

## Set it in Stone: Investing in 21<sup>st</sup> Century Broadband in New Hampshire to Secure Telehealth for All Residents

### Introduction

Broadband - a digital connection permitting a large amount of data to be transmitted over a connection within a certain amount of time - has gone from being a luxury to a near necessity in the U.S., impacting education, business, and healthcare. According to the Federal Communications Commission, "... high-speed broadband and the digital opportunity it brings are increasingly essential to innovation, economic opportunity, healthcare, and civic engagement in today's modern society. With many jobs, schools, and healthcare services shifting to virtual environments in the wake of the ongoing COVID-19 pandemic, the need to deliver broadband connectivity across America has never been greater...Americans in rural and remote regions continue to rely on broadband to stay connected to services and opportunities that are physically in distant locations."<sup>i</sup>

There are multiple federal funding resources for increasing access to broadband, the most recent being state and local recovery funds made available through the American Rescue Plan Act for necessary investments in infrastructure, including broadband.<sup>ii</sup> New Hampshire state government was allotted more than \$994 million in these funds.<sup>iii</sup> In the most recent legislative session, the General Court enacted a state matching funds program to encourage broadband providers, political subdivisions, or communications districts to undertake installation of broadband infrastructure. The General Court also enacted legislation that allowed a municipality, county, or communications district to issue bonds and enter into a public/private partnership with internet services providers for the purpose of financing broadband infrastructure.

New Hampshire is on the cusp of deploying tens of millions of dollars to invest in reliable broadband in every corner of the state. To leverage the most value out of this investment, it is important to understand what broadband modalities and speeds are currently used in the state and where those assets are located. Deployment of 21<sup>st</sup> century broadband throughout the state is fundamental to the continuation of telehealth services. State of the art broadband ensures telehealth services that are equitable in access, robust in every region regardless of demography or topography and sophisticated enough to adapt to technological innovations that although may be as yet unimagined, are undoubtedly on their way.

## The Crux of the Broadband Issue

The Federal Communications Commission (FCC) produces maps that depict broadband access in each state in the US.<sup>iv</sup> On the FCC map of New Hampshire, the most widely available modality of delivering broadband is cable. However, fiber, not cable, is the gold standard for broadband access and can deliver broadband access transmission at the fastest speeds. The cost, however, of installing fiber optic broadband is high. The cost of a mile of broadband infrastructure in Manchester is the same as a mile of infrastructure in Berlin, but the number of potential customers to generate revenue is far smaller. Simply put, in regions with less dense populations, the cost of the infrastructure may simply outweigh the potential revenue. New Hampshire faces two common issues with respect to broadband: where does it need to invest to close the digital divide - the digital divide being the economic, educational, and social inequalities between those who have computers and online access and those who do not; and equally as important, the second issue of what modality of broadband infrastructure should be invested in to ensure equitable access to telehealth, secure the capacity to adapt to technological innovations, and generally optimize broadband in the Granite State for the next 20-30 years.

## Broadband Data and New Hampshire

### Federal Communications Commission Broadband Data Overstate Broadband Access.

According to Federal Communication Commission (FCC) data, 96.85% of New Hampshire has broadband coverage provided by 3 or more providers.<sup>v</sup> This statewide figure masks a few sharp and significant distinctions: 1) Rural regions have significantly less access to broadband service than urban regions, and 2) 68 percent of the state has no access to the gold standard of broadband modalities, which is fiber.<sup>vi</sup> Moreover, how the FCC defines what modalities count as broadband and how the FCC defines whether a region has broadband service together exaggerate broadband access in New Hampshire.

**FCC's Speed Standard for What Constitutes Broadband Access Is Dated and Likely Insufficient for Households Operating Multiple Devices and Conducting Multiple Transactions.** FCC defines broadband access as having access to a high-speed broadband connection offering at least 25 megabits per second (*Mbps*) download by 3 *Mbps* per second upload provided. However, there is disagreement within the FCC as to whether this speed measure is sufficient to reflect current need, with FCC commissioners suggesting that the minimum required speed should be 100 *Mbps*, given that households operate multiple devices and conduct multiple transactions over the internet.<sup>vii</sup>

**FCC’s Service Area Definitions Overstate Broadband Access.** The FCC broadband data is reported by census tract. If an internet service provider reports that one household in a census tract has service, the entire census tract is deemed as having service, even if no other household in the census tract has access to broadband.<sup>viii</sup> Thus, FCC’s reporting of regions where broadband access is available overstates access to broadband.

**FCC’s Definition of Broadband Encompasses 5 Modalities, Only One of Which is Fiber Optic Cable, the Gold Standard for Broadband Transmission.** The FCC broadband map for New Hampshire defines broadband coverage as five modalities listed below and advertised as operating at a speed of equal to or greater than 25 *Mbps* download and 3 *Mbps* upload. Notably, while fiber optic cable is the gold standard for broadband transmission because it has the most capacity for high-speed transmission, it is not the dominant modality for providing broadband in New Hampshire, cable is. Some technologies are faster and less susceptible to interference due to topography and weather than others. Moreover, not all providers provide broadband at the minimum 25/3 speeds to all customers; advertised bandwidth of an internet service provider is not a guarantee that every household serviced will experience those same speeds.

Below are descriptions of each of the five modalities that constitute FCC’s broadband definition along with a New-Hampshire specific analysis that highlights what percentage of New Hampshire has access to each modality, as represented on the FCC broadband map of the Granite State. Only when **all** of the modalities listed below are combined in a search of the New Hampshire broadband map does one obtain the result that 96.85% of the state has broadband.<sup>ix</sup>

- **Asymmetric Digital Subscriber Line (ASDL):** ASDL Stands for Asymmetric Digital Subscriber Line. It is a broadband connection that works through the existing copper wires of landline phone lines. Searching the NH FCC broadband map by this technology alone at the FCC standard speed of 25/3, reveals that **66%** of New Hampshire has no broadband provider and 33% of the state has 1 broadband provider. For rural regions, 71% of the state has no internet service provider and only 29% of the state is considered as having 1 broadband provider through ASDL.
- **Coaxial Cables:** Cable broadband references coaxial cables, which are used to connect to the internet, providing a faster internet connection than the traditional copper phone line cables used. Searching the FCC broadband map by this technology only at the FCC standard speed, **7%** of New Hampshire has no broadband provider and 93% of the state has 1 broadband provider. For rural regions, 15% of the state has no internet service provider and 85% is considered has having 1 broadband provider through cable.

- **Fiber Broadband:** Fiber broadband refers to fiber optic cables, which are better at transferring data than standard copper cables and coaxial cables. Fiber-optic internet, commonly called fiber internet or simply “fiber,” is a broadband connection that can reach speeds of up to 940 Megabits per second (*Mbps*), with low lag time. In addition, fiber-optic cables are not as susceptible to severe weather conditions as other types of traditional cables, which helps minimize outages. **Searching the FCC broadband map by this technology at the FCC standard speed of 25/3, 68% of New Hampshire has 0 broadband access and 31% has only 1 service provider. For rural regions, 74% has 0 broadband access and 25% has 1 service provider.**
- **Fixed Wireless:** Fixed wireless is a type of internet service delivered using transmitters to send and receive internet signals from one point to another. Transmitters are affixed to stationary objects—like poles, buildings, or towers—at strategic locations, combining to create a wireless network. Unlike cellular towers, fixed wireless transmitters are hardwired into an Internet Service Provider (ISP) network. Rain, fog, and other weather conditions can affect signal strength. There also has to be a line of sight between the receiver and the wireless base station. Obstructions such as trees and hills can affect the quality of the service and can even prevent it from being set up.<sup>x</sup> Searching the FCC broadband map by this technology only at the FCC standard speed of 25/3, **99%** of New Hampshire has **no** broadband provider, .73% has only 1 service provider. For rural regions, 98% has no broadband access and 1.63% has 1 service provider.
- **Satellite Internet:** Satellite internet is wireless internet beamed down from satellites orbiting the Earth. Weather conditions affect satellite internet. The signal has to travel through the entire atmosphere and back. That means a storm in the next state can cause problems. Lag time can also be an issue because the satellite is positioned much farther from the receiver on the location (the house or the building) than the wireless base station, satellite internet suffers from high latency. This can make even a high-speed connection sluggish and has a big impact on things like online gaming and streaming video.<sup>xi</sup> Searching the FCC broadband map by this technology only at the FCC standard speed of 25/3, 100% of New Hampshire has access in both urban and rural regions.

### [Older FCC Broadband Data about New Hampshire Suggested 99,000 People Do Not Have Broadband Access, Predominantly in Rural Regions.](#)

Other data from FCC also suggest that tens of thousands of Granite Staters do not have adequate access to broadband: a 2016 FCC report reported that more than 99,000 people in New Hampshire did not have access to broadband, with 77,000 of them living in rural regions.<sup>xii</sup> A more recent FCC report reflected that by the end 2019, New Hampshire had an adoption rate of 83.4% for fixed terrestrial broadband services. In other words, the state adoption rate for the four modalities of broadband delivery that the FCC tracks, excluding

satellite coverage, was 83 percent.<sup>xiii</sup> In the same report, FCC data reflects that 98% of the 818,191 people in urban populations and 94% of the 541,515 people in rural population have access to 25/3 *mbps* broadband.<sup>xiv</sup>

### Non-FCC Federal Broadband Data about New Hampshire Reveals Rural/Urban Divide

Other federal resources reflecting broadband access in the US also reveal differences in broadband service availability among regions of the state. For example, the National Telecommunications and Information Administration (NTIA) issued an interactive broadband access map in June of 2021.<sup>xv</sup> A county-by-county search of this map in New Hampshire reflects a wide disparity of access to internet service at speeds of 25/3 *mbps* by county, ranging from nearly 18% of households in Coos County having no internet access to 6.6% of households in Rockingham County having no internet access.<sup>xvi</sup>

Indicators of Broadband Need in New Hampshire	
As Recorded on National Telecommunications and Information Administration Map <sup>xvii</sup>	
County	Access
Belknap County, population 61,303	10% of households have no internet access
Carroll County, population 48,138	10.4% of households have no internet access
Cheshire County, population 76,085	12.9% of households have no internet access
Coos County, population 31,563	17.6% of households have no internet access
Grafton County, population 89,886	11.9% of households have no internet access
Hillsborough County, population 417,025	7.9% of households have no internet access
Merrimack County, population 151,391	10.4% of households have no internet access
Rockingham County, population 309,769	6.6% of households have no internet access
Strafford County, population 130,633	10.5% of households have no internet access
Sullivan County, population 43,146	13.4% of households have no internet access

Each of these data sources underscores that a digital divide exists in New Hampshire and that cable is the dominant vehicle for broadband transmission in New Hampshire. This data is significant to understand as the state choose what type of service it wants to invest in and where it wants to locate those assets.

## How Other States are Approaching Broadband Access Initiatives

While states and regions can vary significantly, broadband expansion and access have been addressed in many states. Generally, state broadband activities appear to center around some combination of the following activities and goals:

- achieving universal access to broadband for residents,

- providing grant support to encourage projects in unserved or underserved areas,
- identifying policies and procedures that could speed broadband infrastructure deployment,
- establishing an entity to coordinate broadband activities for the state,
- improving data collection and mapping of broadband access, and
- soliciting stakeholder participation in broadband initiatives.

New Hampshire has not, to date, established a broadband authority, but it did create a broadband state matching grant fund program, located within the Department of Business and Economic Affairs.<sup>xviii</sup> The matching grant fund program is intended to support deployment of broadband infrastructure in regions without 25 *mbps*/3*mbps* broadband access in the state. Below are some examples of Broadband authorities in a variety of regions of the US, starting with northern New England.

## Northern New England

### Maine

Maine established the Maine Connectivity Authority in statute in June, 2021. Using federal funds allocated to the State of Maine under the American Rescue Plan, the Authority will work to ensure three goals: that effective, accessible connectivity be universally available in the state; that there be secure, affordable, reliable, competitive and sustainable forward-looking infrastructure that can meet future needs; and that all residents, businesses and institutions in Maine be able to take full advantage of the economic, health, educational, and other opportunities available through connectivity services.<sup>xix</sup>

The Maine Connectivity Authority is different from the ConnectMaine Authority, which was established previously. The Maine Connectivity Authority will subsume ConnectMaine Authority.<sup>xx</sup> Notably, earlier in 2021, the predecessor entity, ConnectMaine, approved the designation of broadband service as at least 100/100*mbps*, and the use of 50/10*mbps* for the designation of unserved areas. Previously, broadband service has been determined as 25*mbps* download and 3*mbps* upload, and unserved areas were those where this level of broadband service is unavailable. Observers will be following whether the new Maine Connectivity Authority adopts the 100 *mbps* definition of service or not. The Maine Connectivity Authority will work with the \$150m in federal funding available from the American Rescue Plan. Local sources estimate about 83,000 residences are considered underserved.

### Vermont

Vermont also enacted broadband legislation in June of 2021, which established a Vermont Community Broadband Board. The new body will award grants to build out the state's

telecommunications network so as to provide 100 megabit-per-second download and upload speeds. The new statute places communications union districts, or CUDs, in a pivotal position in the broadband expansion. A 2015 law established the districts as local public entities that – compared to big telecom companies – would have the advantages and incentives of knowing the territory, removing the profit motive, and answering directly to the community in expanding the broadband network, especially in poorly served rural areas. The law essentially defines broadband as any internet capability except dial-up; it does not define high-speed broadband, leaving the speed benchmark a matter of some flexibility. Private providers are already offering download speeds of 1 billion bits (1 gigabit) per second – but only in as-yet-limited areas where the fiber-optic cable required for such speeds is in place.<sup>xxi</sup>

## Other Regions of the US

### Minnesota

Minnesota established the Office of Broadband Development to support the state’s goal to achieve coverage to all businesses and homes in the state, with minimum download speeds of 25 megabits per second and minimum upload speeds of at least 3 megabits per second, no later than the year 2022.<sup>xxii</sup> Minnesota has allocated over \$125 million for broadband support programs. Since 2017, the MN state legislature has directed \$125 million in broadband funds annually for the Border-to-Border Broadband grant program. These grants focus on providing state resources to help make the financial case for new and existing providers to invest in building infrastructure into unserved and underserved areas of the state. The grants provide that any area unserved or underserved is eligible based on availability of a wireline service; service provided by mobile – and even fixed – wireless carriers are not considered in determining areas eligible for grant programs. The grants provide up to 50 percent of project development costs with an established maximum grant of \$5 million per project. The grants require matching funds and eligible applicants include businesses, political subdivisions, Indian tribes, and non-profits. Minnesota has also funded statewide mapping efforts to complement, and often supplement, federal mapping tools. The state contracts with a third party to prepare maps, based on provider submitted data,<sup>xxiii</sup> to represent areas of broadband service availability.

### North Carolina

North Carolina’s Broadband Infrastructure Office (BIO) was established by North Carolina’s chief information officer in 2015 to serve as a statewide resource for broadband access, first responder communications and classroom connectivity initiatives that the state leads. The BIO provides Technical Assistance to counties, including the rural broadband grant program, which was established in 2017.<sup>xxiv</sup> The program has invested \$10 million in funding to provide grants to deploy broadband infrastructure in 2018 and 2019, with \$15 million allocated to the program for the next 10 years. the BIO also established a statewide broadband plan and

offers mapping and data analysis to communities to better understand their broadband infrastructure landscape so that they can plan for strategic growth. To do that, the office assists local communities to understand the data that they are gathering. That data can then be useful in identifying where infrastructure exists and where it doesn't. North Carolina's efforts also include "The Playbook," a guide for local communities to create incentives and favorable policies that enable them to build new partnerships with broadband providers and increase broadband access. The BIO has divided the state into three regions and provides a single point-of-contact for technical assistance.

## Colorado

The Colorado Broadband Office (CBO) was created in 2012, when Executive Order D 2012 037 charged the Governor's Office of Information Technology (OIT) with overseeing and coordinating broadband activity across state agencies. The Colorado Broadband Office was formed within OIT in 2016 to support this responsibility. In 2020, Executive Order B 2020 009 superseded and replaced Executive Order D 2012 037 and restated the broadband responsibilities in OIT. And in 2021, HB21-1289 codified the Colorado Broadband Office in OIT. CBO leads the statewide effort to expand broadband coverage and quality for all Coloradans and coordinates all broadband efforts for Colorado. Colorado's broadband office has a broadband mapping function, a consumer advisory board and a deployment board and fund that issues grants twice a year in January and July. To be an eligible applicant for the grant program, the applicant can be a for profit or a not-for-profit entity and be seeking funding for a project that has to provide last mile service – service that connects a household to a provider - to a broadband network. Eligible applicants must provide more than 25% matching funds and provide service in excess of the minimum speed standards which are 25 *mbps* down/3 *mbps* up.

## Virginia

Virginia established Commonwealth Connect (CC) in 2018, which is its comprehensive effort to achieve universal broadband access in 10 years. Commonwealth Connect coordinates broadband activity for the state in four main areas. 1) Grants. CC Issues state broadband grants to encourage public/private partnerships to build broadband for unserved and underserved communities, when there aren't enough potential customers in unconnected communities to justify private sector broadband providers building broadband infrastructure to connect them. Since 2017, the Commonwealth has awarded \$124 million in broadband grants, connecting over 140,000 Virginia homes and businesses. 2) Policy leadership. CC provides leadership on legislation that brings down costs of building, increases competition, and allows localities to participate in the effort to build out broadband. 3) Technical Assistance. CC provides technical assistance to local leaders in developing a local plan for broadband including a step by step build and model broadband solicitations and 4) Coalition

building. CC convenes a diverse coalition of more than 100 different trade associations, fortune 500 companies, non-profits, and broadband providers as an advisory entity to the state broadband efforts.<sup>xxv</sup>

## Conclusion

As New Hampshire begins the regulatory process to set standards and rules for deploying tens of millions federal funds to improve access to broadband services in New Hampshire, it should set a goal to eliminate any digital divide that exists within New Hampshire by 2027 and to build out new broadband infrastructure that relies mostly on fiber optic cable so that it can provide transmission speeds of 100 *mpbs* up and down. Deployment of 21<sup>st</sup> century broadband throughout the state is fundamental to the continuation of telehealth services critical to the health and wellbeing of our populations, especially in rural regions of the state. State of the art broadband ensures telehealth services that are equitable in access, robust enough to be offered in every region regardless of demography or topography, and infrastructure sophisticated enough to adapt to technological innovations that although may be as yet unimagined, are undoubtedly on their way.

## References

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<sup>i</sup> Fourteenth Broadband Deployment Report, “Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, GN Docket No. 20-269,” Federal Communications Commission, FCC 21-18, January 13, 2021, pp. 2.

<sup>ii</sup> American Rescue Plan Act of 2021, P.L. 117-2, Section 9901. See also \$20.4 billion the Federal Communication Commission committed to the Rural Digital Opportunity Fund to bring high speed fixed broadband service to rural homes and small businesses. <https://www.fcc.gov/auction/904>

<sup>iii</sup> “Federal Aid and the Recovery From the COVID-19 Crisis”, New Hampshire Fiscal Policy Institute, May 19, 2021, slides 26-27. <https://nhfpi.org/resource/federal-aid-and-the-recovery-from-the-covid-19-crisis/>

<sup>iv</sup> See Fixed Broadband Deployment, Compare Broadband Availability in Different Areas, Federal Communications Commission, [https://broadbandmap.fcc.gov/#/area-](https://broadbandmap.fcc.gov/#/area-comparison?version=jun2020&tech=acfosw&speed=25_3&searchtype=county&geoid=33&searched=y)

[comparison?version=jun2020&tech=acfosw&speed=25\\_3&searchtype=county&geoid=33&searched=y](https://broadbandmap.fcc.gov/#/area-comparison?version=jun2020&tech=acfosw&speed=25_3&searchtype=county&geoid=33&searched=y)

<sup>v</sup> Fixed Broadband Deployment, Compare Broadband Availability in Different Areas, Federal Communications Commission, [https://broadbandmap.fcc.gov/#/area-](https://broadbandmap.fcc.gov/#/area-comparison?version=jun2020&tech=acfosw&speed=25_3&searchtype=county&geoid=33&searched=y)

[comparison?version=jun2020&tech=acfosw&speed=25\\_3&searchtype=county&geoid=33&searched=y](https://broadbandmap.fcc.gov/#/area-comparison?version=jun2020&tech=acfosw&speed=25_3&searchtype=county&geoid=33&searched=y)

<sup>vi</sup> Fixed Broadband Deployment, Compare Broadband Availability in Different Areas, Federal Communications Commission, [https://broadbandmap.fcc.gov/#/area-](https://broadbandmap.fcc.gov/#/area-comparison?version=jun2020&tech=acfosw&speed=25_3&searchtype=county&geoid=33&searched=y)

[comparison?version=jun2020&tech=acfosw&speed=25\\_3&searchtype=county&geoid=33&searched=y](https://broadbandmap.fcc.gov/#/area-comparison?version=jun2020&tech=acfosw&speed=25_3&searchtype=county&geoid=33&searched=y)

<sup>vii</sup> In a statement, FCC Commissioner Jessica Rosenworcel argued that the minimum level should be at least 100 Mbps and upstream speeds should be reconsidered. She also recommended measuring the availability of gigabit speed service. “Many households with multiple users are calling, watching, listening, gaming and searching online all at the same time,” said Rosenworcel. “But the FCC has been sticking with a download standard of 25 Mbps that it adopted more than five years ago. We need to set audacious goals if we want to do big things.”

<sup>viii</sup> <https://www.fcc.gov/form-477-census-tract-data-internet-access-services>

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- <sup>ix</sup> [https://broadbandmap.fcc.gov/#/area-comparison?version=jun2020&tech=acfosw&speed=25\\_3&searchtype=county&geoid=33&searched=y](https://broadbandmap.fcc.gov/#/area-comparison?version=jun2020&tech=acfosw&speed=25_3&searchtype=county&geoid=33&searched=y)
- <sup>x</sup> See <https://www.bandwidthplace.com/fixed-wireless-internet/>
- <sup>xi</sup> <https://www.satelliteinternet.com/resources/what-is-satellite-internet/>
- <sup>xii</sup> Fourteenth Broadband Deployment Report, “Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, GN Docket No. 20-269,” Federal Communications Commission, FCC 21-18, January 13, 2021, pp 232-233. Calculations conducted by IHPP. 6 percent of 541,515 is 32,490 and 2 percent of 818,191 is 16,393 for a combined total of 48,853 individuals without 25/3 mbps service. In 2016, FCC estimated that there were 99,129 people in New Hampshire without access to internet service. 2016 Broadband Progress Report, Appendix D, pp. 66
- <sup>xiii</sup> Fourteenth Broadband Deployment Report, “Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, GN Docket No. 20-269,” Federal Communications Commission, FCC 21-18, January 13, 2021, Appendix G, pp 284-285.
- <sup>xiv</sup> Fourteenth Broadband Deployment Report, “Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, GN Docket No. 20-269,” Federal Communications Commission, FCC 21-18, January 13, 2021, pp 232-233.
- <sup>xv</sup> <https://broadbandusa.ntia.doc.gov/resources/data-and-mapping>
- <sup>xvi</sup> National Indicator of Broadband Need, National Telecommunications and Information Administration, <https://broadbandusa.maps.arcgis.com/apps/webappviewer/index.html?id=ba2dcd585f5e43cba41b7c1ebf2a43d0>
- <sup>xvii</sup> National Indicator of Broadband Need, National Telecommunications and Information Administration, <https://broadbandusa.maps.arcgis.com/apps/webappviewer/index.html?id=ba2dcd585f5e43cba41b7c1ebf2a43d0>
- <sup>xviii</sup> See 2021 HB 2, lines 91:456-91:458 <http://www.gencourt.state.nh.us/legislation/2021/HB0002.html>
- <sup>xix</sup> <https://www.maine.gov/governor/mills/news/governor-mills-signs-legislation-establishing-maine-connectivity-authority-2021-06-25> [https://www.maine.gov/connectme/sites/maine.gov.connectme/files/inline-files/statute\\_2020.pdf](https://www.maine.gov/connectme/sites/maine.gov.connectme/files/inline-files/statute_2020.pdf) Maine has a legislative broadband caucus and external to the legislature, the Maine broadband coalition. See <https://www.mainebroadbandcoalition.org/>
- <sup>xx</sup> “Maine Legislature Swears in Broadband Connectivity Agency” <https://www.govtech.com/network/maine-legislature-swears-in-broadband-connectivity-agency>
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- <sup>xxi</sup> “Broadband expansion, looking down those lonely roads,” July 18, 2021 <https://vermontbiz.com/news/2021/july/18/broadband-expansion-looking-down-those-lonely-roads>
- <sup>xxii</sup> More on Minnesota’s program can be found here: <https://mn.gov/deed/programs-services/broadband/>
- <sup>xxiii</sup> The use of a third party allows the providers to carefully curate what information they will and won’t release, permitting more-accurate maps while protecting their proprietary data.
- <sup>xxiv</sup> Details on North Carolina’s grant program can be found here: <https://www.ncleg.net/EnactedLegislation/SessionLaws/HTML/2017-2018/SL2018-5.html>
- <sup>xxv</sup> What is Commonwealth Connect <https://www.commonwealthconnect.virginia.gov/what-is-CC>