

USA: Broadband Access and Adoption in New York State

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1 Introduction

The United States' federal government is placing increasing importance on broadband Internet access. In 2015, the Federal Communications Commission (FCC) classified broadband as a utility, in much the same way as electricity and telephones were classified in an earlier era. This is an explicit acknowledgement of the central role high-speed Internet plays in a modern economy and society, as well as the increased regulatory role the government plays in its development and oversight.

High-speed Internet access has become an integral part of the American economy for both consumers and businesses. Internet access via a broadband connection provides individuals with access to an ever-growing suite of online digital government services and enables participation in the transition to e-commerce and online entertainment. For businesses, particularly small and medium-sized enterprises (SMEs), broadband Internet access is key to increasing competitiveness both domestically and internationally. It reduces transaction costs and enables businesses to actively participate in a global marketplace.

In the U.S., private companies commonly referred to as Internet Service Providers (ISPs) typically provided broadband Internet service. Historically, they were the sole providers and because of the substantial fixed costs involved in the sector, there are few, large telecommunications companies. With the increasing importance of broadband today, government regulation and fiscal policies are increasingly important in ensuring a competitive market to provide universal broadband access and promote adoption. Broadband *access* refers to the physical availability of high-speed Internet service and *adoption* refers to the percentage of people who subscribe to broadband service.

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In 2009, the United States Congress instructed the FCC to develop the National Broadband Plan (NBP). The NBP was one of the first digital strategy documents published by the U.S. federal government. It was released on March 17, 2010 with an overriding goal of providing high-speed Internet access at 100 Megabits per second (Mbps) to 100 million Americans by 2020. This expansive document also outlines the role that broadband services can play in promoting healthcare, education, energy and environment, government performance, civic engagement, public safety, and economic opportunity. Specifically in relation to economic opportunity, the plan outlines goals for increasing the levels of access and adoption that will help businesses compete in a global marketplace and employees participate in a mobile workforce, be it working remotely or while mobile. The plan consists of recommendations for states to act upon and while it does not explicitly require them to take action, federal funding is conditional upon the states implementing these recommendations.

This case study reviews the effectiveness of the NBP's implementation in the State of New York (NYS), in light of the Plan's expectations for the expansive role that the state plays in its implementation. Specifically, it reviews the policies and actions undertaken by both state and local agencies (public and private) to meet the objectives of the NBP to improve access and adoption levels. It also examines the successes as well as challenges that state governments must confront to do so.

2 Broadband Technology

Broadband deployment differs from the construction of other infrastructure in that the standards of what qualifies as "broadband" can shift rapidly. A water line today will still be a water line for the duration of its existence, but broadband connections installed only a decade ago are often obsolete and require upgrading to meet current technological standards of what constitutes "broadband." The evolving definition of broadband proves problematic when assessing broadband projects both in the U.S. and internationally.

Digital data is stored as 'bits' in the form of 1 s and 0 s. Internet speeds represent the bandwidth of the connection and are measured in Megabits per second, with one megabit equal to one million bits. As the size of digital media being produced and consumed increases, so too must the bandwidth required to send and receive it over the network. This need for greater bandwidth is amplified by an increasing number of connected devices, such as mobile phones and tablets, utilizing the connection. A 2015 FCC report¹ concluded that an average household requires a connection of 25 Mbps for all members to be able to realise broadband benefits simultaneously, such as adults performing work-related tasks, children completing school work and entertainment usage.

¹https://apps.fcc.gov/edocs_public/attachmatch/FCC-15-10A1.pdf

The definition of broadband has changed greatly in a relatively short span of time. In 1999 the U.S. FCC defined broadband service as speeds greater than or equal to 200 kbps (0.2 Mbps) for both downloads and uploads. In 2009, the FCC definition was increased to 4 Mbps for downloads and 1 Mbps for uploads. Most recently, the definition was increased again to 25 Mbps down and 3 Mbps up and it is likely that these will be increased further over time. Each change significantly impacts the percentage of the population that had previously been considered to have access. Under the new requirements of 25 Mbps down and 3 Mbps up, many households that previously qualified as having broadband access no longer do— nationwide access levels effectively dropped from 95.4 to 85.3%² in an instant. In 2012 NYS set target specifications for a high-speed connection of 6 Mbps up and 1.5 Mbps down, which were more stringent than the FCC specification at the time. NYS increased its target service speeds again in January 2015, when Governor Andrew Cuomo announced that every resident of the State should have access to at least 100 Mbps connections no later than 2018³ and New Yorkers considered as having broadband by the federal government may not be considered as such by NYS. This evolution of broadband speeds and NYS’s ambitious target are indicated in Fig. 1.

Together with the varied definitions of broadband, the technology and its installation presents many layers of complexity. The exact nature of the construction differs depending on the technology employed. The two dominant technologies are coaxial cable and dedicated Fiber To The Home/Premises (FTTH or FTTP). In both cases cables are run from a local service hub to locations called “nodes” (the

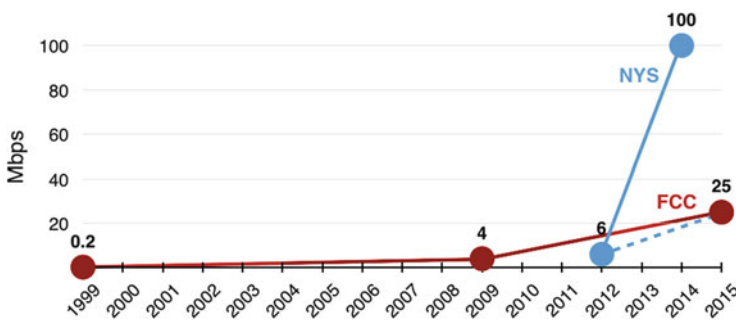


Fig. 1 Minimum FCC Defined and NYS Target Download Speeds. Figure illustrates the disparity in definitions of broadband even within the U.S. by showing the national (FCC) and New York State (NYS) definitions of “broadband” in terms of download speed in megabits per second over time, starting with the FCC’s definition of 200 kbps (0.2 Mbps) in 1999

²Summarize Nationwide Data- National Broadband Map. (n.d.). Retrieved March 20, 2015, from <http://www.broadbandmap.gov/summarize/nationwide>

³2015 Opportunity Agenda: Restoring Economic Opportunity. (2015, January 16). Retrieved April 20, 2015, from <https://www.governor.ny.gov/news/2015-opportunity-agenda-restoring-economic-opportunity-1>

exact nature of this location differs depending on whether it is a cable or fiber connection and also the type of cable or fiber connection). Wire is then laid from the node to the home. A device that translates the raw signal into an electronic signal that is recognisable to personal computing equipment must then be installed at every home or building. Laying the physical connections therefore requires running wires and cables to individual households, which are sometimes contained in multi-family buildings. This differs from many infrastructural provisions such as electricity, gas, and clean and wastewater plumbing which are typically installed at the time of construction. Installing the new broadband connections may require significant access to streets and roads, and remodelling to older buildings.

Country Info:

Estimated Population (2014): 318,400,000

Population Density: 35 people/sq. km

Geographic area: 9,161,923 sq. km

Gross Domestic Product (2014): US\$17,700,000,000,000

GDP per capita (2014):¹ US\$55,590

Internet access (2014)²: 85.3%

Internet adoption (2013)³: 73.4%

Rank in UN E-government Development Index (2014)⁴: 7 of 193

Rank in UN E-participation Index (2014): 9 of 193

Rank in ITU Fixed Broadband Penetration (2013)⁵: 24 of 183

2.1 The United States and Internet and Broadband Services

The United States has historically been the global leader in Internet services. The very first Internet connection was established in the U.S. as part of a cold-war era defense department program called ARPANET and the first transmission occurred between two universities in California in 1969.⁴ The technology to expand access on a commercial level developed through the mid to late 1980s until the formal definition of the Internet by the Federal Networking Council in 1995.⁵ Since then, the ‘network of networks’ has had a transformative impact on telecommunications and digital services in both the United States and globally. A defining characteristic

⁴Leiner et al. (2012).

⁵ibid.

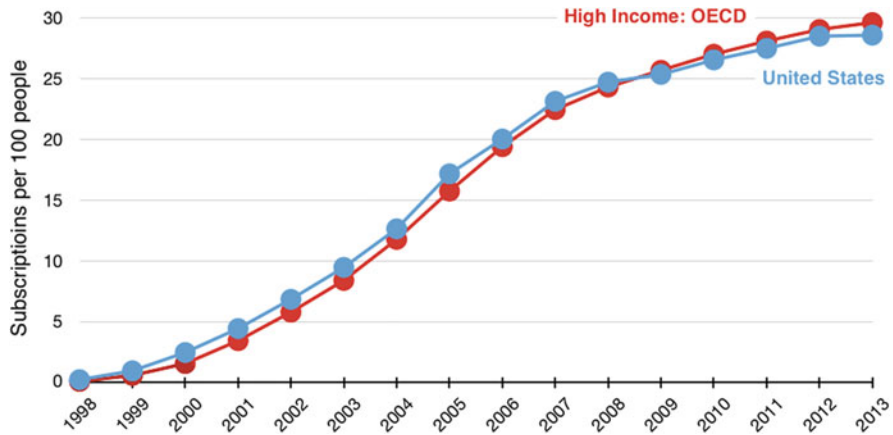


Fig. 2 Internet Subscriptions per 100 People (World Bank (2014))—The World Bank utilizes data from the International Telecommunications Union (ITU). ITU reports household subscriptions per 100 people, rather than subscriptions per 100 people. Multiplying the number of household subscriptions per 100 people by the average number of people in a household yields numbers typically reported in national statistics for broadband penetration). Figure shows the broadband subscription rate (per 100 people) between the United States and the average among all high-income OECD countries over time

of the Internet is the extraordinary speed of its development and the plethora of applications that have been created. It continues to evolve at a pace far beyond those of previous communication technology.

The rapid, early adoption of broadband was not unique to the U.S. and other economically developed countries advanced at a similar rate. According to World Bank data however, starting in 2009 the U.S. fell behind other high income OECD countries in terms of fixed broadband Internet subscribers per 100 people⁶ and by 2010 the U.S. was ranked 15th in global broadband adoption levels.⁷ Figure 2 shows the adoption trends from 1998 to 2013. Adoption in the U.S. leads other high-income OECD countries until 2009, after which it trails by an ever-widening margin.

Even considering a transition to mobile access over fixed connections, the diminished growth of fixed connection subscribers in the U.S. and lower rate in absolute terms compared to other high-income OECD countries is notable. The widening gap between the U.S. and other OECD countries is represented in Fig. 3, which shows the gap as the difference in adoption levels in percentage point terms.

⁶World Bank (2014). Fixed broadband Internet subscribers per 100 people [Interactive online dataset] Retrieved from <http://data.worldbank.org/indicator/IT.NET.BBND.P2>

⁷Shields and Campbell (2010).

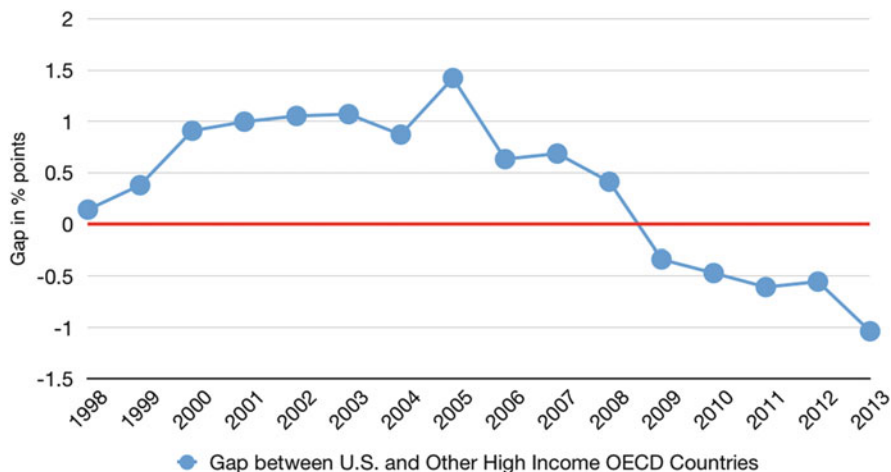


Fig. 3 Adoption Gap Between U.S. and High Income OECD Countries. Figure repurposes the data from Fig. 2 to illustrate how far ahead (or behind) the U.S. is in terms of broadband subscriptions per 100 people. Above the red line (zero) indicates being ahead of the average among high-income OECD countries, below it indicates behind, and the distance indicates the magnitude of the gap

2.2 *Broadband the Economic Crisis of 2008*

This negative and declining trend presented a challenge to the U.S. As early as May 5, 2007, the Congress passed the Broadband Data Improvement Act with the goal of improving “the quality of federal and state data regarding the availability and quality of broadband services and to promote the deployment of affordable broadband services to all parts of the Nation [sic].”⁸ However, in 2008 the U.S. experienced a severe economic downturn. To address this situation, in 2009 the Congress undertook a major financial stimulus program to help the states—The American Recovery and Reinvestment Act⁹ (ARRA). The stimulus package totalled \$840 billion, of which close to \$275 billion has already been disbursed. The legislation contained provisions for three significant broadband related initiatives listed in Table 1. NYS secured a significant amount of funds from the stimulus package.

The Broadband Technologies Opportunity Program¹⁰ (BTOP), which is administered by the National Telecommunications and Information Administration (NTIA), has three categories of projects: comprehensive community infrastructure, public computer centers and sustainable broadband adoption. Community

⁸Broadband Data Improvement Act (2008—S. 1492). (n.d.). Retrieved April 20, 2015, from <https://www.govtrack.us/congress/bills/110/s1492>

⁹Recovery.gov—Track the Money (2015).

¹⁰About | BroadbandUSA—NTIA. (n.d.). Retrieved March 20, 2015, from <http://www2.ntia.doc.gov/about>

Table 1 Broadband Components of ARRA (Data collected from interactive repository:Recovery.gov—Track the Money. (n.d.). Retrieved April 15, 2015, from <http://www.recovery.gov/arra/espsearch/Pages/advanced.aspx?data=recipientAwardsList&AwardType=CGL>)

Name of Provision	US	NYS
10.787 Broadband Initiatives Program	\$3,290,157,834	\$55,531,443
11.557 Broadband Technology Opportunities Program	\$4,051,992,867	\$92,461,218
11.558 State Broadband Data and Development Grant Program	\$318,780,997	\$8,923,532

infrastructure projects focus on laying fiber and increasing access whereas the sustainable adoption programs “include digital literacy training and outreach campaigns to increase the relevance of broadband in people’s everyday lives.” Examples of the latter included a now-defunct New York State program in which old computers were refurbished and provided to economically disadvantaged schoolchildren who were then provided with Internet access at discounted rates.

The State Broadband Data and Development Program¹¹ aims to facilitate the integration of broadband and information technology into state and local economies. Through this program, the NTIA awarded over \$293 million to 56 grantees, one from each state and territory, tasked with supporting “the efficient and creative use of broadband technology to better compete in the digital economy.”¹² In conjunction with this requirement, The NTIA also provides funds to assist states in gathering accurate and current data on the availability, speeds and location of broadband services.

2.3 *Economic Benefits of Broadband*

A 2007 study of the U.S. labor market identified a positive association between nonfarm private employment and broadband penetration. Specifically, the study concluded that, “for every one percentage point increase in broadband penetration in a state, employment is projected to increase by 0.2–0.3 % per year”¹³; on a national level this would result in approximately 300,000 additional jobs. The study further concluded that, “The effect of broadband is most significant in explaining employment growth in education, healthcare, and financial services.”¹⁴

In September 2011, former FCC Chairman Julius Genachowski remarked that, “broadband creates 2.6 new jobs for every one job lost. A 7 % increase in broadband penetration could create an additional 2.4 million new jobs”.¹⁵

¹¹Ibid.

¹²State Broadband Data and Development Program (2010).

¹³Crandall et al. (2007).

¹⁴Ibid.

¹⁵Genachowski, J. (2011, September 27). Fact Sheet: Broadband, Creating Jobs and Driving Economic Growth. Retrieved from <http://www.fcc.gov/document/fact-sheet-broadband-creating-jobs-and-driving-economic-growth>

With a clear understanding that broadband adoption positively impacts economic growth and development, the American Recovery and Reinvestment Act instructed the FCC to develop The National Broadband Plan¹⁶ (described above). President Barack Obama highlighted the significance of the Economic Opportunity and Growth section of the plan in a memorandum published on June 28th 2010: “Few technological developments hold as much potential to enhance America’s economic competitiveness, create jobs, and improve the quality of our lives as wireless high-speed access to the Internet”¹⁷.

Most recently, on April 13th 2015 the NTIA released an impact study which found that, “on average, in only 2 years, BTOP grant communities experienced an estimated 2 % greater growth in broadband availability than non-grant communities. That growth is estimated to generate increased annual economic activity of between \$5.17 billion and \$21 billion. The additional broadband infrastructure could also be expected to create more than 22,000 long-term jobs and generate more than \$1 billion in additional household income each year.”¹⁸

2.4 *New York State*

New York State established the Broadband Program Office (BPO) in 2008 operating under the aegis of the Empire State Development (ESD) agency, New York’s primary economic development agency. BPO is tasked with implementing the state’s broadband strategy and its objectives. Its stated goal is that, “every New Yorker will have access to affordable broadband at speeds of 100 Mbps download [and] 50 Mbps upload” and similarly with respect to adoption that, “New York State will achieve high rates of broadband adoption rate of 80 %.”¹⁹

The BPO has several mandates to oversee New York’s goal of expanding its Broadband program. It is required to publish annual reports documenting progress and upcoming objectives; the latest report issued is from 2012 to 2013. It has also established four taskforces²⁰ comprised of community leaders and government and industry stakeholders. The taskforces were established to assess the needs of the communities before enacting state policies. The BPO’s most important mandate is the allocation of federal and state funds for broadband development, especially in underserved and unserved communities. The federal funds are principally from the American Recovery and Reinvestment Act mentioned above. The BPO then

¹⁶United States Federal Communications Commission (2009).

¹⁷Presidential Memorandum: Unleashing the Wireless Broadband Revolution (2010).

¹⁸Taxali (2015).

¹⁹NYS Goals for Broadband Development and Adoption (n.d.). Retrieved April 3, 2015, from <http://nysbroadband.ny.gov/broadband-goals>

²⁰NYS Broadband Task Forces. (n.d.). Retrieved April 3, 2015, from <http://www.nysbroadband.ny.gov/nys-broadband-taskforces>

redistributes these funds across the state with the goal of achieving local results consistent with the objectives of the National Broadband Plan (for example, grants to private firms who build broadband infrastructure for unserved areas). While 93 % of New York State's population live in urban environments, the state's large population of 19.7 million inhabitants²¹—fourth largest in the country—means there are still 1.4 million residents living in rural regions.²²

In January 2015 New York's Governor, Andrew Cuomo, released the *Opportunity Agenda: Restoring Economic Opportunity*. The strategy document focuses heavily on infrastructural projects particularly in upstate New York, where the population density and average income per capita are considerably lower than in New York City, making it far less attractive for private telecommunications investment. Broadband is the third component of the agenda and Governor Cuomo announced the plan saying, "We're launching the largest state broadband investment in the nation in order to make [our] goal a reality. This is a truly bold undertaking that will improve the lives of New Yorkers in every corner of the State, and I am proud to make it a priority of our administration's second term agenda".²³ The program, *Broadband for All*, which will cost \$500 million in government spending (matching \$500 million in private investments), is funded by state funds received from bank settlements following the economic turmoil several years earlier. It is exclusively aimed at incentivising ISPs to expand service to unserved and underserved areas by promising a 1:1 match of private investments. In addition to attracting private investments it is hoped that the availability of funds will also increase competition where little currently exists, thereby improving affordability and quality of service. Priority for receiving funds is assigned to those ISPs offering speeds of at least 100 Mbps at the lowest costs.

Finally, the plan relies heavily on local communities' input to "guide development". In a similar manner to previous initiatives, Regional Economic Development Councils (REDC), "will submit a comprehensive plan to the State that: (1) identifies unserved and underserved areas; (2) aggregates demand across residential, institutional and business sectors; (3) details the most cost-effective means to provide universal access; and (4) leverages state-owned assets where possible."

3 The New York State Broadband Initiative

This case study focuses primarily on the efforts of New York State and its municipalities to increase broadband access and adoption levels. It uses quantitative data to visualise trends in levels of access and adoption over time, as well

²¹Population—New York City Department of City Planning (2014).

²²USDA ERS—State Fact Sheets New York (2015).

²³Cuomo (2015).

as qualitative data and extensive interviews with various stakeholders to examine broadband policy formulation and implementation.

The case study set out to understand the broadband landscape in New York State. After an initial period of literature review, interviews were conducted with government employees at the state and local level as well as industry experts with extensive experience in the telecommunications industry.

There is considerable documentation detailing the current state of access both nationally and at the state level. The FCC²⁴ and BPO²⁵ both administer mapping projects that aim to show which communities and geographic areas have access at what Internet speeds. NYS Broadband Map is not current and the data is accurate as of June 30th 2014, this results in some discrepancies between the data available via the map and that included on the Governor's website regarding access levels. Figures 4 and 5 show data from New York State's mapping project indicating the percentage of households served by broadband according to the FCC defined speed of 25 Mbps and the NYS target of 100 Mbps: the vast majority of residents have access at 10 Mbps but this decreases considerably for 25 Mbps and further yet for 100 Mbps.

Figure 5 clearly shows how urban areas are much better served at the new higher speed targets. Particularly notable is the sprawling New York City region in the southeastern corner of the state. Other cities in NYS with considerable access are, the capital region (Albany and surrounding cities), the university city of Syracuse, and Buffalo on the western border with Canada.

The FCC also produces biannual reports on Internet usage in households. These studies provided adoption level data that were useful in determining the adoption growth trend in New York State and comparing it to the national average. Figure 6 shows adoption levels for the U.S. and NYS from 2009 to 2013. NYS adoption

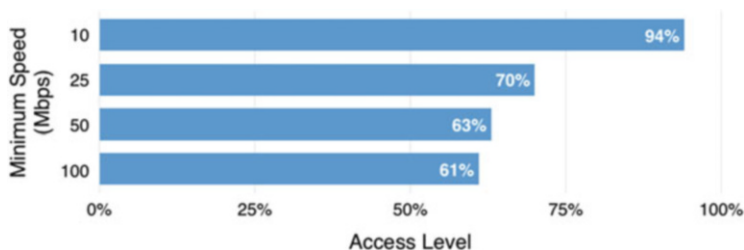


Fig. 4 Percentage of NYS Housing Units with Access at Different Speeds (New York State Broadband Map. (2014, June 30). Retrieved from <http://www.broadbandmap.ny.gov/map/>. Figure shows the level of access that is available for NYS residents at each of the broadband speed tiers. Prior to the recent increase to the minimum speed requirements for broadband, 94 % of NYS residents had access

²⁴Broadband Map—Technology—National Broadband Map (2014).

²⁵NYS Broadband—In Depth (2014).

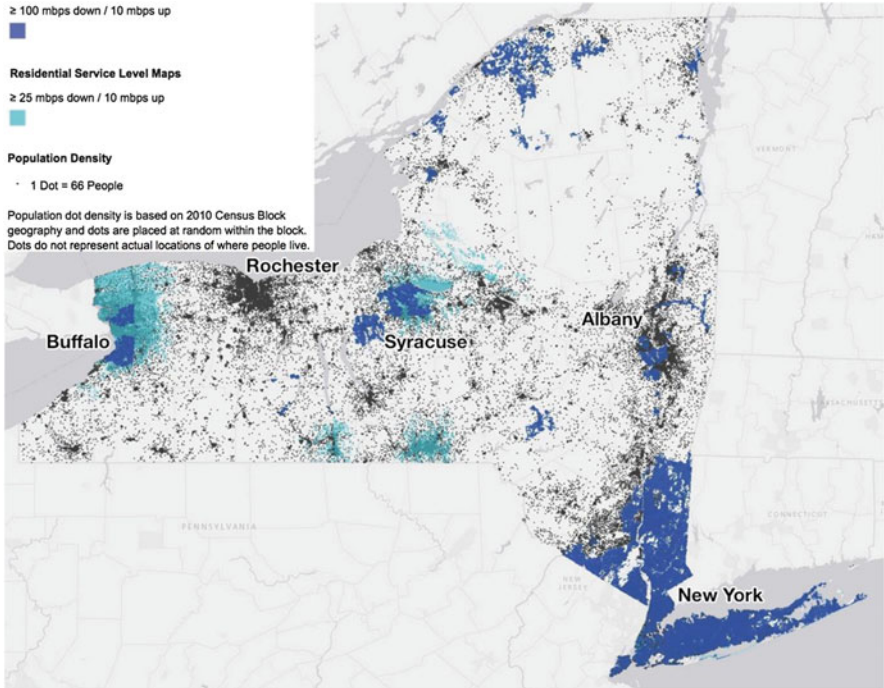


Fig. 5 Areas of NYS with Access Speeds Above 25 Mbps and 100 Mbps. Figure shows areas where residents can subscribe to broadband service at FCC defined speeds of 25 Mbps in *light blue*, NYS target speeds of 100 Mbps in *dark blue* and population density indicated in *black*. Source is in the public domain

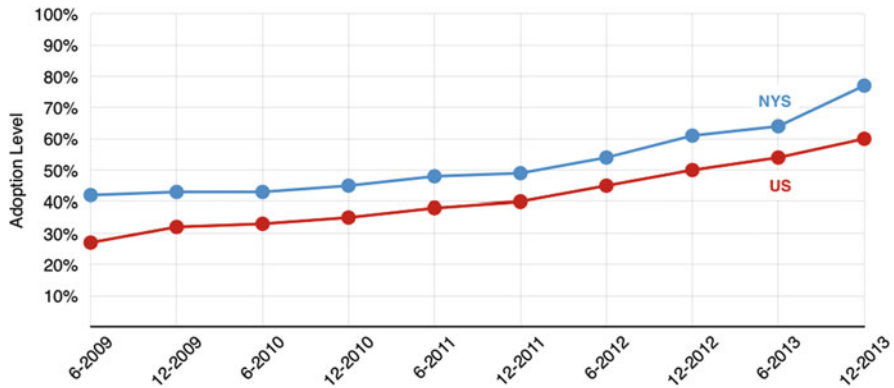


Fig. 6 Adoption in USA and NYS (Data collected from ten biannual FCC reports, all available here: Internet Access Services Reports. (n.d.). Retrieved April 10, 2015, from <http://www.fcc.gov/reports/Internet-access-services-reports>. Figure shows the adoption rate of broadband Internet in the United States and in New York State over time. New York generally tracks national rates until the final period measured (December 2013) when it jumps considerably

levels are higher than the U.S. average although the growth rates are similar. This is true until 2013, when NYS experienced a sharp increase in adoption.

3.1 *The Findings*

On balance, New York State broadband initiative has been effective. New York State is ranked 5th nationally for broadband access measured at the current FCC specification of 25 Mbps.²⁶ However, NYS drops significantly in the rankings for higher broadband speeds, ranking only 25th nationally at the target speed set in 2015 by Governor Cuomo's *Opportunity Agenda* and *Broadband for All* campaign.

Table 2 shows how New York State ranks among the 50 states for providing different download speeds (higher ranking meaning greater percentage of population having access to Internet at that speed).

New York State's success at access (based on current FCC standards) is the reflection of the availability of considerable sums of federal and state funds, a proactive state strategy encouraging broadband access and adoption, and New York City's focus on technology. However, its success is tempered by two factors: the continued need to provide broadband in underserved communities, especially rural areas, and the influence of New York City and its populous and wealthy metropolitan area, on the state broadband performance averages. NYC has a history of embracing technology, especially under the administration of former Mayor Michael Bloomberg (2002–2013). Bloomberg's administration sought to attract technology start-ups to the city and a fundamental requirement for these companies was advanced Internet connectivity. Today, access is predominantly an issue in the city's outer boroughs. In the central parts of the city, where access is less a significant problem, technology initiatives in NYC are focused more on adoption and wireless Internet access. For instance, the LinkNYC Program seeks to convert disused payphones throughout the city into wireless Internet hotspots, free for all to access.

Table 2 New York State's National Ranking for Broadband Availability by Speed (National Broadband Map, Analyze Rank. (2014, June 30). Retrieved from <http://www.broadbandmap.gov/rank>)

Minimum speed (Mbps)	National ranking
10	11
25	5
100	25
1000	18

²⁶Reese and Anderson (2015).

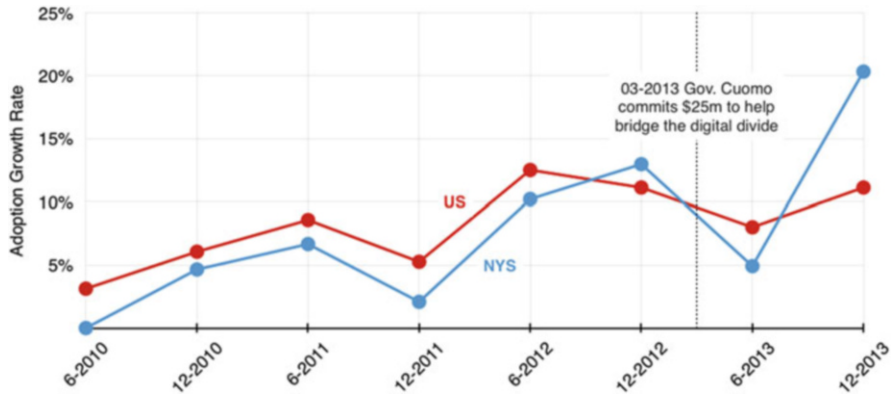


Fig. 7 Adoption Growth Rates in U.S. and NYS. Figure illustrates the rate of growth of broadband adoption both nationally and in New York State and more clearly emphasises the spike in NYS in 2013

A number of rural and urban government officials cited the state funded Connect NY Broadband Program as a probable cause for the spike in state-wide access and adoption numbers in 2013—a trend that can be clearly identified on Fig. 7 showing biannual broadband adoption growth rates for the U.S. and NYS.

The program disbursed grants via Regional Councils and the Empire State Development agency “to promote and expand high-speed Internet access in rural upstate and underserved urban areas of the State [sic]”.²⁷ The program has awarded 70 million dollars in grants and was hailed as “the largest state-level broadband funding commitment in the nation and the first step in strengthening our state’s broadband capacity. The Connect NY Broadband Program has enabled an additional 160,000 New York households, 8000 businesses and 400 community anchor institutions to harness the power of broadband”. A full evaluation of this program is pending completion by the governor’s office in Albany but the *Opportunity Agenda* released by the same office refers to its success and borrows key elements to aid with the implementation of the upcoming \$500 million investment matching program.

Along with the state level programs, New York City has shown remarkable aptitude for finding innovative ways to provide broadband access and adoption to its unserved and underserved residents. Many of these programs have only recently been announced and will be evaluated at a later date. The creativity of these proposals is impressive. Two of the most noteworthy programs involve converting disused telephone booths to gigabit Wi-Fi hotspots (the LinkNYC program detailed below) and the New York Public Libraries providing wireless Internet access

²⁷Connect NY Broadband Program. (n.d.). Retrieved April 11, 2015, from <http://nysbroadband.ny.gov/ConnectNY2012>

devices for free to patrons who enroll in their afterschool education and adult literacy programs and who do not have Internet at home.²⁸

LinkNYC is expected to generate \$500 million in revenue for the government over the next 12 years,²⁹ a feature that distinguishes it from the majority of broadband programs, such as ConnectNY and Broadband for All, that typically require large sums of government spending. Electronic displays on disused telephone booths will serve as an advertising platform managed by a consortium composed of government and private firms known as CityBridge, with the NYC government receiving a share of revenues. The program has been criticised for promoting inequality; the argument is that advertisers strive to locate the booths in areas with high disposable incomes, precisely the sector of society that does not need free broadband access. Government officials have responded by saying the revenue would be spent improving access in other underserved areas of city. In response to this criticism an amendment to the plan relocated some booths to lower income communities. NYC's ability to earn income from LinkNYC is somewhat unique. Midtown Manhattan, where the first, and majority of the booths will eventually be located, has high pedestrian traffic and is a prime location for advertisements. While potentially highly lucrative, it would be a challenge to replicate this program outside of major metropolitan areas.

City officials who were interviewed for the case credited the successful development of innovative ideas to two practices: listening to residents and paying attention to new and exciting technologies. One city official noted that when sourcing ideas for new ways to expand broadband, their traditional feedback process (issuing an official 'request for comment') was often of limited value. Community groups can use it to lobby for tangentially related issues and vendors might use the process to promote their tangentially related services. Instead of relying solely on these requests, city officials have adopted a proactive strategy of idea generation, attending tech-focused social gatherings such as hackathons and informal 'meetups' of like-minded individuals interested in technology. They have also initiated design competitions in which the public is invited to propose ideas for improving broadband access. The city selects the best ideas and creates traditional requests for proposals (RFPs) asking private firms to submit plans and cost estimates as to how the idea can be turned into a reality. A number of these projects, including the conversion of phone booths and the Internet hotspots on loan from libraries, are now underway. While it is too soon to tell whether such projects will be successful, the originality and inventiveness of these concepts, especially for a city the size of New York, is impressive. It also demonstrates the continuing need to adapt new technologies to meet the complex tasks envisioned for digital governance.

²⁸Library HotSpot (2014).

²⁹City Bridge, New York City (2015).

4 Challenges

Despite the fact that broadband penetration in New York State is among the highest in the U.S. in percentage terms, the absolute number of people without access is larger than the entire population of Vermont and Wyoming combined (as well as the population of ten other states).³⁰ There remains considerable work to be done in connecting those who remain without broadband and many complex challenges both internal and external to NYS's actions. Internal challenges are posed by government operations and capacity concerns, while stakeholders such as ISPs, landowners and local communities pose external challenges. These issues are explored in the sections that follow.

4.1 Data Acquisition

The 2007 Broadband Data Improvement Act (p. 8) recognised the importance of accurate and current data prior to the creation of the National Broadband Plan. For example, it is very difficult to design a program that gets broadband to unserved populations if you do not know which populations are unserved. Much of the federal, state and city's work is focused on gathering this data but significant challenges remain. While there is considerable information at the macro level, at the micro level it is comparably imprecise. It is worth noting that at the city level, innovative approaches such as crowdsourcing the data are improving the situation in specific locations. For example, the NYC Broadband Map solicits building tenants to contribute information regarding the Internet services in their building.³¹

Every 6 months, the FCC publishes statistics on broadband subscriber levels across the country broken down by geography and connection speed. The statistics take roughly 1 year to gather, process and publish. Yet numerous government sources from outside the FCC point out that even that effort can only record connections at the "census tract" at the lowest level. One "census tract" can cover between 1200 and 8000 people, and if one of their homes has a connection, they are all recorded as having that connection for the purposes of this survey. Because of the geographic nature of census tracts, this might not be as wildly inaccurate as it may seem on the surface, but it is still far from ideal.

One obvious solution is to collect this information from Internet Service Providers, but these companies are not obligated to share this data with the government. In local projects, smaller ISPs have been willing to do so, but the major telecommunications providers have not.

³⁰Salway, D. et al. (2013). The State of Broadband in New York. In *New York State Broadband Program Office Annual Report 2012-13* (p. 25).

³¹Frequently Asked Questions-NYC Broadband Map [New York Economic Development Corporation]. (n.d.). Retrieved April 7, 2015, from <https://www.nycbbmap.com/#/faq>

4.2 *Pace of Technological Change*

A shift to wireless access also marks a significant change to the telecommunications industry that could have far-reaching consequences. One rural ISP provider noted that wireless broadband access, either satellite or cellular, could make his industry redundant. Currently, range issues and high cost of service limit wireless technology. Mobile technology is not sufficiently fast or reliable to replace fixed connections and meet the needs of businesses—a wired broadband connection is currently between 20–100 times faster than a 4G LTE mobile connection,³² and the caps on data usage are a hindrance for consumers. According to Susan Crawford of the Harvard Kennedy School of Government, the only way for this to change would be for wireless service providers to acquire a significant amount of wireless spectrum (most of which has already been allocated to other users) or construct cellular towers in many more places at enormous expense, neither of which she expects to happen.³³

However, among average users there is increasing evidence that mobile access is the sole point of access for a growing share of users, and mobile connections utilizing 4G LTE technology can meet or exceed the new minimum required speeds of broadband.³⁴ Even if today such speeds are only available in dense urban areas and capped at a batch level of data so as to make it practically unworkable as a substitute for wireline connections, there is significant potential for wireless broadband to be an effective substitute for consumers in the future. This transition to mobile will undoubtedly continue and likely accelerate. If users are content with one, convenient point of access at speeds below those classified as broadband, it affects both access and adoption. The demand for high-speed fixed connections at broadband speeds would decrease and so would investment by Internet service providers in broadband infrastructure. Additionally, in places where access exists, users will choose not to adopt, instead settling for below-broadband speed via wireless connections.

While NYC recognises the transition to wireless and is well positioned to be a forerunner in broadband connectivity, a valuable question is whether the expensive infrastructural investments in the rest of the state will be redundant much sooner than anticipated. This should be a cause for concern for governments aiming to implement digital strategies. Digital technologies advance at a rapid pace, if government implementation does not keep up, strategies may be out-dated before they are implemented. One government employee affirmed this concern and noted

³²Noam (2011).

³³Crawford (2013).

³⁴Aside from Sprint, all major U.S. Carriers exceeded both 25 Mb/s down and 3 Mb/s up in an independent test where all carriers had active networks, San Jose, CA—La, L. (2014, August 5). 4G LTE showdown: How fast is your carrier?—CNET. <http://www.cnet.com/news/4g-lte-show-down-how-fast-is-your-carrier/>

that technology procurement procedures are particularly slow, which delays implementation and exacerbates the situation.

4.3 Economic Incentives for Rural Communities

ISPs are often reluctant to serve sparsely populated rural areas rather than densely populated urban areas for two reasons: low population density means that more miles of cable must be laid to reach the same number of people and areas with low population densities tend to have a lower level of income per square foot. With private companies responsible for building the broadband infrastructure, the business decision of whether to build is determined by the profitability of a proposed project. This was confirmed by a rural ISP CEO, who despite being a staunch proponent of free markets and limited government intervention, commented that without subsidising the broadband access to rural areas it simply would not happen. It was also noted that the subsidies must be carefully targeted toward capital expenditures and not used as supplemental income for local telecommunication companies. The ability to subsidise the ISPs' operations in rural areas is a driving force in providing broadband access in these regions of New York State. This need was confirmed by the State Rural Resources Committee, a research body serving the NYS legislature, which explained that a primary goal is securing funds for broadband infrastructure investments in their rural districts, both from federal and local sources.

4.4 Community Buy-in

Community buy-in takes many different forms. Effective broadband implementation requires the cooperation of the diverse communities involved, and especially the property owners who control access for broadband installation. In urban areas, one of the challenges to broadband implementation is obtaining cooperation from owners of multi-family dwellings whose reluctance to allow ISPs to build on their properties was frequently cited as an obstacle to the installation of broadband infrastructure. As of February 2015,³⁵ broadband is classified as a public utility by the FCC and as such landlords will be legally obliged to grant service providers unhindered access to install required equipment in their buildings. Discussions with city officials revealed a common dispute concerns not whether the connection is installed but rather how the connection is installed. Landlords prefer the cables to

³⁵FCC Adopts Strong, Sustainable Rules to Protect the Open Internet. (2015, February 26). Retrieved from <http://www.fcc.gov/document/fcc-adopts-strong-sustainable-rules-protect-open-Internet>

be underground and out of sight while utilities companies prefer to connect to homes via wires linked to communications towers and poles, thereby avoiding the high cost of digging. This conflict can lead to long delays and difficult negotiations between landlords and ISPs.

To promote community access and building owner cooperation, the New York City's "franchise agreements" allow Internet service providers (ISPs) to build fiber connections to areas that are potentially highly profitable on condition that they also build infrastructure to areas that they otherwise would not serve, typically areas with low income households. While in the short term the ISPs profits may be offset by the added expense, in the long run they stand to benefit from increased revenues over an extended period. However, one major impediment in this program is the 'last mile' stage wherein the city only has the legal authority to make ISPs build to the front door of a building, beyond which the interest of each individual property owner or resident is necessary. In the case of fiber optic, this decision could include the willingness to fund installation. According to the not-for-profit New York City Economic Development Corporation, one way to confront this challenge is to incorporate provisions into the franchise agreements that require the ISPs to finance installations. In contrast, the State Rural Resources Committee noted that in rural areas this has been less of an issue since they are able to use easements, legally obliging a landowner to allow the construction of necessary infrastructure on their property.

City and state employees frequently cited the importance of community buy-in. It was highlighted repeatedly as being critical to any broadband initiative's success. An official at a NYC organisation charged with driving economic growth and creating jobs illustrated this point. The official commented that in the outer boroughs of NYC, SMEs are reliant on local business development organisations for assistance. By working directly with ISPs and these local business development organisations, the city was able to reach a large number of local businesses and provide them with the education and information regarding broadband, its utility, and potential benefits. It was specifically noted that the trust SMEs place in these business development organisations proves extremely valuable and is far more effective than the ISPs marketing the same materials to businesses in a less strategic fashion.

At the state level, the taskforces recently formed by the BPO have devoted their time to engaging with local communities and Regional Economic Development Councils (REDC). The REDCs are headed by prominent community leaders³⁶ and work with the taskforces to assess and convey the needs of their communities, both residents and businesses. The role of the taskforce is to evaluate where investments

³⁶Each Regional Council is made up of approximately 20 members appointed by the Governor, drawn from a broad spectrum of regional stakeholders representing private business, including small businesses; minority- and women-owned business enterprises (MWBES); non-profit organizations; chambers of commerce and trade organizations; organized labor; higher education; community-based organizations; and the agricultural community. https://www.ny.gov/sites/ny.gov/files/atoms/files/2015REDCGuidebook_FINAL1.pdf

in expanding broadband access will be most beneficial. An important role is also developing close relationships with the communities, with the belief that involving them in the process at an early stage and ensuring their cooperation will help lessen the challenge posed by any potential community opposition.

4.5 *Barriers to Adoption*

Access and adoption are inextricably linked. There cannot be adoption without access, but demand, a determinant of adoption levels, is likely to be lower in areas without access due to less familiarity with the technology and its benefits. NYS acknowledges this interconnected nature by integrating adoption requirements in the grants it provides to ISPs for infrastructure expansion. Additionally, approximately 10 % of the \$500 million earmarked by the state for broadband expansion will be devoted to adoption programs. However, ISPs admittedly will only implement the required adoption component once they have laid the infrastructure and customers are able to subscribe. This results in investments in adoption being dependent on investments in access. NYC, with substantial access in place, has progressed further with adoption initiatives than the rest of the state.

There are a number of commonly identified reasons for users not adopting broadband services. Among them are cost, lack of perceived utility, low levels of digital literacy, and security and privacy concerns. One determinant of cost is competition (or the lack of it). Two companies currently dominate the broadband market in the U.S.³⁷ with a combined market share of 57 %. In a nationally televised interview, the CEO of one firm stated that they have effectively divided the country into designated areas so that they do not compete.³⁸ The FCC overtly expresses its concern over the lack of competition within the service footprint of these companies and FCC reports document the number of providers available to consumers in an effort to monitor the competitive nature of the broadband market. In September 2014, FCC Chairman Tom Wheeler said, “three-quarters of American homes have no competitive choice for the essential infrastructure for twenty-first century economics and democracy”³⁹ and on April 23rd 2015, FCC opposition was cited as the reason for the proposed merger of the two largest ISPs being cancelled.⁴⁰ The NBP explicitly addresses the issue of competition and prescribes policies to encourage a healthy marketplace.

³⁷Ramachandran (2015).

³⁸Roberts (2014).

³⁹Reardon (2014).

⁴⁰Garrahan et al. (2015).

Cost factors are also reflected in other ways. Residential service at 500 Mbps in NYC costs \$299.99 per month according to a December 2014 report⁴¹ issued by the New York City Comptroller and other government officials indicate that in NYC a 1 Gbps (1000 Mbps) connection costs approximately \$8000 per month. To provide access to economically disadvantaged communities, ISPs offer special discounted plans but these programs have limitations. For example, entry requirements are limited to those with at least one child in public school eligible for reduced price lunches, approximately 1.85 times the national poverty level, \$35,158 in 2015.⁴² New York City officials were quick to point out that a significant portion of these families do not live in the service areas of these companies. Even for families who both qualify and live in a serviced area, the speeds are only 5 Mbps, one-fifth the current definition of broadband speed.

While the high cost of installation and service is the most intuitive obstacle to broadband adoption, recent studies have cited digital illiteracy and a lack of perceived utility as possibly more instrumental in influencing consumers' behaviour. Price is a more significant factor in commercial grade connectivity, where gigabit connections cost upwards of \$8000 per month. Small and medium sized businesses have difficulty affording these high prices. To effectively reduce the cost of accessing high-speed Internet, the NYC Economic Development Corporation operated a program called ConnectNYC⁴³ that allowed companies to receive free fiber build-out to their business, valued at \$50,000, on condition of obtaining a signed landlord agreement and committing to a service contract with a provider. The equivalent of \$12 million of funding was distributed over the 2 years of the program.

One proposed reason for a lack of adoption initiatives, particularly outside of the urban setting, is the idea of "technological arrogance." This refers to the failure of early adopters and 'tech savvy' individuals to foresee that consumers would not avail themselves of the opportunity to subscribe to broadband Internet services as soon as they had access. Without an understanding of the perceived benefit there might not be demand even if the cost is low. Subscription rates in rural, previously unserved, areas are currently 50%. Half of those now with broadband access choose not to subscribe. Connect NY grants expire after 3 years and contain an explicit requirement for the ISPs to implement an adoption component. As of now, the adoption initiatives are at the planning stage with discussions being held with public libraries and other community institutions on how best to drive adoption higher. Ideas being considered include, subsidising the cost of hardware (chromebooks and iPads) for school children without broadband at home and

⁴¹Internet Inequality: Broadband Access in NYC. Office of the New York City Comptroller. (2014, December 1). Retrieved from http://comptroller.nyc.gov/wp-content/uploads/documents/Internet_Inequality.pdf

⁴²Income Eligibility Guidelines for School Meals. USDA (2015).

⁴³ConnectNYC Fiber Challenge. (n.d.). Retrieved April 13, 2015, from <http://nycfiberchallenge.challengepost.com/>

establishing weekly classes for elderly residents to improve digital literacy. All the initiatives being pursued focus on residential service as opposed to businesses. It was noted that NYS considered utilising the services of a private firm (SNG) that communicates the benefits of broadband to businesses by presenting data showing increased revenues on a progressive scale as a company's level of technology integration and adoption increased. After evaluation, NYS chose not to proceed with that initiative but other states have and they have seen successful outcomes.

5 Conclusion

New York State's focus on broadband expansion to underserved communities and increasing broadband adoption through innovative programs are prime examples of how states are seeking to achieve the United States' national goal of expanding broadband access to its citizens. A number of factors have emerged as being influential in New York State's relatively successful broadband rollout.

A critical element in successfully implementing its broadband strategy is active governmental support. Government leaders for both New York State and New York City have clearly and repeatedly stated that broadband access and adoption will be a priority during their tenure. The willingness of local leaders to prioritize political capital and resources to this cause undoubtedly has had a significant impact on broadband funding and established it as a priority for the departments under their aegis. While state and local officials have occasionally admitted that federal policy can have a limited influence (at least without funds to back it up), there is little question that such policy stances demonstrate the critical focus placed on the importance of broadband access and adoption.

Not surprising, financial resources are extremely important in installing broadband infrastructure, both in the form of grants and investment matching programs. Government policies that provide financial incentives are a primary tool to be used in incentivising firms to expand to less lucrative markets—primarily rural and low-income regions. New York is a wealthy state, largely considered the financial hub of the world. The financial crisis of 2008 ironically provided a silver lining for the future broadband agenda by furnishing the state with extensive settlement funds from banks that had acted irresponsibly. The government agencies that administer the monies to ISPs are able to set the conditions of these grants to maximise their effectiveness. The Connect NY program's requirement that ISPs implement an adoption component following the expansion of broadband infrastructure is a positive example of how the state can productively use its influence and power. Similarly, Governor Cuomo's Broadband for All initiative, announced in early 2015, will prioritise the granting of funds to those ISPs who will provide the fastest Internet service at the lowest cost to consumers.

New York State's relative success is also the result of it being a highly urbanized environment, with 93 % of its residents living in an urban setting. Dense urban environments have better broadband service because of the lower cost per capita to

ISPs to install infrastructure. Yet challenges remain. More than a million residents of the state do not have access to broadband and even New York City, with its high rates of accessibility, still has 27 % of its households without broadband.⁴⁴

When asked directly for advice, officials involved in these new innovative programs offered three practices that they expected would help communities improve their broadband access and adoption: find creative ways to get the opinions of your citizens, pay careful attention to what is happening in the technological space, and spend time meeting with other governments who are facing similar issues, as even if their circumstances are different, they may have a solution that can be adapted to fit your needs.

At this stage of technological development, evaluating the success of broadband initiatives focuses principally on assessing output in terms of increased access and adoption rates. However, the NBP views increasing access and adoption rates as a means to an end—having a potentially significant positive impact on economic growth and opportunity. New York State is not currently measuring these outcomes. It is critical that government not lose sight of the National Broadband Plan’s ultimate goal.

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⁴⁴Internet Inequality: Broadband Access in NYC. (2014, December 1). Office of the Comptroller, City of New York. Retrieved April 23, 2015, from http://comptroller.nyc.gov/wp-content/uploads/documents/Internet_Inequality.pdf

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