband policy, strategy and promotion to enhance economic development and leadership opportunities for Connecticut.

Since this does not represent creation of a new entity but rather coordination of existing entities, it is not anticipated that significant additional state funding will be needed to support this function. However, if the cabinet decides to move forward with some or all of the recommendations outlines in this report, additional funding or legislation may be required to carry them out.

The broadband cabinet creates a comprehensive process, shared by the legislative and administrative branches of government, to deliberate, develop and monitor effectiveness of broadband policy.

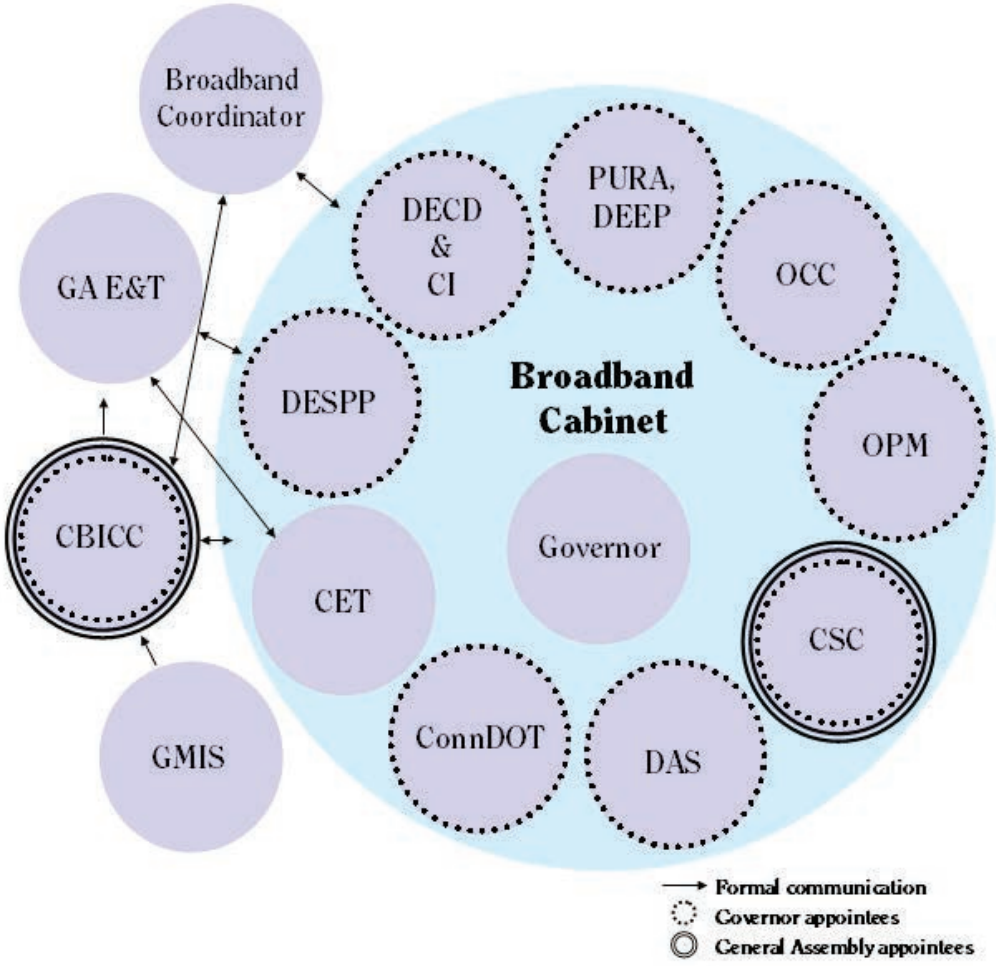


FIGURE 4: INCREASING COMMUNICATION AMONG EXISTING POLICY MAKERS IN CONNECTICUT

The state's **broadband coordinator** would be responsible for developing and advancing the state's strategic broadband plan, continuing data collection/mapping of statewide broadband access and applying for federal funding. Sustaining these efforts that started with federal funding will be vital to advancing state and federal public policy goals. Under the proposed structure, the broadband coordinator will also:

- develop the annual broadband report in consultation with and on behalf of the broadband cabinet
- staff the proposed broadband cabinet as needed
- serve as an ex officio member of CBICC (requires an amendment to CBICC enabling legislation)
- coordinate communications between the legislative function (CBICC) and the executive function (broadband cabinet)

The **proposed broadband cabinet** would be composed of existing state agency leaders who can have an impact on broadband policy development. Figure 4 includes the agencies that are primarily involved in broadband policy issues currently, although additional agency leaders may be added. The cabinet, which could be created through an executive order or state statute, will coordinate state activities that relate to broadband and issue an annual broadband report that will consider issues such as:

- Setting the progress goals that can be continually benchmarked over time including comparing advertised speeds offered by providers versus actual speeds being recorded by speed tests of residents and businesses.
- Encouraging the integration of broadband issues into other statewide strategic plans.
- Having mechanisms to maintain a sustainable, long-term effort.
- Periodically reviewing the broadband vision for the state and ensuring that the minimum standard for all citizens and businesses remains globally competitive.
- Developing and maintaining the broadband website and dashboards that measure progress.
- Reviewing the leadership, vision, mission, goals, sustainability, and management structure of the Connecticut Education Network (CEN) to plan for the possible future demand from its open access network.
- Building upon and integrating the statewide plan with the national broadband plan.
- Ensuring the sustainability of broadband efforts through policies.
- Monitoring federal funding opportunities.
- Communicating progress to the public and policy makers by continually updating and making available timely broadband benchmarking and mapping information.
- Promoting the development of state e-government efforts.
- Advocating for broadband improvements at the national level. One example involves supporting the use of unlicensed bandwidth spectrum for applications such as Wi-Fi that increase the utility of broadband. Another example involves allowing Connecticut to be a recipient of funding from the Connect America Fund even though there are no areas in Connecticut with a federal rural designation.
- Reviewing Internet security and privacy issues that may impact residents or businesses.
- Reviewing emergency events regarding preparedness, disaster recovery and service restoration for lessons learned and determining if there are ways to enhance broadband system reliability and resiliency.

The CBICC continues to act as legislatively mandated; that is, to monitor trends in the state's efforts to develop statewide world-class communications infrastructure, and to issue reports to General Assembly about technology.[57] In addition to its current role, the CBICC provides an advisory role to the broadband cabinet by reviewing and commenting on the annual broadband

[57] See C.G.S § 4d-100(a) which provides the empowering statutory authority granted to the CBICC.

report—creating a formal link between the executive branch and the committee. An amendment to the CBICC-enabling legislation will be required to name additional ex officio members of the CBICC. These additional members should include the broadband coordinator to facilitate policy discussions, as well as a member of GMIS to provide municipal perspectives on state issues within the broadband policy arena.

BROADBAND GOALS AND PROGRESS METRICS

Findings

In researching other states and nations, one common thread that was evident among broadband leaders was a need for a clearly defined goal and actionable steps to achieve that goal. Goals help guide policy decisions and create a defined end point to identify level of achievement.

Korea, Japan, and Finland, which lead the world in terms of speed and adoption, established broadband goals. Another example is North Carolina, which has an overarching goal of at least 100 Mbps symmetrical broadband service available to homes and businesses by 2018. In the intermediate term, North Carolina by 2012 wants to have broadband infrastructure of at least 5 Mbps symmetrical[58] service available to all North Carolina households and businesses through deployment of a variety of technologies. In addition, North Carolina has established a goal of ubiquitous mobile telecommunication services for voice and high-speed data to be available throughout the state by 2012. These are just a few examples of clearly defined goals that communicate to businesses and residents that the state or country has a vision for the future.

Recommendations

Therefore, it is recommended that the following broadband vision statement be integrated into Connecticut's strategic plan and serve as a guide for all future recommendations and action steps:

Broadband technology is an enabler that significantly advances the ability of Connecticut's residents, organizations and businesses to communicate, learn, work, create, consume, access services, and recreate, therefore participating competitively in the national and global economies. Connecticut residents, organizations and businesses will have access to affordable broadband service that meets their current and future needs. To this end, the State shall adopt and promote the policies and programs needed to achieve affordable, ubiquitous access and adoption of broadband services sufficient to enable today's applications and the applications of tomorrow.

In addition it is recommended that the following action steps be taken by the proposed broadband cabinet in order to ensure both that the highest performance broadband infrastructure as practical is offered, and that a base level of broadband access is available across the state:

- Determine a minimum standard for all Connecticut citizens and businesses to access broadband, such as the ability to email, browse the web and conduct basic transactions on government and other websites. The minimum standard for Connecticut should be at least the national standard set forth in the National Broadband Plan.[59]

[58] same upload and download speeds

[59] http://www.broadband.gov/plan/2-goals-for-a-high-performance-america/

- The proposed broadband cabinet should also consider setting goals to make Connecticut stand out as a broadband leader, such as the goals set forth by the state of North Carolina as well as by other countries.[60]
- Publish the minimum standard and other goals on www.ct.gov/broadband.
- Routinely monitor and upgrade the minimum standard and other goals as needed.
- Monitor broadband metrics to assure Connecticut is globally competitive and communicate these attributes as an economic development tool.

ADOPTION OF BROADBAND

Findings

Unlike other parts of the country where access to broadband is an issue, in Connecticut adoption of broadband service presents a greater challenge for some residents. As the consumer survey results of this study indicate, fewer urban respondents access the computer at home and this was statistically different than the respondents from rural and suburban towns. Urban respondents are also less likely to use the Internet, which was also statistically significant. The highest level of education of the respondents who do not use a computer was a high school diploma with education level often used as a proxy for income. Both in Connecticut and nationwide, an alternative to a typical broadband connection with a computer is a smartphone with its wireless connection. In recent studies, as well as from the findings of this study use of a smartphone is often adopted when the up-front cost of the typical connection is an issue.

Also, focus group findings suggest that both the cost of buying a computer and the monthly service plans required for broadband adoption create barriers for lower income households. Therefore, the challenge for Connecticut is to find ways to lower the cost of broadband service and improve computer literacy in order to increase adoption rates.

Furthermore, state government has not fully realized the potential of broadband capabilities in e-government interactions between residents and businesses. Several reports that rank the states' adoption of technology have placed Connecticut at the bottom. For example, the Center for Digital Government, a national research institute on informational technology policies and best practices in state and local government, gave Connecticut a B- in 2010 based on using technology to streamline operations and improve service delivery.

In addition, even though the CEN reaches at least one school in every municipality, not every school utilizes its full capabilities either through teacher instruction or student use, which further perpetuates the digital divide in the state and inhibits adoption.

Recommendations

Therefore the following recommendations should be reviewed by the proposed broadband cabinet and implemented through legislation if necessary:

[60] See page 43 of report for details

- Find ways to both address the cost of broadband service and to increase digital literacy in populations not currently using broadband service in order to increase adoption rates, thereby decreasing the growing "digital divide." For example, advocate at the national level that the Universal Service Fund (currently a surcharge on all telephone bills), which has now been made available to broadband providers who offer reduced rates for broadband service to low-income residents in rural areas, be expanded to include states such as Connecticut that do not have designated rural areas, but have unserved areas where the market does not support broadband provider investment. This could also include a special rate for wireless Internet users for this same group of residents.
- Consider establishing a statewide pilot program designed to assist low-income residents with the cost of broadband service, such as the issuance of data vouchers, if the Universal Service Fund is not made available to broadband service.
- Consider mobilizing the state agencies to embrace broadband use throughout their business activities as a way to advance e-government efforts.
- Increase awareness of the CEN to teachers and students not yet taking advantage of the current system as a way to promote broadband adoption and reduce the educational digital divide.
- Facilitate the development of public-private partnerships between nonprofits that are educating residents in the use of broadband and gifting computers and providers that offer reduced-price broadband services to low-income residents (e.g., Comcast's "Internet Essentials Program" and the FCC's "Connect-to-Compete"). These partner relationships can jointly promote programs that increase adoption with low-income residents. Once the Lifeline/Linkup federal program funding (through the Universal Service Fund) is expanded to broadband services, the nonprofit-provider partnerships may be able to receive additional funding to expand efforts and offer alternatives such as less expensive mobile devices. These public-private partnerships should focus on urban households where there is a lower rate of adoption. Examples of existing programs that could be expanded include:
    - Concepts for Adaptive Learning (CfAL), based in New Haven, targets underserved parents of students at urban public schools, provides software that adapts teaching methods to each student's learning style, and works with teachers to adopt technology in the classroom. The program for parents first provides technology training and then installs computers and computer-related equipment in the home.
    - One Economy engages youth in major cities throughout the United States to provide technology training and support to their peers and neighbors by becoming a Digital Connector. The youth first receive training and then serve as volunteers in their community.

POLE ATTACHMENT AND CELL-TOWER SITING PROCESSES

Findings

Currently, Connecticut is a leader in the nation in terms of accessibility of broadband services. As of December 2010, wireline broadband is available to 93% of the Census blocks within the state with the option to choose from two or more providers.[61] In addition, wireline coverage of at least 100 Mbps exists in portions of Fairfield and Litchfield counties along with a few local pockets throughout the state.[62]

Current trends in broadband indicate that the future will continually demand broadband access at higher speeds with greater reliability, reduced latency and enhanced security. In addition, the demand for mobile devices continues to rise, which increases the need for expanded and faster wireless networks.

Connecticut was fortunate that providers were willing to make the infrastructure investments in the state in the early phase of broadband availability to meet consumer demand, and state policies should continue to promote an environment where Connecticut remains an attractive market for providers to invest in communications innovation. Improvements in broadband capacity frequently require the deployment of new infrastructure, and the state regulatory system has not kept pace with the changes. Two hurdles faced by companies wanting to enter or expand in the broadband market include pole attachment and cell tower siting processes.

Currently, any provider who wishes to expand services in the state must execute two or three separate pole attachment agreements—with the electric companies and a telecommunications company, since the utility poles on which communications infrastructure are hung are owned and managed by the electric utilities and telecommunication providers. The provider must also submit separate applications and fees to each of the respective pole owners before make-ready work can be completed. In addition, companies must seek construction plan approval from PURA before installing any facilities in the public-rights-of-way.[63]

In 2008, the Department of Public Utility Control (DPUC, now PURA) established fixed time intervals for pole owners to issue licenses to third party attachers, regulated the completion of make-ready work, and imposed other limitations on the pole owners' management of telecommunication infrastructure.[64] The department also ordered the establishment of a working group to "resolve common issues (e.g., develop guidelines relative to pole make-ready plans and procedures, etc.) among the pole administrators and attachers"[65] although as of June 2011, the group has ceased meeting. However, telecommunications providers continue to face obstacles in trying to deploy facilities and fiber on poles. For example, pole owners have 90 days

[61] Applied Geographics (as of 12/31/10)

[62] ibid.

[63] DPUC Docket Number: 11-03-07, DPUC Investigation into the Appointment of a Third Party Statewide Utility Telephone Pole Administrator for the State of Connecticut, 6/16/2011

[64] DPUC Docket Number: 07-02-13, DPUC Review of the State's Public Service Company Utility Pole Make-Ready Procedures - Phase I, 4/30/2008

[65] ibid.

to issue licenses to third-party attachers. However, deadlines are often not met and recourse is rarely taken. In addition, if a customer wants service in less than 90 days, accommodations are rarely made.

Other states have established laws as a way to streamline the process and allow for competition in the market. For example, New York not only allows temporary pole attachments to occur prior to the 90 days but also allows approved contractors to install the pole attachment if the pole owners' workers cannot complete the work. This enables new companies to expeditiously meet the demands of their customers without burdening the existing pole owners. The Massachusetts Broadband Institute (MBI) serves as a contractor to the state for installing infrastructure. MBI subcontracts with installers to attach infrastructure in the public rights-of-way through ordinary statutes and regulations. Interconnection agreements have been arranged with the pole owners to streamline operations. A law was passed in California in October, 2011 that creates a process for local, publicly owned electric utilities to determine pole attachment rates and sets up a system to resolve pole attachment requests within 45 or 60 days, depending on the number of poles affected.

Furthermore, as experienced by the power outages during the 2011 October Nor'easter, many of Connecticut's poles were damaged and confusion over ownership created delays in repairs.[66] A streamlined process would provide greater security for Connecticut's power and telecommunications services through a more responsive management system that in turn would enhance the state's emergency preparedness.

In addition, in some areas of Connecticut, the siting of cell towers can be a challenge. Tower siting issues in towns are often due to opposition of town residents for aesthetic or other reasons even before the proposed tower siting is brought to the Connecticut Siting Council for approval. However, this prevents access to broadband for residents and also creates public safety issues because residents do not have a reliable way to communicate.

Recommendations

Removing the barriers to pole attachment and cell tower siting processes will help open up competition and allow companies to invest in new broadband infrastructure, which will enhance Connecticut's competitiveness.

Therefore, it is recommended that the following action steps be reviewed by the proposed broadband cabinet and implemented through legislation if necessary:

- Develop a streamlined process for pole access to allow Connecticut to be seen as a business-friendly state with a competitive broadband market. A representative within PURA with pole administration duties should have the authority to keep pole access schedules on track, allow for temporary pole attachments when warranted by customer needs, and impose penalties if the timelines are not met. In addition to assuring fair policies for the companies seeking access to poles that they do not own, the pole administrator within PURA will work to assure that the state remains an attractive

[66] PURA Docket Number: 11-09-09, PURA Investigation of Public Service Companies' Response to 2011 Storms, 12/6/11.

place for continued investment by the companies that currently own the poles. Enabling legislation that will allow for this single pole administrator function within PURA will reduce the need to open dockets and carry forth with litigation when there are disputes over the time needed for pole access.

- In areas where cell tower siting is an issue, consider the use of newer technologies to bring wireless access to areas that are currently not served.
- With respect to the Connecticut Siting Council's roles and responsibilities for siting cell towers, review and seek amendments to statutes of any state or federal legislation that may facilitate the location of additional towers in order to increase public safety and emergency operations efforts.
- Explore the use of leasing space on state-owned equipment, buildings, or land (e.g., fire towers, telecommunications towers, public safety towers and state forests) for the deployment of wireless- based broadband equipment. This will significantly expedite the deployment of broadband networks.

BROADBAND INFRASTRUCTURE AND ACCESS

Findings

The majority of the state's residential and business customers are accessing the Internet through a broadband infrastructure which includes coaxial cable and DSL. Through ARRA, many states received federal funding to install the latest technology, fiber-to-the-home or node, which has the capability to deliver broadband at speeds multiple times faster than traditional cable or DSL. In addition, providers continue to invest in advanced networks in the state where there is an expected return on their investments.

However, in some areas of the state, broadband access is not available. In these areas where the providers have not provided service, the state may consider strategies to address the market failure so that all citizens and businesses have some broadband service. (See Appendix H for maps of Connecticut broadband access.)

As was recently published by the FCC in the report titled, "Measuring Broadband America," fiber technology outperforms older technologies (DSL and cable) for both upload and download speeds. Demand for bandwidth, speed, reliability, and performance is expected to continue to grow. The youth population of today will consume as much bandwidth as they can afford and demands for performance will grow with all populations. Social services, government, and emergency services will only stimulate further use and enhancement. Entertainment such as gaming, telecommunication, research, music, reading, television and movie viewing have already moved to the web, further creating demands for higher bandwidth. In addition, businesses will continue to require more bandwidth for remote data storage and disaster recovery.

How is Connecticut positioned to meet the bandwidth demands of tomorrow? In addition to the private investments already occurring in the state, Connecticut received almost $94 million in ARRA funding to install additional fiber that expands the Connecticut Education

Network (CEN) into rural areas of the state and is being used to connect to public safety facilities in towns to an enhanced 911 system. The original shared core infrastructure and fiber of the CEN were funded through state bonding, with no federal e-rate funding. The portion of the CEN that used e-rate[67] funding included AT&T's OPT-E-MAN circuits, frame and DSL. Furthermore, the fiber network and subsequent upgrades did not use e-rate funding but instead were funded through ARRA funding, which places no use restrictions on this network and requires open access. In addition, fiber networks are being installed in neighboring states (e.g., MassBroadband 123), which may provide an opportunity to create regional networks, particularly along the I-91 and I-95 corridors. An expanded network would support regional economic development efforts.

In mid-2013, when the fiber network is complete, it will serve approximately 450 sites across the state—including areas where no other broadband service exists (northeast CT, northwest CT, Colchester area and shoreline). The network will bring the next generation of broadband service to residents and businesses through this untapped network. The CEN currently allows users other than libraries and K-12 educational institutions access to their network (currently mostly colleges and universities) but they must first connect to the network.

Recommendations

Therefore, the following recommendations should be reviewed by the proposed broadband cabinet and implemented through legislation if necessary:

- Explore the feasibility of expanding the CEN to additional municipal buildings, including public safety and first responder facilities. Assess which municipal buildings, in addition to the libraries and schools already on the CEN, are in close proximity to the CEN and could be easily linked up, thereby increasing the number of public spaces with fiber-optic broadband access. Examples of successful private-public partnerships that can guide Connecticut's efforts include Axcess Ontario in New York (see Appendix G for more information).
- Municipalities can explore the feasibility of connecting to the fiber networks in the state through any provider although the cost to do so may be prohibitive.
- In areas of the state that are underserved or unserved by broadband, even after the CEN is fully built out using the federal funding, consider ways to fund broadband expansion projects. A revolving loan fund that would leverage public funds and make loans to private companies that invest in broadband infrastructure could be established similar to state infrastructure banks established for transportation.[68] There have also been proposals at the national level to create a National Infrastructure Development Bank. The national proposal, most recently championed by Representative Rosa DeLauro in the 111th Congress, was to create a stand-alone entity that would make loans or loan

[67] E-rate is the common name for the Universal Service Fund for Schools and Libraries, established by section 254 of the federal Telecommunications Act of 1996. The E-Rate program is administered by the Universal Service Administrative Company (USAC) under the direction of the Federal Communications Commission and provides discounts to K-12 schools and libraries to obtain affordable telecommunications and Internet access for educational purposes. E-rate funding stipulates that the money can only be used for "educational purposes."

[68] State Infrastructure Banks (SIB) were authorized in 1995 as a part of the National Highway Designation Act (NHS) to help accelerate needed mobility improvements through a variety of financial assistance options made to local entities through state transportation departments.

guarantees to leverage private dollars for infrastructure projects. Projects would be selected based on merit and demonstrated need. Therefore, Connecticut should assess how an infrastructure bank could work in expanding the reach of the fiber broadband infrastructure to areas throughout the state. In addition, tax incentives to providers that build out in unserved areas could be considered.

TIMELINE FOR IMPLEMENTATION OF RECOMMENDATIONS

Given the nature of the recommendations, some can be accomplished in the short term and others are meant to be accomplished over a longer time frame. The focus in the short term should be on maximizing the current statewide fiber network and state-owned towers; increasing competition through a streamlined pole attachment process; and increasing household adoption rates of broadband. In the longer term, assess the effectiveness of pilot programs and review feasibility studies to determine whether they should be expanded to the greater population.

CONNECTICUT'S RECOMMENDATIONS COMPARED TO THE NATIONAL BROADBAND PLAN

Many of the recommendations set forth in this plan coincide with recommendations in the National Broadband Plan. With the implementation of the national plan underway, it behooves Connecticut to mirror the federal initiatives to avoid conflicting policies but also to be in a position to receive federal dollars if they become available. The following goals from the national plan mirror goals set forth by Connecticut:

- Ensure efficient allocation and use of government-owned and government-influenced assets. Government establishes policies for the use of spectrum and oversees access to poles, conduits, rooftops and rights-of-way, which are used in the deployment of broadband networks. Government also finances a large number of infrastructure projects. Ensuring these assets and resources are allocated and managed efficiently can encourage deployment of broadband infrastructure and lower barriers to competitive entry.
- Infrastructure such as poles, conduits, rooftops and rights-of-way play an important role in the economics of broadband networks. Ensuring service providers can access these resources efficiently and at fair prices can drive upgrades and facilitate competitive entry. In addition, testbeds can drive innovation of next-generation applications and, ultimately, may promote infrastructure deployment.
    - o Establish low and more uniform rental rates for access to poles, and simplify and expedite the process for service providers to attach facilities to poles
    - o Improve rights-of-way management for cost and time savings, promote use of federal facilities for broadband, expedite resolution of disputes and identify and establish "best practices" guidelines for rights-of-way policies and fee practices that are consistent with broadband deployment

- Facilitate efficient new infrastructure construction, including implementation of "dig-once" policies that would make federal financing of highway, road and bridge projects contingent on states and localities allowing joint deployment of broadband infrastructure.

CONCLUDING REMARKS

Given that broadband technology is an enabler that significantly advances the ability of Connecticut's residents, organizations and businesses to communicate, learn, work, create, consume, access services, and recreate, it merits serious state attention. The recommendation regarding creating formal communication among existing policy makers places greater emphasis on broadband policy with the development of the broadband cabinet. This will help increase communication and coordination between state agency leaders who can impact broadband policy. The establishment of a broadband goal provides direction for policy makers and helps establish Connecticut as a broadband leader.

In order to be a global leader in broadband capacity, Connecticut must ensure that it maintains a competitive environment for broadband providers and remains attractive for continued investment. Streamlining the pole attachment and cell tower siting processes will ease the burden for providers in the market. Furthermore, since open access to the CEN is required as part of receiving ARRA funding, the leadership, vision, mission, goals, sustainability, and management structure of the CEN should be reviewed, so that it may adapt to the possible future demands on the fiber network.

Finally, although Connecticut does have some of the highest broadband access rates in the nation, there are segments of the population that lack broadband connections due to factors such as lack of interest or understanding of the need for an Internet connection as well as the cost of technology and broadband service. Therefore, it is hoped that the proposed recommendations will increase access rates by leveraging existing resources within the existing infrastructure of nonprofits and organizations that assist low-income residents.

APPENDIX A: GUEST PRESENTERS

Oct. 5, 2010

- **Connecticut Broadband Mapping Presentation**
  Steve Anderson, Vice President, Applied Geographics, Inc.
  John Roache, PMP, MCITP, Senior Project Manager, Applied Geographics, Inc.
- **Trends in Home Broadband Adoption**
  Lee Rainie, Director, PEW Internet & American Life Project

Nov. 17, 2010

- **Digital Connectors Program**
  Karla Ballard, Vice President of Social Innovations, One Economy Corporation
- **Municipal Accessibility Issues and Potential for Connecticut Broadband**
  Jack McCoy, CIO, Town of Manchester, CT
- **Connecticut's Health Information Technology Initiative**
  Warren Wollschlager, State HIT Coordinator, CT Department of Public Health

Dec. 17, 2010

- **The Need for Broadband Acceptance: A New Framework for Promoting Digital Inclusion**
  Nicol Turner-Lee, PhD, Vice President and Director, Media and Technology Institute
  Joint Center for Political and Economic Studies
- **New England Cable & Telecommunications Association Presentation**
  Paul Cianelli, President, NECTA

Jan. 31, 2011

- **Broadband: AT&T & Connecticut**
  John Emra, Regional Vice President, AT&T
- **Virtual High School Global Consortium and CT schools: Using Technology to Support Equity and Access to Educational Resources**
  Liz Pape, President and CEO, Virtual High School Global Consortium
- **Assessment of CT's Implementation of E-Government**
  Michelle Castillo, Principal Analyst, Program Review and Investigations
  Maryellen Duffy, Principal Analyst, Program Review and Investigations
  Eric Gray, Legislative Analyst II, Program Review and Investigations
- **The Impact of the Future Workforce**
  Barbara Hampton, Principal, Jamestown Advisors (on behalf of MetroHartford Alliance)

March 1, 2011

- **Wireless Industry Technology Trend: 4G Long Term Evolution (LTE)**
  Adam Koeppe, Executive Director, Verizon Wireless
  Richard Bozsik, Director, Public Policy, Verizon
- **Presentation from the Open Technology Initiative, *Wireless Future Project***
  James Losey, Policy Analyst, New America Foundation
- **Does Facebook Prevent Alzheimer's? & Effective Information Communication to Teens**
  Joanie Kim, 12th Grade, Amity Regional High School

April 2, 2011

- **Author of the Paper: Radio Revolution, *The Coming Age of Unlicensed Wireless***
  Kevin Werbach, Technology Analyst and Associate Professor of Legal Studies and Business Ethics, The Wharton School, University of Pennsylvania
- **Presentation of Charles Stockdale and Glenn Carberry to the CASE Committee on behalf of Fiber Technologies Networks, LLC**
  Charles Stockdale, General Counsel for Fiber Technologies Networks, LLC,
  Glenn Carberry, Tobin, Carberry, O'Malley, Riley, Salinger

May 3, 2011

- **Cloud Computing: Re-engineering the IT Delivery Supply Chain and Business Models**
  T. Basil Smith, PhD, Senior Manager, Server Architecture
  IBM T.J. Watson Research Center (ret.)
- **A National Perspective on CT's Virtual High School**
  Diane J. Goldsmith, PhD, Executive Director, CTDLC.org, E-Learning Solutions (Connecticut Distance Learning Consortium)
- **Broadband Access and Adoption as a Connecticut Priority**
  Nicholas Bramble, JD, Lecturer in Law & MacArthur Fellow in Law, Information Society Project, Yale Law School

June 9, 2011

- **State Broadband Mapping Project Update, User Dashboard Ideas/Discussion**
  Steve Anderson, Vice President, Applied Geographics, Inc.
  John Roache, PMP, MCITP, Senior Project Manager, Applied Geographics, Inc.
- **Presentation by Ronald Thorpe, Vice President and Director, Education, WNET**

June 9, 2011 (continued)

- **Universal Service for Broadband: Why It Is Better to Give Subsidies to Low-Income People Than to "High Cost" Areas**
  Gregory L. Rosston, Deputy Director of the Stanford Institute for Economic Policy Research and Deputy Director, Public Policy Program, Stanford University

  Scott J. Wallsten, Vice President for Research and Senior Fellow, Technology Policy Institute and Senior Fellow, Georgetown Center for Business and Public Policy

July 20, 2011

- **State Broadband Mapping Project Update, User Dashboard Presentation**
  Steve Anderson, Vice President, Applied Geographics, Inc.
  John Roache, PMP, MCITP, Senior Project Manager, Applied Geographics, Inc.

Sept. 13, 2011

- **Presentation on Comcast Low-Income Broadband Program**
  Sharon Codeanne, Senior Manager, Government Relations, Comcast
- **Q&A on Leveraging the Connecticut Education Netw**ork
  Scott Taylor, Connecticut Education Network

APPENDIX B: GLOSSARY OF TERMS

ARRA - American Recovery and Reinvestment Act

Asymmetrical – For the purposes of broadband technologies, it means the download and upload speeds are not the same.

Bandwidth (Capacity) – The transmission capacity of an electronic pathway such as a communications line. In a digital line, it is measured in bits per second or bytes per second. In an analog or digital channel that is wrapped in a carrier frequency, bandwidth is the difference between the highest and lowest frequencies and is measured in Hertz. In more general terms, it refers to the volume of data per unit in time an Internet connection can handle.

Broadband - means providing two-way data transmission with advertised speeds of at least 768 kilobits per second (kbps) downstream and at least 200 kbps upstream to end users.

CBICC – Connecticut Broadband Internet Coordinating Council

CEN – Connecticut Education Network

CET – Commission for Education Technology

CI – Connecticut Innovations

Cloud Computing - refers to an architecture that links computers in a grid and allows users to access data or processing power. Storing photos on the web or accessing webmail are two examples of cloud computing. (From Pew Internet)

Congestion – results from applications sending more data than network devices (e.g., routers and switches) can accommodate.

ConnDOT – Connecticut Department of Transportation

DAS – Department of Administrative Services

DECD – Department of Economic and Community Development

DEEP – Department of Energy and Environmental Protection

DESPP – Department of Emergency Services and Public Protection

FCC (Federal Communications Commission) – The FCC is responsible for regulating interstate and international communications by radio, television, wire, satellite, and cable.

Fiber Optic – Refers to systems that use optical fibers. Starting in the late 1960s but really

gaining momentum in the 1980s, telephone companies began to replace their copper long distance trunks with fiber cable. Eventually, all transmission systems and networks are expected to become fiber based.

Fixed-Wireless – Refers to point-to-point transmission through the air between stationary devices. Fixed wireless is typically used for last mile connectivity to buildings.

FTP (File Transfer Protocol)- A protocol used to transfer files over a TCP/IP network. For example, after developing the html pages for a website on a local machine, they are typically uploaded to the web server using FTP.

GA E&T – Energy and Technology Committee, General Assembly

GMIS – Government Management Information Sciences

Latency (Speed) - A measure of the amount of time (usually measured in milliseconds) it takes for data packets to travel from one computer to another application or computer across a network. Latency can help describe a measure of "distance" between hosts on a network. For example, a reasonable roundtrip latency measurement between a pair of hosts from east coast to west coast may be roughly 90 milliseconds, whereas the latency between Atlanta and Philadelphia is closer to 20 milliseconds. High latency can be a problem with applications that require real-time back-and-forth communication, such as online phone calls and video conferencing.

Last Mile - provides broadband service to end users or end-user devices. Typically the connection between the customer and the telephone company, cable company, or ISP.

Middle Mile - Broadband infrastructure project category in BTOP Round 1 that does not predominantly provide broadband service to end users or to end-user devices and that may include interoffice transport, backhaul, Internet connectivity, or special access. The CCI project category used in BTOP Round 2 may include Middle Mile components that provide broadband service from one or more centralized facilities (i.e., the central office, the cable dead end, the wireless switching station, or other equivalent centralized facility) to an Internet point of presence.

OCC – Office of Consumer Counsel

OPM – Office of Policy and Management

Peering Point – The location where many networks connect to exchange traffic

PURA – Public Utilities Regulatory Authority, DEEP

Unserved/Underserved Area- means a service area with no access to facilities-based, terrestrial broadband service, either fixed or mobile, at the minimum broadband transmission speed (set forth in the definition of broadband in this section). A premise has access to broadband service if it can readily subscribe to that service upon request.

Spectrum - Spectrum is the range of electromagnetic radio frequencies used to transmit sound, data, and video across the country. It is what carries voice between cell phones, television shows from broadcasters to your TV, and online information from one computer to the next, wirelessly. Because there is a finite amount of spectrum and a growing demand for it, effectively managing the available spectrum is an important priority for the FCC (from FCC website).

APPENDIX C:
HIGHLIGHTS OF NATIONAL BROADBAND PLAN

In early 2009, Congress directed the Federal Communication Commission (FCC) to develop a plan to ensure that every American has "access to broadband capability." In March 2010, the FCC issued "Connecting America: The National Broadband Plan." This section highlights the major goals as prescribed in the plan as well as the role of the government in implementing the goals.

Government can influence the development of broadband in four main ways:

- Design policies to ensure robust competition and, as a result, maximize consumer welfare, innovation and investment.
- Ensure efficient allocation and management of assets government controls or influences, such as spectrum, poles, and rights-of-way, to encourage network upgrades and competitive entry.
- Reform current universal service mechanisms to support deployment of broadband and voice in high-cost areas; ensure that low-income Americans can afford broadband; and support efforts to boost adoption and utilization.
- Reform laws, policies, standards and incentives to maximize the benefits of broadband in sectors government influences significantly, such as public education, health care and government operations.

Long-term Goals:

1. At least 100 million US homes should have affordable access to actual download speeds of at least 100 megabits per second and actual upload speeds of at least 50 megabits per second.
    a. Milestone – by 2015, 100 million homes should have affordable access to actual download speeds of 50 megabits per second and actual upload speeds of 20 megabits per second.
2. The United States should lead the world in mobile innovation, with the fastest and most extensive wireless networks of any nation.
    a. To achieve this goal, the federal government through the FCC will make 500 megahertz of spectrum newly available for broadband by 2020, with a benchmark of making 300 megahertz available by 2015.
2. Every American should have affordable access to robust broadband service, and the means and skills to subscribe if they so choose.

3. Every American community should have affordable access to at least 1 gigabit per second broadband service to anchor institutions such as schools, hospitals and government buildings.
4. To ensure the safety of the American people, every first responder should have access to a nationwide, wireless, interoperable broadband public safety network.
5. To ensure that America leads in the clean energy economy, every American should be able to use broadband to track and manage their real-time energy consumption.

APPENDIX D: CONSUMER SURVEY RESULTS

This section of the report describes the results from the consumer survey conducted regarding broadband use in the home. The methodology selected to understand consumer adoption rates of broadband was a rigorous, unbiased survey; a telephone survey was deemed to be the best approach because the results could be gleaned in a timely manner. The results from the phone survey, presented below, will be used by the CASE Broadband Study Committee as guidance in the development of the state's broadband strategic plan.

The telephone survey was conducted among a random sampling of Connecticut residents at least 18 years old; 400 surveys were completed and evenly distributed by population density (urban, average, rural)[69] and phone type (landline, cell). Interviews were conducted during the months of November and December 2010. See Addendum 1 for more detail on the methodology of the survey.

In addition to the Connecticut survey results, this report also provides a comparison to 2010 national survey results. Each spring, the Pew Internet and American Life Project conducts a national survey of household broadband use and many of the questions in their survey mirror the questions asked of Connecticut residents.

KEY FINDINGS

- 89% of Connecticut residents use a computer—12 percentage points higher than the national average of 77%
- Fewer urban respondents in Connecticut access the computer at home which was statistically different than respondents living in rural and average towns
- 87% of Connecticut residents use the Internet—8 percentage points higher than the national average of 79%
- Urban respondents were less likely to use the Internet than rural and average respondents, and it was statistically significant
- Majority of Connecticut residents have cable modem (54%) to connect to the Internet
- Even though 36% of Americans who have broadband subscribe to premium service, versus 27% in Connecticut, the average price for service was between $21 and $40 a month for both consumers in Connecticut and the nation
- 91% of Connecticut residents own a cell phone
- 77% of Connecticut residents never telecommute; however, as household income increases the frequency of telecommuting also increases
- For respondents who do not use the Internet or email, the main reasons given were that they are just not interested or it is too costly

[69] Rural defined as less than 325 people per square mile; average defined as 325-2,700 people per square mile; and urban defined as more than 2,700 people per square mile

COMPUTER ACCESS

Eighty-nine percent of respondents, or 355, use a computer. Connecticut's computer use is higher than the national average by 12 percentage points. In the most recent survey results issued by the Pew Center, 77% of adults indicated they use a computer.[70]

When asked where they access a computer, most respondents indicated they access a computer at home followed by work as the next most common place (Figure 1). Since respondents could give multiple places as to where they access a computer, the responses total more than the number of people participating in the survey.

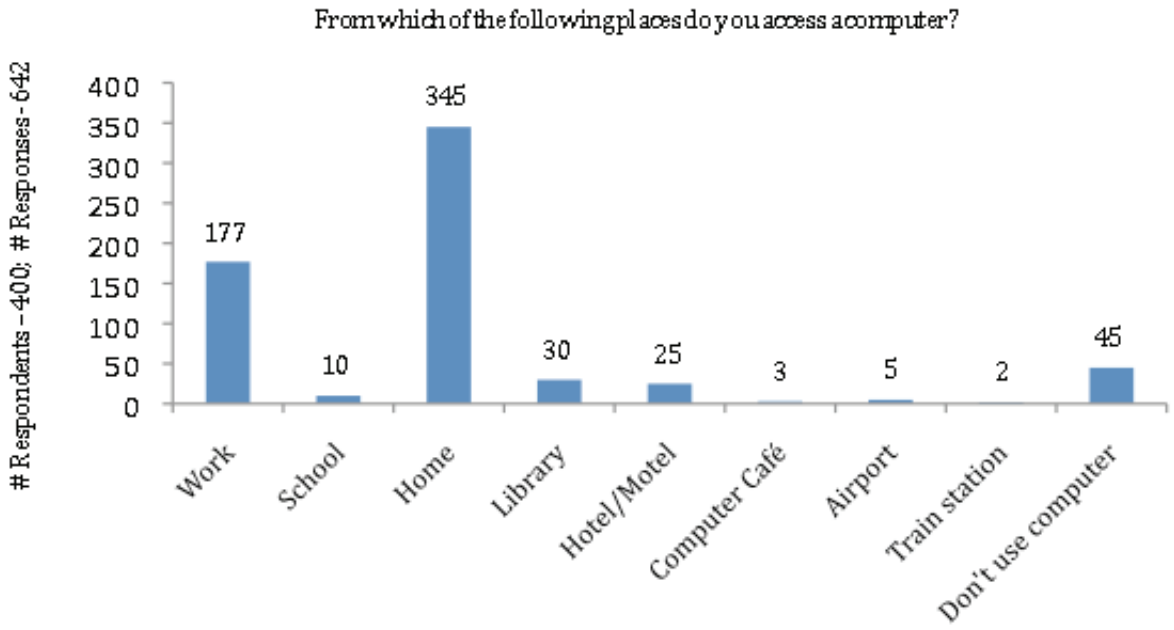


FIGURE 1: COMPUTER ACCESS LOCATIONS

Although not displayed in the chart above, fewer urban respondents access a computer at home (80%) and it was statistically different than the respondents from rural (89%) and average towns (89%). In addition, half of those accessing a computer at the library are in urban areas and this was statistically different from those living in rural areas.

Computer Access by Household Income

Respondents were also asked about household income. However, only 153 respondents of the 400 provided an amount.

Based on the responses from those providing income information, there appears to be a relationship between computer access and income. Nine respondents who earn between $25,000

[70] Pew Internet and American Life Project, "Home Broadband 2010," August 11, 2010.

and $49,999 do not use a computer and it was statistically different than the respondents earning between $50,000 and $74,999, and $75,000 to $99,999.

Accessing a computer from either work, home, the library, or a hotel for the group earning between $25,000 and $49,999 was statistically different than those earning between $50,000 to $74,999 and $75,000 to $99,999.

Almost half of the respondents who use the library earn between $75,000 and $99,999 and this was statistically different than households with incomes between $25,000 to $49,999 and $50,000 to $74,999.

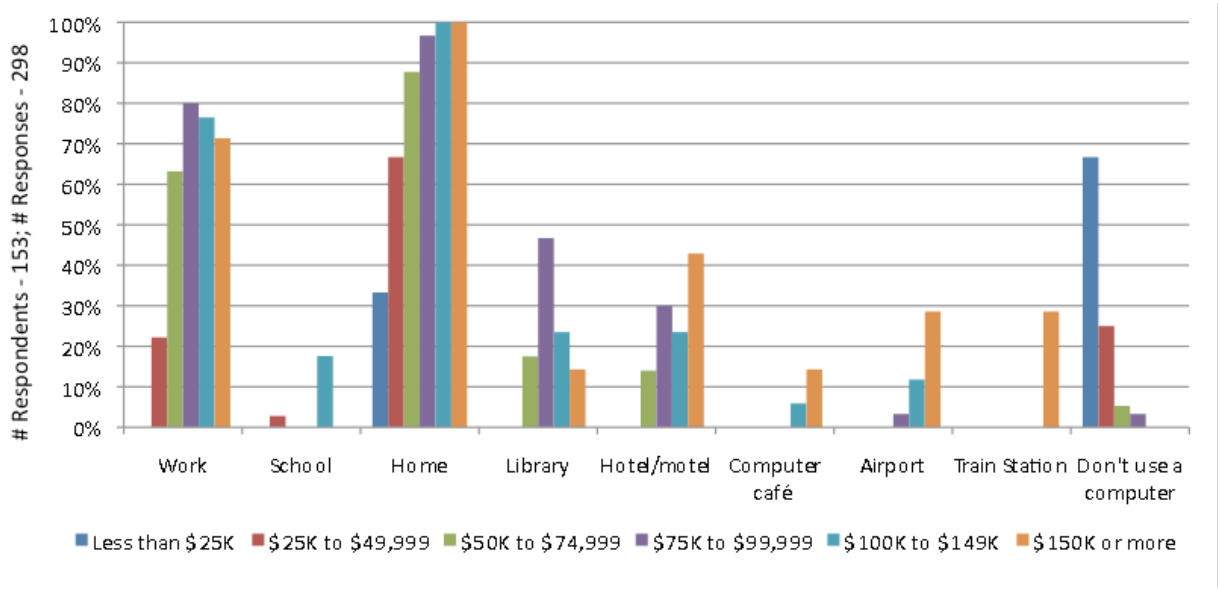


FIGURE 2: COMPUTER ACCESS BY HOUSEHOLD INCOME

Computer Access by Race and Ethnicity

As shown in Table 1 below, the majority of respondents from all races access a computer at home.

TABLE 1: COMPUTER ACCESS BY RACE

From which of the following places do you access a computer? (# Respondents - 389; # Responses - 620)					
	Caucasian	African American	Am. Indian	Asian	Multi-racial/ Other
# Respondents	340	33	2	7	7
Work	44%	52%	0%	57%	67%
School	3%	0	0%	0%	33%
Home	88%	67%	100%	100%	100%
Library	7%	12%	0%	0%	67%
Motel/hotel	5%	18%	0%	0%	67%
Computer café	1%	0%	0%	0%	0%
Airport	1%	0%	0%	0%	33%
Train station	0.6%	0%	0%	0%	0%
Don't use a computer	11%	21%	0%	0%	0%

Columns add to more than 100% because respondents could give more than one response
'Other' includes people who self-identified as Latino which is an ethnicity, not a race

As depicted in Table 2, a higher percentage of those of Hispanic ethnicity access a computer at work than those not of Hispanic origin.

TABLE 2: COMPUTER ACCESS BY ETHNICITY - HISPANIC/NON-HISPANIC

From which of the following places do you access a computer? (# Respondents - 389; # Responses – 625)		
	Hispanic	Non-Hispanic
Work	61%	43%
School	3%	2.5%
Home	74%	87%
Library	16%	7%
Motel/hotel	23%	5%
Computer café	0%	1%
Airport	3%	1%
Train station	0%	0.6%
Don't use a computer	13%	11%

INTERNET/EMAIL USE

The 355 respondents who indicated that they use computers were then asked a series of questions about their Internet use.

Ninety-eight percent of those who use the computer use the Internet at least occasionally. Again, more Connecticut respondents use the Internet than indicated by respondents in the national survey results. In the Connecticut survey, 87% of those surveyed (regardless of whether they use a computer or not) use the Internet, however, nationally 79% report using the Internet.[71]

[71] Pew Internet and American Life Project, "Home Broadband 2010," August 11, 2010.

Seven respondents who have computers do not use the Internet and of these seven respondents, two have children under the age of 12 living in the household and the highest level of education completed for this group was a high school diploma or GED. Five of the respondents earned between $25,000 and $74,999; four were African American and three were Caucasian.

Another interesting finding was that the "yes" and "no" responses for respondents classified as living in average and rural areas were statistically different from the urban responders. As indicated in Table 3, urban respondents are less likely to use the Internet and it is statistically significant.

TABLE 3: INTERNET USE BY GEOGRAPHY

Do you use the Internet, at least occasionally?				
	Total	Urban	Average	Rural
Yes	348	108	119	121
No	7	6	0	1
Total	355	114	119	122

The respondents who indicated they use the Internet (348) were then asked about email use. Ninety-seven percent (339 respondents) of Internet users send or receive email, while 3% (9 respondents) indicated they do not use email. Seventy-seven percent of respondents indicated they used the Internet yesterday (Figure 3).

The respondents that do not send or receive email also do not have any children under the age of 17 living in the household and the highest level of education completed was an associate's degree. Five of the respondents earned between $25,000 and $74,999.

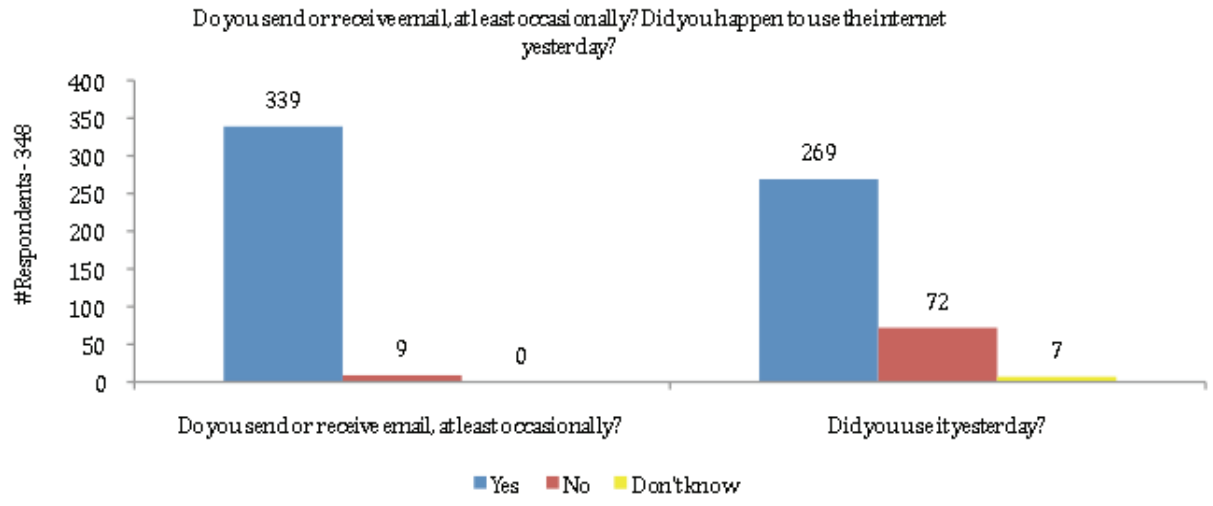


FIGURE 3: EMAIL AND INTERNET USE

In fact, 72% of respondents who use the Internet access both the Internet and email from home

either once or several times a day. In terms of using the Internet at work, the two most common responses were either "several times a day" or "never." As shown in Figure 4, 44%, or 154 respondents, use it several times a day.

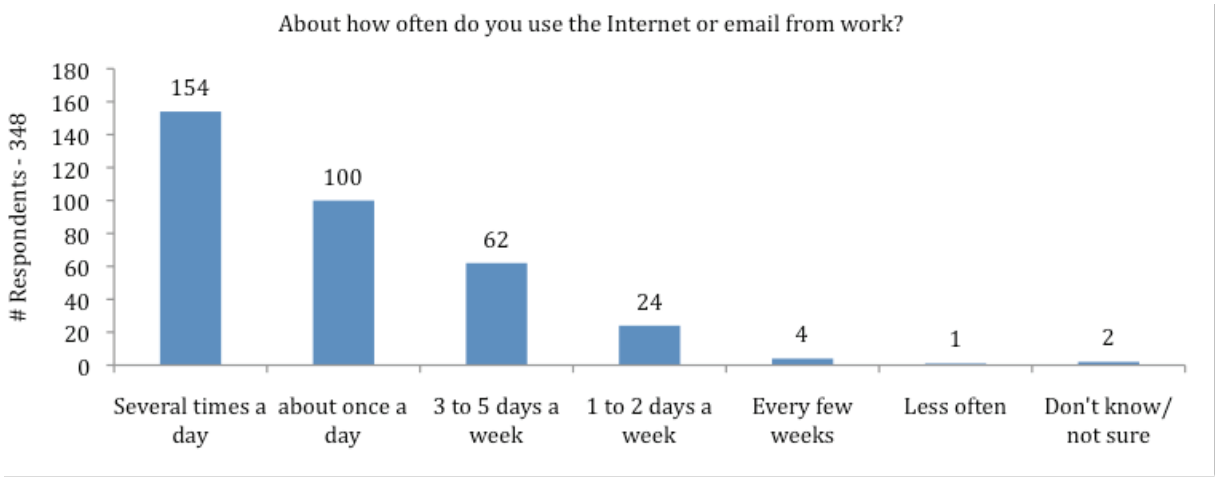


FIGURE 4: INTERNET OR EMAIL AT WORK

The following two tables show Internet and email use by race. The lowest percentage of respondents, within an individual race, not using the Internet identified themselves as African American.

TABLE 4: INTERNET USE BY RACE

Do you use the Internet by *race* (# respondents—346)					
	Caucasian	African Am.	Asian	Am. Indian	Multi-racial / Other
Yes	301	22	7	2	7
No	3	4	0	0	0
Other includes those who self-identified as Latino which is an ethnicity					

TABLE 5: EMAIL USE BY RACE

Do you send or receive email by *race* (# respondents – 339)					
	Caucasian	African Am.	Asian	Am. Indian	Multi-racial / Other
Yes	293	22	6	2	7
No	8	0	1	0	0
Other includes those who self-identified as Latino which is an ethnicity					

All Hispanic respondents who use the Internet also send or receive email. However, not all non-Hispanic respondents who use the Internet also use email.

TABLE 6: INTERNET AND EMAIL USE BY ETHNICITY

Do you use the Internet by *ethnicity* (# respondents – 346)				
	Hispanic		Non-Hispanic	
	#	%	#	%
Yes	23	85%	316	99%
No	4	15%	3	1%

Do you send or receive email by *ethnicity* (# respondents – 339)				
	Hispanic		Non-Hispanic	
	#	%	#	%
Yes	23	100%	307	97%
No	0	0%	9	3%

INTERNET CONNECTIONS

Respondents who have Internet at home were asked a series of questions to learn about their broadband service. As displayed in Figure 5, more than half of respondents connect to the Internet through a cable modem and a little less than a third use a DSL enabled phone line. No one indicated that they use FIOS or T-1.

When compared to the national survey results of Internet service, Connecticut has a higher percentage of residents connecting through cable modems and fewer residents using wireless and dial-up. Cable Internet connection is 21 percentage points higher than the national average and DSL connections are 4 percentage points higher than the national average, whereas wireless connections are 10 percentage points lower and dial-up is 5 percentage points lower than the national average. Fiber-optic and T-1 connections were not in use by Connecticut respondents, yet in the nation they have a small presence, with use by approximately 5% and 1% of respondents respectively.

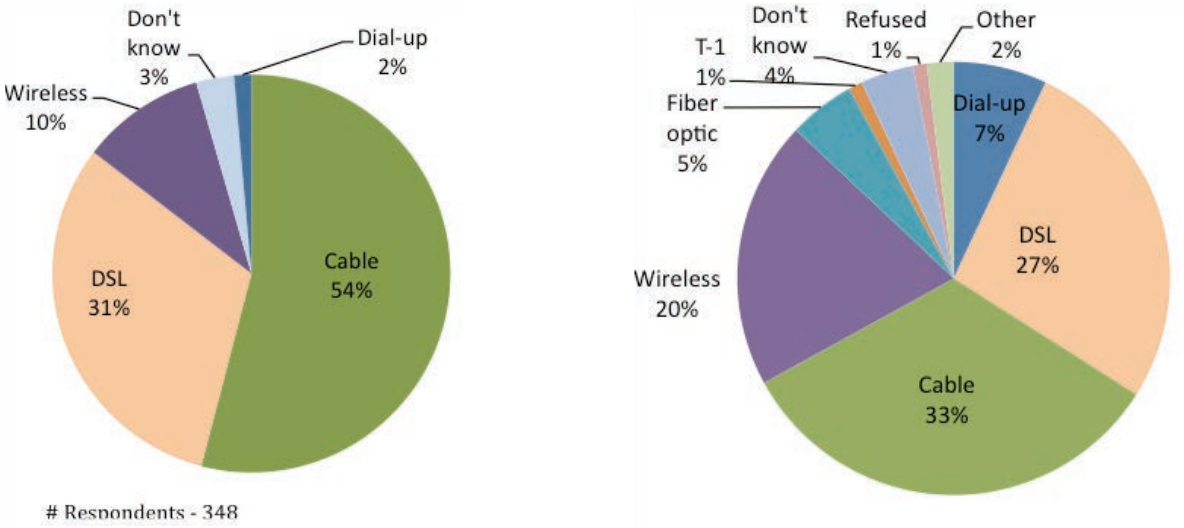


FIGURE 5

CONNECTICUT CONSUMER INTERNET SERVICE US CONSUMER INTERNET SERVICE[72]

Although not shown in the Connecticut figure above, 78% of respondents with computers and Internet, or 271, have bundled service with television or other services from a single provider, 17% do not, and 5% did not know.

The five respondents who use dial-up service were asked why they do not use broadband and three said they do not need it, one said it was too expensive, and one said it was not available. Almost 70% of respondents subscribe to basic service for their Internet connection at home (Figure 6). Only a little more than a quarter of the respondents who have broadband subscribe

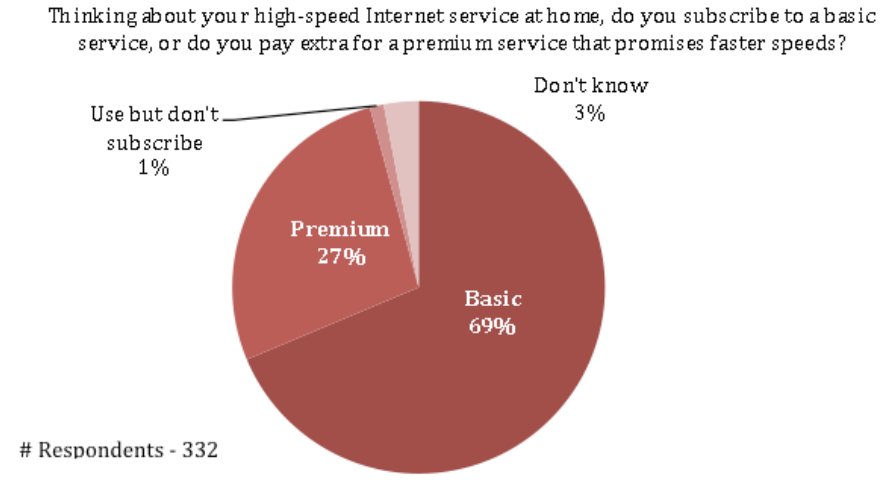


FIGURE 6: LEVEL OF BROADBAND SERVICE

[72] Pew Internet and American Life Project, "Home Broadband 2010," August 11, 2010.

to premium service. However, nationally, 51% subscribe to basic, 36% to premium, and 13% are unsure whether they have basic or premium service.

The 348 respondents who have Internet service were asked how much they pay each month (Figure 7). The most common response for consumers in Connecticut and the United States was between $21 and $40 a month. However, 8% of Connecticut consumers spend more than $80 a month whereas only 2% of those surveyed nationally do. One quarter of respondents in both surveys did not know how much they pay a month.

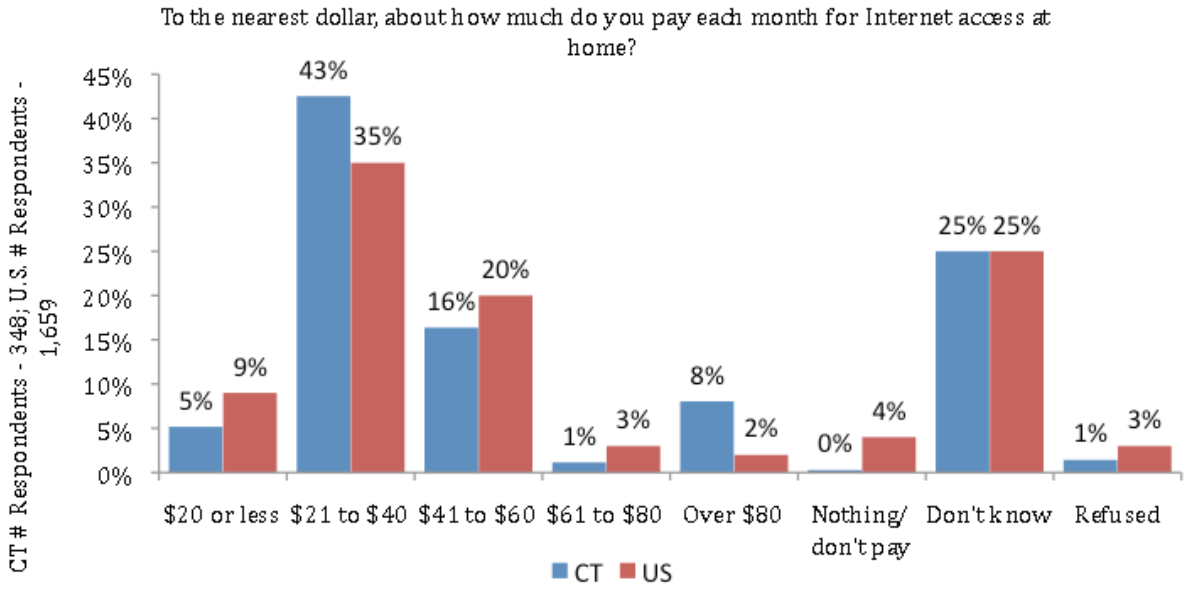


FIGURE 7: MONTHLY CONSUMER INTERNET COST – CONNECTICUT AND THE UNITED STATES

Connecticut respondents were then asked if they would like faster service. Seventy-two percent said they do not want faster service while 24% would like faster service (Figure 8). The remainder of respondents either did not know if they wanted faster service or refused to answer the question.

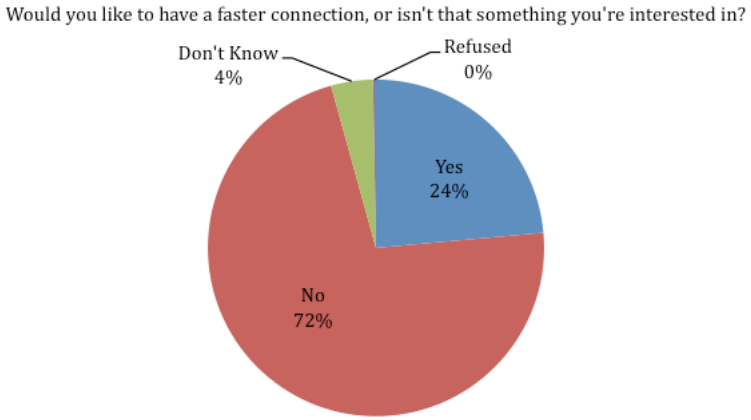


FIGURE 8: WOULD RESPONDENTS LIKE FASTER SERVICE

The 82 respondents who indicated they would like faster service were asked why they have not yet upgraded. More than half of the respondents cited cost as one reason for not upgrading (Figure 9).

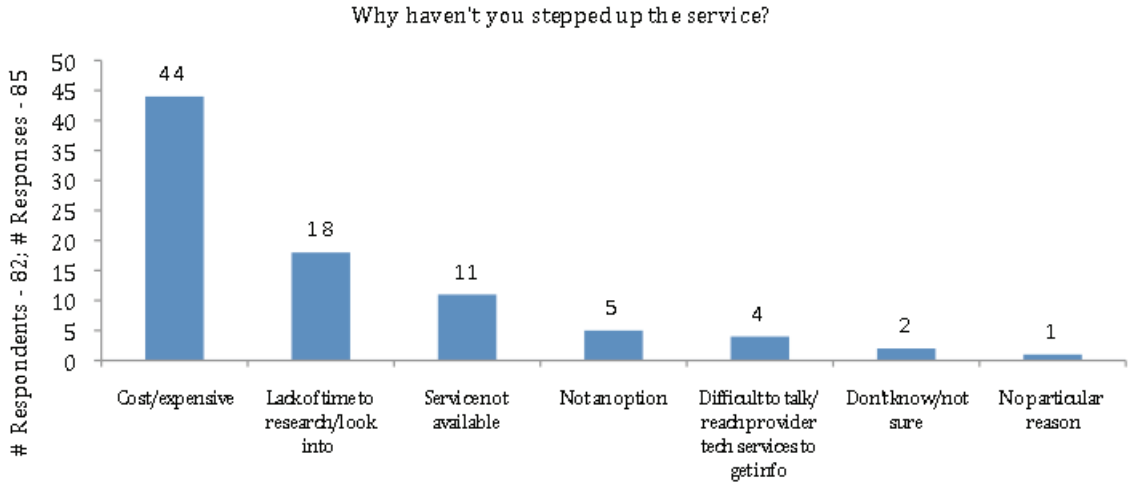


FIGURE 9: REASON FOR NOT UPGRADING SERVICE

INTERNET ACTIVITIES

The respondents who have computers and use the Internet were asked whether or not they use the computer and Internet for different types of activities. For example, respondents were asked if they get news or weather online, play games, or do online banking, among others. There were eight uses of the Internet where more than half of the respondents indicated they used the Internet. These included emailing, researching information on products, getting news or weather, buying products, making travel reservations, online banking, social networking, and getting health information. Table 7 lists all the activities consumers were asked about and whether or not they use the computer or Internet for that particular activity.

TABLE 7: INTERNET ACTIVITIES

Which of the following activities do you use the Internet for? (# respondents – 348)					
	Yes	%	No	%	Don't know
Send or read email	336	97%	12	3%	0
Information on a product you are considering buying	258	74%	90	26%	0
Get news or weather	244	70%	104	30%	0
Buy products	233	67%	115	33%	0
Buy or make travel reservation	219	63%	129	37%	0
Do any online banking	207	60%	140	40%	1
Social networking	196	56%	152	44%	0
Get health info	189	54%	159	46%	0
Play games	154	44%	194	56%	0
Get financial information (stocks)	125	36%	222	64%	1
Visit a government website	101	29%	245	70%	2
Watch video on a video-sharing site	80	23%	268	77%	0
Use online classified ads	79	23%	268	77%	1
Search for info about a job	65	19%	283	81%	0
Make a donation to a charity	60	17%	288	83%	0
Participate in an online auction	57	16%	290	83%	1
Work from home	56	16%	292	84%	0
Homework for you or children	55	16%	293	84%	0
Send instant message	51	15%	297	85%	0
Twitter	37	11%	310	89%	1
Download podcast	26	8%	317	91%	5
Religious or spiritual info	25	7%	323	93%	0
Use a service such as Foursquare	5	1%	341	98%	2

In addition, respondents were asked if they could think of additional activities that they use the Internet for that were not included in the table above. Sixty-three percent, or 219 respondents, could not think of any other activities; however, some respondents were able to identify additional activities, which are listed in Table 8.

TABLE 8: ADDITIONAL INTERNET ACTIVITIES

What other activities do you use the Internet for? (# Respondents – 348; # Responses – 368)	Number	%
No other activities/ can't think of anything else	219	63%
Entertainment options/ movie times/ restaurants	51	15%
Sports update/ results/ scores	28	8%
Don't know/ not sure	22	6%
Get driving directions	13	4%
Celebrity/ Tabloid news	9	3%
Obtain recipes/ menu planning	8	2%
Download/ upload pictures	5	1%
Traffic updates	4	1%
Find telephone numbers	4	1%
Skype	3	1%
Political commentary/ viewpoints	1	0.3%
Gamble	1	0.3%

FUTURE PURCHASES

Next respondents were asked about future device purchases given their knowledge of what might be coming to market in the near future. Interestingly, more than 200 respondents do not know what devices they might purchase (Figure 10). Of those who will purchase a device, a smartphone was the most common device mentioned.

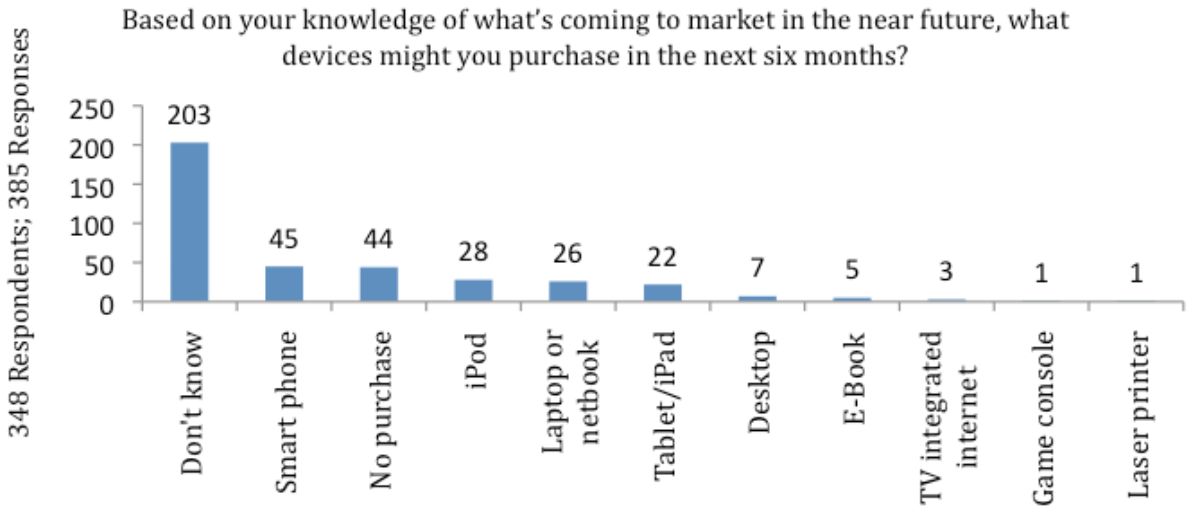
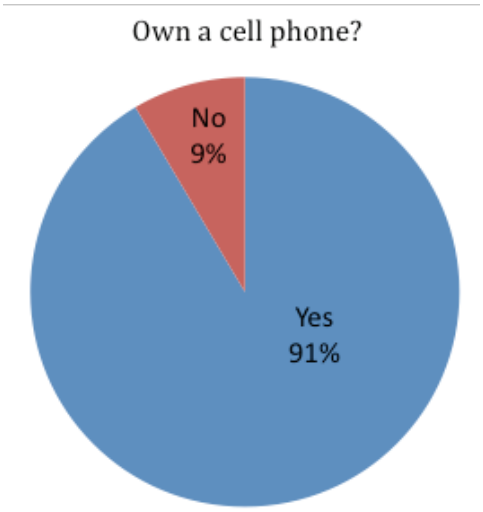


FIGURE 10: FUTURE DEVICE PURCHASES

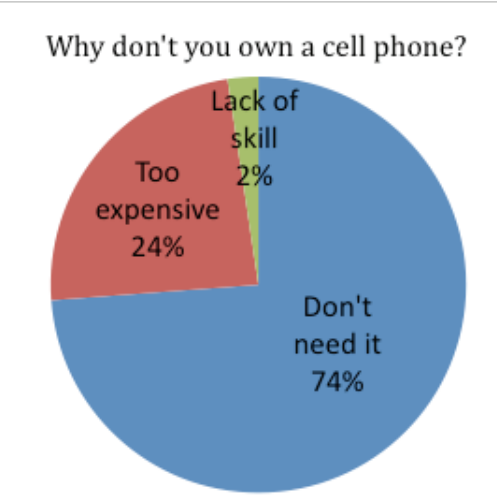
CELL PHONE OWNERSHIP AND USE

Of the 400 consumers surveyed, 365 or 91% own either a regular or smart cell phone (1 respondent did not know or was unsure if he/she owned a cell phone). The 34 respondents who do not own a cell phone were asked why they do not. A few respondents gave multiple responses, however, the most common response was that they "do not need" and 24% said it was "too expensive" as shown in Figure 12.



400 Respondents

FIGURE 11: CELL PHONE OWNERSHIP



34 Respondents; 42 Responses

FIGURE 12: REASON FOR NOT OWNING A CELL PHONE

The 365 respondents with a cell phone were asked how often they use their cell phones. Approximately 71%, or 258 respondents with a cell phone, make or receive one to ten calls a day (Figure 13).

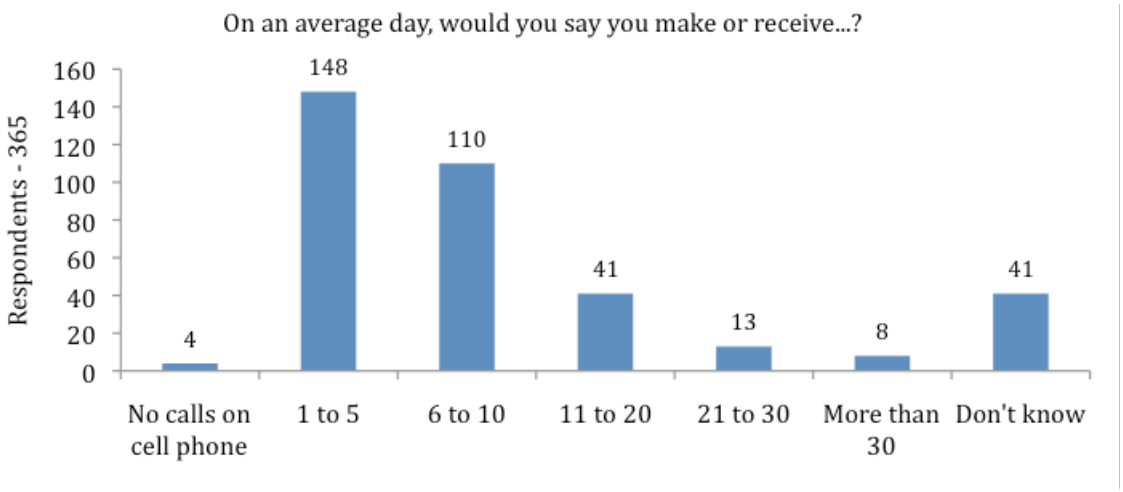


FIGURE 13: FREQUENCY OF CELL PHONE USE

About one-quarter of respondents, or 91 people, receive all their calls on a cell phone (Figure

14). Almost a third of respondents, or 156 people, receive all or almost all of their calls on a home phone.

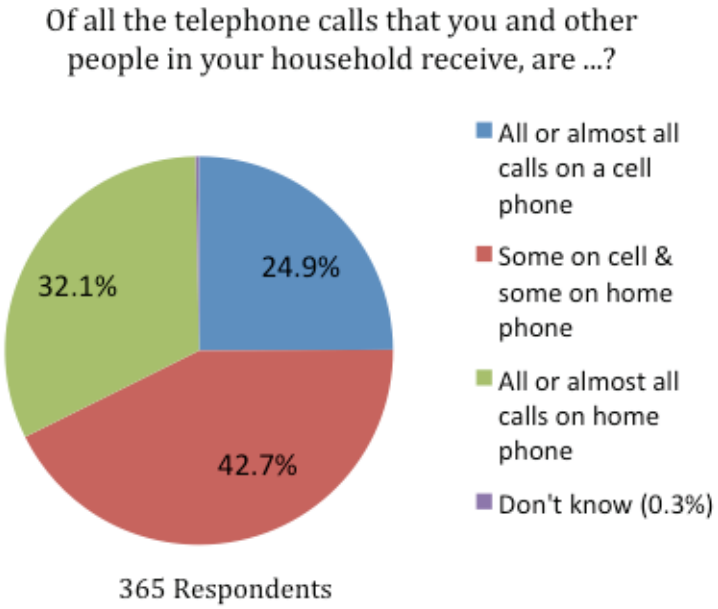


FIGURE 14: NUMBER OF CALLS ON CELL PHONE

The 365 respondents who own a cell phone were then asked whether or not they do certain activities with their cell phones other than making or receiving calls. Figure 15 lists the activities that can be done with a cell phone and how many respondents indicated they use their cell phone in that manner. The majority of respondents use their cell phones to send or receive email and texts, or to take pictures. As for the other activities listed such as playing music and playing games, the majority of respondents do not use their cell phones for those purposes.

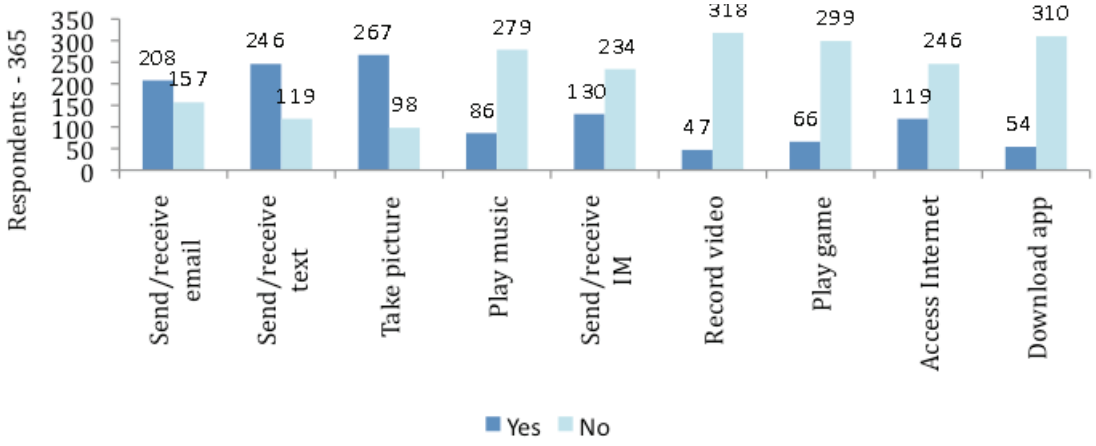


FIGURE 15: HOW RESPONDENTS USE THEIR CELL PHONES

About 30% of cell phone owners, or 113 respondents, neither send nor receive text messages. But of those who do send or receive texts, on an average day most people said they send or receive between 1 and 10 texts.

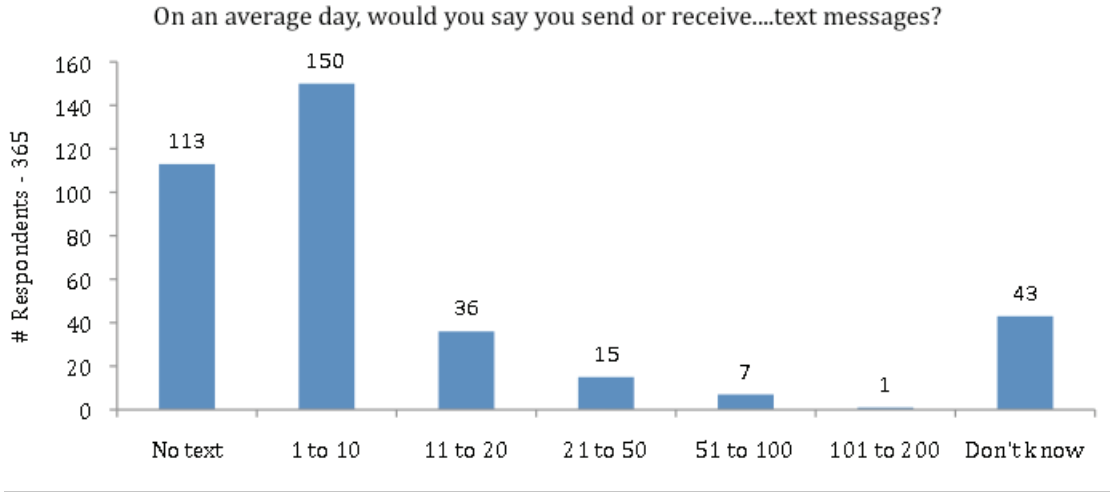


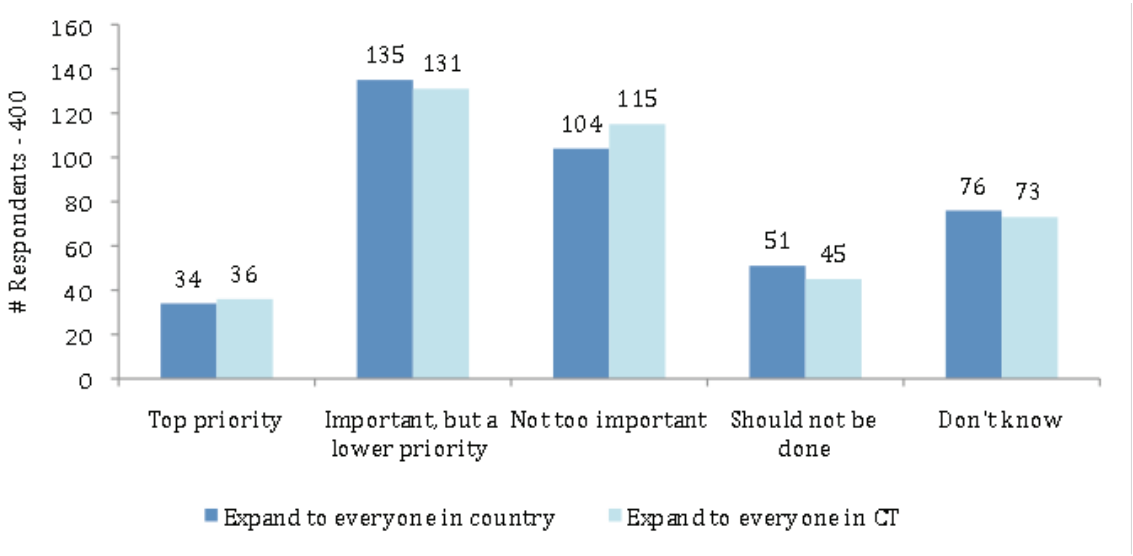
FIGURE 16: DAILY FREQUENCY OF TEXT MESSAGING

BROADBAND—A GOVERNMENT PRIORITY

In order to evaluate the importance that residents place on broadband, all survey respondents, regardless of whether they are users or non-users of the Internet, were asked whether or not the state and federal government should make it a priority to expand affordable high-speed Internet access to everyone. This question was also asked of business survey respondents. About an equal number of respondents from both the business and consumer surveys felt it should be a "top priority" or "important but lower priority" for both the state and federal government.

As shown in Figure 17, between 167 and 169 consumer respondents felt it should be a priority for the state and federal government; this represents about 42% of the 400 survey respondents. In contrast, half of the businesses felt it should be a priority for the federal government and 52% said it should be a priority for the state government. Approximately 40% of consumers felt it "should not be done" or is "not too important" for either state or federal government with the remaining 20% of respondents unsure.

In the national survey results, 26% of Americans felt that expansion of affordable broadband access should not be done by the federal government whereas in Connecticut only 13% felt that way. However, similar to the Connecticut findings, 41% of respondents nationally felt it should be a "top priority" or "important, but lower priority."



	Federal	%	State	%
Top priority	34	8%	36	9%
Important	135	34%	131	33%
Not too important	104	26%	115	29%
Should not be done	51	13%	45	11%
Don't know	76	19%	73	18%
Total	400	100%	400	100%

FIGURE17: EXPANDING AFFORDABLE HIGH-SPEED INTERNET - FEDERAL AND STATE GOVERNMENT

When looking at the responses by highest level of educational attainment as to whether Connecticut government should expand affordable Internet, respondents with an associate's degree or higher were more likely to feel it should be a "top priority" or "important but lower" (Table 9). Educational attainment is often used as a proxy for income—higher educational attainment levels earn more income. The data suggests that those with higher incomes are more likely to favor government programs that support expansion of broadband. Although not shown in the table, similar results were found when asked whether the federal government should expand affordable high-speed Internet access.

TABLE 9: RESPONSE TO BROADBAND EXPANSION BY CONNECTICUT GOVERNMENT BY HIGHEST LEVEL OF EDUCATIONAL ATTAINMENT

	Less than high school	High School graduate	Trade school grad	Some college	Associate's degree	Bachelor's degree or more	Refused
Top priority	1	5	1	10	5	11	3
Important, but lower	2	36	8	25	13	31	16
Not too important	0	30	11	29	3	18	24
Should not be done	6	7	0	17	2	11	2
Don't know	2	18	6	12	1	6	28
% saying Top priority, or important but lower	27%	43%	35%	38%	75%	55%	26%

On the other hand, when looking at the responses by town population density (average, rural, urban) as shown in Table 10, where individuals reside does not seem to affect whether or not they feel state government should help expand broadband. About an equal percentage in each of the geographic areas felt it should either be a "top priority"/ "important, but lower" or "not too important"/"should not be done." However, respondents living in towns classified as "average" were more likely to favor government programs to expand broadband service rather than not.

TABLE 10: GOVERNMENT EXPANSION OF BROADBAND BY TOWN POPULATION DENSITY

	Average	Rural	Urban
Top priority	9%	6%	11%
Important, but lower	37%	36%	28%
Not too important	20%	34%	25%
Should not be done	14%	8%	16%
Don't know	21%	16%	20%

Respondents were also provided with a list to determine if not having access at home was a disadvantage to conducting certain activities that are now possible due to the availability of the Internet. In all the categories, more than half of the respondents felt it was a disadvantage to not have Internet access. However, there was no major issue on which majority of Connecticut residents felt the lack of broadband was a *major* disadvantage. In fact, only 13% of respondents felt that not having Internet access at home was a major disadvantage for using government services (Figure 18). This demonstrates that e-government services are rare and have not reached the level where they are a regular presence for consumers.

Keeping up with local community news and learning new things were the two categories with the highest number of respondents feeling it was a "major disadvantage" to not have high-speed Internet at home.

The Pew Internet survey also found similar findings at the national level. There was no issue where the majority of Americans felt it was a major disadvantage.

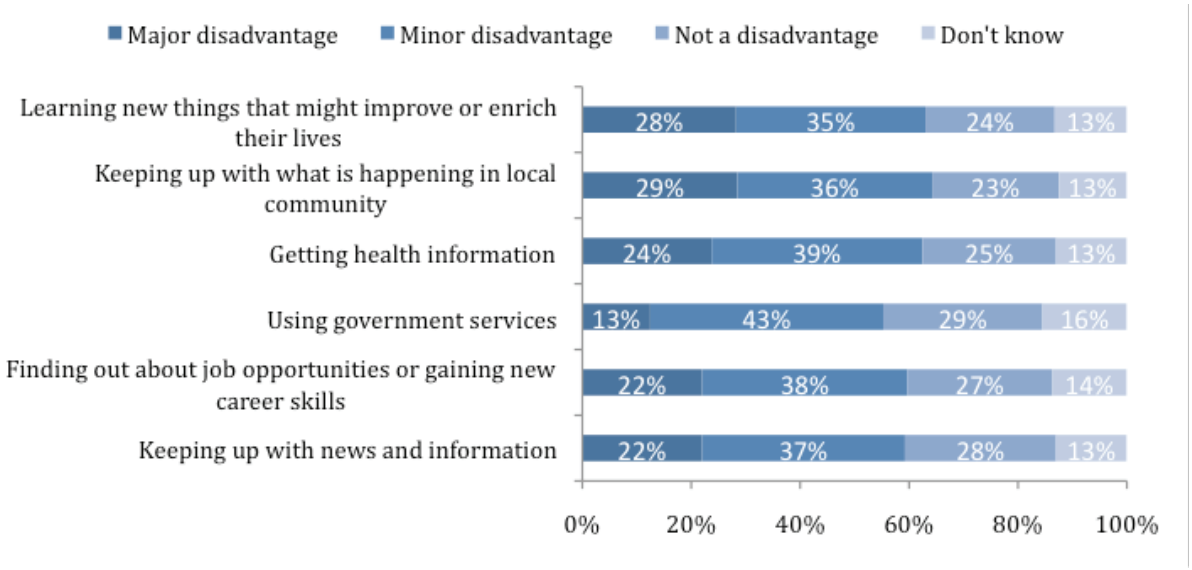


FIGURE 18: ADVANTAGE/DISADVANTAGE OF HAVING HIGH-SPEED INTERNET AT HOME

TELECOMMUTING

Even though telecommuting is mentioned more often as an increasing trend, the results from the survey indicate it is still only a small percentage of workers in the state who telecommute. As displayed in Figure 19, only 6% of respondents telecommute frequently and more than three-quarters never telecommute. The business surveys also produced similar findings.

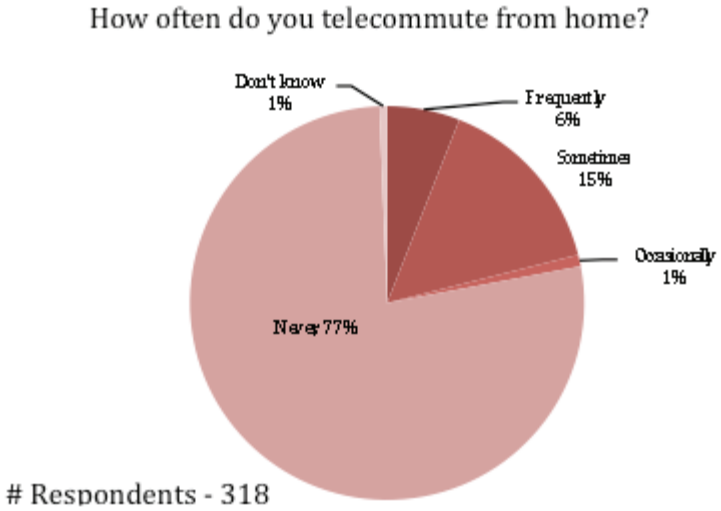


FIGURE 19: TELECOMMUTING

As household income increases, the percentage of the respondents who telecommute also increases. For households that reported an annual income of less than $49,999, twenty-two of the 23 respondents never telecommute. Sixty-five percent of households with incomes between $50,000 and $74,999 also never telecommute. However, 62% of households with income between $75,000 and $99,999 sometimes or frequently telecommute. Additionally, 57% of households with income of $150,000 or more telecommute and this represents one-fifth of those who telecommute frequently.

RESPONDENTS WITHOUT COMPUTERS

Connecticut has a smaller percentage of its population not using computers or the Internet when compared to the nation. In Connecticut, 52 survey respondents, or 13%, indicated they either do not use a computer or the Internet compared with 21% in the nation.

The Connecticut respondents who do not use the Internet were asked a series of questions. First respondents were asked if anyone in the household uses the Internet from home or sends email. The overwhelming majority, or 83%, said no (43 respondents), and 17% (9 respondents) said yes. These results mirror the national findings issued by Pew where 82% said no and 16% said yes. Then they were asked if they ever at some point used the Internet but stopped for some reason. Again the majority, 44 respondents, said no and 8 said yes.

Third, they were asked if they would like to start using the Internet or email (again) and 87%, or 45 respondents, are just not interested. Eight respondents, or 15%, expressed an interest and one was not sure. Again, these results are similar to the national findings, where 89% said they are not interested and 10% were interested.

Finally respondents were asked if they knew enough about computers and technology to start using the Internet or email (again) if they wanted to or would they need help. Twenty-eight said they would need help, 21 said they do not want to start using the Internet, and 3 said they knew enough.

When respondents were asked, “What is the *main* reason they do not use a computer or the Internet,” the most common response was ”not interested.“ Slightly less than half of the respondents indicated that the main reason for not using the Internet was that they are not interested (Figure 20) and 17% said it was because they do not have a computer.

These results are somewhat different than the findings at the national level. In the Pew survey, the top three reasons for not using the Internet or email were: not interested (31%), don’t have a computer (12%), and too expensive (10%). Interestingly, in the Connecticut survey only 2 respondents or approximately 4% of those surveyed specifically cited cost as a reason.

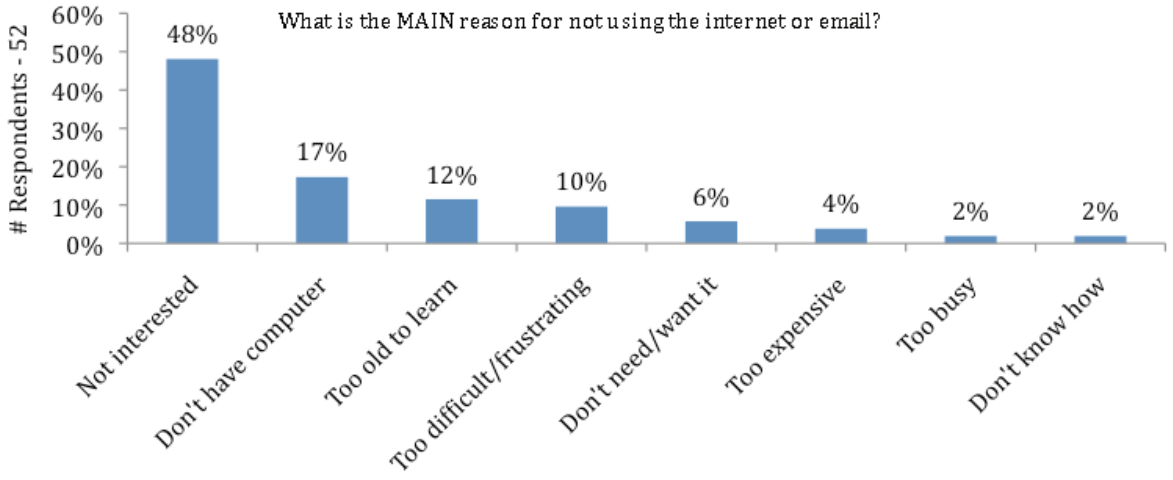


FIGURE 20: MAIN REASON FOR NOT USING THE INTERNET OR EMAIL

Table 11 lists the other responses provided. Respondents were also asked if there were other reasons, other the main reason, as to why they do not use the Internet or email. The most common response, which was given by 15 people, was "no other reason." The next two most common responses were "too expensive" which was mentioned 12 times and "do not need it/ want it" which was mentioned 10 times.

TABLE 11: OTHER REASONS FOR NOT USING THE INTERNET OR EMAIL

For what other reasons don't you use the Internet or email? (# Respondents – 52; # Responses – 81)				
Reason	# of responses		Reason	# of responses
No other reason	15		Too busy/no time	4
Too expensive	12		It's a waste of time	3
Don't need it/want it	10		Don't know how	2
Don't have a computer	9		Physically unable/ poor eyesight/ disabled	2
Too old to learn	8		Worried about computer viruses	1
Just not interested	7		Worried about spam	1
Too difficult	6		Worried about privacy	1

Education Level of Respondents without Computers

The highest level of education completed by the 45 respondents who do not use a computer is as follows: 20 have a high school diploma or GED; 8 did not finish high school; 8 refused to answer; 5 have some college; 2 completed trade school; and 2 have bachelor's degrees.

DEMOGRAPHIC INFORMATION OF SURVEY RESPONDENTS

Survey respondents were asked a series of questions to ascertain demographic information. For example, respondents were asked to provide their race, age, highest level of education, and household income before taxes. There were 205 male respondents and 195 female respondents. Table 12 shows the number of respondents by age, area, and telephone type. Thirty-six percent of the respondents were between the ages of 30 and 49 years.

TABLE 12: NUMBER OF RESPONDENTS BY AGE, AREA, AND PHONE TYPE

		Area			Telephone	
Age	**Total**	**Urban**	**Average**	**Rural**	**Cell phone**	**Landline**
18 to 29 years old	32	15	8	9	16	16
30 to 49 years old	144	51	48	45	86	58
50 to 64 years old	125	37	43	45	63	62
65 to 74 years old	53	18	15	20	21	32
75 years old or older	23	8	11	4	1	22
Refused but over 18 years old	23	5	8	10	13	10
Total	**400**	**134**	**133**	**133**	**200**	**200**

RACE

All respondents were asked to identify their race. 389 provided a racial group and 11 respondents refused to answer the question. Figure 21 shows the breakout by race.

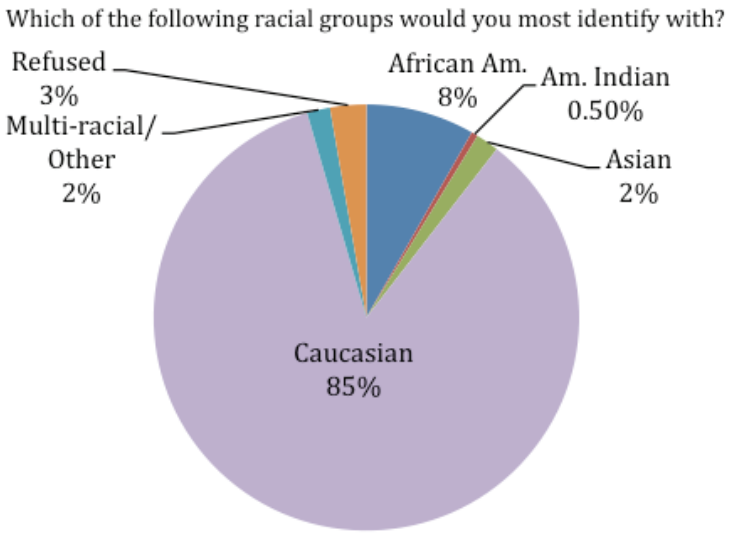


FIGURE 21: RACIAL GROUPS OF RESPONDENTS

HOUSEHOLD SIZE

Respondents were also asked about their household composition. The majority of respondents live in two-person households with no children.

TABLE 13: PEOPLE LIVING IN THE HOUSEHOLD

	One	Two	Three	Four	Five	Six or more	Don't Know	Refused
How many adults live in your household?	78	241	59	10	2	1	2	7

	None	One	Two	Three	Four	Don't know	Refused
How many children under age 12?	318	26	29	14	3	1	9

	None	One	Two	Three	Six or more	Don't know	Refused
How many children between 12 and 17?	312	46	29	2	1	1	9

HIGHEST LEVEL OF EDUCATION

Respondents were asked to provide the highest level of education they completed. 327 people answered the question while 73 refused (Figure 22). The majority of respondents' highest level of education completed is a high school diploma/GED or some college.

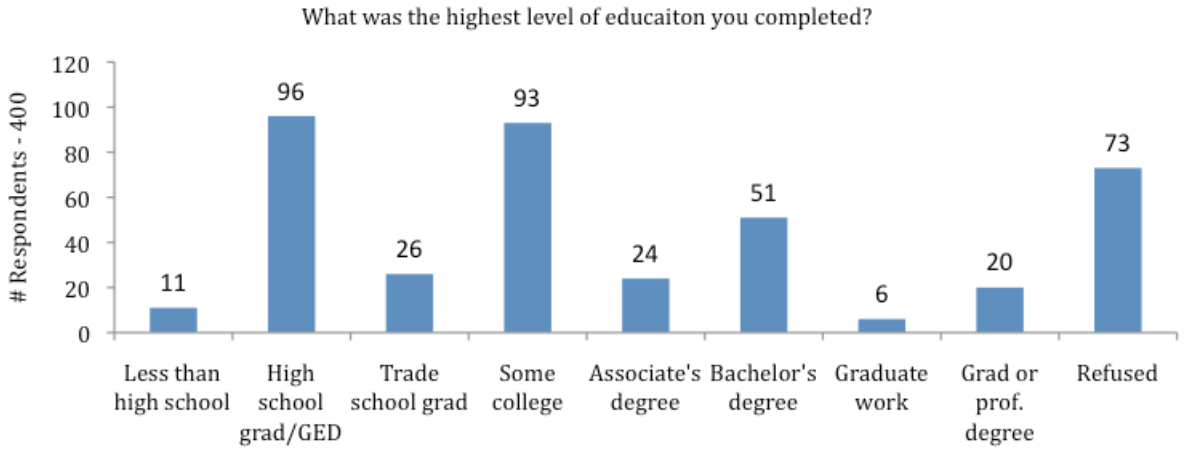


FIGURE 22: HIGHEST LEVEL OF EDUCATION

HOUSEHOLD INCOME

Respondents were asked to provide a range for household income before taxes. 153 respondents provided a range, 81 did not know the household's income, and 166 refused to provide a range. Of those who responded, 57, or 37%, have incomes between $50,000 and $74,999 (Figure 23).

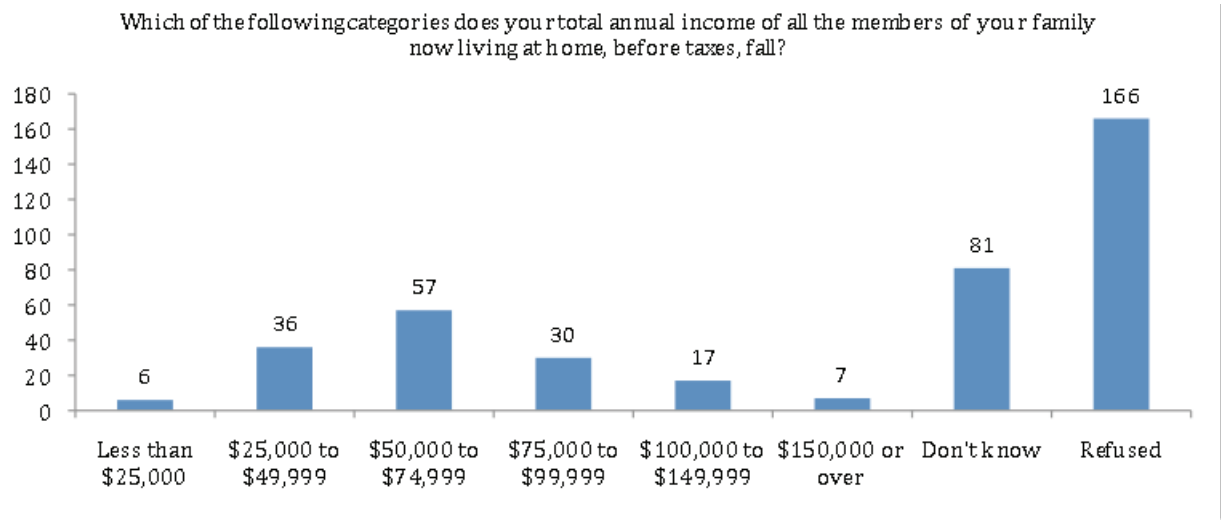


FIGURE 23: HOUSEHOLD INCOME

ADDENDUM 1: SURVEY METHODOLOGY

The results of this report are based on data from a telephone survey conducted by the Horizon Research Group during the months of November and December 2010. Respondents were contacted Monday through Friday between 5 PM and 9 PM and Saturday from 10 AM to 3 PM. All respondents were over the age of 18. In order to obtain a sample size of 400, more than 2,500 calls were made. Interviews were conducted in English and the average length of a call was 9 minutes.

In order to produce a representative sample, an Address Based Sample was purchased which generates an address sample and appends telephone numbers, where possible. To compensate for the missing information, a list vendor incorporates other commercial databases that have different and more complete data on individual households.

Since the sample frame is based on addresses and not on landline telephone numbers, cell phone only households are included in the sampling frame. Additionally, respondents were screened to determine whether the telephone number used to contact them was a landline or cell phone and respondents were segmented accordingly.

Systematic and proportionate stratified probabilistic sampling was used to provide all the individuals in the population equal chances of being selected.

Following is the full disposition of all the telephone numbers sampled. The disposition reports all of the sampled numbers ever dialed from the original sample. The response estimates

the fraction of all eligible respondents in the sample who were ultimately interviewed. It is calculated by multiplying the contact rate by the cooperation rate by the completion rate.

Call Disposition	
2,561	Total Numbers Dialed
4	Fax/Modem
92	Not Working
2,465	Working numbers
96%	Working Rate
89	No answer/busy
1,238	Voicemail
429	Blocked Calls
709	Contacted numbers
29%	Contact Rate
73	Call back
178	Refusal
458	Cooperating numbers
65%	Cooperation Rate
25	Language barrier
433	Eligible numbers
95%	Eligibility Rate
33	Terminated
400	Completes
92%	Completion Rate
17%	Response Rate

ADDENDUM 2: POPULATION DENSITY OF TOWNS

The following table shows how the zip codes in Connecticut were divided into rural, average, and urban.

CLASSIFICATION	Population Density	# OF ZIP CODES
RURAL	< 325 people per square mile	102
AVERAGE	325 to 2,700 people per square mile	137
URBAN	> 2,700 people per square mile	45

APPENDIX E: BUSINESS SURVEY RESULTS

This section describes the results from the survey of businesses. The survey was designed to assess broadband use among Connecticut businesses. The methodology selected to understand the business adoption rates of broadband was a rigorous, unbiased survey; a telephone survey was deemed to be the best approach because the results could be gleaned in a timely manner. The results from the phone survey, presented below, will be used by the CASE Broadband Study Committee as guidance in the development of the state's broadband strategic plan.

The telephone survey (landline only) was conducted among a random sampling of Connecticut business decision makers; 400 surveys were completed and evenly distributed by population density (urban, average, rural).[73] Interviews were conducted during the months of November and December 2010. More detail on the survey methodology can be found in Addendum 2.

Questions were developed to understand the prevalence of computers in businesses and the extent to which they are used to access the Internet.

KEY FINDINGS:

- 85% of businesses use computers; 100% of businesses from the manufacturing, finance and insurance, real estate, and government sectors use computers.
- Almost 19% of businesses either do not have computers, do not use the Internet, or do not email; the reason provided by over 80% of these businesses is that they are just not interested in using the Internet or email.
- Of the respondents who have computers, 75% stated that all the computers in their businesses can connect to the Internet.
- 87% of businesses connect to the Internet through either a DSL or cable modem.
- More than 70% of businesses said they use the Internet several times a day, regardless of business size.
- 60% of businesses have a website but only one-third sell their products and services online.
- Only 19% of businesses surveyed said they support telecommuting; the finance and insurance industry sector was the only sector where more respondents supported telecommuting than not.
- Business respondents have difficulty predicting what will be needed in the future. In particular they had a difficult time determining device purchases or whether or not their Internet speed will be adequate.
- 52% of businesses believe it should either be a "top priority" or "important but lower priority" for state government to expand affordable high-speed Internet access. One-third felt it was "not too important" or "should not be done."

[73] Rural defined as less than 325 people per square mile; average defined as 325-2,700 people per square mile; and urban defined as more than 2,700 people per square mile

Computer Usage

As shown in Table 1, the majority of the businesses surveyed, regardless of geographic location, use computers in their business. Of those surveyed, 59% had fewer than 10 employees and 63% serve the local (own town or surrounding town) area.

TABLE 1: SURVEY RESPONSES

	Total	Do you use computers in your business?		How many employees work at this location?					Is your market area primarily...?		
		Yes	No	1 to 9	10 to 24	25 to 49	50+	Don't know	Local	State-wide	Outside CT
Base	400	340	60	247	92	29	22	10	259	83	58
Average	133	117	16	78	30	7	12	6	84	29	20
Rural	133	110	23	89	30	8	4	2	90	26	17
Urban	134	113	21	80	32	14	6	2	85	28	21

Business responses were also grouped by industry sector. All respondents from the following manufacturing; finance and insurance; real estate; and government industry sectors stated that they use computers in their businesses. Figure 1 shows the industry sectors where not all businesses use computers. As for these industry sectors, the majority of respondents said their business uses computers, with the lowest percentage of computer use in the accommodation and food services industry (65%) and the agriculture, fishing, forestry, and mining industry (60%).

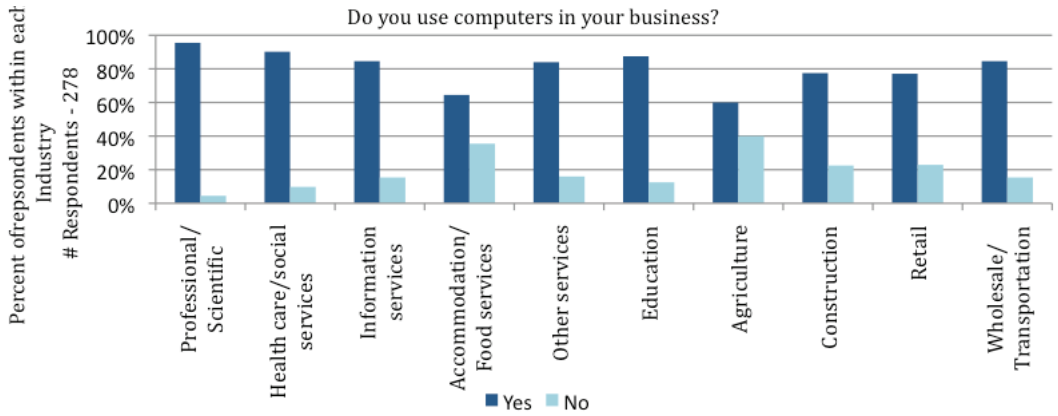


FIGURE 1: PERCENT COMPUTER USE IN BUSINESSES BY INDUSTRY

Internet/Email Use

Next, respondents were asked whether or not the computers in their business can connect to the Internet. Of the respondents who have computers, 74.7% stated that all the computers in their business can connect to the Internet (Table 2). Five respondents, or 1.5%, said none of the computers in their business can connect to the Internet.

TABLE 2: PERCENT OF COMPUTERS CONNECTED TO THE INTERNET

What percentage of the business computers can connect to the Internet? (# respondents = 340)		
% of computers connected to Internet	# of responses	% of responses
0%	5	1.5%
1 - 24%	13	3.8%
25-49%	13	3.8%
50-74%	32	9.4%
75-99%	23	6.8%
100%	254	74.7%

Respondents who use the Internet were then asked what type of devices they use to access business email or to conduct other business activities on the Internet. The two most common devices mentioned were desktop and laptop computers with 95% and 41% of respondents, respectively.

Interestingly, when asked what type of device might be purchased in the next six months, over 70% of the respondents said they will not be purchasing devices or do not know what they would purchase.

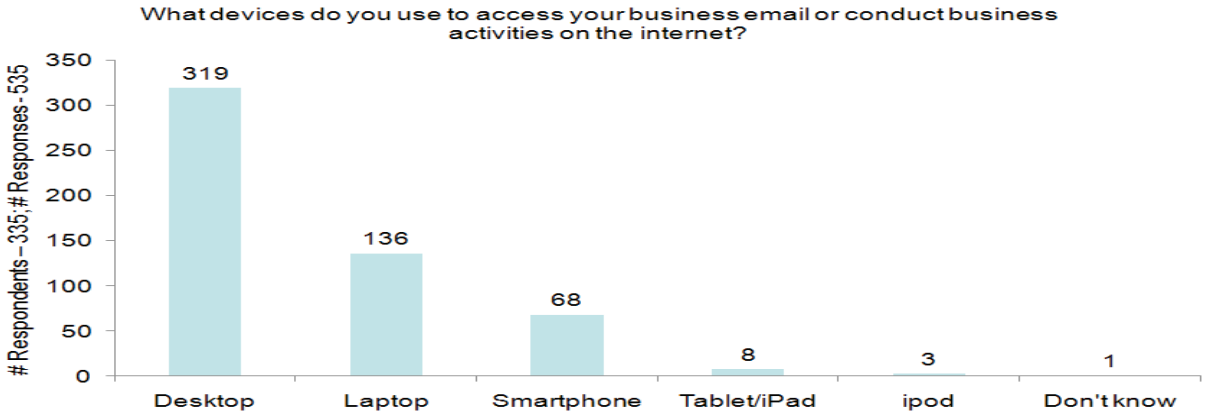


FIGURE 2: DEVICES USED TO ACCESS THE INTERNET

Internet Connection

Next, businesses were asked the type of connection they use to access the Internet. As shown in Figure 3, approximately 87% of respondents, or 291 businesses, said they have either a DSL or cable modem connection. Of particular note is the fact that there was no statistical difference between urban and rural respondents as to the type of connection in use. Six businesses said they do not use broadband either because they do not need it, can use it somewhere else, or was too expensive."

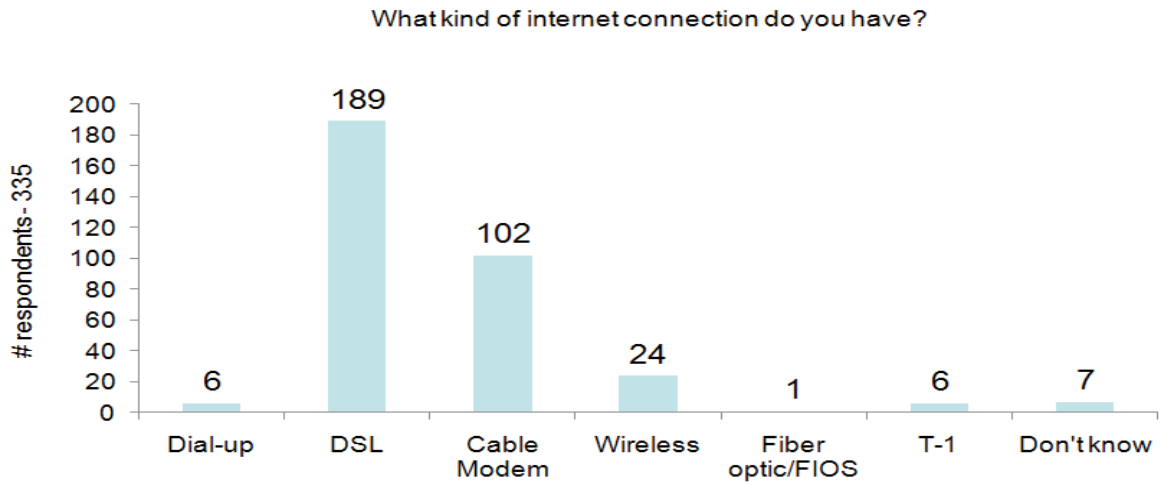


FIGURE 3: TYPE OF INTERNET CONNECTION

Businesses with Internet connections were then asked if they send or receive email at least occasionally. All businesses with 25 or more employees said they do (Table 3). However, not all businesses with 24 or fewer employees said they send or receive email at least occasionally. Approximately 97% of those with 24 or fewer employees responded that they do.

TABLE 3: SEND OR RECEIVE EMAIL, AT LEAST OCCASIONALLY

Do you send or receive email, at least occasionally? (# respondents = 335)				
Employees at worksite	Yes	% yes	No	% No
1 to 9	185	97%	6	3%
10 to 24	83	97%	3	3%
25 to 49	28	100%	0	0%
50+	22	100%	0	0%
Don't Know	8	100%	0	
Total	326		9	

However, when businesses were asked how often they use the Internet or email at work, regardless of business size, more than 70% said they use it several times a day.

FIGURE 4: USE OF THE INTERNET OR EMAIL AT WORK

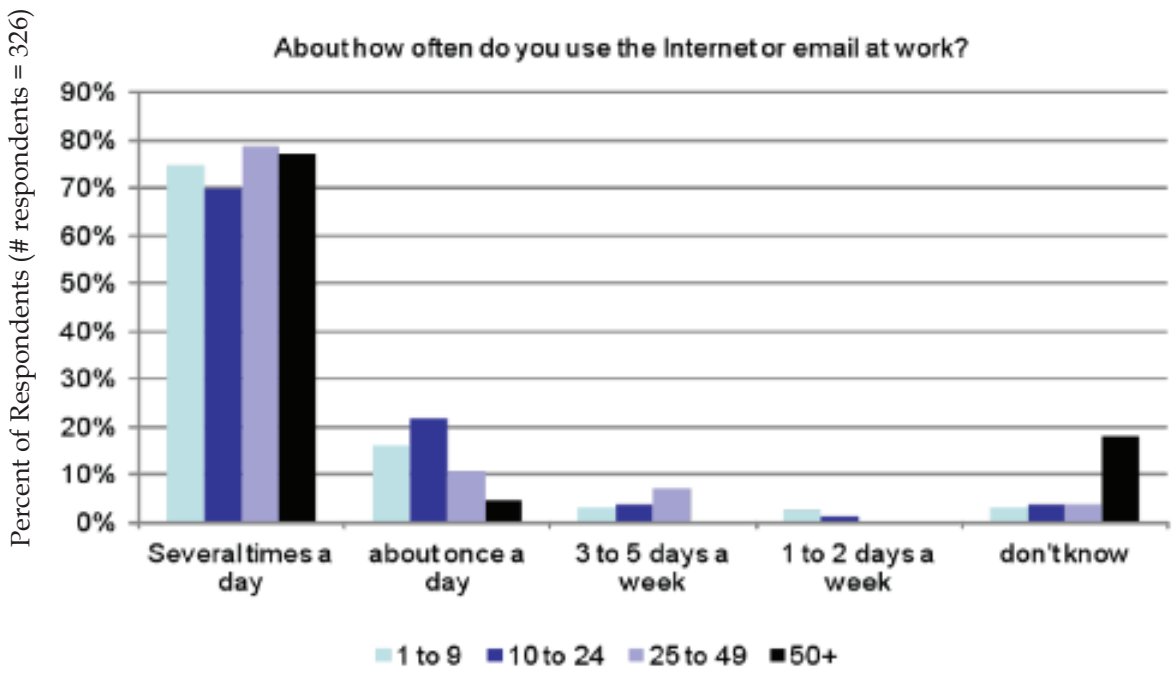


TABLE 4: FREQUENCY OF INTERNET AND EMAIL USE BY BUSINESS SIZE

Business Size	Several times a day	Once a day	3 to 5 days a week	1 to 2 days a week	Don't know
Don't know	5	0	0	0	3
1 to 9 empl.	138	30	6	5	6
10 to 24 empl.	58	18	3	1	3
25 to 49 empl.	22	3	2	0	1
50 or more empl.	17	1	0	0	4
Total	240	52	11	6	17

Businesses Without Computers, Internet or Email

Almost 19% of the businesses in the survey do not have computers, do not use the Internet, or do not email. Table 5 shows the number of businesses for each of these categories. Sixty business respondents do not have computers, five have computers but no Internet, and nine businesses have computers and Internet but no email.

TABLE 5: BUSINESSES WITHOUT COMPUTER, INTERNET, OR EMAIL

Business Response	# of Responses
No computers	60
No Internet	5
No email but have computers and Internet	9
Total	74

These businesses were asked first, if they ever used the Internet or email at some point and then, would they like to start using the Internet and email (again). Fifty-seven respondents said they have never used the Internet or email while only seventeen stated that at some point they used the Internet or email. Additionally, only six businesses expressed an interest in using the Internet or email; over 80% of the 74 respondents are just not interested in using the Internet or email.

Overall, the main reason for not using the Internet or email was that the businesses were just not interested (Figure 5). The next most common response was that they are not interested or do not want it. Businesses were then asked if there were additional reasons for not using the Internet or email and the most common responses were "don't need it" or "too busy." Eight responses of "too expensive" were recorded for either the main or secondary reason as to why Internet and email are not used.

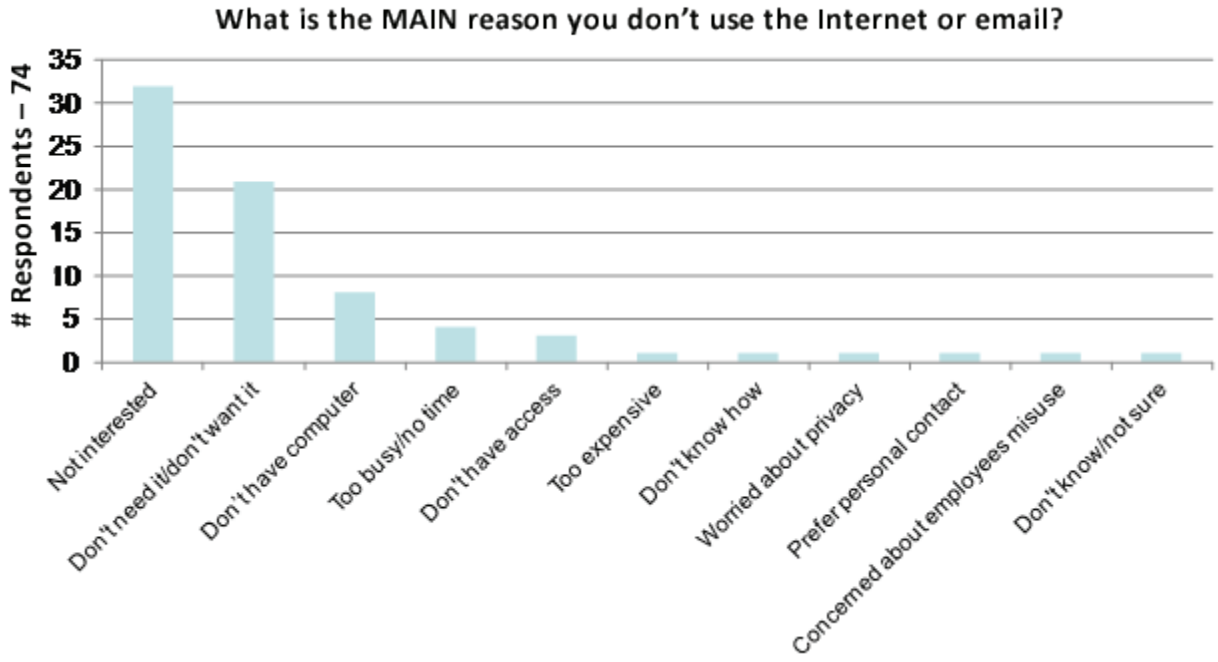


FIGURE 5: MAIN REASON FOR NOT USING THE INTERNET OR EMAIL

These same businesses were also asked whether they know enough about technology and computers to be able to start using the Internet and email if they wanted to. Forty-two respondents, or 57%, said they know enough, and 17, or 23%, continued to express a lack of interest (Figure 6).

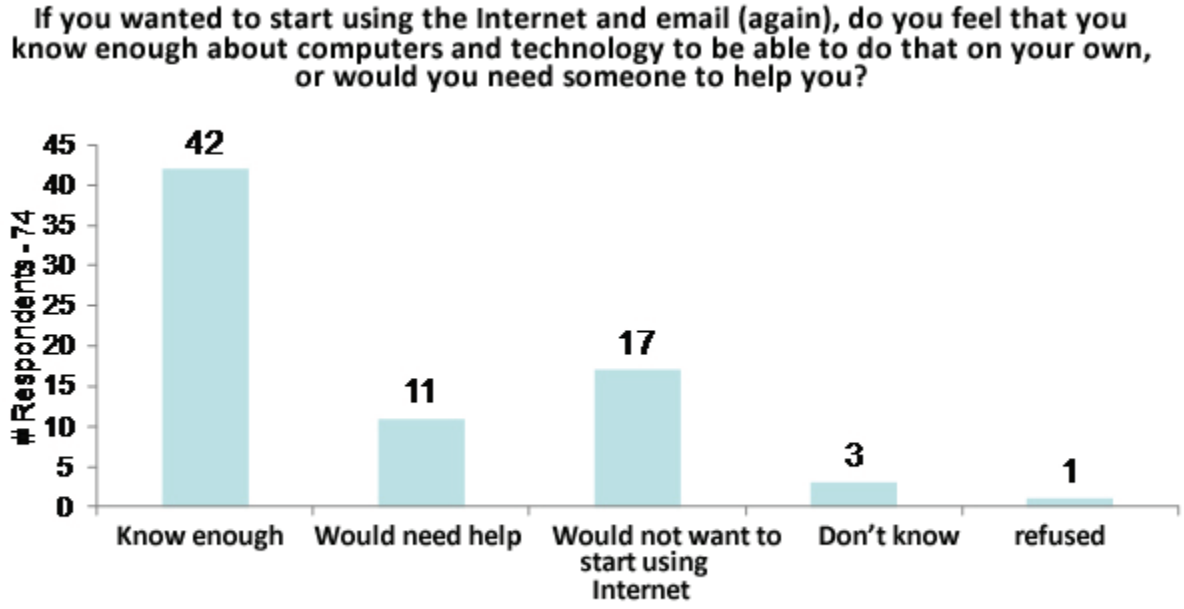


FIGURE 6: ABILITY TO START USING INTERNET AND EMAIL ON OWN

Business Use of the Internet

Businesses that use the Internet were asked whether or not they conducted certain activities such as selling products and services or purchasing goods online. The three most common uses of the Internet by businesses were: having a website, having an email for customer support, and purchasing supplies or services online.

Of the 326 business respondents that use Internet and email, 241 businesses, or 74%, have a website, but only 136 businesses, or 42%, sell their products or services via the Internet (Figure 7). However, when looking at the total population of businesses surveyed, 60% have a website, but only a third sell products and services online.

Additional uses for the Internet (displayed in the graph as "other primary activities") that were mentioned by businesses included conducting research, sending faxes, and issuing newsletters.

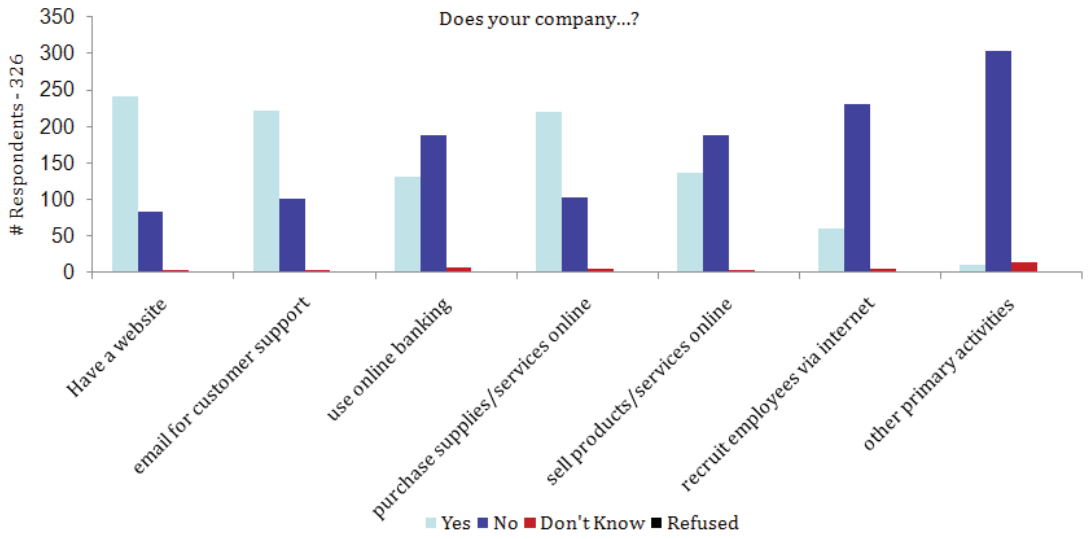


FIGURE 7: BUSINESS USE OF THE INTERNET

Internet Service Satisfaction

Next, businesses that use the Internet were asked about their broadband service. First they were asked if service was reliable, second whether the current speed was adequate, and finally whether the speed will be adequate in 12 months. Figure 8 shows that most businesses are satisfied with the reliability and speed of their service with more expressing concern over the speed than reliability. Even though 78% of respondents said the speed will be adequate over the next 12 months, almost 20%, or 60 respondents, did not know whether it would be adequate or not.

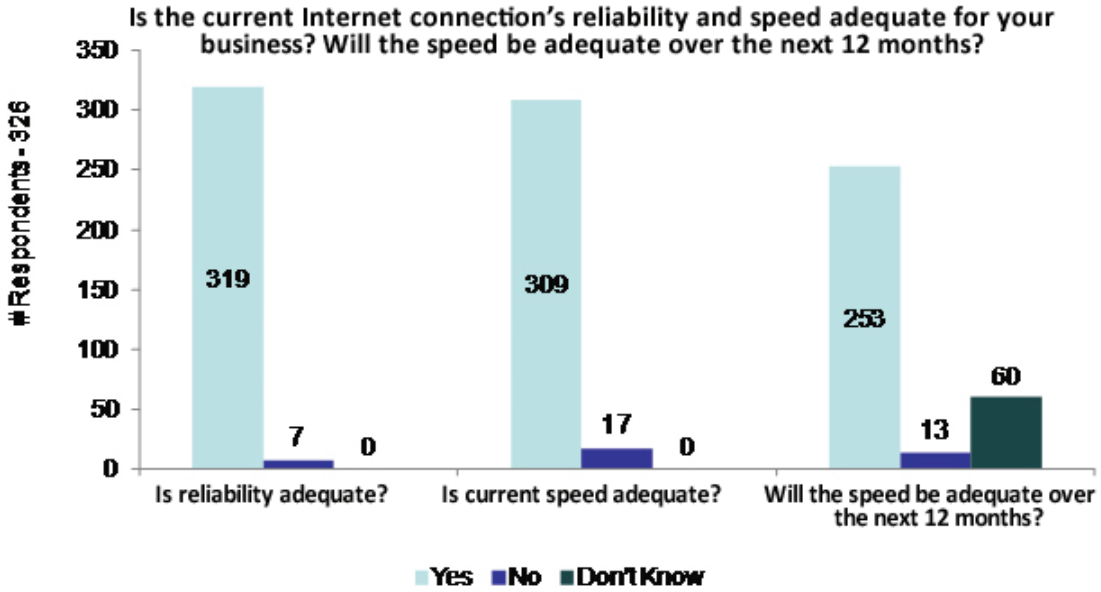


FIGURE 8: RELIABILITY AND SPEED OF BROADBAND SERVICE

Telecommuting

Telecommuting was the next topic area discussed. Businesses were first asked if they support telecommuting for their employees. As shown in Figure 9, 80% of respondents do not support it, 19% do support it, and 1% was unsure. There was no difference in support or lack of support between urban and rural businesses.

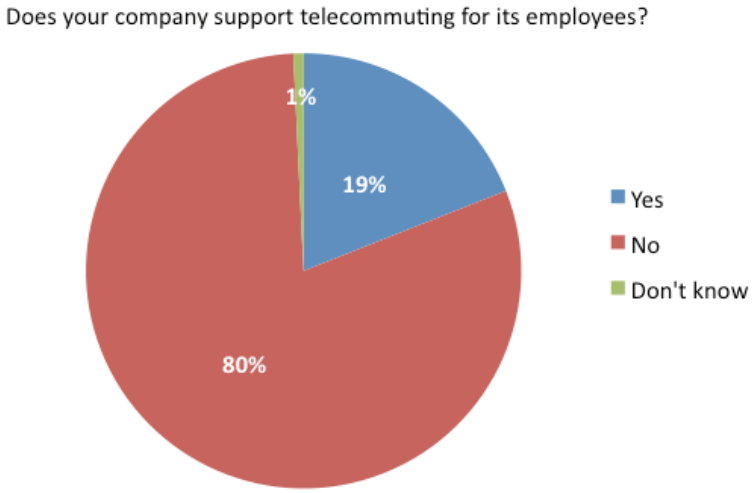


FIGURE 9: TELECOMMUTING

However, there was a statistical difference between the "support" and "do not support" categories for businesses with 1 to 9 employees and 10 to 24 employees. For example, a higher percentage (86%) of businesses with 1 to 9 employees do not support telecommuting versus businesses with 10 to 24 employees (72%), which was statistically different. This was also true for the "support" category where 13% of businesses with 1 to 9 employees support telecommuting and 28% of businesses with 10 to 24 employees support it. These results indicate that size of the business factors into a company's policy regarding telecommuting.

As displayed in Table 6, the Finance and Insurance industry sector was the only sector where more respondents supported telecommuting than not. In all other industry sectors, more business respondents said they do not support telecommuting.

TABLE 6: TELECOMMUTING BY INDUSTRY SECTOR

Industry Sector (# Respondents – 400)	Yes	No	Don't know	Total
Retail	6	63	1	70
Health care/Social service	7	43	1	51
Other services	2	48		50
Professional/Scientific	17	27		44
Construction	5	35		40
Accommodation/ food services	3	28		31
Wholesale, transportation	7	18	1	26
Manufacturing	4	19		23
Finance and insurance	11	7		18
Real estate	6	8		14
Information services	3	10		13
Education	2	6		8
Government	3	4		7
Agriculture/Fishing/Forestry/ Mining	0	5		5

Of the 76 businesses that support telecommuting, 42, or 55%, stated employees telecommute frequently and another third stated employees sometimes telecommute (Figure 10). The responses to the telecommuting questions indicate that businesses either really support telecommuting or do not support it at all.

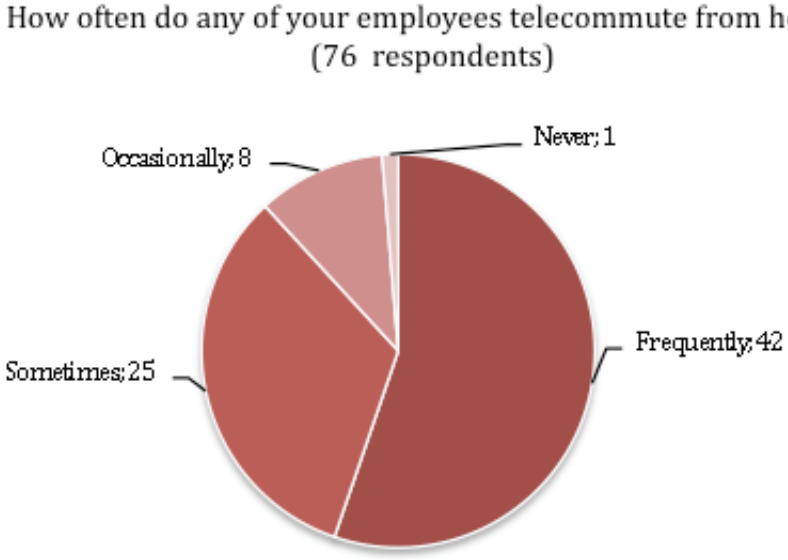


FIGURE 10: FREQUENCY OF TELECOMMUTING

Broadband - A Government Priority

All businesses participating in the survey were asked two questions regarding making affordable high-speed Internet accessible to everyone. First, businesses were asked whether it should be a priority of the federal government and then they were asked whether it should be a priority for the state government to make high-speed Internet available to all Connecticut residents.

Half of the respondents said it should either be a "top priority" or "important but lower priority" for the federal government to expand affordable high-speed Internet access (Figure 11). When asked whether expanding affordable high-speed Internet access to everyone in Connecticut should be a priority for the state government, 52% said it should be either a "top priority" or "important, but a lower priority." In both questions, more than a third of business respondents felt expanding high-speed Internet access was "not too important" or "should not be done" by either the federal or state government.

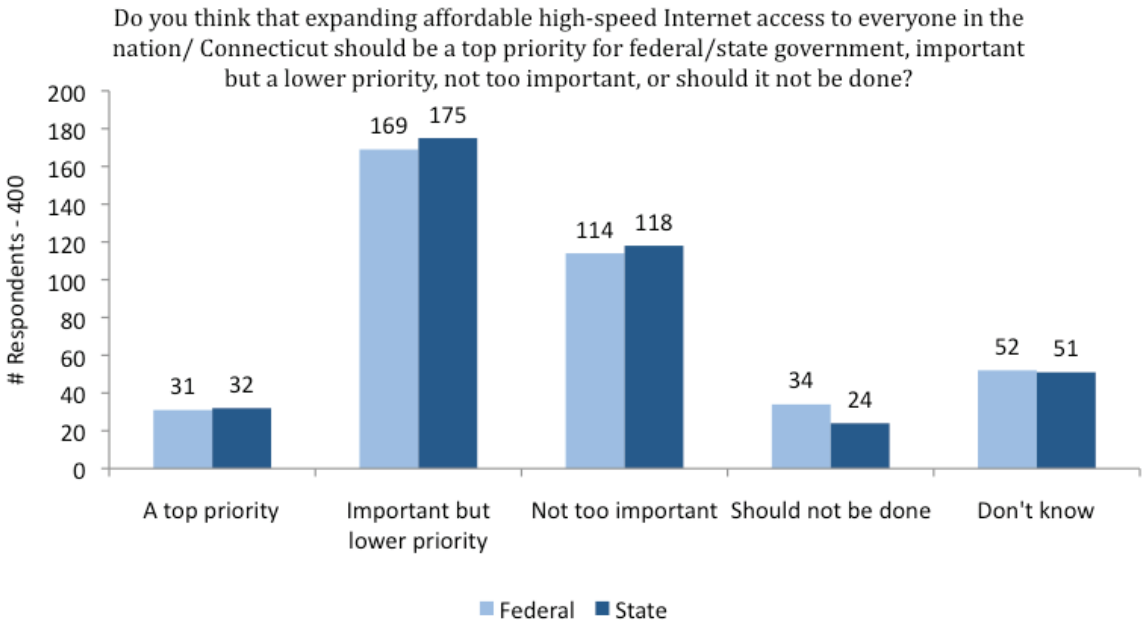


FIGURE 11: EXPANDING AFFORDABLE HIGH-SPEED INTERNET - FEDERAL AND STATE GOVERNMENT

Government Survey Respondents

There were seven respondents working in government. These respondents were asked a series of questions to glean the types of government services offered online. Table 7 lists the types of services and whether the government respondent's agency participates in that activity.

Table 7: Government Activities

Which of the following activities does the government agency you work for participate in? (# Respondents = 7)				
	Yes	No	Don't Know	Refused
Online permitting	0	4	1	2
Post grand list data	1	4	0	2
Post meeting notices, minutes, agendas	1	4	0	2
Provide economic development data for businesses	2	3	0	2
Detailed budget data	0	4	1	2
Provide maps and GIS	1	3	1	2
Post rules, regulations and/or ordinances	5	0	0	2

DESCRIPTIVE INFORMATION ON BUSINESS RESPONDENTS

Table 8 shows the location of the business survey respondents. Fairfield and Hartford counties had the most numbers of respondents with the least from Tolland and Middlesex counties.

Table 8: Location of Business Survey Respondents

Location of the business (# respondents = 400)		
County	# of Responses	% of Total
Fairfield County	99	25%
Hartford County	89	22%
New Haven County	66	17%
Litchfield County	49	12%
New London County	35	9%
Windham County	28	7%
Middlesex County	18	5%
Tolland County	16	4%
Total	400	100%

Of the respondents from Fairfield County, 60% were from either Bridgeport or Stamford (Figure 12).

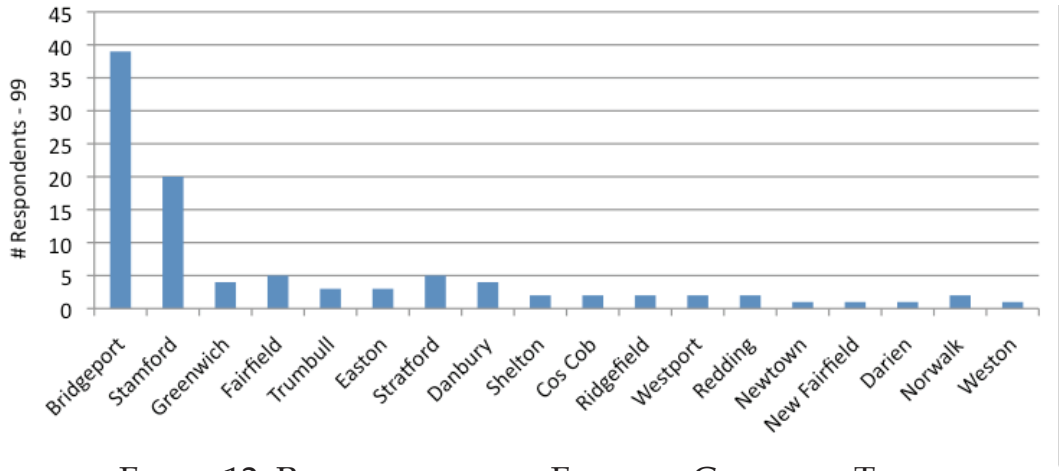


FIGURE 12: RESPONDENTS FROM FAIRFIELD COUNTY BY TOWN

In Hartford County, 35% of the business respondents were located in the city of Hartford.

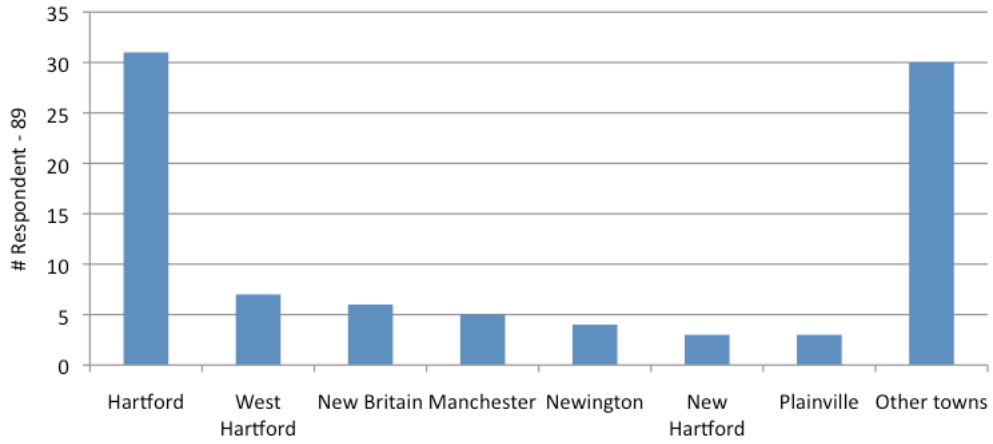


FIGURE 13: HARTFORD COUNTY BY TOWN

In New Haven County, 30% of the business respondents were located in the city of New Haven.

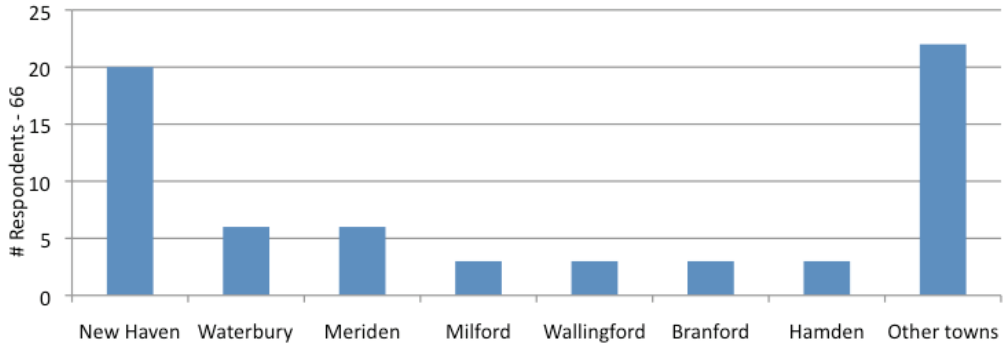


FIGURE 14: NEW HAVEN COUNTY BY TOWN

In Litchfield County, the businesses were evenly distributed throughout the towns in the county.

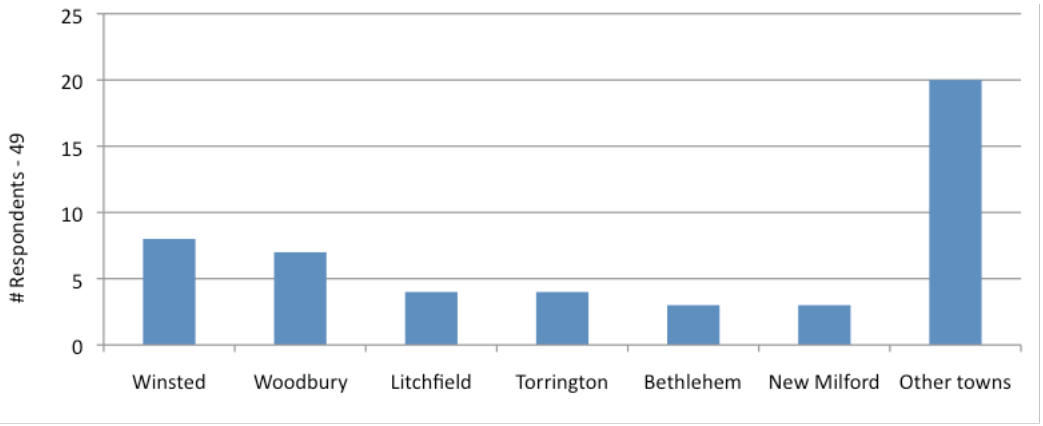


FIGURE15: LITCHFIELD COUNTY BY TOWN

Respondents from New London, Windham, Middlesex, and Tolland counties had fewer survey respondents. Table 9 shows the towns that had the highest number of participants in each county.

TABLE 9: COUNTIES WITH SMALLER NUMBER OF BUSINESS SURVEY RESPONDENTS

	# of Respondents	% of Respondents from county
New London County	35	
Old Lyme	6	17%
Lebanon	6	17%
Stonington	4	11%
Windham County	28	
Dayville	4	14%
Woodstock	4	14%
Brooklyn	3	11%
Middlesex County	18	
Durham	5	28%
Tolland County	16	
Stafford Springs	9	56%

Of the 400 businesses completing the survey, 62% had between 1 and 9 employees, 23% had between 10 and 24 employees, and 7% had between 25and 49 employees (Figure 16). Three percent of respondents had 50 to 99 or 100 or more employees and 2% of the respondents did not know how many employees were at their business locations.

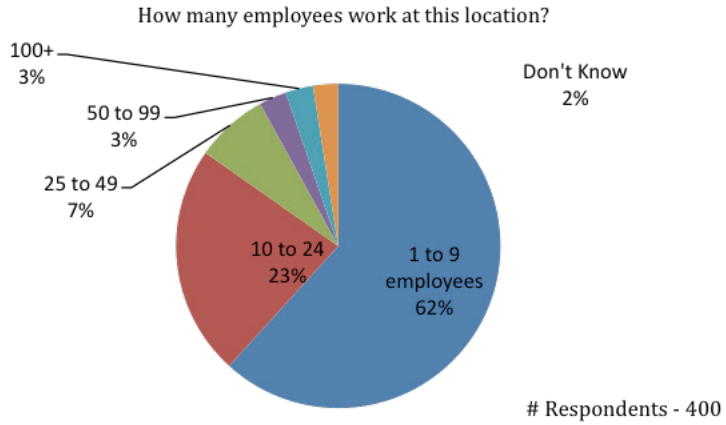


FIGURE 16: BUSINESS RESPONDENTS BY NUMBER OF EMPLOYEES

As shown in Figure 17 below, businesses with 1 to 9 employees were also the most common size of business for all primary market areas.

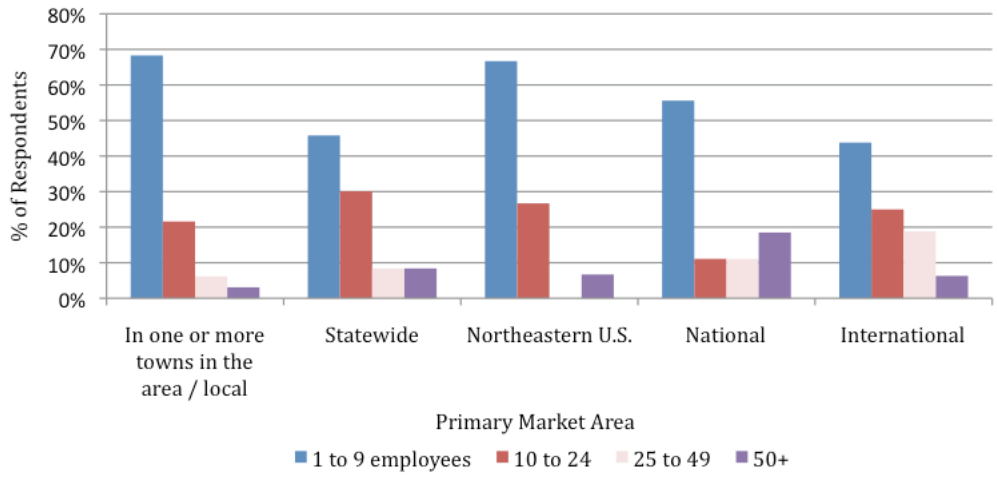


FIGURE 17: BUSINESS RESPONDENTS BY SIZE OF BUSINESS AND PRIMARY MARKET AREA

The location of businesses by primary market area was evenly distributed in rural, average, and urban areas (Figure 18).

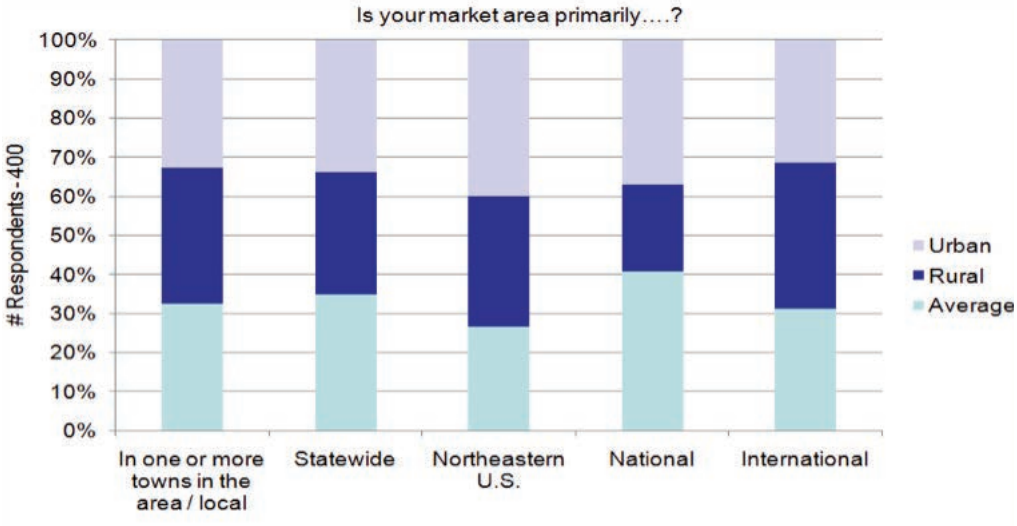


FIGURE 18: BUSINESS RESPONDENTS BY PRIMARY MARKET AREA AND LOCATION OF BUSINESS

Survey respondents were from a variety of industry sectors as Figure 19 shows. The three most common industry sectors were retail, health care and social services, and other services.

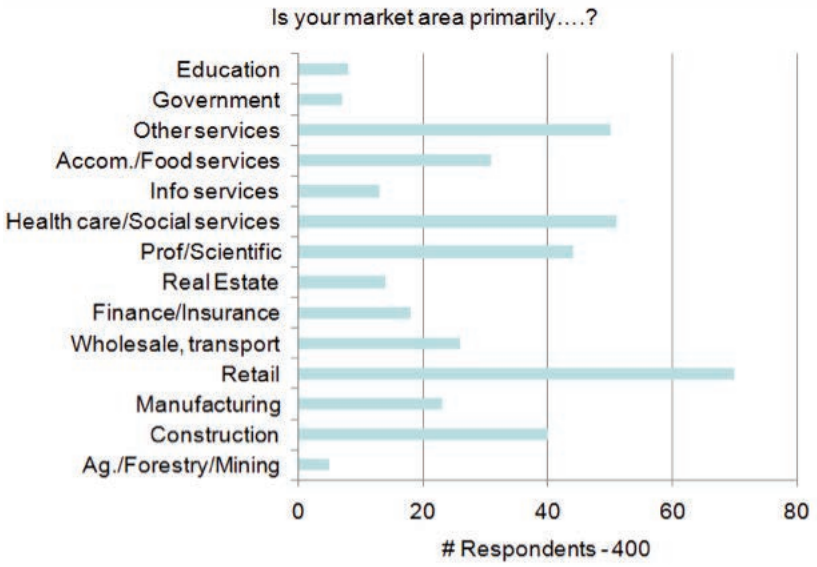


FIGURE 19: BUSINESS RESPONDENTS BY PRIMARY MARKET AREA AND INDUSTRY SECTOR

ADDENDUM 2: SURVEY METHODOLOGY

The 400 survey completions of business decision makers were evenly distributed by population density of the location of the business (urban, average, rural). The survey had a confidence level of 95%, with a confidence interval at the town level of 10%.

Using random digit dialing and computer-assisted-telephone-interview (CATI) software, the polling contractor, Horizon Research Group, made almost 2,200 calls to obtain 400 survey completions. The surveys were conducted during the months of November and December 2010. Survey respondents were contacted Monday through Friday, 8:30 AM to 5 PM. Surveys were conducted in English and the average length of the call was 7.5 minutes.

To produce a representative sample, the survey contractor purchased an Address Based Sample which generates an address sample and appends telephone numbers, where possible. To compensate for the missing information, list vendor incorporates other commercial databases that have different and more complete data.

Systematic and proportionate stratified probabilistic sampling was used to provide all the businesses in the population equal chances of being selected.

Table 10 shows the full disposition of all the telephone numbers sampled. The disposition reports all of the sampled numbers ever dialed from the original sample. The response estimates the fraction of all eligible respondents in the sample that were ultimately interviewed. It is calculated by multiplying the contact rate by the cooperation rate by the completion rate.

TABLE 10: FINAL CALL DISPOSITION

2,192	Total Numbers Dialed
19	Fax/Modem
150	Not working
2,023	Working numbers
92%	Working Rate
71	No answer/busy
1,036	Voicemail
96	Blocked calls
820	Contacted numbers
41%	Contact Rate
211	Call back
184	Refusal
425	Cooperating numbers
52%	Cooperation Rate
25	Terminated
400	Completes
94%	Completion Rate
20%	Response Rate

APPENDIX F: FOCUS GROUPS

Focus groups were held in all regions of the state—northwestern, northeastern, southeastern, central, and southwestern—from February to April 2011. Approximately 120 people attended the focus groups. The following is a cross-section of the people who attended the sessions: librarians, State Representative, hospital leaders, business leaders and CIOs, k-12 education, higher education, and town government representatives.

STAMFORD

Importance of Broadband

- Broadband has been a game-changer in nearly all aspects of the business world (legal, health care, business to business services, etc.) Broadband has changed the business model for some entrepreneurs who have businesses entirely based on broadband, for example.
- Fast/reliable broadband is crucial for business competitiveness. Being a leader in this area could give Connecticut a global competitive advantage. A participant said that high-speed broadband service should be a higher state priority as compared to high-speed rail.
- A trend among businesses is to have an internal network and an external network.
- It was said that having fast broadband service will make Connecticut an attractive place to live and work.
- The fiber backbone is critical to the state's community colleges.

Security

- Security is an increasingly important issue. Cyberattacks are commonplace.
- Large businesses are concerned with having robust, redundant and secure broadband networks.
- Schools like Connecticut's state universities are subject to frequent cyberattackss because they are a rich source of personal data.

Access/Unserved

- The FCC is investigating whether the Universal Service Fund (USF) could be restructured to be useful for expanding access to broadband services into unserved areas and for low-income families.
- WIMAX technology may be useful in expanding relatively fast broadband service into areas without any service, as well as useful in improving mobile and fixed service as an alternative to cable and DSL.

- There is better access and levels of broadband service in the "golden banana" (Fairfield, New Haven and Hartford Counties) due to population and business density.
- There was some lack of awareness that some areas of Connecticut still only have access to dial-up.
- It was suggested that computers at public schools should be made available to community members after school hours and perhaps supported by use of some state funding.
- A participant familiar with telecommunications finance cited the Universal Service Fund (USF) for telephone service as likely being restructured by the federal government for application to broadband service.
- There was discussion about the notion that broadband technology is changing our culture. Examples of fixed price service for the US Mail, electricity in all homes, lavatories in all New York City apartments were cited as analogies to providing universal broadband access in the future.

State's Role

- More than one person voiced the opinion that regulation of broadband may be needed to remove roadblocks and ensure universal access.
- There was clear disagreement as to the state's role in ensuring universal broadband access. It was noted that while the state owns the roads, the state does not own broadband infrastructure and therefore it may not be the state's place to intervene. The free market system should be used for provider infrastructure investment decisions. However, the opposite view was also expressed.
- The state cannot invest in technology when the technology is changing so fast. Leave that to the providers. Public/private partnerships were suggested.
- It was noted that from a global competitiveness standpoint, the United States is at the bottom tier on the OECD list of nations with more than 1% fiber to the home/building penetration (July 2007). Also, if Connecticut maintains a broadband policy similar to its transportation policy, that will not be good for competitiveness.
- It was pointed out that Connecticut's history shows that broadband providers will resist service improvements and innovation. What is the role of the state given this knowledge? What responsibility does the state have to invest in capacity now that enables future uses and applications not known today that may be available in the future?

Cost

- Cloud computing is being used more frequently. It is viewed as a method for smaller organizations to maximize resources and be cost effective.
- AT&T charges for the ability to tether a laptop to a wireless device for broadband.

General Comments

- One participant from a large company cited a trend for using company's internal network for email and other transactions, but using external capacity for streaming, video conferencing, software updates (the high-bandwidth demands).
- There was disagreement about whether Connecticut is attractive to businesses.
- Cablevision is a common provider of home broadband services among participants.
- Stamford has free public Wi-Fi hotspots.
- Telecommuting is common among employees at the participants' companies. Most have a formal policy for telecommuting and telecommuting is viewed as advantageous.
- It was noted that the need for faster download speeds than upload speeds may shift.
- It was noted that in New York, Cablevision has begun providing wireless service with use of devices on telephone poles.
- There were questions about what the state's emergency communications abilities are if broadband service is not available.
- An investment in broadband could alleviate billions of dollars in waste in the radiological imaging field of health care.
- It was noted that the average person experiences broadband through the device they use, not the infrastructure associated with that device. They may not be aware of how decisions about infrastructure or decisions about potential government policy are made.

SOUTHEASTERN CONNECTICUT

Importance of Broadband

- Broadband is essential for work and home use of participants.
- Having quality broadband service may be viewed as a competitiveness issue, as well as a cooperation issue among municipalities.
- All participants use broadband at home and would have a hard time getting by without it. At work, it is considered essential.

Security

- It was noted that security will become more of an issue. One participant had received computer infections from advertisements on the websites of two local newspapers.

Access / Unserved

- Some areas of northeastern Connecticut do not have broadband service or cell phone coverage. The organization seCTer (Southeastern Connecticut Enterprise Region) may be able to provide more information about coverage.

- There was general agreement that young people need to be provided with broadband access and knowledge as a tool for success. The point was made that educating Connecticut children makes the state more competitive.
- Reportedly AT&T U-Verse is not available in all areas of the region (i.e., it may be available in one area but not on nearby streets.)

State's Role

- There was some agreement that if the government and schools provide more services online, then there is an obligation for the state to ensure that broadband service will be accessible to all citizens.
- Broadband was compared to interstate highway system and it was also suggested that broadband should be considered a utility.
- There was agreement that if the state expands its use of e-government services, the state then has a role in ensuring access. This point was made after it was noted that many are of the view that the state should not intervene in private business.
- Other points were made about the need for the state to provide leadership to towns, which vary in their adoption of technology. One idea put forth is that high-schoolers could work on town websites in towns that lack the personnel or capacity to undertake these efforts, or that small towns could pool resources and outsource IT services to one organization.

Cost

- DSL is a more cost-effective solution for small organizations and businesses, but service quality is an issue.
- Cloud computing is becoming more commonplace and factors into planning at major organizations like Pfizer.
- It is more expensive to transport data than to store it given the current maturity level of these technologies.

General Comments

- Municipalities vary in their level of service. Some are more advanced; others may still be using dial-up. It was noted that municipalities being connected to each other could be beneficial.
- There does not appear to be widespread awareness among participants as to how the United States ranks on broadband deployment compared with other countries. However, those working with advanced broadband technology seem to have more awareness about this topic.
- Arts organizations are looking at creative ways to use the web to connect people and share live performances.
- Broadband is sometimes used in lieu of cable TV service.

Future of Broadband

- In 5-10 years, participants see advances like ubiquitous public Wi-Fi and greatly increased use of devices such as iPad (or similar), immersion video for virtual meetings and other applications, possibly low-level satellites to replace cell towers.
- Participants predicted the following as important developments in the next 5-10 years:
    - Increased cloud computing and therefore increased focus on security.
    - A focus on security relating to use of electronic health records.
    - The potential of AT&T U-Verse providing fast affordable service for small or non-profit organizations.
    - Need to ensure reliable broadband infrastructure for emergency medical services.
    - Increased use of smartphones, tablets, mobile devices.
    - Increase in digital divide, if ubiquitous access not addressed.
    - Convergence of key technologies.
    - Possible paradigm shift for schools that would involve student use of mobile devices as a learning tool.

CENTRAL CONNECTICUT (ROCKY HILL)

Importance of Broadband

- There was agreement that computer knowledge and broadband service are necessary for success in today's world.
- Broadband access is a competitiveness necessity for most people, although it blurs the lines between work and home.
- The comparison of broadband to telephone service, electricity and roads was mentioned.
- Broadband is essential for business activities and is considered essential for the home as well.

State's Role

- As more areas of e-government are enabled (i.e., certain functions only available online like DMV, Medicare, Food Stamps, IRS forms, etc.), does the government have an obligation to offer universal access?
- Government Role: The government could require build out and affordable basic service for everyone. However, it was noted that the state needs to work with providers to find ways for providers to receive a return on their investment.

- There was some question as to whether intervention should be the role of the federal or state government.
- Concern was expressed that government intervention could stifle innovation since technology is evolving rapidly. It was suggested that a flexible policy be considered to allow providers to select the technology they wish to pursue.
- If the state continues to expand its e-government services and mandates the use of the Internet for certain transactions, it was agreed that it is reasonable for the state to ensure that people can access those services.

Access/Unserved

- At a point, it is individual choice and people cannot be forced to use online services; however, issues around the digital divide need to be addressed so that residents who don't have access don't fall further behind because they cannot gain access to services.
- Use of broadband at libraries on public computers has increased especially in light of the economic downturn.
- Participants generally felt that everyone should have access to broadband and several comparisons were made to basic phone service, as well as basic cable service. Federal investment in interstate highways and railroads also served as an analogy. It was noted that AT&T offers a lifeline credit for phone service for low-income homes, but the same is not true for broadband. A question was raised as to why there is a difference.
- The definition of access was discussed. It was suggested that providing access at locations such as public libraries should be considered as an individual having access to broadband services even if access is not available at home. However, others indicated that access should be available directly in the home.
- Consider schools as another way to provide learning experiences through adult education programs and other programs to address digital literacy among parents/ caregivers and others.
- It was noted that all 169 of Connecticut's towns are required by law to have a library. It was also noted, however, that some of the libraries are small - and in some cases one-room buildings that lack bathroom facilities. Libraries have become even more vital during the current economic downturn for users seeking free access to broadband services. It was noted that since libraries have long served as a level playing field for rich and poor, it would make sense for the state to ensure that all libraries have access to broadband service and be equipped with computers to provide free access to the Internet for the public.
- There was agreement that if the state expands its e-government services online, the state has an obligation to ensure that its citizens can access those services. The example of tax forms no longer being sent via mail was cited. Libraries have experienced increased demand from users for paper IRS tax forms.
- There was general agreement that hubs (like libraries or PC centers) should not be considered as providing universal access.

- Restructuring the USF to address broadband inequities was raised—including having a "lifeline" program for broadband service that currently exists for low-income telephone customers.

General Comments

- The need for bandwidth is increasing in certain industries like architecture, engineering, and health care.
- Cloud computing has become a more ubiquitous solution for small businesses, organizations and individuals.
- The Connecticut Education Network (CEN) is considered a vital resource for schools and libraries.
- The State Department of Education is investigating moving all testing online. This notion raised the issue of needing more bandwidth to accommodate such demand on the system. It was also noted that students unable to adopt broadband at home for financial reasons may be at a disadvantage which could have a negative impact on their learning experience and achievement.
- Some participants are already experiencing the need for greater broadband speed at home and at work. Engineering firms using computer-assisted design (CAD) would benefit from speeds higher than 1.5 Mbps upload and 10 Mbps download.
- Latency can be an issue in the news business, particularly with relation to live video transmission.
- There was agreement that Connecticut students must be skilled broadband users for their own benefit and for the purpose of preparing today's students for the workforce of the future for the benefit of the state.
- The belief exists that paper textbooks will become a thing of the past. The issue of addressing inequities in digital literacy and technology affordability was raised.
- In order to have true competition among Internet services providers, some regulation is necessary. Competition, it was noted, will help bring prices down for those who are least able to afford broadband.
- The opinion was expressed that businesses might be able to pay part of a subsidy for universal broadband. Concern that such a move would be considered anti-competitive and business-unfriendly was also expressed.
- Broadband is crucial to the health care radiology business and the need for more bandwidth in that field continues to grow.
- Some businesses still use DSL, but it is considered too slow for some needs.
- Participants in this and other focus groups have foregone cable TV service, choosing to use the Internet to stream movies and TV.
- Broadband has converged telephone, television, and Internet usage.
- Consider tax credits to incent ISPs.

- A technically oriented participant stated that low-earth orbit satellites may be a good solution for rural broadband.
- It was stated that public Wi-Fi would help cities and towns with economic development, or "placemaking."
- The City of New Haven issued an RFP to implement public Wi-Fi, but AT&T reportedly impeded the process.

NORTHWEST CONNECTICUT

Importance of Broadband

- Broadband is instrumental, indispensible in the workplace.
- Broadband and computer/Internet know-how are crucial for job seekers.
- Broadband is key to being economically competitive globally.
- Broadband is viewed as a major economic driver.
- Digital literacy among youth is very important.
- Participants indicated that it is important that northwest Connecticut have broadband and cell phone coverage. It was expressed that lack of cell phone coverage could be considered a public health issue if the public is unable to access 911 assistance from mobile devices. However, some towns' residents are against the installation of cell phone towers.

State's Role

- People and businesses have grown wary of government intervention.
- Some view the state's role as stepping in to level the playing field by incenting the market to complete the broadband build-out in northwest Connecticut.
- There was general agreement that providers have not been interested in expanding service into areas of northwest Connecticut that do not have broadband service and the state should consider ways to incent private investment. It was noted that AT&T would have to at least break even to consider any investment.

Access / Unserved

- Some areas in northwest Connecticut have access to just dial-up or dial-up and DSL only (lower speeds). Also, there are areas without cell phone coverage.
- Most in the focus group were comfortable with broadband use and were unaware that young people may not be able to adopt.

- Broadband may isolate people from human interaction if they spend a lot of time online. However it also helps connect people who may be in rural areas or part of a marginalized group.
- Large companies in northwest Connecticut have to pay for their last mile broadband infrastructure if it is not there. Smaller companies have to make do with service offered because they cannot afford added cost.
- There are many home-based businesses in northwest Connecticut. The lack of broadband is a problem for those interested in access for home-based work.

Cost

- Affordability - Cost of purchasing a device (computer, etc) and paying for an Internet connection is a reason for non-adoption for many.

General Comments

- There may be a need for better hardware at community organizations like senior centers and the YMCA.
- Hospitals are likely to double their demand for bandwidth every two years for the foreseeable future.
- Generally there is opposition to construction of cell phone towers in northwest Connecticut.

STATE GOVERNMENT OR QUASI-PUBLIC REPRESENTATIVES

Importance of Broadband

- Broadband was compared to electricity and clean water as a necessity of daily living.

State's Role

- There was general agreement that if the state moves more services online, it has some obligation to ensure that all citizens have access. The definition of "access" was discussed: access hubs, direct to the home and ubiquitous Wi-Fi.
- It was suggested that the PURA conduct a study to identify how many Connecticut families live at or below $20,000 annual income. It was also suggested that the PURA could require the broadband providers to provide a "lifeline" type level of broadband service for these families.
- The fact that there is a culture of resistance against government mandates was noted in the context of broadband having grown up as an entirely private enterprise.
- E-government

- The Secretary of State's office is moving toward an online real-time election results reporting system. It was also noted that, while there are legislative proposals to allow troops overseas to vote online, the system's security is not yet advanced enough for this to take place.
- The state is considered to be moving slowly in putting services online in an effective manner.
- DPS has a fiber-optic broadband network across the state, funded by the 911 surcharge. Further expansion of that network has been funded by a BTOP grant. The network does have capacity for others to eventually use it. However this requires a governance plan that DPS is in the process of developing that addresses security, technology, feasibility, provisioning standards, et al.
- The Office of the Secretary of State is not statutorily permitted to do online processing of batch payments. The state requires up-front payment. This prevents, for example, a company in Germany that wants to open a location in Connecticut from processing fees to the state online during non-business hours, due to time zone differences.

Access / Unserved

- AT&T offers two years of free services for participants in Concepts for Adaptive Learning's (CFAL) program. CFAL has given away donated computers to 1,800 families. After the free service terminates, CFAL sees families disconnecting because they cannot afford the service.

PARENT PARTICIPANTS WITHOUT A COMPUTER AT HOME

Everyone in the group had some type of cell phone. No one had broadband service or a computer at home.

Importance of Broadband

- The group agreed that broadband access is becoming a necessity, like telephone service or even electricity. One cannot search or apply for jobs without it.

State's Role

- The group also agreed that if the state expands use of e-government services online, the state absolutely does have an obligation to ensure access.

Access / Unserved

- Of the participants who do access the Internet, the following locations were cited: public library, work, school (Branford Hall Institute), a neighbor's house, parents' house.
- It was pointed out that access at a hub (like a PC center or library) is not sufficient for people who do not have transportation or cannot leave home for health reasons. In addition, public libraries often have waiting lists and time limits for computer use.

Cost

- Participants cited cost as the main reason why they are unable to have a computer and broadband service in the home. Paying for the purchase of a computer and then the monthly fee for broadband service is difficult. It is also a hardship to have to buy bundled service.
- Participants generally agreed that broadband is worth paying for. A suggestion was made that price could be based on a sliding scale according to income for low-income families. When the lifeline program for phone service was mentioned, participants generally agreed that a similar model should exist for broadband.
- Some parents mentioned that Internet-enabled cell phones are too expensive.

YOUTH PARTICIPANTS

Importance of Broadband

- Students who do not have broadband access at home rely on school libraries for access for school work.
- Most homework assignments must be typed, requiring the use of a computer. Students also use other software programs like PowerPoint, Excel, and Photoshop. They also conduct most of their homework research online. Computers are a major part of teaching and learning in Manchester (and likely all Connecticut) schools.
- Students who do not have a computer and broadband access at home are at a clear disadvantage compared to students who do. The time they can be online is limited by school hours and computer availability.
- For schools that use an online program for communicating student progress, parents who do not have broadband at home are at a disadvantage compared to parents that do.

Access / Unserved

- There are some students who do not have any type of cell phone.
- Students who have smartphones with Internet access use their phones for school-related needs (emailing teachers, tracking assignments, doing homework and online research).
- Even if students have access to a computer, their access to printers may be limited. Students cited use of thumb drives or cloud computing to transfer files when necessary.

Cost

- Cost is a key reason why students do not have a computer and broadband at home.

APPENDIX G: BEST PRACTICE RESEARCH

SUMMARY

This section of the report examines broadband deployment and policy development in other states and countries. The study committee selected the states and countries to be studied in this report. Most of the information was gathered through Internet research. However for the states that appeared to be leaders in broadband adoption and access rates, staff conducted phone interviews of the leaders within those particular states who are responsible for broadband policy.

Research was conducted on the following states and countries: Kentucky, North Carolina, Vermont, Colorado, Maryland, Maine, Massachusetts, Rhode Island, Washington, New Jersey, Virginia, Japan, South Korea, Finland, Australia, Germany, United Kingdom, and Chattanooga, Tennessee. For the states where phone interviews were conducted, an 'in-depth' section follows the general description of the broadband policy development in the state.

Kentucky

In 2004, Governor Ernie Fletcher launched the "Prescription for Innovation—Delivering Broadband Technology for the 21st Century" with a goal of having broadband access for every Kentucky household by the end of 2007. Connect Kentucky, a nonprofit, was tasked with achieving the goals as set forth in the plan. The goals of the initiative included:

1. Significant improvement in broadband deployment;
2. Dramatically improved use of computers and the Internet by all Kentuckians;
3. A meaningful online presence for all Kentucky communities, to improve citizen services and promote economic development through e-government, virtual education, online health care; and
4. eCommunity Leadership Teams in every county.

ConnectKentucky employed a three-year process to expand service while increasing demand. The first step was to map broadband availability. This was done by **working with local volunteers to develop community plans that serve as the strategy to bring service to the unserved areas**. "eCommunity Leadership Teams" comprising volunteers from various backgrounds formulated the strategy and demonstrated to providers that demand existed for service. These teams developed comprehensive technology growth plans that involved major sectors of the community ¾ health, education and local government. During this phase, surveys of households were conducted to identify current usage and barriers to adoption.

The state contributed $7.5 million over three years for the ConnectKentucky program. This contribution has funded an ongoing effort that includes continual mapping, community outreach, and research. ConnectKentucky secures 20% of its operating costs from service providers and other stakeholders. Private companies can become partners of ConnectKentucky

through a membership fee. However, this model has received criticism in that the larger telecom companies who can afford the fee dictate the policy of the organization.

- *Access/Adoption*[74]
    - In 2003, broadband was available to 60% of households
    - By the end of 2007, broadband was available to 95% of households—58% increase
    - Since 2004, Kentucky has seen a 73% increase in use of broadband
    - Since 2004, Kentucky has seen a 24% increase in household computer ownership
- *Public/Private Partnerships*
    - ConnectKentucky is implementing the Prescription for Innovation initiative with operational support from the Department for Local Development, the Appalachian Regional Commission, and the Department for Commercialization and Innovation in the Kentucky Economic Development Cabinet. More than $860 million in private capital has been invested in Kentucky telecommunications.75
    - Rural access: To get access to remote parts of Kentucky, seven counties partnered with a wireless ISP, with the local government purchasing the equipment and the provider providing back office, service provision, testing, installation, and computer performance evaluation
    - Computers 4Kids: Partnered with corporate foundations, private partners and state government to distribute nearly 3,230 Internet-ready computers to low-income households and nonprofits. Through a partnership with two nonprofits, computers were refurbished by prisoners ¾ providing them with the opportunity to learn a marketable skill.
        - Some of the partners involved with the project include: Lexmark, AT&T, Microsoft, and American Electric Power Foundation.

KENTUCKY—IN DEPTH

Kentucky's approach focused on building teams at the community level with a focus on increasing demand. Community teams, which were volunteers from the counties, developed strategic plans with the help of ConnectKY. Teams were comprised of representatives from the following groups: local government; business community; K-12 education; higher education; tourism; libraries; health care; community-based organizations; and agriculture. ConnectKY facilitated four meetings a year with the individual communities. However, they found that in order to sustain the momentum, it was best to assign a local representative to hold interim meetings. Through this initiative, ConnectKY helped 120 counties develop technology strategic plans. Integral to the success of these plans was the fact that the broadband planning efforts were integrated into the local general planning efforts.

Another major initiative for Kentucky was increasing computer access for children. They had a Computer4Kids program which gave computers to children in 6th grade who were

[74] www.connectkentucky.org

[75] NGA Center for Best Practices, "State Efforts to Expand Broadband Access," May 2008.

on free or reduced lunch. Parents were also given cybersafety training classes as part of the initiative. What they found was that when Kentucky was able to get more computers in schools and to children, broadband adoption rates increased.

An important component of their success was the fact that they empowered local government to drive the policy and action rather than it being driven from the state level. Often local economic development agencies or chambers of commerce have local leaders who can and are best suited to lead e-government initiatives and integrate the initiatives into local planning efforts.

Kentucky recommended focusing on both supply and demand when developing broadband plans. The state just looked at the demand side when launching their initiatives, but learned it is best to do both simultaneously.

Sustaining ConnectKY has been an issue. Initially they received state support but due to difficult economic times, those funds have been cut. ConnectKY, which is a part of the Connected Nation organization, relies on consulting engagements within and outside of the state in order to maintain a constant source of revenues.

North Carolina

In 2000, North Carolina created the nation's first state agency devoted to broadband policy. E-NC Authority is the state initiative to link all North Carolinians, especially in rural areas, to the Internet. In addition, the authority is responsible for[76]

- Tracking the availability of high-speed service in each county throughout the state;
- Advocating for high-speed access at competitive prices;
- Increasing the number of individuals, businesses, and organizations who own computers and computer devices and who subscribe to the Internet;
- **Establishing telecenters located in the state's most distressed areas**; and
- Establishing a website to provide residents with complete information on Internet and telecommunication services.

The organization became fully functional in 2001 and is governed by a 15-member commission appointed by the governor and legislature. Funding for the organization comes from the General Assembly, federal funds, and private foundations.

Funds for grant-making, operations and initial development of the e-NC Business and Technology Telecenter program were initially received from MCNC, a nonprofit in Research Triangle Park. In 2005, the state appropriated the first funding for operations. In recent years, over $2 million has been made available for matching grants to telecommunications providers that deploy to unserved rural communities. Over $3 million has been invested via state grants to develop e-NC Business and Technology Telecenters.

[76] http://www.e-nc.org/WhoWeAre.asp

Between 2001 and 2007, the state invested $11 million in "demand building" through e-Community projects, establishing public Internet access sites, offering digital literacy training grants, e-government training, and other educational efforts. On the "supply side," the agency is focused on bringing services to underserved and unserved areas by 1) mapping availability and 2) providing grants to stimulate deployment of broadband services. While many states are beginning the process of mapping availability, North Carolina was the first state to do so.

In January 2009, the state issued a "10-year Action Plan Using Broadband Internet to Increase North Carolina's Competitiveness and Sustainability in the Global Economy." The plan sets forth goals around five topic areas: access, bandwidth, applications, inclusion, and funding.

In September 2010, the e-NC Authority, received a $4.5 million grant from the National Telecommunications and Information Administration's (NTIA) State Broadband Data and Development program. The grant is matched by an additional $1 million, including $400,000 from the Golden Leaf Foundation, for a total $5.5 million investment. The funds will enable the e-NC Authority to continue four more years of statewide mapping of broadband availability. The funding will also be used to pilot the Lifeline Online program to improve computer ownership and Internet usage in economically distressed areas. A partnership with the NC Center for Geographic Information Analysis (CGIA) will also be supported to improve the state's address lookup functionality, to benefit emergency and public safety services. Since January, North Carolina has received $275 million in federal recovery awards for expanding access to broadband.[77]

- *Access/Adoption*
    - In 2002, twenty-five counties had less than 50% access to high-speed Internet service with three counties—Clay, Graham and Swain—having no access (0%).
    - In 2007, that number was reduced to one county with less than 50% access and an additional 20 counties having less than 70% access to high-speed Internet service. Through an e-NC grant, the lowest four counties moved into the greater than 70% access category.
    - By the end of 2007, 83.3% of households were able to access high-speed Internet services compared to 74.9% in 2002 (meaning 600,000 households are still without access)[78]
        - § Urban/Rural breakdown—86.98% of urban households and 79.64% of rural households
- *Lessons Learned*
    - Participating in joint federal and state programs of Lifeline and Link-Up which provide reduced rates to low income households for telephone installations and monthly subscription rates helped increase access.

[77] "Gov. Perdue: North Carolina to Receive $4.5M to Support Broadband Projects," Southern Governors' Association, September 2010

[78] High-Speed Internet Access in North Carolina: A 100 County Report (Nov 2008)

- Small providers headquartered in the state are more likely than large providers headquartered outside the state to offer broadband throughout their entire service area
- Mapping - The e-NC Authority has found that key factors in a successful data collection process are strong relationships and cooperation with the telecommunications service providers, and the ability to utilize proprietary data to perform independent connectivity status analysis.[79]

NORTH CAROLINA—IN DEPTH

In several of the state interviews that were conducted, North Carolina was often mentioned as the leader in increasing broadband access and adoption rates. The state started concentrating on broadband policy in 1999 with a legislatively established taskforce focused on bringing prosperity to rural areas of the state. The state has 100 counties with 85 considered rural and, according to the 2000 Census, North Carolina has the second largest rural population (behind Texas).

Out of the taskforce came the creation of the Rural Internet Access Authority (later renamed e-NC) which is a quasi-public entity. They were initially funded by private money and now receive state funding to operate.

Some of the major initiatives the organization has spearheaded include: eCommunities; public access centers; a telehealth network; connecting all high schools in the state; and telecenters. The eCommunities initiative gave each county $10,000 and in return they had to appoint an eLeader, inventory access, create a digital plan, and offer digital literacy classes. In 8 months, 85 counties completed the work. Currently, e-NC is working on developing a telehealth network. The network currently includes county public health departments and nonprofit hospitals and hopes to add doctors' offices in the future.

Seven telecenters are operational in the state with three that have been in operation since 2001. These centers help entrepreneurs, small businesses, local governments, and community organizations with the most up-to-date technology resources and services. Since 2001, these centers have created 1,900 jobs in areas with relatively high unemployment rates (15%-20%). A success story that emerged from one of the centers in a rural area was the creation of a website by an entrepreneur that now links small farmers (2-3 acres) with restaurants seeking locally grown ingredients.

The state also had a goal of making sure a public access center was within 40 minutes of every citizen. They used the library system first and then created about 100 other centers where citizens could access the Internet and get training. 137 public access centers were created in rural counties of the state, which have provided hundreds of thousands of North Carolinians a place to access the Internet.

North Carolina has a goal to have at least 100 Mbps symmetrical broadband service available to homes and businesses by 2018. They realize that this is a lofty goal but they need it in order to make progress. The state broadband office believes these are the four

[79] 2007-2009 Biennial Report

steps to success: building collaboration, developing communities, creating demand, building programs, and addressing supply.

The challenges North Carolina faces are similar to many of those mentioned by other states. A few challenges mentioned in the interview include: getting providers to provide service in rural areas; extending fiber to the home; and providing enough technical assistance to increase adoption. For the latter challenge, North Carolina is trying to increase public-private partnerships to provide the assistance.

Vermont

In 2004, the Vermont state legislature created the Vermont Broadband Grant Program which provided funds to local governments in order to create partnerships with wireless broadband providers that would serve areas with little access. The program provided up to four towns with $200,000 of funding per year. As of the summer of 2008, more than $800,000 had been provided to 16 communities.[80]

Passed into law in June 2007 (Act 79), **Vermont e-state Initiative** set out to bring broadband and wireless access to all Vermonters by 2010 in the hopes of making Vermont the first "e-state." The Vermont Telecommunications Authority (VTA) was also established by Act 79 to facilitate the establishment and delivery of mobile phone and Internet access infrastructure and services for residents and businesses throughout Vermont. The authority's overall long-term goal is to bring broadband and mobile phone infrastructure throughout the state with a focus on the unserved and underserved areas. The Authority is chartered by the state and governed by a board of directors.

- Financing for the Authority:
    - Financial backing from the state in the form of moral obligation bonds. Leveraging loan dollars available through the Technology Infrastructure Fund of the Vermont Economic Development Authority. State was willing to provide up to $40 million in bonds in the first year and hopefully leverage $200 million in private dollars.
    - **Payment of bonds will be based on revenues from leasing access to the infrastructure**, such as fiber-optic networks and space on towers, or from revenues from services provided over the network. Value of the assets will also help secure the bonds.
    - Any portion of the networks that could be paid for directly through a federal appropriation would reduce the amount of capital required without reducing revenues, thereby lowering the risk involved in the project.
    - Some private investment could be structured so that it flows through limited-obligation municipal indebtedness and gains the advantages of that investment.
- Access/Adoption
    - As of 2007, broadband was available to 90% of Vermonters.[81]

[80] http://www.telecomvt.org/press.php

[81] NGA Center For Best Practices, "State Efforts to Expand Broadband Access," May 2008.

VERMONT—IN DEPTH

Former Vermont governor Jim Douglas (2003–2011) wanted Vermont to be the first e-State and now the current governor, Peter Shumlin (2011–present), has made broadband accessibility his number two priority behind universal health care (number one priority for economic development). The challenge for Vermont is that almost 20% of Vermonters still rely on dial-up. The governor's goal is to deliver broadband and cell service to every corner of Vermont by 2013.[82]

In 2007, the Vermont Telecom Authority was established to build infrastructure rather than increase adoption since Vermont is a rural state. However, the bonds were never authorized and the projects never got underway. But, with the new governor's commitment to expanding broadband service to every corner of the state, the Authority received federal stimulus funding (American Recovery and Reinvestment Act [ARRA]) of $32.4 million to augment both the $40 million in bonding and a commitment of $13 million from the state's two-year capital budget. They are now working on securing properties and building towers to build out fiber-optic lines and wireless networks.

As a way to increase adoption rates, Vermont has focused on improving e-government policies and services. Government agencies have often revamped how they offer services by using the Internet as a tool to improve services.

Vermont also places emphasis on initiatives being driven at the local level. Rather than creating a one-size-fits-all plan, Vermont's broadband office helps regional planning commissions develop regional technology plans. The teams are made up of individuals from education, health care, economic development, and key businesses. Each regional organization requires a different level of service and has different needs, which is reflected in the customized plans.

As of writing this report, Vermont passed Senate Bill 78, which expedites the deployment of telecom services by removing much of the permitting process associated with telecom siting. For example, projects that require attaching equipment to existing poles would not require additional permits. For projects that must go through the Public Service Board (PSB), the board must approve applications within 60 days rather than the current 90 days. The bill also allows the PSB to determine on a case-by-case basis whether or not the applicant must notify every property owner affected by a new tower or pole attachment.

Colorado

In 2000, the state of **Colorado contracted with Qwest** to build a high-speed fiber-optic network linking rural and urban areas of the state to create the Colorado Multi-Use Network (MNT). Qwest was the partner selected with the state as the anchor tenant. The project is complete, with the contract ending in June 2010. The project includes 65 points of service (Aggregated Network Access Points throughout Colorado). The state contributed $23 million with private investment of $60 million.[83]

[82] Governor Shumlin's Budget Address, January 25, 2011.

[83] http://www.colorado.gov/cs/Satellite/OEDIT/OEDIT/1167928218404

In 2008, Senate Bill 215 called for an inventory of broadband availability. The Governor's Office of Information Technology partnered with Connect Colorado and the final map was issued in November 2009.

To overcome the issue of investments in underserved areas, Colorado designated boundaries for areas in need of Internet infrastructure development and offers a tax credit for taxpayers who invest in technology infrastructure and meet certain requirements.[84]

The EAGLE-Net[85] project is being led by an intergovernmental agency composed of multiple governmental entities to create an affordable broadband network across the state for schools, libraries, colleges and communities who lack affordable high-capacity broadband access. The entity is a cost-sharing non-profit consortium, allowing school districts to pool their needs and purchase concentrated amounts of larger bandwidth. The infrastructure will include 1,600 miles of terrestrial fiber and 3,000 miles of microwave wireless broadband expanding services across all 64 counties and 178 school districts. Project Partners include:

Private: IBM; Adesta, LLC; Cisco Systems; Conterra Telecom Services; Level 3 Communications
Public: Colorado DOT; Colorado State University
Nonprofit: Rotary Clubs; University of Wyoming

- Access/Adoption
    - 97.5% of Colorado households have broadband service available to them of at least 768 kbps downstream and at least 200 kbps upstream, representing 1.6 million households[86]
        - Availability by area: Urban—99%; Suburban—99%; Rural—89%

Maryland

In 2003, state government established the Maryland Rural Broadband Task Force (MRBTF) comprising elected officials and employees from state and local government. The task force examined broadband initiatives in other states, determined what would work best for Maryland, and developed proposals, legislation, and procurement policies to enhance broadband in the state. One of the recommendations was to create a public-private partnership to oversee the planning and development of a rural fiber-optic network to improve the economic feasibility of providing the last mile of service to unserved communities.

The Maryland Broadband Cooperative (MdBC) developed from the task force's recommendation. It is a public-private partnership to promote economic development through the deployment of technology supporting infrastructures. The MdBC is a member owned and operated, fiber-optic network designed to provide network access to eastern, southern, and western Maryland. Funding to build the infrastructure comes from the Maryland Rural Broadband Coordination Board established by legislation in 2006.[87] The state set up $10 million

[84] http://www.revenue.state.co.us/fyi/html/income36.html

[85] Education Access Gateway Learning Environment Network - http://www.co-eaglenet.net/

[86] Colorado Broadband Mapping Project Final Report, November 2009

[87] Formed under Senate Bill 753

for a 3-year fiber-optic backbone line deployment to counties on the Eastern Shore and in the southern part of the state. The private sector provides last mile connections from the fiber backbone to residences and businesses.[88]

MdBC, in partnership with Department of Economic and Community Development and two universities, used NTIA grant funding to work on mapping broadband availability. An interactive broadband map showing availability across the state can be accessed at www.mdbroadbandmap.org.

In September 2010, Maryland received $115.2 million in BTOP federal funding to build over 1,200 miles of fiber-optic cable. One Maryland Broadband Network will link together and extend three independent networks: the state-run networkMaryland; the Inter-County Broadband Network (ICBN), a 10-county consortium; and the Maryland Broadband Cooperative (MdBC), a rural non-profit carrier. The nearly 650 miles of new fiber in the rural portions of the state would substantially improve public safety, government services, health-care delivery, and education, offering community anchor institutions access speeds between 10 Mbps and 10 Gbps.

MARYLAND—IN DEPTH

The Maryland Broadband Cooperative (MdBC) is the recipient of the federal broadband mapping grant. Although Maryland has high access rates, it has little competition for service.

In 2003, a taskforce was established to study broadband and it was determined that there was good access to broadband but the "last mile" was not served. The MdBC was established as a cooperative business model (could not have the state selling service—using taxpayers money and then sell service to private citizens) and received, from mid-2006 to mid-2009, $10 million from the state to get started. Now counties and companies join the cooperative for a one-time fee. The mission of the organization is to build a fiber-optic network so that members have access to broadband services at a reduced price.

When businesses are negotiating for building contracts they are focusing more on broadband availability and service and assuming water and sewer services to be part of the deal. As more businesses move out of the metro areas due to costs, broadband access has become a major issue.

Maine

Created by legislation in 2007, ConnectME Authority is tasked with expanding broadband access in the most rural, unserved areas of the state that are unlikely to be served by a traditional provider. In 2009, the Legislature created the Broadband Strategy Council (BBSC) to help implement Maine's strategy. The council advises the authority on ARRA opportunities and advises the University of Maine System with matters pertaining to the lease and sale of excess broadband capacity.

[88] http://www.nga.org/Files/pdf/0805Broadbandaccess.pdf

The Authority is funded by a 0.25% surcharge on in-state retail communication services. The charge generates between $1.25 million and $1.4 million per year. In addition, Verizon-Maine, as a condition of its merger with Fairpoint, contributed $2.5 million to the ConnectME fund. The Authority funds proposals through grants, direct investments, or loans made on behalf of or in partnership with communication service providers.

ConnectME Grant Activity since 2007					
Grant Year	# of Grants	Total Grant Value	Project Cost	Household Availability	Increased Availability
2007	6	$0.7 million	$1.5 million	13,800	2.7%
2008	5	$1.4 million	$5.5 million	9,000	1.7%
2009	8	$0.6 million	$1.2 million	4,200	0.8%
Source: 2010 ConnectME Annual Report					

- *Access/Adoption*
    - Before the Authority was established, 86% of the state had access to broadband.
    - In the three years since the Authority was established, 90% of the state has access and 60% of households subscribe to service.
- *Challenges*
    - Identifying unserved areas due to incomplete data

MAINE—IN DEPTH

In 2005, the governor commissioned a study on broadband that resulted in the creation of the Maine Authority in 2007. The Legislature established the Authority "to stimulate investment in advanced communications technology infrastructure in unserved or underserved areas.[89]" The Maine Authority is independent, quasi-public, and not restricted by government contracting laws, with a 5-member board, 3 of whom are appointed by the governor. The Authority only has two staff. Funding for the authority comes from a surcharge on broadband service providers and customers. Approximately $1.25 to $1.5 million is collected annually.

Funding from the surcharge is primarily used for capital expenses. The Authority believes that the goal of expanding broadband access in the most rural, unserved areas which have little prospect of broadband service from a traditional or existing provider, is its highest priority. The Authority accomplishes this goal primarily by awarding broadband expansion grants for projects dedicated to serving unserved areas. Typically 50% to 70% of capital expenses will be funded on any given project. Between 2007 and 2010, the Authority awarded 58 grants, issuing $4.6 million in grant funding with total project costs of $11.5 million. Grants can be challenged by providers if they already serve the area of the project. The idea is to create infrastructure in unserved areas. Currently four projects are being challenged.

[89] Connect Maine Authority website

Massachusetts

The Massachusetts Broadband Institute (MBI) was created by legislation in August 2008. The MBI, a division of the quasi-public Massachusetts Technology Collaborative, is led by a nine-member governing board and is authorized to invest up to $40 million in bonds for infrastructure ¾ fiber cables and wireless towers. The approach is a public-private partnership with a co-investment model ¾ public bonds fund long-lived infrastructure (e.g., fiber or wireless towers) and private partners fund complementary infrastructure and provide service. Private partners also may leverage additional federal funds, for example, through the Department of Commerce and the Rural Utilities Services.

MBI will first assess existing broadband availability, resources, and needs for the state. In partnership with Massachusetts Geographic Information System (MassGIS), MBI is conducting a detailed mapping project, focusing on Western Massachusetts where the digital divide is most acute. MBI has also started engaging private broadband providers to develop the co-investment partnerships expected to provide service to remote areas.

MassBroadband 123 will provide middle mile fiber network covering one-third of the state focusing solely on the unserved areas of western and north-central Massachusetts. Once the infrastructure is complete, MBI will focus on increasing adoption rates. The project received $45.4 million in federal funds under Round 2 of the Broadband Technology Opportunities Program (BTOP) and was matched by $26.2 million in state funds for a total investment of $71.6 million. The following state agencies provided matching funds: Executive Office of Public Safety and Security ($3.1 million), Information and Technology Division ($3.1 million), and MBI ($20 million).

- MassBroadband 123 project facts
    - 1,338 mile network covering 123 communities and 1,392 anchor institutions
    - Cost per mile – $42,392
    - Total households – 388,405
    - Total businesses – 44,306
    - Timeline – 3 years

MBI hired Axia to serve as the Management Operator of the network. Axia invests its own money to build out the network. MBI did not want a managed services model and chose Axia based on its success in running networks and attracting last mile providers in Calgary, Canada. Axia will pay MBI a fee and keep the remainder. The fee is low in the beginning but rises as anchor institutions join the network and eventually MBI and Axia will create a revenue-sharing agreement. Since the project connects to 1,400 anchor institutions, it is guaranteed revenue for Axia. In addition, the state wants to consolidate and push all state offices onto the MBI network, again guaranteeing revenue for Axia.

MBI was able to negotiate an agreement with the pole owners (Verizon, National Grid, and Western Mass Electric) on a pole attachment approval process that would occur in a timely manner. MBI hired a pole attachment project manager to coordinate the process.

MBI worked closely with the state department of transportation to put in cables on a project that was already underway along I-91. There are 288 strands of fiber down I-91 to the Connecticut border. The network being built will be an open access network. Since broadband is not regulated, the cost to the consumer for access to the network will be determined by the market.

Rhode Island

The Office of Economic Recovery and Reinvestment established a Broadband Review Team in May 2009. Members of the team included representatives from Rhode Island universities, the Department of Public Utilities, and the executive branch. The team was tasked with increasing awareness of broadband funding opportunities; exploring opportunities for collaborative efforts among potential applicants for broadband funding; and obtaining public comment on broadband priorities for Rhode Island.

Rhode Island has not completed mapping the availability of broadband but does have a website that allows users to test their Internet speed; this then allows the data mapping team to verify the accuracy of the data they are collecting for the map. In addition, residents can enter their information into the website if they do not have broadband service.

Round 2 BTOP funding was awarded to the Ocean State Higher Education Economic Development Administrative Network (OSHEAN), a consortium of nonprofit organizations dedicated to creating a statewide Internet communications network. OSHEAN provides and maintains a secure communications infrastructure for Rhode Island's research, education, health-care, and public service communities. Members of the consortium include all Rhode Island universities, some state government agencies/entities, and four health organizations. The nonprofit Business Innovation Factory established RI-WINS (Rhode Island Wireless Innovation Networks), a project to blanket the state with a wireless broadband network that will allow enterprise users to exchange large quantities and sophisticated forms of data (video, plans, specs, etc.) from any location in Rhode Island. The Treasury Department participated in a pilot in June 2006 with the goal to take it statewide by February 2007. The project was mostly privately funded with the state providing only a loan guarantee. Similar to Colorado, Rhode Island has a centralized consortium model for school districts, libraries, and nonprofits called RINET.[90]

Washington

The State Department of Information Services (DIS) is responsible for coordinating, programming, and outreach about opportunities for funding, education, and increasing awareness of broadband issues. In May 2010, DIS launched the state's first map showing service by provider, technology and advertised speed. Between August and October 2010, DIS will validate the information on the existing maps and determine where services are needed. In November 2010, DIS will issue a report identifying the current availability of broadband and comparing Washington to other states and countries in terms of use and access.

[90] www2.ri.net

In 1997, the Washington state legislature allowed rural counties to use sales taxes for the purpose of building and maintaining telecommunications infrastructure.[91]

In May 2008, the legislature commissioned a study on broadband availability, adoption, and use in five rural counties of Washington. Listed below are some of the general findings.

- Major inhibitors to broadband availability:
    - o low population density
    - o distance from a major transportation corridor
    - o mountainous and heavily forested terrain
    - o permitting delays and problems
    - o providers not being included in the community planning process
    - o longer than acceptable Return on Investment
    - o limitations of existing technology

  The study also found that broadband adoption generally follows availability. However, there were some exceptions to this finding. In rural areas served by broadband, subscription rates are lower than in urban areas. Research suggests that this is due to some residents not perceiving the value of the service and a segment of residents who do not want or require high-speed service.

New Jersey

Although the state has high adoption rates, it is not a model state. The state has not established broadband initiatives other than pursuing ARRA grant funds from NTIA. It appears their adoption rates are high due more to circumstances (densely populated areas, proximity to NYC, and wealth) as opposed to a state initiative.

Virginia—In depth

Virginia was not a state originally selected by the committee to examine; however, during the course of the interviews the state was mentioned as a leader and a good resource for the research.

The Center for Innovative Technology is a quasi-public entity that is focused on broadband policy for Virginia. Their greatest achievement has been the development and use of a Community Broadband Toolkit. The toolkit lays a framework for community leaders to assess their broadband needs and how best to plan for them. Below is the toolkit "at a glance":

- Is your "policy" house in order (state and local level)?
    - o Comprehensive asset and land use documents
    - o Broadband-friendly zoning
    - o Expedited permitting process
    - o Fees/charges

[91] http://apps.leg.wa.gov/RCW/default.aspx?cite=82.14.370

- What are you trying to do?
    - Who are you trying to connect
    - What applications are of interest—now and in future
    - Who will lead the initiative
- How do you do it?
    - Assessing assets and demand for services
    - Determine desired technology
    - Evaluate deal structure options (wireless authority, public-private partnerships, contract, etc.)
- Business case analysis and funding
    - Reallocate existing telecom spend[92] and "in-kind" contributions (rights of way, towers, tanks, etc.)
    - Evaluate and leverage grant opportunities (existing and future)
    - Leverage existing funding mechanisms

Furthermore, Virginia suggests that at the state level, the role should be that of an advocate and enabler, documenting best practices and developing tools and assistance programs, whereas the leaders and decision-makers should be at the local level driving action and implementation on the frontline for broadband initiatives. The state needs to be the enactor of policies with broad impact such as removing barriers, allowing the use of state-owned assets, and keeping the focus on the overall goal of ubiquitous affordable broadband access.

Japan

In 2000, top business and government leaders convened to make Japan the world's leader in information and communication technology and adopted a plan in 2001 called "e-Japan Strategy." In 2004, when the goals of reaching e-Japan were in sight, the country adopted "Ubiquitous Japan" or "u-Japan"—seamless access, meaning receiving services without being conscious of networks (wired or wireless) by 2010. [93]

- *Factors leading to success of broadband deployment*[94]:
    - Subsidies, low-interest and no-interest loans to both private entities and local governments; loan guarantees, tax breaks, targeted government purchases of services, grants-in-aid to local governments, and national public education campaign
    - Private sector's sense of responsibility to contribute to national goals
    - Financial sector's willingness to view investments from a long-term perspective

[92] For example, each department within a local or state government might have a line item for telecommunication spending (vertical budgeting). Virginia suggests looking across departments (horizontally) to pool resources.

[93] http://www.soumu.go.jp/menu_seisaku/ict/u-japan_en/new_outline01.html

[94] "Capturing the promise of broadband for North Carolina and America," The Baller Herbst Law Group, June 2008.

§ In particular, the partially government-owned incumbent telecom provider Nippon Telegraph and Telephone (NTT) faces significantly less pressure from capital markets for short-term profits. As a result, unlike in the United States, it is easier to invest in faster fiber deployment than what market forces alone would generate.

- *Access/Adoption*
  - Number of subscribers between March 2001 and August 2004 increased 20 times - from 0.85 million to 16.9 million—while usage charges decreased by one-third
- *Factors leading to increased demand*
  - The government also has driven demand by putting all administrative agencies online, with the result that in 2005, Japanese citizens completed more than 95% of government applications and notifications and more than 63% of other types of administrative procedures online. In addition, nearly all local municipal organizations had their own websites.[95]
- *Lessons learned*
  - Japan saw an increase in competition by requiring telecommunication carriers to unbundle their copper telephone lines, which led to more choices for consumers and ultimately to lower prices. However, unbundling of fiber lines did not have the same effect because of the high cost of accessing a competitor's fiber network.[96]

South Korea

Korea Information Infrastructure (KII) plan was adopted in 2002 with the goal of connecting 84% of households to broadband services with speeds up to 1 Mbps by 2005. By the first quarter of 2009, about 99.6% of households had access to broadband.

- *Factors leading to success*[97]:
  - Geography—80% of population lives in urban areas
  - Highly literate, well-educated population
  - "Hurry, hurry" mentality
  - Substantial government tax breaks and investments in infrastructure, first connecting government facilities, public research centers, major libraries, and schools—created a way for companies to enter the market without investing huge sums in infrastructure
  - Relatively low and flat prices
  - Aggressive competition among telecom companies (more options than in the United States)

[95] "Explaining International Broadband Leadership," The Information and Technology Foundation, May 2008.

[96] "National Broadband Plan Reflects the Experiences of Leading Countries, but Implementation will be Challenging," GAO Report 10-825, September 2010.

[97] "Capturing the promise of broadband for North Carolina and America," The Baller Herbst Law Group, June 2008.

- *Factors leading to lower prices*
    - The fact that over 50% of South Koreans live in large, multi-tenant apartment buildings makes it significantly cheaper on a per-subscriber basis to roll out fast broadband there compared to the United States, where many people live in single-family suburban homes.[98]
    - In 2000, the South Korean government created "The Certification Program for Broadband Buildings," which requires all buildings to be designed to enable high-speed broadband connections, such as locating digital subscriber line (DSL) access multiplexers (DSLAMs) or cable head-ends in apartment basements. The program grades multiple unit buildings of 50 units based on the level of high-speed access they support, rating them as 1st, 2nd, 3rd class based on whether they provide access at speeds of 100 Mbps, 10-100 Mbps, or 10 Mbps, respectively.[99]
        - The result is that 90% of South Korean households are within a radius of 4 km from a local exchange, which helps keep down the costs of the "last mile" to the home
- *Factors leading to increased demand*[100]
    - As a result of the South Korean government requiring teachers to give online assignments and communicating via email, nearly all South Korean students are online (99%)
    - Other programs that have increased demand include: distributing computers to low-income students with good grades; leasing computers with free broadband to low-income households; and offering courses on computer literacy to housewives (20-hour, week-long course for about $30—in the first ten days 70,000 women signed up)

Finland

Finland adopted its first national broadband strategy in 2004. This plan stated a goal of 1 million broadband subscriptions by the end of 2005. In January 2007, broadband services through a fixed network were available to 96.1% of the population (reached 1.5 million).

As of July 2010, telecom providers defined as universal service providers were required to provide every permanent resident and business access to a reasonably priced and high-quality connection with a downstream rate of at least 1 Mbps, and by 2015 a goal of 100 Mbps.
By 2015, the goal is to have optical fiber or cable network available to everyone. The Finnish government will offer business subsidies to companies that undertake commercially unviable measures to upgrade the public telecommunications network.

- Financing: Auction off radio frequencies that are coming up for allocation. If the revenues are insufficient to cover the government's public aid for infrastructure, the shortfall would be made up with telecommunications network compensatory payment to be collected from telecommunications operators.

[98] "Explaining International Broadband Leadership," The Information and Technology Foundation, May 2008.
[99] ibid.
[100] ibid.

- How did they reach more remote areas?
    - o Issue permits for radio systems to use wireless connections
- Interesting Facts:
    - o Growth in the number of broadband connections fastest in world in the first two years of the strategy (2004-2006), in the third year of the strategy it was the third fastest in Europe—went from 300,000 to 1.5 million connections[101]
    - o Access to fixed network broadband services went from 75% to 96%[102]
    - o Prices dropped by 45% in the first year and about 45% in the second year, and no major price changes in 2006, suggesting a competitive market was achieved[103]

Comparison of Broadband availability, speed and cost: United States versus Select Countries				
Ranking	Country	**Household penetration**	**Speed** (Avg download speed Mbps)	**Price** (lowest monthly price per Mbps) (US $ purchasing power parity)
1	South Korea	0.93	49.5	0.37
2	Japan	0.55	63.6	0.13
3	Finland	0.61	21.7	0.42
15	US	0.57	4.9	2.83
Source: ITIF May 2008				

OTHER GEOGRAPHIES OF NOTE:

Australia

- Government in April 2009 announced it would establish a new company to build and operate a new high-speed National Broadband Network (NBN). It is the largest national infrastructure project at a projected cost of $43 billion and with the goal to provide 93% of homes, schools and workplaces with a fiber connection to location of service that is capable of delivering speeds of 100 megabits per second.[104]
- In August 2010, the first services provided over the NBN were launched in Tasmania[105]

[101] "National Broadband Strategy Final Report," Ministry of Transport and Communications Finland,(pg 1) 2007.
[102] ibid.
[103] ibid.
[104] Department of Broadband, Communications, and Digital Economy (http://www.dbcde.gov.au/broadband/national_broadband_network)
[105] ibid.

Germany

Government will help private companies by opening up public infrastructure such as sewers for deployment and by setting up a new database platform through which carriers can share plans[106]

United Kingdom

In 2009, the United Kingdom issued the Digital Britain plan, which calls for 100% availability of a connection capable of download speeds of at least 2 Mbps by 2012.

In the United Kingdom, officials of the Office of Communications (Ofcom), the telecommunications regulator, noted that since unbundling, at least four additional operators have entered the British broadband market.

In the United Kingdom, access to the infrastructure of British Telecommunications is required to be provided at cost-based rates nationally. A formal price control is imposed for the most frequently used services—thus encouraging competition and ensuring that incumbents do not stifle competition by charging prohibitively high prices for access to their infrastructure.[107]

Factors leading to increased demand

- Directgov, launched in 2004, allows British citizens to access information from a variety of government agencies, and Government Gateway, a centralized registration point for government services online[108]
- The availability of increased speed also fueled demand as it facilitates a wider variety of Internet services such as video, streaming television, and Internet Protocols Television.

Chattanooga, Tennessee

In September 2010, the city-owned utility, ETB[109], announced it would offer ultra-high-speed, fiber-optic Internet service up to one gigabit a second symmetrical service in its 600- square-mile service area (200 times faster than average speed in America), offering the fastest service in the country However, the 1 Gbps service, costs $350 a month, with service at lower speeds offered for less.[110]

Ontario County, New York

- The 200-mile, open-access, dark-fiber infrastructure that forms a ring around Ontario County provides businesses and residents with advanced broadband capabilities.

[106] "German Government Introduces National Broadband Strategy, Pledges to Auction Digital Dividend," Information policy, February 2009.

[107] "National Broadband Plan Reflects the Experiences of Leading Countries, but Implementation will be Challenging," GAO Report 10-825, September 2010.

[108] "Explaining International Broadband Leadership," The Information and Technology Foundation, May 2008.

[109] https://epbfi.com/

[110] "Fastest Net Service in U.S. Coming to Chattanooga," New York Times, September 12, 2010.

Axcess Ontario is the public-benefit corporation that manages the fiber ring. The nonprofit was established to build, maintain, and lease the fiber-optic cable, but not to provide broadband service. The corporation is managed by a board of directors and does not have any employees. Axcess Ontario directly serves telecom carriers and business-to-business users who provide broadband service using the fiber infrastructure. A few of the objectives of the organization include:

- To support and enhance technology-led economic development;
- To provide infrastructure to address fragmented regional telecommunications; and
- To offer a non-competitive, open-access model for all users with the main purpose of public service rather than profit.

State Broadband Leaders who were interviewed

State broadband leaders who were interviewed include:

- Executive Director, e-NC
- Executive Director, Connect Kentucky
- Broadband Program Assistant, Virginia Center for Innovative Technology
- Director of Broadband Outreach and Communication, Vermont Telecommunications Authority
- President and CEO, Maryland Broadband Cooperative
- Executive Director, ConnectME Authority
- President, The Baller Herbst Law Group
- Portfolio Manager—IT Infrastructure and Operations, Governor's Office of Information Technology (CO)

BEST PRACTICES SUMMARY TABLE

State	Model Type	First Year of Initiative	Funding	Availability	Adoption	Lessons	Further study questions
Kentucky	Public-private partnership	2004	Public/private—$7.5 million from state over 3 years and 20% of operating costs from providers and other stakeholders	2003: 60% of households 2007: 95% of households	Between 2003 and 2007—73% increase in adoption		Sustainability of the program—might be kept afloat by the larger organization, ConnectedNation
North Carolina	State agency	2000	State, federal, and private	2002: 74.9% of households 2007: 83.3% of households		-Small providers in state more likely to provide service to unserved areas -Accuracy of data mapping reliant on good partnerships with providers	Telecenters as a model
Vermont	State agency	2004	Using state revenue bonds to finance infrastructure. Revenue from leasing infrastructure will pay off bonds.	As of 2006, available to 90% of households			
Colorado	Public-private partnership	2000	State invested $23 million; private dollars of $60 million	97.5% of households—1.6 million		Minimum requirements of the contract were met	How Eagle-Net came about—next step or needs not met by Qwest?
Maryland	Public-private partnership	2003	State funding with private dollars				Learn more about partnership—seems to be a true public/private endeavor
Maine	Quasi-public	2007	0.25% surcharge on retail communication services	In 3 years increased from 86% to 90%	60% of households	Obtaining accurate data on number of unserved households	
Massachusetts	Quasi-public	2008	Public/private; up to $40 million in bonds for infrastructure	Initiative just beginning			Partnerships and funding for MassBroadband 123
Rhode Island	Task force established by governor	2009	Round 2 BTOP funding awarded to OSHEAN (consortium of nonprofits)	Initiative just beginning			
Washington	State agency	2010		Initiative just beginning			

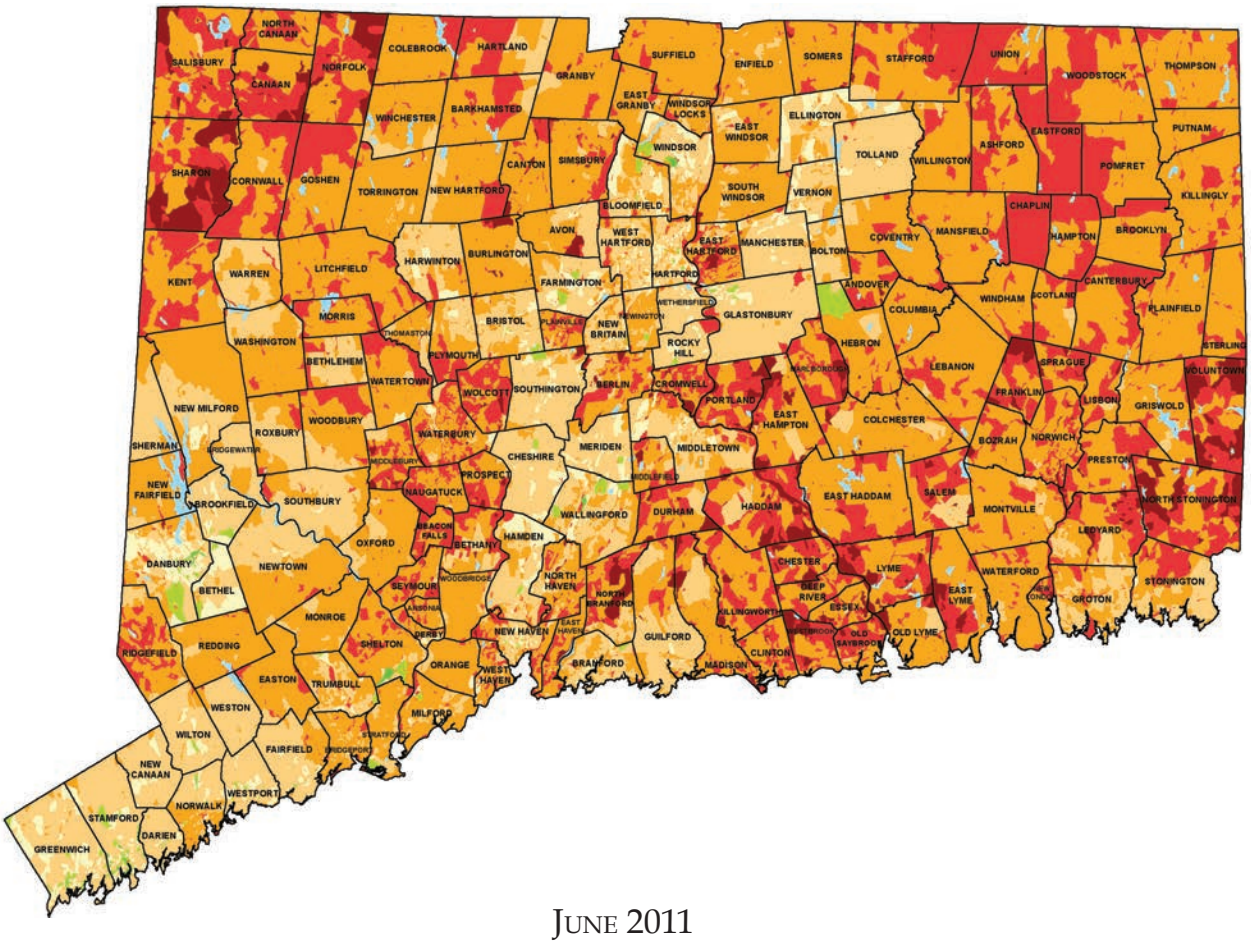
NOTE: * OSHEAN – Ocean State Higher Education Economic Development Administrative Network

APPENDIX H:
MAPS OF BROADBAND PROVIDERS AND COVERAGE

1. # of Wireline Providers as of 6/2011
2. # of Wireless Providers as of 6/2011
3. Max Advertised download speeds (all tech types) as of 6/2011
4. Comparison pages
    a. Satellite speeds 6/2010 and 6/2011
    a. DSL speeds 6/2010 and 6/2011
    a. Cable speeds 6/2010 and 6/2011
    a. Fiber speeds 6/2010 and 6/2011
    a. Wireless speeds (no satellite) 6/2010 and 6/2011

Number of Wireline Providers

(By census block)



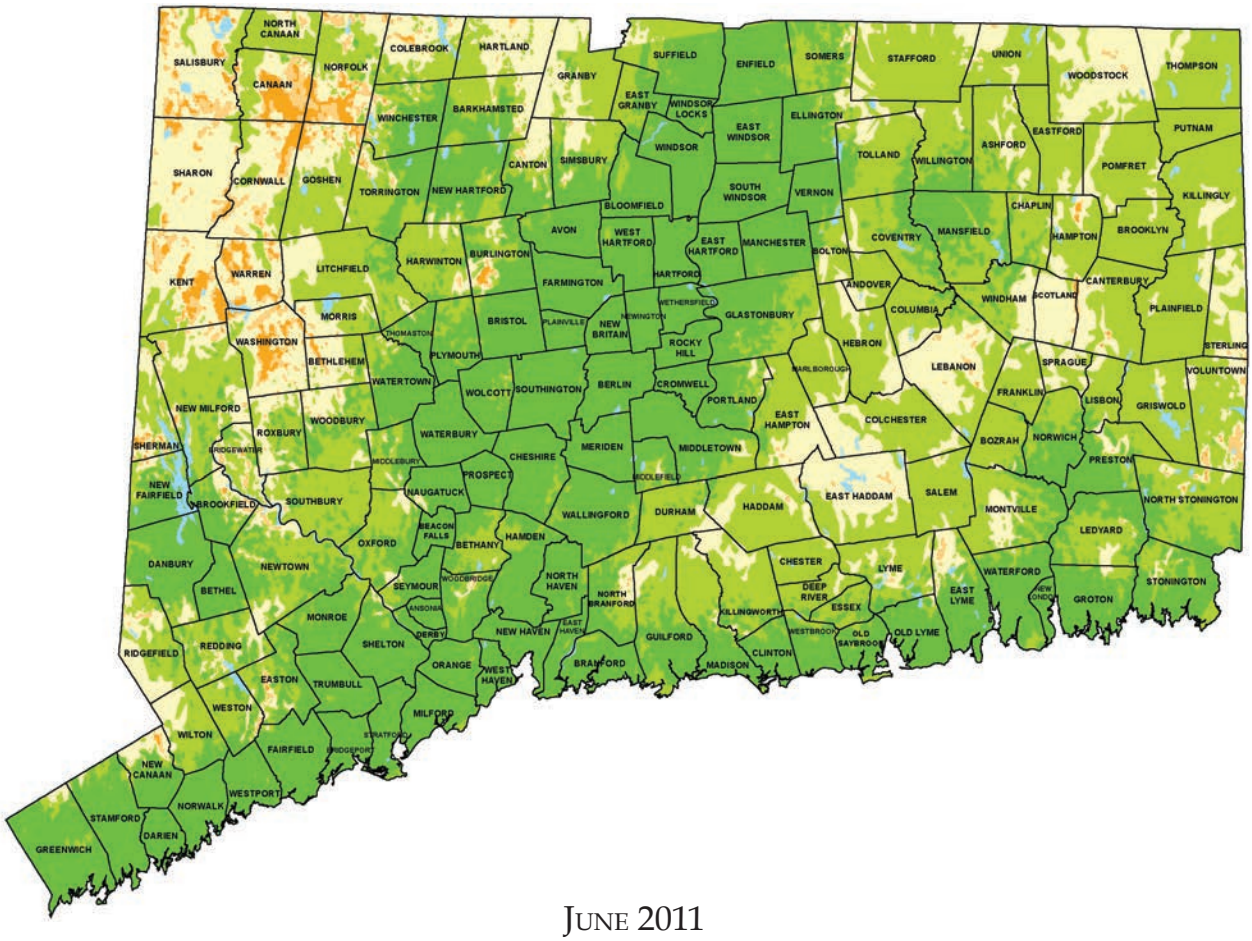
June 2011

Legend

- Lakes
- 6 or More Providers
- 5 Providers
- 4 Providers
- 3 Providers
- 2 Providers
- 1 Provider
- No Providers

Map courtesy of AppGeo, East Hartford, CT.

Number of Wireless Providers
(Includes 2 statewide satellite providers)



June 2011

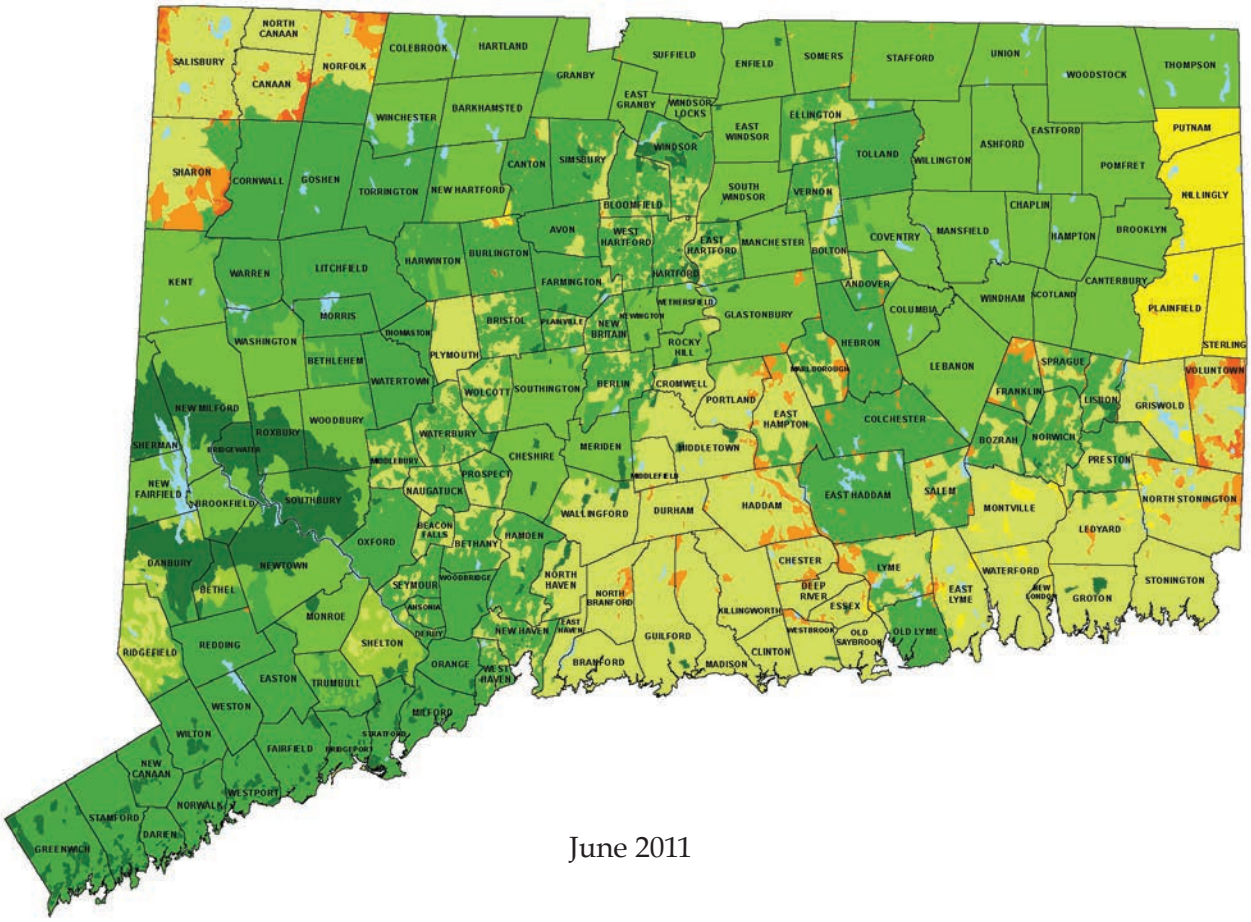
Legend

Lakes	3 Providers
6 or More Providers	2 Providers
5 Providers	1 Provider
4 Providers	No Providers

Map courtesy of AppGeo, East Hartford, CT.

All Providers

Maximum Advertised Download Speed



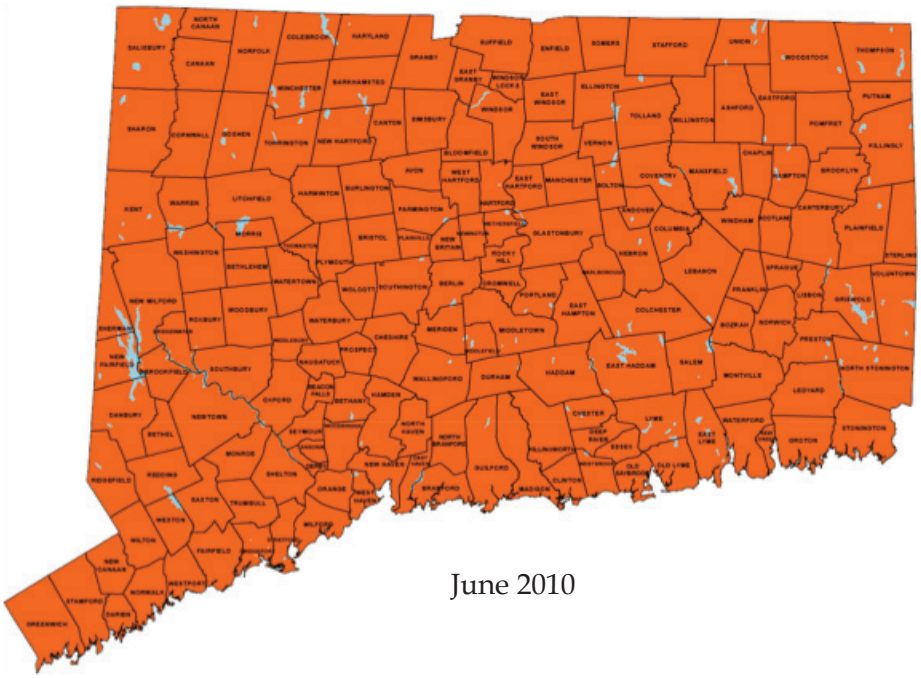
June 2011

Legend

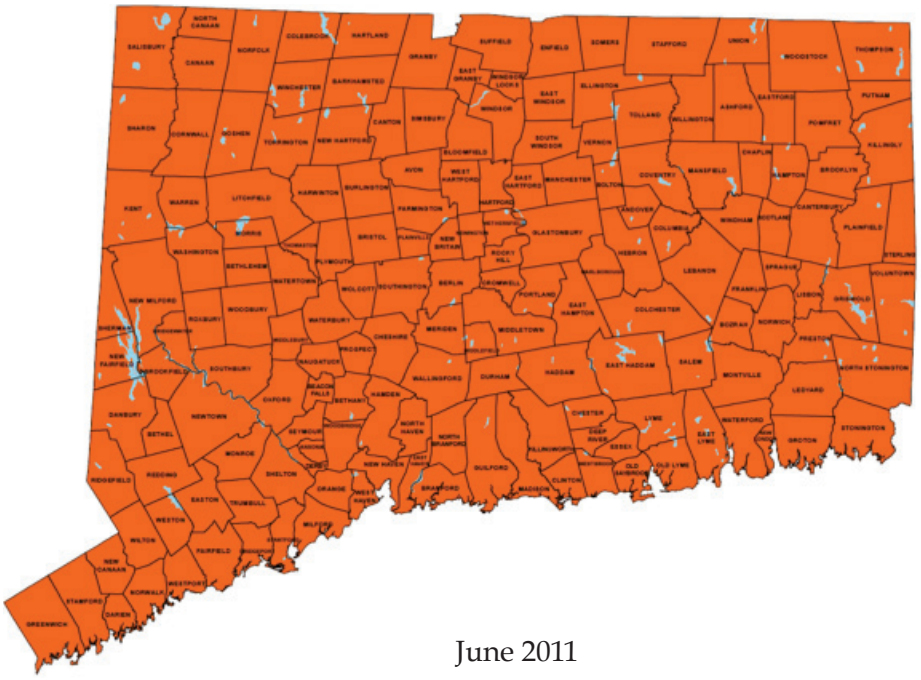
- ≥ 1gbps
- ≥100mbps & < 1gbps
- ≥ 50mbps & < 100mbps
- ≥ 25mbps & < 50mbps
- ≥ 10mbps & < 25mbps
- ≥ 6mbps & < 10mbps
- ≥ 3mbps & < 6mbps
- ≥ 1.5mbps & < 3mbps
- ≥ 768kbps & < 1.5mbps
- Lakes

Map courtesy of AppGeo, East Hartford, CT.

Satellite
Maximum Advertised Download Speed



June 2010



June 2011

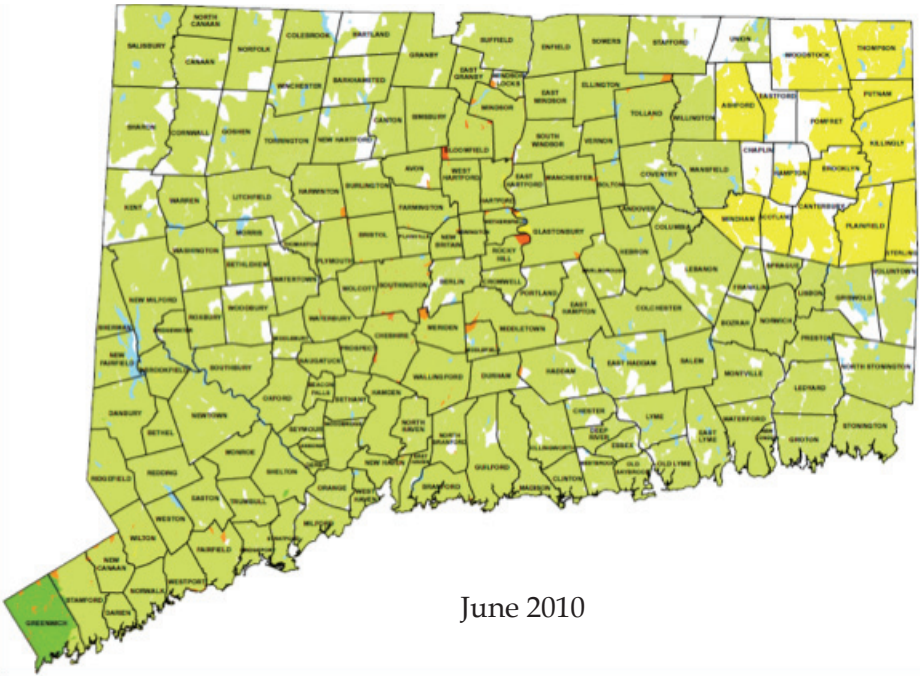
Legend

- ≥ 1gbps
- ≥100mbps & < 1gbps
- ≥ 50mbps & < 100mbps
- ≥ 25mbps & < 50mbps
- ≥ 10mbps & < 25mbps
- ≥ 6mbps & < 10mbps
- ≥ 3mbps & < 6mbps
- ≥ 1.5mbps & < 3mbps
- ≥ 768kbps & < 1.5mbps
- Lakes

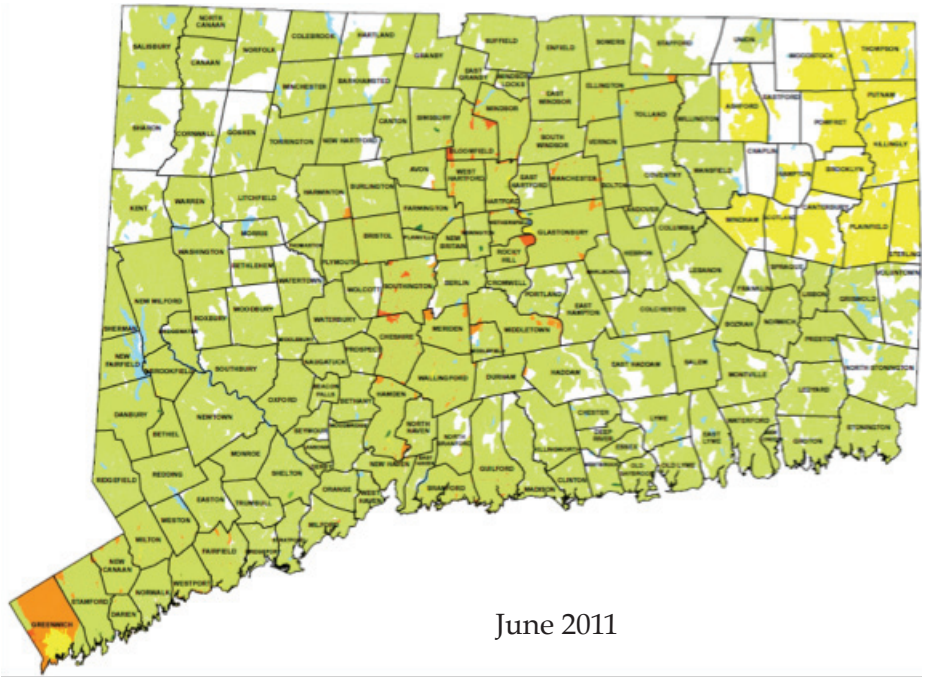
Maps courtesy of AppGeo, East Hartford, CT.

DSL

Maximum Advertised Download Speed



June 2010



June 2011

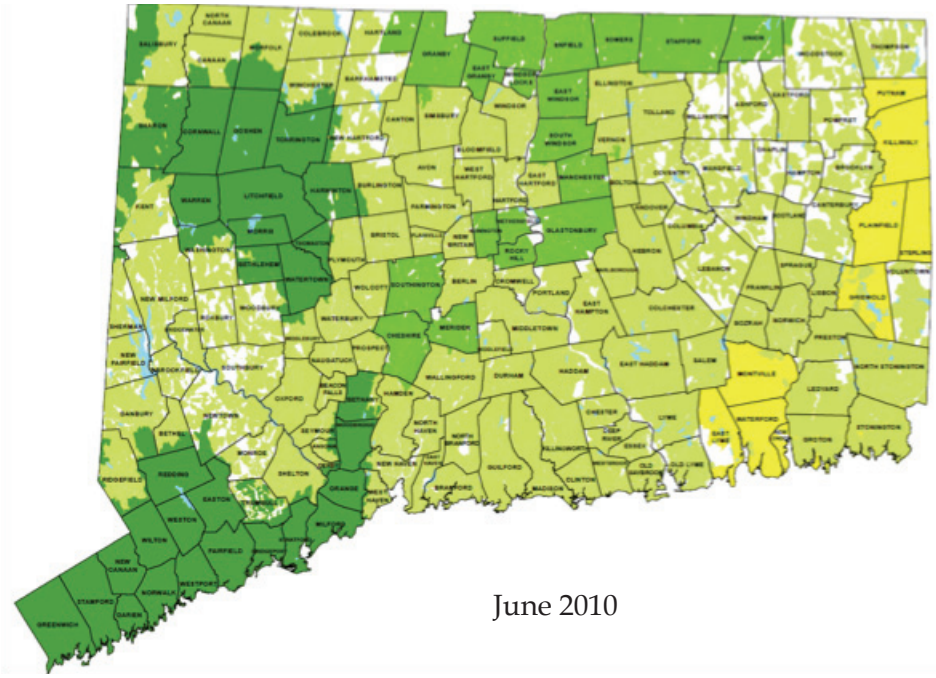
Legend

- ≥ 1gbps
- ≥100mbps & < 1gbps
- ≥ 50mbps & < 100mbps
- ≥ 25mbps & < 50mbps
- ≥ 10mbps & < 25mbps
- ≥ 6mbps & < 10mbps
- ≥ 3mbps & < 6mbps
- ≥ 1.5mbps & < 3mbps
- ≥ 768kbps & < 1.5mbps
- Lakes

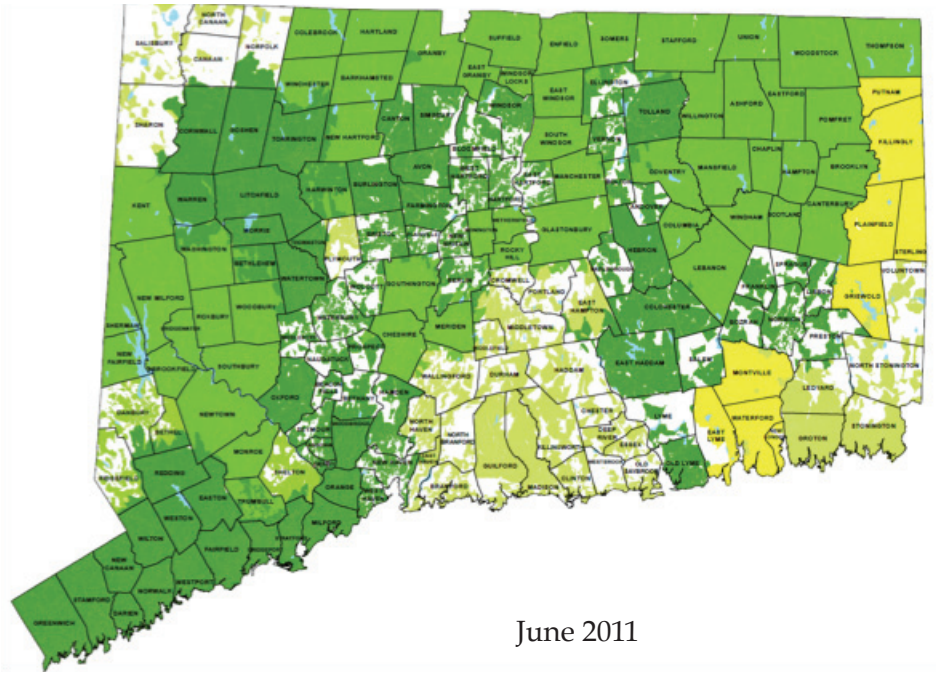
Maps courtesy of AppGeo, East Hartford, CT.

Cable Internet

Maximum Advertised Download Speed



June 2010



June 2011

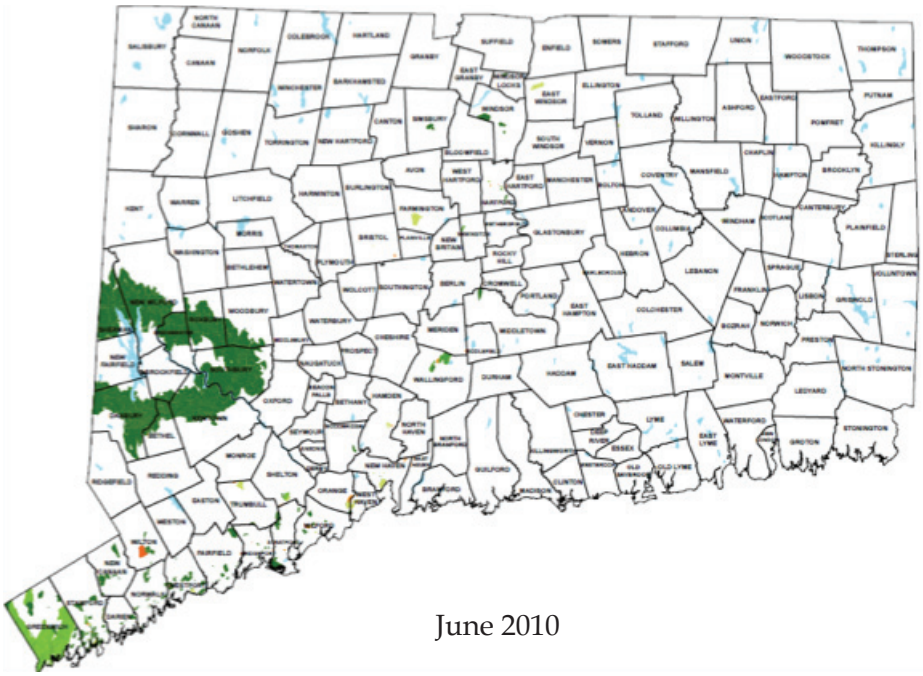
Legend

- ≥ 1gbps
- ≥100mbps & < 1gbps
- ≥ 50mbps & < 100mbps
- ≥ 25mbps & < 50mbps
- ≥ 10mbps & < 25mbps
- ≥ 6mbps & < 10mbps
- ≥ 3mbps & < 6mbps
- ≥ 1.5mbps & < 3mbps
- ≥ 768kbps & < 1.5mbps
- Lakes

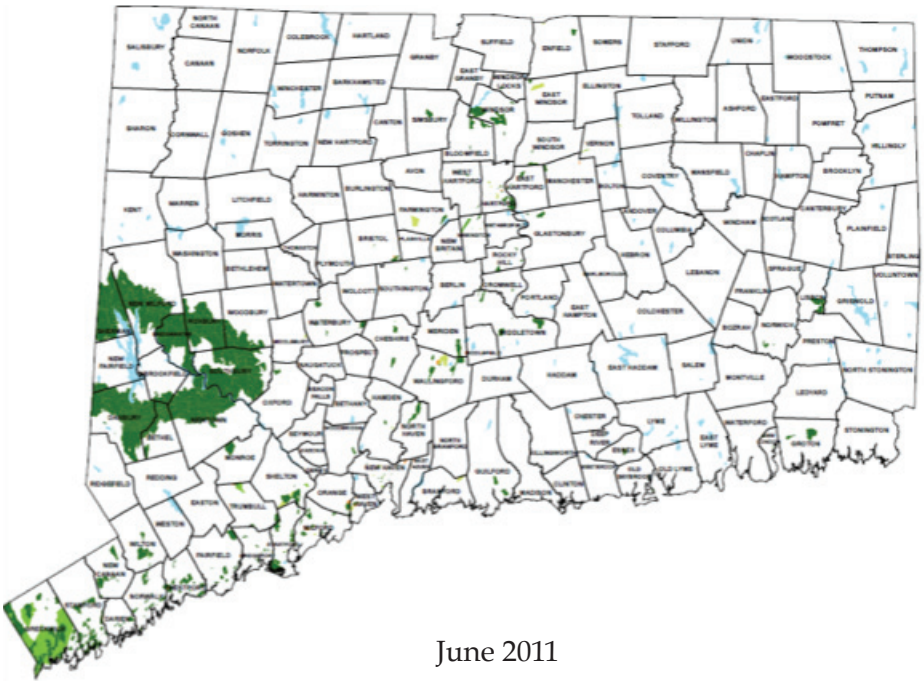
Maps courtesy of AppGeo, East Hartford, CT.

Fiber Optic

Maximum Advertised Download Speed



June 2010



June 2011

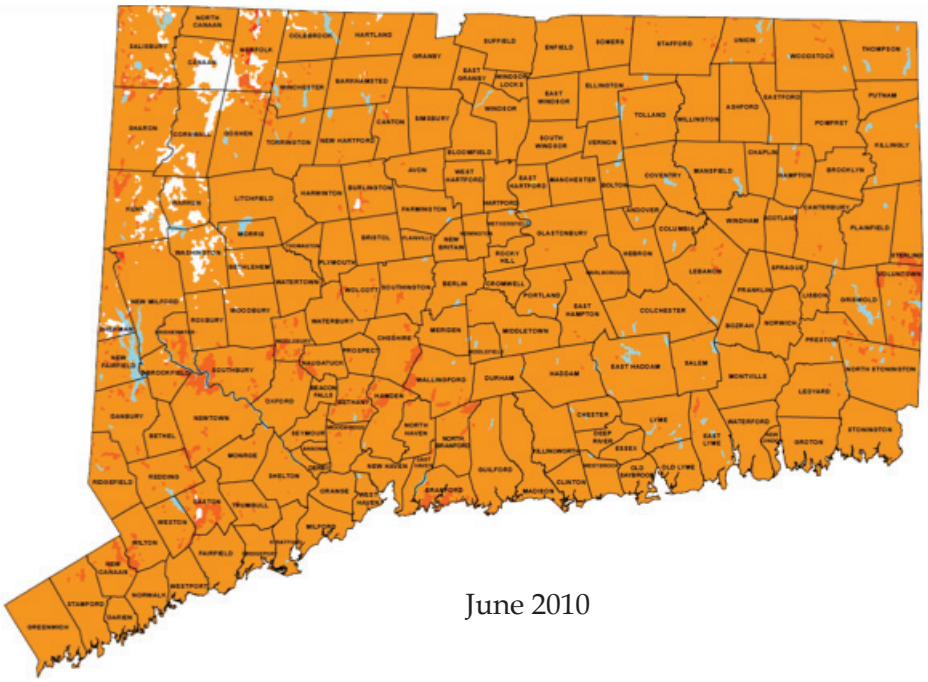
Legend

- ≥ 1gbps
- ≥100mbps & < 1gbps
- ≥ 50mbps & < 100mbps
- ≥ 25mbps & < 50mbps
- ≥ 10mbps & < 25mbps
- ≥ 6mbps & < 10mbps
- ≥ 3mbps & < 6mbps
- ≥ 1.5mbps & < 3mbps
- ≥ 768kbps & < 1.5mbps
- Lakes

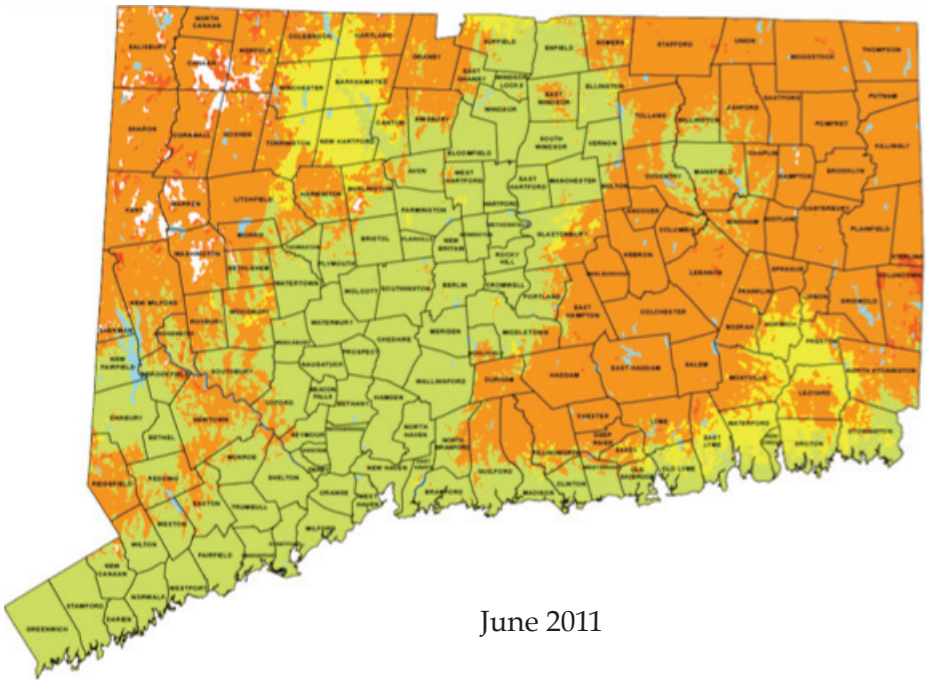
Maps courtesy of AppGeo, East Hartford, CT.

Terrestrial Wireless

Maximum Advertised Download Speed



June 2010



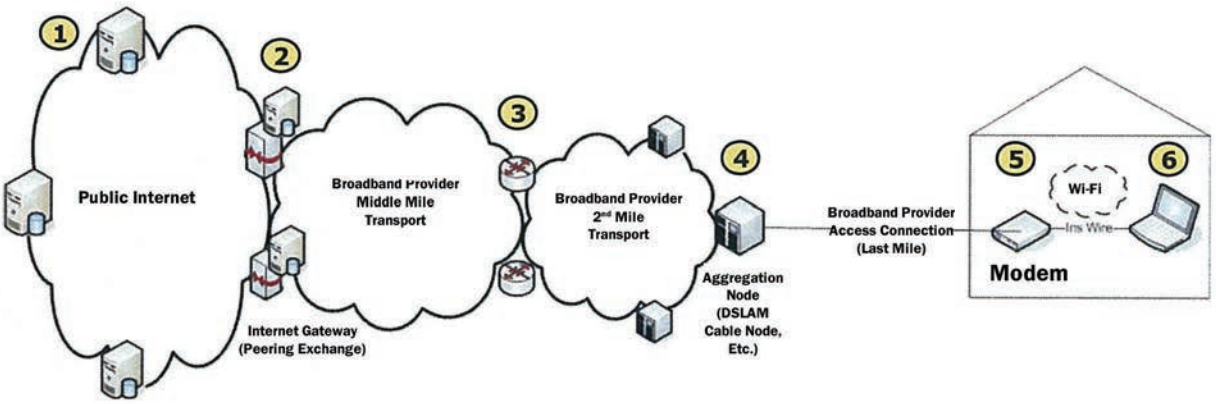
June 2011

Legend

- ≥ 1gbps
- ≥100mbps & < 1gbps
- ≥ 50mbps & < 100mbps
- ≥ 25mbps & < 50mbps
- ≥ 10mbps & < 25mbps
- ≥ 6mbps & < 10mbps
- ≥ 3mbps & < 6mbps
- ≥ 1.5mbps & < 3mbps
- ≥ 768kbps & < 1.5mbps
- Lakes

Maps courtesy of AppGeo, East Hartford, CT.

APPENDIX I:
NETWORK DIAGRAM OF MOST IMPORTANT DEVICES AND LINKS CONNECTING BROADBAND USERS WITH DESTINATIONS ON THE INTERNET



1: Public Internet content: hosted by multiple service providers all over the world

2: Internet gateway: closest peering point between broadband providers and public Internet for consumer connections

3: Link between 2nd mile and middle mile: broadband provider manages connection between middle mile and last mile

4: Aggregation node: first aggregation point for broadband provider (e.g., cable node, satellite, etc.)

5: Modem: CPE (customer premise equipment) usually managed by a broadband provider as last connection point to managed network (e.g., DSL modem, cable modem, satellite modem, etc.)

6: Consumer device: connected to modem through internal wire or WiFi

[Source: Federal Communications Commission, Reply to Attn of: RFQ-1O-000013, March 12, 2010, Subject: Federal Communications Commission Request for Quotation for Residential Fixed Broadband Services Testing and Measurement Solution]

MAJOR STUDIES OF THE ACADEMY

2011

- Advances in Nuclear Power Technology

2010

- Environmental Mitigation Alternatives for Transportation Projects in Connecticut
- The Design-Build Contracting Methodology for Transportation Projects: A Review of Practice and Evaluation for Connecticut Applications
- Peer Review of an Evaluation of the Health and Environmental Impacts Associated with Synthetic Turf Playing Fields

2009

- A Study of the Feasibility of Utilizing Waste Heat from Central Electric Power Generating Stations and Potential Applications
- Independent Monitor Report: Implementation of the UCHC Study Recommendations

2008

- Preparing for Connecticut's Energy Future
- Applying Transportation Asset Management in Connecticut
- A Study of Weigh and Inspection Station Technologies
- A Needs-Based Analysis of the University of Connecticut Health Center Facilities Plan

2007

- A Study of the Feasibility of Utilizing Fuel Cells to Generate Power for the New Haven Rail Line
- Guidelines for Developing a Strategic Plan for Connecticut's Stem Cell Research Program

2006

- Energy Alternatives and Conservation
- Evaluating the Impact of Supplementary Science, Technology, Engineering and Mathematics Educational Programs
- Advanced Communications Technologies
- Preparing for the Hydrogen Economy: Transportation
- Improving Winter Highway Maintenance: Case Studies for Connecticut's Consideration
- Information Technology Systems for Use in Incident Management and Work Zones
- An Evaluation of the Geotechnical Engineering and Limited Environmental Assessment of the Beverly Hills Development, New Haven, Connecticut

2005

- Assessment of a Connecticut Technology Seed Capital Fund/Program
- Demonstration and Evaluation of Hybrid Diesel-Electric Transit Buses
- An Evaluation of Asbestos Exposures in Occupied Spaces

2004

- Long Island Sound Symposium: A Study of Benthic Habitats
- A Study of Railcar Lavatories and Waste Management Systems

2003

- An Analysis of Energy Available from Agricultural Byproducts, Phase II: Assessing the Energy Production Processes
- Study Update: Bus Propulsion Technologies Available in Connecticut

2002

- A Study of Fuel Cell Systems
- Transportation Investment Evaluation Methods and Tools
- An Analysis of Energy Available from Agricultural Byproducts, Phase 1: Defining the Latent Energy Available

Connecticut Academy of Scienc and Engineering
805 Brook Street, Building 4-CERC, Rocky Hill, CT 06067-3405
Phone: 860-571-7143 • e-mail: acad@ctcase.org
web: www.ctcase.org

Connecticut Academy of Science and Engineering

The Connecticut Academy is a non-profit institution patterned after the National Academy of Sciences to identify and study issues and technological advancements that are or should be of concern to the state of Connecticut. It was founded in 1976 by Special Act of the Connecticut General Assembly.

Vision

The Connecticut Academy will foster an environment in Connecticut where scientific and technological creativity can thrive and contribute to Connecticut becoming a leading place in the country to live, work and produce for all its citizens, who will continue to enjoy economic well- being and a high quality of life.

Mission Statement

The Connecticut Academy will provide expert guidance on science and technology to the people and to the State of Connecticut, and promote its application to human welfare and economic well being.

Goals

- Provide information and advice on science and technology to the government, industry and people of Connecticut.
- Initiate activities that foster science and engineering education of the highest quality, and promote interest in science and engineering on the part of the public, especially young people.
- Provide opportunities for both specialized and interdisciplinary discourse among its own members, members of the broader technical community, and the community at large.

Connecticut Academy of Science and Engineering
805 Brook Street, Building 4-CERC, Rocky Hill, CT 06067-3405
Phone: 860-571-7143 • e-mail: acad@ctcase.org
web: www.ctcase.org