BEFORE THE
DEPARTMENT OF AGRICULTURE
RURAL UTILITIES SERVICE

In the Matter of Broadband e-Connectivity Pilot Program	RUS-18-TELECOM-0004

COMMENTS OF INTERNET2

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Executive Summary

Research and education ("R&E") networks play a critical role in advancing the country's broadband capabilities and investing in the infrastructure necessary to connect millions of rural Americans to broadband services. Internet2 and the larger R&E community are in a special position to assist the Rural Utilities Service ("RUS") in its efforts to provide broadband access to rural Americans on par with urban areas, as outlined in the Notice.[1] Internet2 respectfully provides the following recommendations to help guide RUS in this endeavor.

First, RUS should support middle-mile and fiber backhaul projects that will make it easier to deploy more last-mile projects at substantially less overall cost. The closer that new backbone infrastructure can be moved to rural areas, the more cost-effective it will be for service providers to build last-mile facilities and to do so much more quickly.

Second, connecting rural community anchor institutions ("CAIs") should be a top priority because this will not only provide broadband access to the greatest number of people with one connection, but it also will make it easier to connect the surrounding residential community.

Third, one important way to improve rural prosperity through these pilot projects would be to connect rural Americans to R&E networks so that they can leverage the broad educational resources made available by the higher education community.

Fourth, pilot projects funded through this proceeding should not duplicate other loan- and subsidy-based federal programs, but should instead favor grants for projects that will make deployments sustainable over the long term.

Fifth, RUS should support public-private partnerships, which have a proven track record of bridging the broadband gap in rural areas.

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[1] 83 Fed. Reg. 35,609, https://www.gpo.gov/fdsys/pkg/FR-2018-07-27/pdf/2018-16014.pdf.

Finally, Internet2 recommends that sufficient access to broadband can only be properly measured if connections are *consistently* above minimum speed requirements, and grantees should be required to certify that they will meet these standards even during peak usage hours.

These proposals are based on the decades of experience that the R&E community has amassed by not only playing a pivotal role in creating the internet, but continuing to propel the next generations of this vital technology and empowering new economic opportunities throughout the United States. Internet2 and the larger R&E community stand ready to assist RUS to accomplish its goal of deploying future-proof infrastructure in rural America. By adopting the recommendations that follow, Internet2 is confident that RUS can turn its vision into reality.

I. INTRODUCTION

A. Background on Internet2

Internet2 is a non-profit, member-driven advanced technology community founded by the nation's leading higher education institutions in 1996. Internet2 operates the nation's premier publicly available national research and education network ("NREN"), which now serves 332 U.S. universities, 60 government agencies, and 43 regional and state education networks. With these partners, Internet2 supports more than 100,000 CAIs and more than 900 InCommon participants. Internet2 also collaborates with 65 leading corporations working with the R&E community and 70 NREN partners across the globe that represent more than 100 countries.

Much of the cutting-edge research that is taking place at and between research universities and private laboratories across the country is powered by the Internet2 Network. Internet2 works closely with its state and regional network partners in The Quilt, the national coalition of non-profit U.S. regional R&E networks across the country, to help those universities

and laboratories connect to the Internet2 Network.[2] With the goal of promoting consistent, reliable, interoperable, and efficient advanced networking services that extend to the broadest possible community, the Internet2 Network serves as the backbone for the state and regional R&E networks.

Internet2 has a proven track record of innovating in networking, deploying and continually upgrading advanced networks, and extending those networks where connectivity is needed. This is the DNA of Internet2. Indeed, while certain specialized networks are designed for a specific research need, the Internet2 Network was built and architected to enable sustained networking innovation across competing networking demands and great distances. The Internet2 Network has advanced Layer 2 services built on software defined networking ("SDN"), which allows users to optimize the network for their specific application needs. With 17.6 Terabit capacity nationwide, the Internet2 Network is one of the most advanced networks in the world.

Since 2014, Internet2 has provided network services to the U.S. Department of Agriculture's ("USDA") Agriculture Research Service ("ARS") and Forest Service ("FS"), helping those agencies improve agricultural productivity and preserve natural resources. As an Internet2 member, ARS has been a leader in the Internet2 community of academic and government organizations. In providing high-speed network services to various ARS locations (Stoneville, MS; Beltsville, MD; Clay Center, NE; Missoula, MT; Albany, CA; Ft. Collins, CO, and Ames, IA), Internet2 has developed an understanding of both the rural communities served by the USDA and the long-standing research and networking partnerships with land grant

[2] *See also* the Comments of The Quilt filed in this docket, RUS-18-TELECOM-0004. Internet2 supports the Comments of The Quilt and respectfully recommends that RUS support pilot programs in this proceeding consistent with The Quilt's proposals.

universities. Over many years, these partnerships have built a proven track record of deploying high-bandwidth infrastructure in rural areas.

B. The Continuing Broadband Gap in Rural Areas

Some parts of the country remain broadband deserts with little or no access to broadband, or where the available broadband coverage is inadequate to meet the needs of the surrounding community. According to the Federal Communications Commission's ("FCC") latest broadband deployment progress report, broadband speeds of at least 25 Mbps (download) are not available to nearly 31 percent of rural households and 35.4 percent of people living on tribal lands.[3] However, 98 percent of urban households have access to broadband at those speeds.[4] Making matters worse for rural Americans, high-speed broadband access often is not available for rural and tribal residents even at their CAIs, with 6.5 million students still not receiving adequate broadband at their schools.[5] In short, the technologies and applications enabled by broadband that many take for granted simply are not available to tens of millions of Americans because of where they live.

One of the major reasons why particular areas remain unconnected is that access to middle-mile infrastructure for wired broadband, and wireless backhaul infrastructure for mobile broadband service, is not available in large swathes of the country. For example, and as depicted below, along the Interstate 40 corridor in the South and Southwest, there are backbone infrastructure "donut holes" that span hundreds of miles, such as between Albuquerque, New Mexico and Las Vegas, Nevada.

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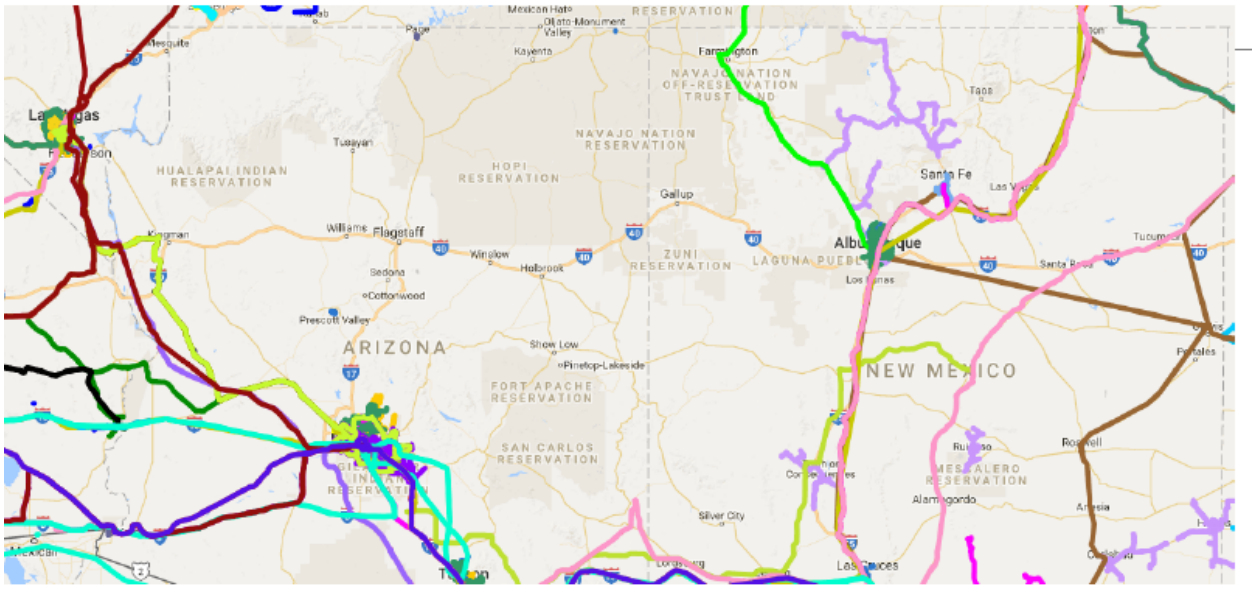
[3] *In the Matter of Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, 2018 Broadband Deployment Report ¶ 50, GN Docket No. 17-199 (Feb. 2, 2018), available at https://docs.fcc.gov/public/attachments/FCC-18-10A1.pdf.

[4] *Id.*

[5] *Id.* ¶ 70.



Without middle-mile and backbone infrastructure in place in these areas, residents and CAIs are isolated from advanced solutions, route diversity, and interstate options that, if available, would make last-mile deployments much more feasible.

C. The Opportunity Presented By The Broadband e-Connectivity Pilot Program

The Distance Learning, Telemedicine, and Broadband Program at RUS was established by H.R. 1625, the Consolidated Appropriations Act of 2018. Section 779 of this Act authorizes $600 million for a pilot broadband program to be operated under Section 601(a) of the Rural Electrification Act of 1936, as amended, in order "to expedite loans and grants for the costs of the construction, improvement, and acquisition of facilities and equipment for broadband service in eligible rural areas."[6]

RUS now has a golden opportunity to not only make immediate impacts in rural areas, but also to seed future investments by funding middle mile infrastructure that will make last-mile projects much more economical to deploy and sustain. In response to the Notice, Internet2 respectfully submits the recommendations set forth below.

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[6] 7 U.S.C. § 901 *et seq*.

II. PROPOSALS FOR RUS PILOT PROGRAMS

A. RUS Should Make Funding Available For Middle-Mile And Backhaul Projects

In order to connect more rural and tribal Americans over time and at substantially less total cost, it is critical for RUS to take a holistic view of broadband infrastructure and fund middle-mile and backhaul projects. Rural areas do not simply lack the last-mile connections to finally bridge the digital divide. They often lack the necessary middle-mile and backhaul infrastructure as well. It is simply an unfortunate reality that the cost of deploying broadband to particular areas is too high relative to the return for-profit service providers demand before making the necessary infrastructure investments. But these decisions regarding who to serve, and who not to, impact a broadband network beyond last-mile deployment issues. That is, access to national long-haul networks is limited, if not unavailable, to many rural areas, further disincentivizing service providers to build out their networks to rural communities.

To get out of this cycle, RUS should permit grants toward middle-mile and wireless backhaul infrastructure projects that will enable last-mile buildout to be achieved more cost effectively.[7] By bringing middle-mile infrastructure closer to rural communities, either areas that were too expensive to connect without ongoing government support can become profitable to serve in their own right or many more rural areas can at least be connected more cheaply and quickly by reducing the distance that last-mile connections must traverse. Moreover, deploying middle-mile infrastructure closer to rural areas also will alleviate network congestion and

[7] For the avoidance of doubt, RUS has ample authority under the Consolidated Appropriations Act of 2018 to fund middle-mile projects if "at least 90 percent of the households *to be* served by a project receiving a loan or grant under the pilot program shall be in a rural area without sufficient access to broadband." Section 779 of the Act (emphasis added). In other words, there is no requirement that all specific projects funded involve immediate last-mile deployments. Rather, if a project ultimately will be utilized to serve the required percentage of households in rural areas that lack sufficient access to broadband, this is all Congress requires.

bottlenecks at over-utilized backbone access points, which cause speed and latency problems during peak usage hours, a key concern in the Notice.

This is a textbook example of where government funding can correct persistent market failure by creating the conditions for more sustainable and less expensive broadband deployment later. The Broadband Technology Opportunities Program ("BTOP"), which was part of the American Recovery and Reinvestment Act of 2009, focused on funding "open middle-mile" networks to CAIs that could make it easier for providers to build out last-mile networks, not only to CAIs, but also to the rest of the community, including residential users. The evidence shows that this policy has worked tremendously well, as demonstrated by the fact that CAIs "served by BTOP infrastructure experienced a decline in broadband prices of approximately 95 percent."[8] And such open middle-mile networks provide for "jumping off" points that allow competitive broadband providers to extend service to the surrounding community at reduced costs, which will alleviate funding pressure on RUS and other universal service support mechanisms over the long term.

It also is important to emphasize that where wired broadband deployment is not the most effective solution to provide rural and tribal Americans some form of broadband service, wireless broadband services still require wired backhaul infrastructure. However, many existing backhaul networks were built to handle comparatively low volumes of voice traffic. As data traffic usage for LTE networks continues to grow, shortcomings of backhaul designed for voice traffic have begun to materialize. In fact, with faster devices coupled with more data-intensive applications, backhaul has become the bottleneck in legacy TDM networks. As a result, more middle-mile infrastructure is needed to support the growth in wireless broadband.

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[8] ASR Analytics, Final Report, at 4. *Available at* https://www.ntia.doc.gov/files/ntia/publications/asr_final_report.pdf

B. Last-Mile Projects Connecting Community Anchor Institutions in Rural Areas Should Receive Priority Consideration

CAIs, including schools, libraries, museums, healthcare organizations, and other not-for-profit community organizations that provide support and services to citizens, increasingly are being recognized as critical indicators and influencers of a community's socio-economic well-being. Over the past 10 years, CAIs also have emerged as vital organizations for promoting digital literacy, broadband adoption, and related applications. Further, given the central role a CAI has and the number of citizens it impacts through one broadband connection, a CAI's ability to access broadband has a social, educational, and economic multiplier impact.

Over the last two years, Internet2 has developed a broadband toolkit and broadband improvement plan document for rural and tribal areas as part of an Institute for Museum and Library Services ("IMLS")-funded grant entitled "Toward Gigabit Libraries."[9] During the course of conducting site visits with over 50 rural and remote public and tribal libraries, Internet2 noted firsthand several common issues among such rural libraries, including insufficient bandwidth, insufficient internal data wiring, inefficient network setups, old and/or obsolete equipment, poor Wi-Fi coverage, and low participation in E-rate due to the complex application process and lack of knowledge on how to take advantage of the program. This is further evidence that broadband funding should be prioritized for CAIs in rural communities.[10]

Indeed, providing robust broadband connectivity to one CAI can have "network effects" in terms of broadband deployment, availability, adoption, and use.[11] One fiber drop to a

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[9] *See* https://www.imls.gov/grants/awarded/re-00-15-0110-15.

[10] The broadband tool kit, the final project report, and other supporting documents from the "Toward Gigabit Libraries" project can be found at http://www.internet2.edu/tgl.

[11] *See* Internet2, "The Impact Anchor Institutions on a Community's Broadband Connections" at 3 (2016), *available at*

university, a community college, a high school, or a library can impact hundreds, if not thousands of citizens versus a single fiber drop to a residential home.[12] Deploying robust broadband connections is analogous to building roads: you need to first build the highways to connect the towns and their core institutions to the broader world and then invest in the diffusion of the connections within the community. In other words, funding connections to CAIs helps "kick start" last-mile deployment. Focusing broadband deployment on these core, public-serving CAIs can positively affect the broader public in multiple ways while allowing these institutions to better fulfill their missions. The pilot projects funded by RUS therefore should focus on ensuring that all CAIs in the country are connected as soon as possible to the nation's fiber backbone network.

C. RUS Should Prioritize Projects That Benefit Rural Education

As RUS rightfully notes in the Notice, demonstration projects should be evaluated in terms of their contribution to overall rural prosperity. It is difficult to overstate the positive externalities that are generated by connecting rural areas to non-profit R&E networks. One proven contributor to the nation's economic health is its education system. The success of both the U.S. economy and students seeking a college or graduate degree are inextricably interlinked. K-12 students increasingly are taking advantage of the educational applications that high-capacity broadband makes possible as they prepare themselves to enter college. Yet entire segments of the K-12 population do not have broadband at home or in their schools and thus are blocked from essential educational and training resources, which threatens to leave them unprepared for college, or at least at a distinct disadvantage.

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https://www.internet2.edu/media/medialibrary/2016/06/22/CAI-Influence-in-Broadband-White-Paper.pdf.

[12] *Id.*

As the U.S. Chamber of Commerce concluded in a study analyzing the impact of broadband on education, less than half of all U.S. high school graduates are adequately prepared for college or for the workforce, and "[s]chools are generally failing to instill 21st century skills in students."[13] However, as the Chamber also noted, the FCC recently has recognized that "'digital literacy is a necessary life skill, much like the ability to read and write.'"[14] Internet access enables socio-economic development, and those without access are left behind, facing tremendous competitive and economic disadvantage. In short, increased connectivity and the exchange of information spurs economic growth, strengthens local research and education, and enables sharing of culture and ideas in ways previously unimaginable.

This is why it is essential for rural areas to be connected to R&E networks so that students in rural areas can compete on a level playing field with their urban and suburban peers. Internet2 and the larger R&E community realize that today's students are dependent on broadband services for their education long before they reach college, and that helping them access broadband and the training to exploit its potential will ensure that they come into the higher education system with a full complement of the skills necessary for success.

Consequently, the educational benefits that broadband enables are tied tightly to the country's colleges and universities, and RUS should leverage Internet2's and the larger R&E community's broad resources and experience to drive broadband deployment, adoption and innovative learning applications in rural areas. By no means exhaustive, examples of the important roles that the R&E community has played to ensure greater rural development include

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[13] *See* U.S. CHAMBER OF COMMERCE, THE IMPACT OF BROADBAND ON EDUCATION at 3 (2010), available at https://www.uschamber.com/sites/default/files/legacy/about/US_Chamber_Paper_on_Broadband_and_Education.pdf.

[14] *Id.* at 24.

efforts to bridge the homework gap for learners across their lifetimes, expanding the reach of telehealth services, increasing access to workforce training, and improving crop production through timely data capture and analysis throughout the growing season with improved connectivity between the farm/ranch operation, the local research extension center, and the agronomy services provider. Ultimately, by strengthening ties across the educational spectrum while expanding access to broadband, RUS undoubtedly will strengthen overall rural prosperity.

D. RUS Should Favor Pilot Projects Funded Through Grants

The FCC's Universal Service Fund ("USF") has functioned as an ongoing subsidy to keep the operation of advanced communications networks profitable for providers in areas where there is little or no business case to extend broadband. RUS's Telecommunications Infrastructure Loan Program almost exclusively provides loans for broadband infrastructure projects to service providers that are simultaneously receiving USF high-cost support, as the subsidy received from USF is necessary to make the loan viable. It follows then that if an area could be economically served through a combination of RUS-subsidized loans for special construction costs and USF-subsidies for ongoing provision of service, there would not be such persistent broadband deserts in rural areas.

Thus, the pilot programs funded by RUS should not rely on more of the same but instead should focus on providing grants for projects that will be sustainable into the future. Such grants will have a multiplier effect on rural economies. A 2016 study from the Hudson Institute found that rural broadband service directly and indirectly added $24.1 billion to the U.S. economy in 2015, while the rural broadband industry supported approximately 70,000 jobs.[15] When

[15] *See* Hanns Kuttner, Hudson Institute, The Economic Impact of Rural Broadband, April 2016, available at

additional positive externalities that broadband access provides are considered – such as enabling ecommerce, telecommuting, distance learning, telemedicine, and public safety – the capital infusion that grants can provide to rural communities, if done wisely, ultimately can pay for themselves on a macro level.

E. RUS Should Encourage Public-Private Partnerships

RUS's pilot program should build on the success of recent public-private partnerships to fund broadband infrastructure projects to ensure grants are allocated with sustainability in mind. For example, BTOP successfully leveraged public-private partnerships to help close the digital divide in many unserved and underserved areas. BTOP, which oversaw the disbursement of approximately $4 billion in grants, required all recipients to provide matching funds toward the total cost of their broadband infrastructure, adoption, and training projects.[16] BTOP funded more than a quarter of all infrastructure grants made either directly to a member of the R&E community or with an R&E network as a partner or sub-recipient.

Here too, RUS should support public-private consortiums made up of a broad spectrum of rural stakeholders. As The Quilt rightly notes in its comments, there "is no 'one size fits all' when it comes to solutions to bridge the broadband gap in underserved areas," and traditional telecommunications carriers are not the only entities that can help bridge the digital divide.[17] Thus, consistent with Section 950(b)(b) of the Rural Electrification Act, RUS should deem

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https://s3.amazonaws.com/media.hudson.org/files/publications/20160419KuttnerTheEconomicImpactofRuralBroadband.pdf

[16] *See* Broadband Technology Opportunities Program (BTOP) Quarterly Program Status Report at 2, available at https://www.ntia.doc.gov/files/ntia/publications/ntia_btop_19th_quarterly_report.pdf.

[17] *See* Comments of The Quilt, Section 6.

public-private partnerships eligible for participation in the pilot program so long as they can demonstrate the ability to extend or improve broadband service in rural areas.[18]

F. Performance Metric Tools will Help Define "Sufficient Access"

Finally, Internet2 also recommends that it is crucial for RUS to require grantees to certify that they will be providing broadband at speeds *consistently* at or above 10 Mbps downstream and 1 Mbps upstream, including during peak usage hours. Internet2 notes, however, that broadband connectivity goals for the nation must be higher and trending toward 1 Gbps and beyond. Rapid advancements in both networking technologies and the applications that run over those networks can and do quickly make what would appear to be a high-capacity connection today less than adequate in the near future. As a result, Internet2 recommends that RUS establish higher speeds for grantees and not shoot for the floor by settling on slower broadband speeds.[19]

Regarding performance metrics, Internet2 currently is assisting in a research project examining how advanced broadband measurement capabilities can support the infrastructure and services needed to respond to the digital demands of public library users across the United States.[20] As part of this project, Internet2 and its research partners are gathering quantitative and qualitative data from public libraries across the country to better understand the broadband speeds and quality of service that public libraries receive, and to assess how well broadband service provided at these CAIs are meeting the needs of the surrounding community. The

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[18] *See* 7 U.S.C. § 950(b)(b)(d).

[19] *See* Comments of Internet2, Broadband Opportunity Council Notice and Request for Comment, Docket No. 1540414365-5365-01, available at https://www.ntia.doc.gov/files/ntia/university_corporation_for_advanced_internet_development_boc.pdf.

[20] *See* Measuring Library Broadband Networks for the National Digital Platform, available at https://www.imls.gov/sites/default/files/grants/lg-71-18-0110-18/proposals/lg-71-18-0110-18-full-proposal.pdf.

project deliverables will include an open source and replicable broadband measurement platform that can be used to accurately measure broadband speeds to ensure that rural premises have access to broadband speeds similar to those offered in urban areas, particularly in peak usage hours. Some of these deliverables may help RUS verify the broadband speeds that it requires of grantees.

Conclusion

For all of the foregoing reasons, Internet2 respectfully requests that RUS fund pilot projects consistent with the recommendations set forth above.

Respectfully submitted,

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