CONNECTED NATION.

P.O. Box 3448
Bowling Green, KY 42102
1.877.846.7710
connectednation.org

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National Telecommunications and Information Administration (NTIA)
U.S. Department of Commerce
1401 Constitution Avenue NW
Room 4621
Washington, DC 20230

Re: National Broadband Research Agenda [Docket No. 160831803–6803–01]

Dear Sir or Madam:

Connected Nation, Inc., respectfully submits these comments in response to the request for comment on the National Broadband Research Agenda.

Connected Nation (CN) is a nationwide, non-profit organization that is focused on advancing access, adoption, and effective use of broadband technology by all Americans. For over a decade, we have been working with state governments and local communities to gather and verify information about broadband availability, study broadband adoption and barriers to adoption, and develop public-private initiatives designed to spread the use of broadband technology in our nation's libraries, schools, and communities.

Connected Nation submits these comments from a unique perspective as both a **collector** of broadband availability, adoption, and use data, as well as a ravenous **consumer** of access, adoption, and use data published by government and private sources.

As part of its mission, Connected Nation uses a data-driven approach to help states and communities write broadband and technology action plans. These projects and initiatives span the country and involve hundreds of communities. Since 2009, through a combination of federal grant and direct state funding, Connected Nation has

- Surveyed residents and businesses on their use of broadband in 10 states;
- Collected and validated data on broadband availability, including nearly one-quarter of the data points in the National Broadband Map funded by the NTIA;
- Facilitated and supported the research, writing, and policy recommendations of state broadband plans in Puerto Rico, Nevada, Alaska, Iowa, and Minnesota;

- Organized and helped 131 communities write volunteer-driven community Technology Action Plans, through the Connected Community Engagement program and engaged 336 communities since its inception in 2011.[1]
- Validated mobile wireless broadband availability data for the Federal Communications Commission's Mobility Fund; and
- Conducted a statewide census of connectivity and use of broadband technology for every school district in Alaska and Utah.

These are data-driven programs, plans, and initiatives that benefit residents in communities, rural and urban alike, by facilitating the expansion of technology access, adoption, and use. For nearly 15 years, Connected Nation has been helping communities across the country achieve their technology goals and create a stronger economic, educational, healthy, and sustainable digital environment in communities.

As a result of Connected Nation's experience, we have arrived at one overarching recommendation for the National Broadband Research Agenda: if the federal government collects and distributes more-granular, more-accurate, and more-comprehensive broadband data, communities and organizations like Connected Nation will be able to perform more of these state and locally based broadband initiatives in a significantly more efficient and effective manner. Stated simply, the less expensive it is to understand the broadband challenges a community faces, more communities will study those gaps and develop plans to bridge them.

Conversely, if comprehensive broadband data is not available, or if the data that is available is incomplete, faulty, or difficult to use, it will be *more* costly for communities to study their challenges and develop solutions—and the result is that there will be fewer successful state and local broadband initiatives.

The same is true for program data collection and evaluation processes. State and local institutions that are on the front lines in fighting the digital divide are cash-strapped and neither collect sufficient data nor comprehensively evaluate the effectiveness of their programs in a manner that allows policymakers to compare and evaluate the impact of those interventions. For example, there is no consistent definition of "new broadband adopter" that can be used to determine whether a formal digital skill training program at a library is a more effective method of getting vulnerable populations online compared to informal assistance provided at a local food bank or job training center. Measurements of "digital literacy" are also inconsistent and define the term in different manners. As a result, any analysis of the effectiveness of local or community broadband initiatives must confront a hodgepodge of incompatible, incomplete, and sometimes indecipherable datasets.

[1] Connected Community Engagement Program, *Connected Nation,* http://www.connectmycommunity.org.

A National Broadband Research Agenda can help close these data and research gaps; and in so doing, an effective Agenda will help close broadband gaps nationwide.

With this perspective in mind, Connected Nation participated in the National Science Foundation workshop on the Agenda earlier this year and contributed to the final Working Group Report from that event released in July 2016. These comments will not restate the important and comprehensive findings in that report, but will instead focus on specific data and research needs that Connected Nation believes can and should be addressed by the Agenda.

Recommendations and Responses to Questions

Broadband Access (Questions 4-6)

Improve Broadband Availability Data Collection and Publication. The National Broadband Research Agenda should recognize that today, in late 2016, the public has less information at its disposal on the availability of broadband services in their neighborhoods than it did in 2011. At a time when policymakers have placed increasing emphasis on broadband as critical economic and social infrastructure, the information we have about broadband availability has decreased substantially.

In 2008, Congress unanimously passed the Broadband Data Improvement Act of 2008 (BDIA), which was then funded by the American Recovery and Reinvestment Act of 2009.[2] For the purposes of the National Broadband Research Agenda, the BDIA provided a bipartisan, congressionally authorized framework for collecting comprehensive data on broadband access, adoption and use, organizing and engaging state and local community teams, building public-private partnerships to develop solutions, and assisting states and communities in developing broadband plans and strategies. BDIA programs covering every state and U.S. territory were funded from 2009-2014, and these programs collected information about residential broadband access, anchor institution connectivity, developed the National Broadband Map, and, using that data, developed state and local community initiatives designed to build effective public-private partnerships.

The failure of the federal government to fund BDIA programs since 2015 has created a significant gap in knowledge, engagement, and technical assistance that will affirmatively make it more difficult for the National Broadband Research Agenda to succeed. In 2015, the federal government stopped providing funding to state programs to create and validate the National Broadband Map, and the Federal Communications Commission is now the only federal institution that regularly collects broadband availability information. However, that data

[2] Pub. L. No. 110-385, 122 Stat. 4097 (codified at 47 U.S.C. §§ 1301-04).

(collected through FCC Form 477[3]) is more limited than the data that was available in the National Broadband Map. In particular, with Form 477, the FCC does not report out broadband subscriptions by category of end user (such as anchor institutions), does not independently validate the data, and does not release it with any granularity for all census blocks that can be of use to solution-oriented community projects. Data releases and updates to Form 477 data to date have been sporadic, and modifications to the data have been made without prior notice and without corresponding change logs. When released, Form 477 fixed broadband data is simply posted by the FCC in census block CSV file format. While this format can be processed and joined to geospatial data for review and analysis, it can be an arduous task to complete, compared with simply providing the datasets in GIS shapefiles in the first place.

Connected Nation uses and relies on Form 477 data to support its state and local broadband community engagement program, and in so doing finds that there are many instances where accurate data is not being filed at the onset. Since the Form 477 filing must be made in a list format, if the provider does not use GIS software to compile or develop the data, the resulting map of availability can unwittingly look like confetti. In our programs, Connected Nation has made maps of provider's own data, and after seeing these maps, some subsequently recognize that their submissions are incorrect.

These issues could be solved with a better data collection visualization, and verification process. If the FCC Form 477 filing portal had a way to allow providers to visualize on an interactive map what their filing looks like, this would decrease the number of filing errors in the data. Regular, scheduled updates, with descriptive change logs, would allow community users of Form 477 data to determine whether any change in data from one dataset to another is the result of an actual network upgrade or a correction of a faulty prior dataset.

All of these failings limit the utility of Form 477 data for community programs and research projects. The National Broadband Research Agenda should set forward a strategic plan for closing this critical gap in knowledge by following the principles and process already established by Congress in the BDIA. Connected Nation proposes that the National Broadband Research Agenda adopt the BDIA framework for its strategic plan, and that it recommend the restoration of funding for a robust broadband access data collection, verification, and publication program.

Improve FCC Wireless Tower Siting Data. Wireless broadband access is increasingly important, and communities across the country are exploring methods to improve signal coverage in their areas. As part of our community engagement process, Connected Nation network engineers routinely research, map, and validate wireless broadband service availability, and a critical input to those assessments are the locations of wireless base stations, or towers.

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[3] Federal Communications Commission, *Fixed Broadband Deployment Data From FCC Form 477,* https://www.fcc.gov/general/broadband-deployment-data-fcc-form-477

The FCC currently maintains a database of towers over 200 feet tall; however, the data in that database is difficult to use and frequently does not generate replicable results from near-simultaneous, identical searches.[4] Additionally, the filter has a relatively small cap on the number of towers that can be viewed on a map in the application while a query outputs files to a text file with inconsistent formatting. Because the database is unreliable and difficult to manipulate, Connected Nation network engineers have stopped relying solely on this database as a primary source for wireless broadband tower locations. This makes community engineering assessments and planning activities more costly and also undermines any academic research that might use this database to study wireless broadband. The National Broadband Research Agenda should recommend specific improvements to this database in order to make it a useful tool for states, communities, and researchers, which include GIS shapefiles of the registered towers by state with tower attributes included.

Improve Information on the Nation's Road Network. Broadband is infrastructure that commonly traverses the federal, state, county, and local road system, and the FCC's Mobility Fund provides a subsidy to wireless broadband providers for providing 3G and 4G coverage by the road mile. Connected Nation commonly is asked to validate broadband coverage along our nation's roads, but these activities are hampered by the lack of comprehensive, accurate data on the road network. While the Census Bureau makes road data publicly available for download,[5] the accuracy of the data decreases substantially outside the city limits. CN does a significant amount of drive testing in rural areas, using the Census road information for planning purposes. However, we have consistency found that the information is severely offset from actual road locations, some roads haven't existed for decades, and some "roads" are actually cattle trails, dry river beds, or ATV paths. Accurate road information is vital to planning broadband expansion for rights-of-way, drive testing, and budgeting using mileage calculations. Federal broadband programs are currently being impacting by inaccurate road data in rural and remote areas. The National Broadband Research Agenda should recommend an improvement to the road data available to decrease unnecessary federal spending and ensure more reliable information available to researchers and states.

Create a National Address Dataset. Being able to impact broadband access and adoption, especially in rural and underserved areas, relies on accurate information of where the unserved households are located. The Federal Geographic Data Committee recently announced the establishment of the Address Theme,[6] which will hopefully support the development of a National Address Database. This database, once developed, would be essential in being able to

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[4] Federal Communications Commission, *Antenna Structure Registration*, http://wireless.fcc.gov/antenna/index.htm?job=home.

[5] United States Census Bureau, *TIGER/Line Shapefiles and TIGER/Line Files*, https://www.census.gov/geo/maps-data/data/tiger-line.html.

[6] Federal Geographic Data Committee, *FGDC Announces Establishment of New Address Theme*, https://www.fgdc.gov/fgdc-news/new-a16-address-theme.

precisely locate the households that have been unserved by broadband for various reasons. Being able to accurately analyze the locations of these households will allow various broadband stakeholder groups the ability to better serve and get broadband services to residents and businesses more effectively and efficiently.

Update the FCC Spectrum Dashboard. While the FCC makes information available on the Spectrum Dashboard, it has not been updated since July 2014, and there is currently a disclaimer on the website that it is not being updated.[7] CN uses the Spectrum Dashboard to find providers that own spectrum and the specifics about the towers and locations in use (such as the Geographic Service Area of Educational Broadband Service and Broadband Radio Service licensees or the site specifics found within Antenna Structure Registration database), making up-to-date information extremely useful. The Spectrum Dashboard site once offered the ability to download shapefiles, KMLs, etc. of the geocoded boundaries of such licenses, but that is no longer the case. Data extraction is challenging, leading to inefficiencies when analyzing potential expansion areas and preparing more granular service areas for providers. Queries and attempts to view maps in the Universal Licensing System are cumbersome and frustrating, often returning cryptic messages like "The server has not found anything matching the Request-URL." No indication is given of whether the condition is temporary or permanent. If the server does not wish to make this information available to the client, the status code 403 (Forbidden) can be used instead. The 410 (Gone) status code should be used if the server knows, through some internally configurable mechanism, that an old resource is permanently unavailable and has no forwarding address. Updates to the Dashboard in order to make the data more timely and less challenging to access will greatly improve Connected Nation's research in the future.

Broadband Adoption (Questions 7-9)

Create National Benchmarks for Broadband Adoption. Unlike broadband availability, where public data is now scarcer than it was a few years ago, the federal government has greatly improved its collection and release of broadband adoption in recent years. Section 103(d) of the Broadband Data Improvement Act of 2008 required the Census Bureau to begin collecting information on broadband availability in its annual American Community Survey (ACS), and over the last few years the Census Bureau, along with the NTIA Computer and Internet Use supplement, has released more granular data that has been valuable to community programs and researchers.[8]

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[7] Federal Communications Commission, *Spectrum Dashboard*, http://reboot.fcc.gov/reform/systems/spectrum-dashboard.

[8] The FCC has not complied with the requirement of Section 103(c) of the BDIA that it conduct an annual consumer survey of residential broadband adoption, cost, use, and barriers to adoption. Since Section 103(c) was passed into law, the FCC has conducted only one survey that complied with that law, which was released in 2010.

However, gaps still remain. The ACS data collected annually is robust, but the Census only releases local information on computer and Internet use for communities with populations of 65,000 or more. This limits the ability of Connected Nation to use the data fully to help smaller communities in their broadband planning process. The Census should release all the local data it has available by geography, in order to allow communities to perform their own analyses. Connected Nation's Connected Community Engagement program regularly surveys and samples adoption and use trends in small communities, and even having access to a small sample size of data for that community from ACS would be helpful and provide a useful starting point for more in-depth analyses.

Additionally, even with the NTIA Computer and Internet Use supplement, the survey still only asks a handful of questions on computer ownership, Internet access, and subscribership. Connected Nation proposes that the National Broadband Research Agenda be expanded to include a national baseline assessment of digital skills, typical uses of broadband in the household, frequency, and intensity of broadband use. Additionally, finding the right table(s) needed for a particular analysis and granularity level can be difficult, while joining tabular data to geospatial data can present challenges with the formats available.

Develop Digital Literacy Research Framework. The National Broadband Research Agenda should establish a strategy for defining and collecting data on the level of digital literacy in the general population. While there have been suggested methods for exploring various means to assessing digital literacy, there is currently no widely agreed-upon method for assessment of such skills. As part of the Connected Community Engagement program, Connected Nation seeks to understand the digital skill level and gaps of a community as leaders are eager to understand how their community lines up with national benchmarks; however, the ability to compare a population's digital skills with another is nonexistent. To get the most out of an assessment on digital literacy, a research framework must be agreed upon, nationally, to help communities answer questions such as: *How can we know if our residents are digitally literate? How can digital literacy programs more effectively respond to the literacy needs of our community?*

More so, with technology rapidly changing, the assessment of digital literacy also needs to change to ensure residents are keeping pace with developments in skills needed to learn, work, and function in society. A federal data collection effort and standard by which to gauge digital skills across communities would be vital to broadband planning efforts underway in communities across the country.

Establish a Common Framework and Platform for Adoption Program Monitoring and Evaluation. Nearly all existing programs seeking to bridge the digital divide are run by resource-constrained nonprofits, public libraries, community centers, and local governments. These institutions include food banks, community technology centers, and other programs that simply do not have broadband monitoring, evaluation, and research budgets. To the extent that these

programs study their impact, they will generally do so with individualized data collection methods and techniques, commonly deployed with an eye toward securing ongoing funding. As a result, it is nearly impossible to compare, for example, the cost-effectiveness of formal digital literacy training coupled with Wi-Fi check-out devices at the New York Public Library to informal training bundled with discounted purchased connectivity at a nonprofit community center in Minneapolis-St. Paul.[9]

Connected Nation proposes that the National Broadband Research Agenda include a Broadband Research Technical Assistance program that would arm these local organizations and initiatives with a common research method, definitions of terms, data format, and research capacity. This program would be supported and administered by a research network that is funded to provide research support for broadband program evaluation. Connected Nation suggests that the National Science Foundation contract with research institutions whose purpose would be to provide these tools and rudimentary research support to local community institutions. The resulting data collection would not only benefit the nonprofit in understanding its operations and securing funding, but over time, the data collected in this manner would increase our national knowledge base and allow results and effectiveness of local adoption initiatives to be compared nationally.

Socioeconomic Impacts (Questions 10-12)

Rapid technological change in broadband technology and the fact that broadband is an intermediate good has made research into the economic impact of broadband technology particularly difficult to examine. Commonly cited research on the social and economic benefits of broadband access and adoption needs to be improved and updated. In addition, because GDP calculates the production of *new* products and services that are created and then sold, increases in broadband speed and quality, or the expansion of the number of free online applications, services, and tools, do not directly contribute to GDP.

Due to these difficulties, macroeconomic studies of broadband generally use models that estimate GDP impact. However, many of these papers use inconsistent models, may not incorporate lag, employ inconsistent data, and cannot establish causation.[10] In addition, studies of the impact of broadband investment in a community (such as construction of a fiber network) need to take into account the fact that economic growth in a fiber community might

[9] PCs for People is a Minnesota-based nonprofit that offers digital literacy training, discounted Internet access, and refurbished computers to eligible low-income households. *See* http://www.pcsforpeople.com/about-us/our-story. The New York Public Library and Brooklyn Public Library have implemented Wi-Fi/LTE "hot spot" check out programs at library branches that allow library patrons without home Internet access to check out devices that allow wireless access. Anthony W. Marx, "Too Poor to Afford the Internet," *New York Times* (Aug. 12, 2016), http://www.nytimes.com/2016/08/12/opinion/too-poor-to-afford-the-internet.html?ref=todayspaper&utm_campaign=Newsletters&utm_source=sendgrid&utm_medium=email&_r=1.

[10] *See* Minges (2015).

simply be the result of migration from other, less-connected communities nearby. From a national perspective, economic migration between communities does not necessarily result in overall national economic growth. Finally, research on the social welfare of broadband access, adoption, and use generally does not employ a common understanding of these social values.

Connected Nation proposes that the National Broadband Research Agenda fund research that would:

- Establish a consistent or generally accepted model for assessing economic and social impact.
- Study impact of broadband, not simply on GDP growth, but also on employment, productivity, wages, and other effects.
- Study effect of different broadband speeds and prices on income, employment, etc. Doing so will require release of better pricing data.
- Employ both time-series and cross-sectional data collection and analysis (recognizing the limitations of either approach).
- Study local and regional effects of broadband access and adoption not solely by reference to that community, but also to neighboring communities, to ensure we are measuring economic growth, and not economic migration.[11] Data collection must be robust and at sufficient scale to allow for these comparisons.

Having this research in hand would greatly assist state and community broadband planning initiatives. One challenge of organizing communities to undertake a comprehensive broadband planning initiative is a solid understanding of the social and economic value of broadband. Research along the lines described above would show the areas of the economy most likely to be impacted by broadband growth and would allow for targeted state, local, and regional initiatives designed to maximize the positive social and economic benefits of broadband.

Opportunities for Federal Leadership in Data Collection and Research (Questions 16-17)

Collect Data to Explore the Link Between Internet Connectivity and Educational Outcomes. In 2014, the FCC took several important steps to modernize its E-rate program, which included subsidized Internet and internal connections to K-12 schools and public libraries. Data on the use of that program is now beginning to be released by the FCC and Universal Service Administrative Company (USAC). However, the utility of that data is limited because we still lack comprehensive national data on how this improved connectivity is being used in schools to improve student performance.

[11] See Ford & Koutsky (2006) for one such study.

The National Center for Education Statistics (NCES) in the Department of Education collects a host of demographic, funding, and achievement data for K-12 schools in the United States.[12] However, NCES data proves challenging on a few fronts. First, there is a lag between the school year that the data is accurate for and the current school year. This has previously raised issues at the local level when a school has moved or closed, or a new school has opened in between the time the data is collected and published. Secondly, a significant number of mailing addresses are published with the schools, rather than physical addresses. P.O. Boxes cannot be geocoded and therefore cannot be used; each school in a given situation must be individually researched to find the actual physical address of the school in order to proceed. A similar issue is sometimes the mailing address for a school is the district office and not the individual school, leading to additional location issues that prevent accurate analyses.

Lastly, and more overarching, is the fact that the NCES database does not currently collect data on the deployment, spread, and use of information technology in K-12 schools. Connected Nation has been working to address this information gap through comprehensive, statewide censuses of school district technology deployment across the states of Alaska and Utah in response to state requests for better information and data. Such research has been incredibly important to policymakers in those states in helping them make decisions about future investments, but it is also true that collecting that data required significant time and effort.[13] While research projects like those in Alaska and Utah serve a valuable purpose, the information collected has a limited shelf life if the data collection process is not repeated regularly to allow for the examination of historical trends over time. It is impossible, for example, to study systematically whether students that have had access to a laptop or tablet device for a certain number of years have better test scores than students only recently introduced to the technology. Education levels and resulting achievement gaps are cumulative, and a snapshot dataset would not recognize the difference between those two groups. Beyond that, more comprehensive research needs to be done to understand the correlation and impact of increased technology deployment on student learning outcomes, graduation rates, and student engagement in the learning process.

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[12] "Data Tools," *National Center for Education Statistics,* http://nces.ed.gov/datatools/.

[13] Connected Nation led efforts in 2014 to complete the Alaska School Broadband Audit (www.connectak.org/school-broadband-audit) which assessed school connectivity in every school across all 53 of Alaska's public school districts by conducting rigorous data collection and onsite validation, including traveling over 58,000 miles by air and 2,000 miles by car. In 2016, CN completed the Utah School Technology Inventory (www.uen.org/digital-learning/downloads/inventory/UtahSchoolTechnologyInventoryReport.pdf) in partnership with the Utah Education and Telehealth Network which gathered technology deployment data from 100% of Utah public schools—including charter schools —accounting for 989 schools serving nearly 627,000 students across the state.

The National Broadband Research Agenda should work with NCES to develop a strategy for a comprehensive nationwide data collection of school use of information technology that minimizes the reporting burden on school districts as much as possible, but yields valuable information over time on instructional technology, at-home connectivity, digital content and curriculum, and teacher professional development—and how these things are directly impacting academic achievement.

Collect Data on Business Broadband Adoption and Use. One gap in our understanding of broadband is the adoption and incorporation of broadband technology by businesses, particularly small enterprises. There are very few comprehensive studies on business use of broadband technology, whether or not businesses have difficulty finding employees with technology skills, and the extent to which businesses incorporate broadband into their operations.

Currently, national organizations do not track broadband adoption among businesses, or any number of relevant factors, such as what applications are being used, how to identify best practices for small businesses, and the economic impact of transitioning tasks online.

This information is necessary to identify and overcome skills gaps in America's workforce. Without identifying the skills that businesses need currently, or foresee needing in the future, communities and trade schools cannot work to fill those skill gaps. Connected Nation's Connected Community Engagement program seeks to fill this knowledge gap in communities by directly surveying local employers as to what digital skills are needed for new hires, conducting surveys of digital skills among residents, and assessing training programs at local libraries. While comprehensive, that data collection process is time-consuming, and without nationwide data, it is not possible to benchmark the "connectedness" of a particular community's business sector with the nation.

At the same time, the federal government routinely collects a lot of information about businesses that could be adapted to include broadband information. The Bureau of Labor Statistics' National Compensation Survey currently collects data on job listings, wages, and job characteristics to determine work levels, and information about computer or Internet usage could be incorporated into that survey process. Another option would to be to add questions to the current population survey's labor force questionnaire to ascertain whether an individual uses a computer or the Internet at their workplace for business-related issues. Either option could provide a national or state-level point of comparison against which communities could compare their own usage and growth of broadband adoption in the business sector.

***Develop Groundbreaking Datasets*.** Government has a wealth of data on broadband adoption and use trends at its disposal that it rarely uses to study the spread of technology including government websites and applications. Every day, millions of Americans interact with

government online services and applications, and those interactions can provide a broad picture not only of the quality of an Internet connection but also the intensity of Internet use in particular geographic regions. Curated carefully, this data could reveal neighborhoods where broadband access is trailing peer neighborhoods, or where usage has spiked.

The National Broadband Research Agenda should establish a strategy that would collect this information in an anonymous way that protects Internet users' privacy interests but which still allows researchers and communities to see and visualize these use patterns.
Similarly, data from social media companies like Facebook and Twitter contain vast information on the spread of mobile broadband as well as the quality and frequency of mobile broadband access nationwide. This data also could be folded into a private and secure database that could be accessed and used by researchers seeking to study these trends. The Research Agenda should create a strategy for working with these companies to establish the parameters of access to that data.

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Connected Nation is proud to have worked closely with the NTIA as a State Broadband Initiative grantee, and that program gave us the opportunity to both collect data on broadband access, adoption, and use, and to put that data to work in dozens of state and community broadband planning programs across the country. Connected Nation strongly believes that data-driven and research-informed broadband planning initiatives are an effective means of developing public and private solutions to community broadband gaps. We are proud to offer these comments on subjects our teams have been deeply involved with for the last decade, and we look forward to continuing to work with you to the develop the National Broadband Research Agenda in a way that will help communities expand broadband access, adoption, and use nationwide.

Sincerely,

Thomas W. Ferree
Chairman & CEO