COMMUNITY PLANNING NEW HAMPSHIRE

This information brief is one in a series that explores key facets of community planning in New Hampshire. This brief draws on the experience and expertise of University of New Hampshire Cooperative Extension and leading researchers in this field.

Information Brief #7, January 2015

Leveraging Broadband to Strengthen New Hampshire's Economy and Quality of Life

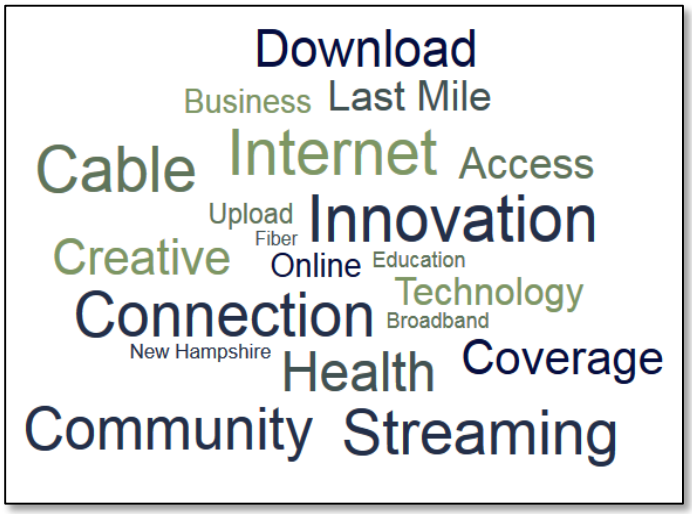
Charlie French, PhD, University of New Hampshire Cooperative Extension
Curt Grimm, PhD, Carsey School for Public Policy, University of New Hampshire

Broadband allows one to shop online, watch streaming video, share photos, connect with friends, manage bank accounts, video conference with people located in other places, and even receive medical consultations; all things that we have come to rely on in our daily lives.

Broadband Overview

Broadband—high-speed internet that is always on, is faster than traditional dial-up access, and allows multiple users to communicate simultaneously—is becoming integral to everyday life.

According to a recent Granite State Poll, one in four New Hampshire households still relies on dial-up internet access or other forms of internet not classified as broadband by the Federal Communications Commission (FCC). Rates of access are lowest in rural counties like Cheshire, Grafton, and Coös. Tens of thousands of individuals, businesses, and institutions in the state can't realize the full potential of the internet, or the social and economic benefits it provides.



Why Broadband Matters

Broadband and Economic Development. The link between broadband and economic development is clear in economic literature, principally that employment has grown faster in regions that have better internet access (Czernick et al., 2011; Kolko, 2012; Stenberg et al., 2009). In fact, from 2009-2010, the National Telecommunications and Information Administration (NTIA) invested roughly $3.5 billion to support the deployment of broadband infrastructure, with an estimated economic impact of more than $10 billion to the economy (BEA, 2010). This impact was partially in the form of jobs created to deploy the infrastructure, but more importantly, in jobs created or sustained by firms that depend on broadband infrastructure and on employment in the sectors that provide services to those firms.

University of New Hampshire Cooperative Extension

NEW HAMPSHIRE broadband MAPPING & PLANNING PROGRAM
Understanding today for a more connected tomorrow.

In New Hampshire, where the broadband penetration rate in 2010 was estimated to be a little more than 70%—which was around 6% higher than the national average—the economy was less impacted by the 2008 recession than other New England states and job growth since has been comparatively strong. According to a 2010 report by the Brookings Institution, much of this economic resilience may be attributed to the state's comparatively high rate of broadband penetration. In fact, it is estimated that the broadband penetration increased by approximately 4-8% over the past five years, adding over $2 billion dollars to the economy in direct and indirect impacts and resulting in thousands of jobs. This technology-driven job growth has helped to mitigate job losses in other sectors, such as construction, manufacturing, and retail.

In spite of New Hampshire's overall advantage with respect to broadband, there are still regions where broadband access is limited, such as the Connecticut River Valley, Lakes Region, and North Country. It is difficult to ascertain to what degree lack of broadband infrastructure has impacted economic growth in these regions, but it is clear that areas without broadband are slower to recover from the economic recession.

Many areas lacking broadband were historically dependent on manufacturing. In such areas, the manufacturing jobs do not appear to have been replaced by jobs in other sectors. In other parts of the state where broadband *is* present—including the Seacoast and Merrimack Valley—manufacturing jobs have largely been replaced by jobs in sectors that rely heavily on broadband infrastructure, such technology, finance, and education.

That is why many rural regions have laid infrastructure to help businesses and households to connect to affordable, high-speed internet. It is key to their success.

A Small Internet Service Provider Provides Affordable Broadband to Rural Residents and Businesses

Most residents of rural Cheshire County have internet access with 3 Megabits per second (Mbps) download speeds in their homes. With that, one can easily browse the web, shop online, share photos and stream some video and audio content. So what's the problem?

Brian Foucher, owner and founder of a small internet service provider called Wi Valley, says that's not enough for our future internet demands. "We have to think to the future and what sort of demands we will have in ten or twenty years," says Foucher. "If we want to grow high-quality jobs in the region, people need the ability to telecommute, transfer large data files, and communicate with others via two-way video. To do all that, 3 Mbps is not enough. Plus, we need to think about upload speed and not just download speed if people want to do things like take online courses."

Because getting access to faster internet is cost prohibitive for many people in New Hampshire, a number of providers are working to provide faster speeds—5-10 Mbps or more up and down—at lower costs by tapping into a new high-speed fiber network built by New Hampshire Fastroads, a public-private partnership that is capable of delivering speeds from 5 Mbps to 100 Mbps. They are using new technologies that enable the transfer of large amounts of data wirelessly.

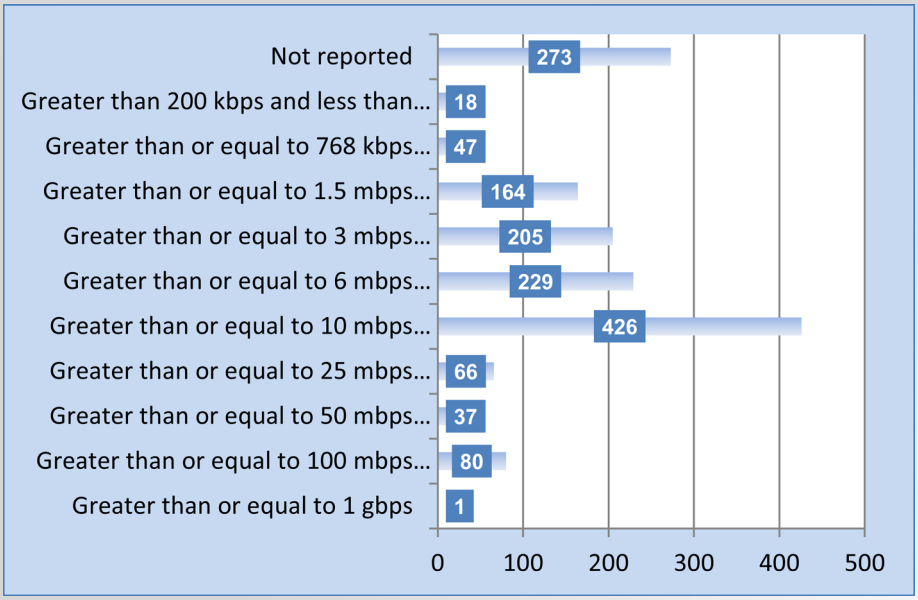
Broadband and Education. A 2013 Pew Internet and American Life report indicates that 93% of teens have access to a computer at home. An earlier Pew poll found that students without access are more likely to have more limited career opportunities after completing high school. Another study reveals that internet-connected high school graduates are twice as likely to go to college as those who are not on-line (NARUC Conference, Washington, D.C. February 16, 2010).

So how does this scenario play out in rural, under-served parts of New Hampshire? Consider that the North Country has nearly twice the high school drop-out rate as the south and central parts of the state. While lack of broadband access in the North Country is not the only factor contributing to a relatively high dropout rate, it highlights a potential competitive disadvantage for students who want to go on to college or secure living-wage jobs. The reality is that students without broadband internet do not have the same learning opportunities as those that do, including access to national curriculum, ability to connect to peers and instructors via video interactive tutoring, and access to interactive learning tools and information.

How Ready is New Hampshire for the White House's ConnectED Initiative?

In June, 2013, President Obama unveiled the ConnectED initiative, a bold new, five-year plan to connect 99% of America's schools to next-generation broadband (at least 100Mbps and a target of 1Gbps) and install high-speed wireless throughout schools and libraries. The Initiative will also train teachers in the use of technology to improve student outcomes and partner with the private sector to make cost competitive educational devices available so students can tap into global opportunities with new technology.

In New Hampshire, many schools and libraries are currently underserved. Others are limited by residential-level broadband that is shared by multiple users, often times in the hundreds. At times of peak demand, this simultaneous use can relegate the level of internet to the underserved category. As of March 2014, only 81 schools met the threshold target of 100 Mbps, leaving 1,465 of the 1,546 schools and libraries to upgrade within the next five years.



Broadband and Health. Broadband offers opportunities to simultaneously improve health outcomes and reduce health care costs. The internet has changed the way that many people access critical services, such as health care. In the age of high definition and real-time video-streaming, it is now possible for doctors to interact with their patients for preliminary consultation in a timelier manner and without the transportation challenge that some patients, particularly those in more rural, remote regions, face every time they need to see a doctor. In fact, for a large percentage of cases, preliminary consults via video eliminate the need for doctor visits, ultimately saving time for both patient and doctor. In other cases, doctors can refer patients to leading experts who may be located anywhere in the world and with broadband technology they can access and review a patient's files. Such opportunities can greatly improve diagnosis and treatment.

In addition to improving the delivery of health care to patients, broadband internet can also increase the efficiency and effectiveness of recording patient information using powerful new medical record systems. More importantly, once such systems are established, high-speed internet enables other care providers who have authorization to access critical patient information. This will ultimately save lives and reduce incorrect diagnoses or treatments.

Carroll and Coös County Residents Consult Medical Professionals Via Video

Residents of some parts of the state that do not have easy access to hospitals or other medical facilities with psychiatric support—including parts of Carroll and Coös County—now have access to experts through a telehealth network managed by Northern Human Services using video collaboration infrastructure provided by ConnectNH at UNH. Using two-way interactive video, which can be a live feed from one's desktop or videoconferencing system, patients can now get consultation from experts and specialists who often provide diagnosis and make recommendations on the next level of care needed.

This remote diagnosis wouldn't be possible without the video equipment maintained by Northern Human Services, and equally important, the high-speed access that has expanded to health institutions and residents in the region.

Consultation with mental health professionals through telepsychiatry networks has given Northern Human Services clients and staff access to resources from NH DHHS Behavioral Health, NH Hospital, and Dartmouth Hitchcock Medical Center, most specifically, regular access to a child psychiatrist because there are none in rural Coös County.

Broadband is Life Changing. While there are compelling data that show the existing and potential economic, educational, and health impacts of broadband, fast and reliable internet is integral to many facets of modern-day life. Broadband has transformed the way we get local, regional, and world news, how we find information about the services we use in our communities, how we shop, how we entertain ourselves, and the way we connect with friends and peers. Who would have thought that both Facebook and YouTube would become the most prevalent forms of media in the history of the world, each with over a billion users? Broadband levels many previous inequalities that existed in peoples' access to services and information, but it also creates a new divide between those who have broadband and those who do not.

Broadband: What Does It *Really* Mean?

According to the National Telecommunications and Information Administration (NTIA), broadband is defined as internet speeds of at least 756 Kbps downstream for downloading data and 200 Kbps upstream for uploading data. Internet speeds below that tier are considered to be unserved by broadband. Although anything above that speed is technically categorized as broadband, speeds between that level and 6 Mbps downstream and 1.5 Mbps upstream may be considered underserved in New Hampshire, meaning that internet use will be limited in functions and performance. This table outlines what functions one can typically perform at different speed tiers.

Category	*Download Speed*	*Upload Speed*	*Typical Functions/Use (functions additive to level above)* NEW HAMPSHIRE broadband MAPPING & PLANNING PROGRAM
Unserved	**< 768 Kbps**	**< 200 Kbps**	• Email (Client/Server-based; POP)
Underserved	**768 Kbps to < 6 Mbps**	**200 Kbps to < 1.5 Mbps**	**Minimum Download Speed: 768 Kbps** | **Minimum Upload Speed: 200 Kbps** • Web-based email • Limited web browsing and shopping • Minimal social media use • Sending/receiving small documents/files (photos, word processing, invoices) • Use of internet not integrated in daily life function • Single user internet device **Minimum Download Speed: 1.5 Mbps** | **Minimum Upload Speed: 768 Kbps** • Web browsing and shopping • Medium social media use • Sending/receiving medium-sized documents/files (photos, word processing) • Limited streaming content; buffering a concern Standard Definition (SD) content • VPN access possible, but speed of operation not critical to job function • Internet integrated in daily life, and "always" connected • 1-3 simultaneous internet devices possible • Multiple functions working simultaneously possible (e.g. web browsing, streaming video/music, downloading content). Not concerned with speed of transmission. • VoIP (Voice over IP, i.e. telephone over the Internet) **Minimum Download Speed: 3 Mbps** | **Minimum Upload Speed: 768 Kbps** • Medium to high social media use • Sending/receiving medium to large-sized documents or files (photos, word processing) • Streaming SD content; buffering not a concern; downloading High Definition (HD) content (movies, video) • 3-5 internet devices possible • VPN access needed, speed of operation important but not critical to job function • Multiple functions performed simultaneously required (e.g. web browsing, streaming video/music, downloading content), but not concerned with speed of downloads • Low quality, small window frame videoconferencing (Skype) • Cloud-based computing and data storage
Served	**6 Mbps to 25+ Mbps**	**1.5 Mbps to 6+ Mbps**	**Minimum Download Speed: 6 Mbps** | **Minimum Upload Speed: 1.5 Mbps** • Heavy social media use • Sending/receiving large documents or files (photos, word processing, small videos) • Streaming HD content (movies, video); buffering not a concern • 5+ internet devices possible • VPN access needed, speed of operation critical to job junction • Higher quality, codec-based videoconferencing • Multi-player online gaming **Minimum Download Speed: 10 Mbps** | **Minimum Upload Speed: 3 Mbps** • Sending/receiving large files and small to medium-sized databases • HD quality, codec-based, large frame videoconferencing; multiple (bridged) sites/users • Remote synchronous education, professional development, workshops, etc., facilitated simultaneously at multiple classrooms and/or other locations • Telehealth/telemedicine applications possible **Minimum Download Speed: 25+ Mbps** | **Minimum Upload Speed: 6+ Mbps** • Sending/receiving medium to large-sized databases • HD quality, codec-based, large frame videoconferencing (Telepresence) connecting multiple (bridged) sites/users • High speed end to end network and business to business applications • Telemetry-based applications (rely critically on the ability of broadband to continuously monitor and multiplex data, i.e. remote patient monitoring, sensing systems, etc.) • Real-time HD medical imaging and consultation (remote dermatology, etc.) • "Internet 2" connectivity and applications

The Digital Divide: What Does that Signify for New Hampshire Residents?

According to a recent report by the National Agricultural & Rural Development Policy Center (NARDeP), access to broadband infrastructure in rural areas is seriously lagging that of urban areas. The results of Granite State Poll, conducted in March of 2012 by the University of New Hampshire's Survey Center, corroborate this notion of a rural-urban digital divide in New Hampshire. The most rural regions of the state—the North Country and the Connecticut River Valley—had the lowest rates of broadband access of 63% and 68% respectively. In contrast, the Merrimack Valley—the state's most populated region—had an access rate of over 80%.

Broadband Access by NH Region (2013)

Region	Primary Form of Internet Access
Connecticut River Valley	No internet at home – 16% Dial-up, cellular, or satellite –12% Other/don't know – 4% **Broadband – 68%**
Northern	No internet – 16% Dial-up, cellular, or Satellite – 17% Other/don't know – 4% **Broadband – 63%**
Central NH/ Lakes Region	No internet at home – 9% Dial-up, cellular, or satellite –15% Other/don't know – 4% **Broadband – 72%**
Seacoast New Hampshire	No internet at home – 8% Dial-up, cellular, or satellite –9% Other/don't know – 6% **Broadband – 77%**
Merrimack Valley	No internet at home – 6% Dial-up, cellular, or satellite – 5% Other/don't know – 6% **Broadband – 83%**

Poll conducted by UNH Survey Center, Spring of 2013.

What Do the NH Broadband Mapping Results Show?

The New Hampshire Broadband Mapping and Planning Program (NHBMPP) has been collecting data on broadband service availability by type of technology and speed. This data has been aggregated to the census block and community level. The data is derived from information provided by the state's internet service providers (ISPs).

Similar to the Granite State Poll, the NHBMPP data collection efforts from 2014 show that around 78% of the total population and 75% of households are considered to be 'served' by residential broadband. But, there is a significant portion of households, and the population overall, that is under- or un-served. Equally important, there are regions of the state where there are gaps in service from one neighborhood to another.

Population Analysis (Residential Providers)		
No Service	0	0.0%
Unserved	8,715	0.7%
Underserved	155,545	11.8%
Underserved with reported gaps	36,430	2.8%
Served	1,029,178	78.2%
Served with reported gaps	86,602	6.6%
Total Population	1,316,470	100.0%

Household Analysis (Residential Providers)		
No Service	0	0.0%
Unserved	4,335	0.7%
Underserved	85,755	13.9%
Underserved with reported gaps	20,621	3.4%
Served	459,851	74.8%
Served with reported gaps	44,192	7.2%
Total Households	614,754	100.0%

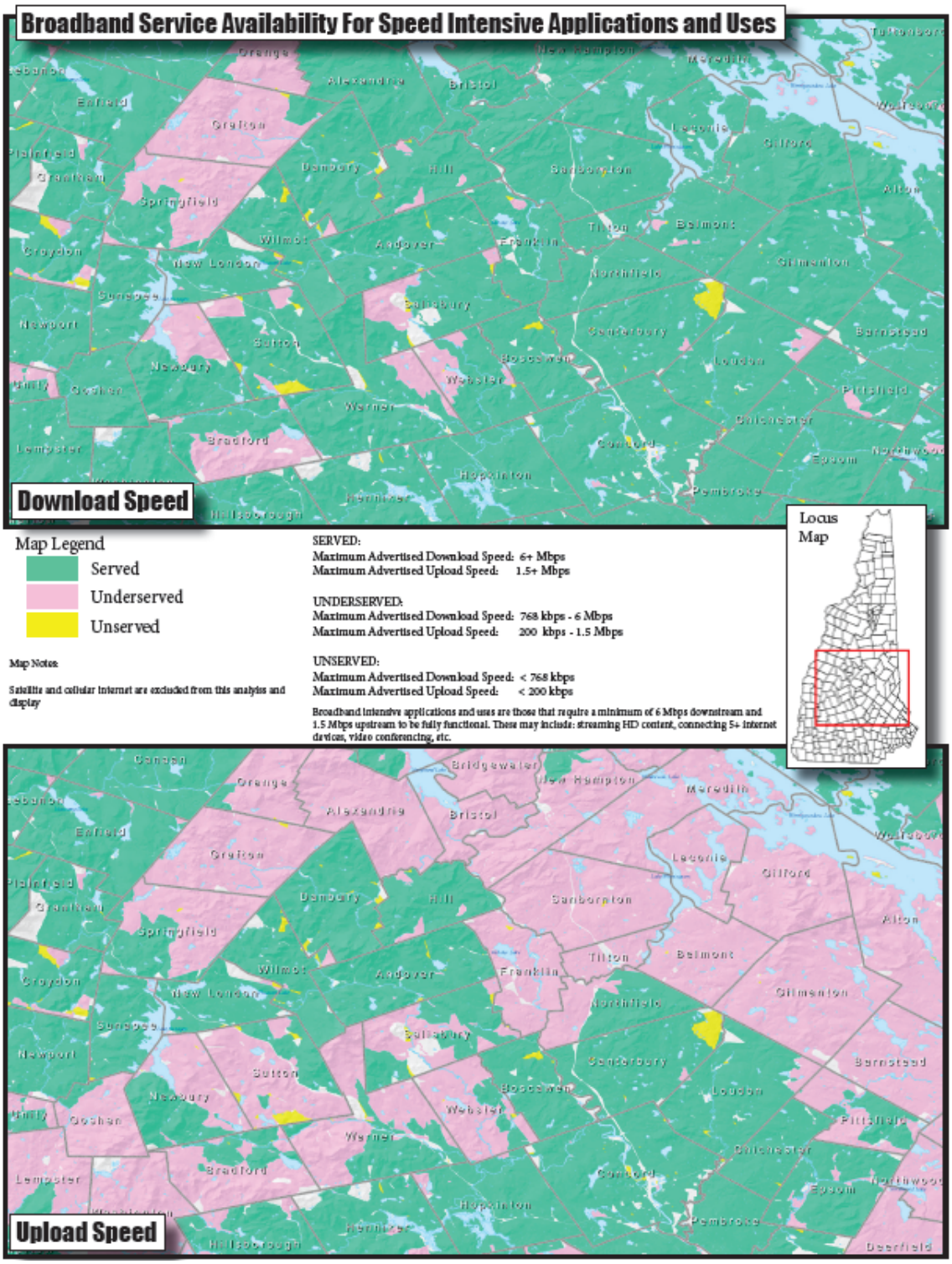
Download Versus Upload Speeds

Much of the discussion around broadband access is focused on "speed." There are two aspects of speed to consider. First is download speed, which refers to the speed at which data is received to a computer or local device from the internet. Download speed is critical when accessing data, video, and other information from the internet. Upload speed, on the other hand, refers to the speed at which data and information is transmitted from your computer or local device to a location on the internet. Upload speed matters when one is transferring large amounts of data from their computer/device to the internet. For individuals, health care facilities, educational institutions, or businesses to utilize functions such as interactive on-line learning, and mega data transfer, upload speeds of 6 Mbps or higher may be required.

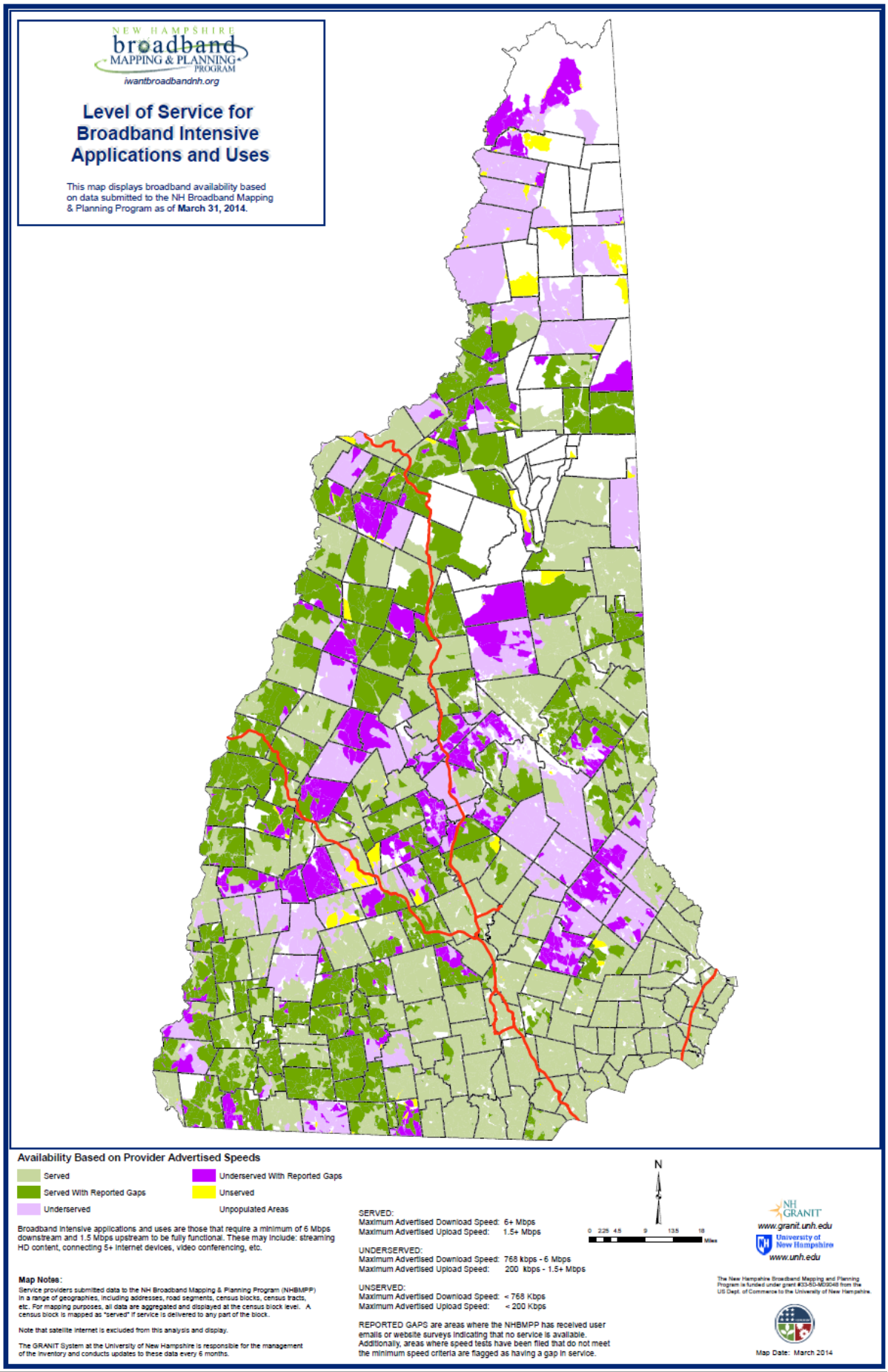
For these and other reasons, high-tech companies are more concerned with upload speed than download speed and are far more likely to move to areas served with respect to upload speed. Today's increasingly mobile workforce is far more likely to consider upload speed when choosing where to locate, particularly if they telecommute to work. As well, educational institutions recognize that students' ability to access and share high-quality, interactive on-line learning content may be dependent on sufficient upload speeds. And lastly, rural areas with limited access to health care facilities require fast upload speeds to facilitate telepsychiatry and telemedicine.

Many internet service providers boast high-speed internet, citing the download speeds accessible in their service areas. Research suggests that there are stark differences in internet upload speeds from one town to another, in spite of advertised download speeds.

In New Hampshire, there are two different stories when looking at maps of download speeds and comparing them to upload speed maps. Different internet providers offer different services and while a large region of the state might look fairly uniform in terms of download speeds, sharp contrasts appear at service provider boundary lines when looking at the same region in terms of upload speeds. The two maps on the following page, using 2014 data, cover the same portion of central New Hampshire. However, the first map displays areas served and unserved in terms of *download* speed and the second map in terms of *upload* speed. When assessing a region's broadband capacity, it is important to consider upload speeds.



Download speeds of 6 Mbps or more and upload speeds of 1.5 Mbps are at the low end of what is functionally needed today. The Federal Communications Commission is looking at redefining broadband as speeds of a minimum of 25 Mbps download and 2 Mbps upload. Using this definition, one can see that vast portions of the state fall into of the “underserved” category.


NEW HAMPSHIRE
broadband
MAPPING & PLANNING PROGRAM
iwantbroadbandnh.org
Level of Service for Broadband Intensive Applications and Uses
This map displays broadband availability based on data submitted to the NH Broadband Mapping & Planning Program as of March 31, 2014.
Availability Based on Provider Advertised Speeds
Served
Served With Reported Gaps
Underserved
Underserved With Reported Gaps
Unserved
Unpopulated Areas
Broadband intensive applications and uses are those that require a minimum of 6 Mbps downstream and 1.5 Mbps upstream to be fully functional. These may include: streaming HD content, connecting 5+ internet devices, video conferencing, etc.
Map Notes:
Service providers submitted data to the NH Broadband Mapping & Planning Program (NHBMPP) in a range of geographies, including addresses, road segments, census blocks, census tracts, etc. For mapping purposes, all data are aggregated and displayed at the census block level. A census block is mapped as "served" if service is delivered to any part of the block.
Note that satellite internet is excluded from this analysis and display.
The GRANIT System at the University of New Hampshire is responsible for the management of the inventory and conducts updates to these data every 6 months.
SERVED:
Maximum Advertised Download Speed: 6+ Mbps
Maximum Advertised Upload Speed: 1.5+ Mbps
UNDERSERVED:
Maximum Advertised Download Speed: 768 kbps - 6 Mbps
Maximum Advertised Upload Speed: 200 kbps - 1.5+ Mbps
UNSERVED:
Maximum Advertised Download Speed: < 768 Kbps
Maximum Advertised Upload Speed: < 200 Kbps
REPORTED GAPS are areas where the NHBMPP has received user emails or website surveys indicating that no service is available. Additionally, areas where speed tests have been filed that do not meet the minimum speed criteria are flagged as having a gap in service.
N
0 2.25 4.5 9 13.5 18
Miles
NH GRANIT
www.granit.unh.edu
University of New Hampshire
www.unh.edu
The New Hampshire Broadband Mapping and Planning Program is funded under grant #33-10-M030048 from the US Dept. of Commerce to the University of New Hampshire.
Map Date: March 2014

What Are Unserved and Underserved New Hampshire Residents Missing Out On?

The consequence of this digital divide is that residents, businesses, and institutions in certain parts of the state are not able to leverage the opportunities and efficiencies gained through broadband access. Without the ability to use high-speed internet, businesses in un-served areas will not be able to compete with those in areas with high levels of broadband access and utilization, children will not be able to access the same kinds of educational resources as their counterparts in metropolitan areas, and many rural residents with limited hospitals and medical facilities will not have ready access to critical care services and consultation.

Community anchor institutions such as schools and libraries need effective broadband to achieve their own educational missions, but also because they play a key role in providing the public with access to broadband and its benefits. Unfortunately, too many of these key institutions remain unserved or underserved with respect to broadband.

What Is the Holdup in New Hampshire?

There are a number of factors that make expanding broadband access across the state difficult. Foremost, there are parts of the state that are sparsely populated, and often topographically challenged, where it is not cost effective for the private sector to provide high-speed internet. The return on investment is generally lower in rural regions, where there are potentially fewer subscribers to purchase services. To mitigate this issue, the FCC instituted the Universal Service Fund, which partially subsidizes cost of deployment in underserved areas. The challenge is that the funds available are not sufficient to address the large number of rural, underserved areas.

There is also a perceived lack of need in some rural regions, as well as some urban areas. If individuals without internet access have no experience from which to gauge the benefits of broadband, they are not likely to value it as much as others with more experience. In New Hampshire, more of those without internet experience tend to be in the rural areas. A recent Granite State Poll, as well as focus groups conducted by several Regional Planning Commissions, suggest that people in rural regions are less supportive of investing in broadband infrastructure than respondents from more urbanized areas. When people across the state were asked what the biggest barrier to broadband internet access was, 30% of respondents statewide said that it is too expensive. In the North Country and the Upper Valley—both of which are rural regions—44% said that broadband is too expensive. Many rural respondents also indicated that they simply don't know how to use the internet.

What Can You Do to Help?

Considering that certain parts of the state have limited access to broadband internet—even though the landscape is changing very rapidly—there are a number of things that you can do to help address challenges and opportunities for expanding access:

1. Take the New Hampshire Broadband Mapping and Planning Program (NHBMPP) speed test. Taking the speed test will not only tell you if your internet is as fast as you think it is, but it will help us assess current broadband availability and plan for future broadband expansion in New Hampshire. To take the speed test, go to http://iwantbroadbandnh.org/speed-test

2. Assess your community's broadband readiness. The readiness assessment will help your community or region determine strengths with respect to and opportunities for expanding broadband access. It is a good starting point if you want to organize locally or regionally. To find out more about what is happening in your community or region, go to http://cecf1.unh.edu/CommDev/econ_surv/index.cfm

3. Get involved with broadband internet-related discussions in your region. Whether you are a resident, business owner, institution representative, or local official, there are a number of opportunities for you to engage in the discussion about broadband in your region. To find out how you can get involved, go to http://www.iwantbroadbandnh.org/get-involved

4. Access NHBMPP resources. These resources explain broadband, why it is important, where it is available and how businesses, organizations, and communities can get more of it and make better use of it. To learn more about NHBMPP, go to http://iwantbroadbandnh.org/

5. Promote the establishment of a formal state entity. Such an entity could help to facilitate the universal availability of broadband in New Hampshire.

References:

Czernich, N., Falck, O., Kretschmer, T., & Woessmann, L. (2011). Broadband infrastructure and economic growth. The Economic Journal, 121(552), 505-532.

Kolko, J. (2012). Broadband and local growth. Journal of Urban Economics, 71(1), 100-113.

Madden, M., Lenhart, A., Duggan, M., Cortesi, S., & Gasser, U. (2013). Teens and technology 2013. Washington, DC: Pew Internet & American Life Project.

Stenberg, P., Morehart, M., Vogel, S., Cromartie, J., Breneman, V., & Brown, D. Broadband Internet's Value for Rural America, white paper, United States Department of Agriculture, Aug. 2009.

Whittacre, R., Gallardo, R., and Strover, S. (2013). Rural Broadband Availability and Adoption: Evidence, Policy Changes, and Options. National Agricultural and Rural Development Policy Center.

Summary

Broadband internet is a fundamental aspect of modern life and a major contributor to quality of life. Economic growth and development, health care, and education all increasingly depend on broadband access. Without it, prospects for enhancing people's well-being are limited.

While basic broadband speeds (less than 6 Mbps down) are available to most New Hampshire residents, not everyone has access to the faster speeds required today for simultaneous use of multiple devices, cloud-based business applications, telemedicine, etc. Places without access to faster speeds—including some rural parts of the state—will ultimately lose potential new businesses, they will not be able to attract or retain telecommuting workers, and their educational and health care institutions will not be able to provide the highest levels of service. These are key factors to economic growth and quality of life in New Hampshire communities.

It is also important to note that both download and upload speeds are equally important for broadband, but these can vary spatially—a given area may be effectively served in terms of download speed, but under-served in terms of upload speed. A lack of attention to upload speed could pose challenges for communities and regions that focus solely on download speed.

Finally, even those areas considered to have adequate broadband today, particularly for those currently near the threshold of what is considered broadband, can and will soon be challenged to meet the broadband needs of our changing technology and communication practices. Many schools and libraries, for example, may have had broadband capable of meeting past demands, but as the nationwide ConnectED Initiative recognizes, new educational technology will require a whole new generation of much more powerful broadband.

This report is partially funded under a grant from the US Dept. of Commerce #33-50-M09048 to the University of New Hampshire.