JUNE 2018

Broadband Access for Native-Serving Schools

Photo: National Indian Education Association (NIEA)

Education SUPERHIGHWAY

Broadband Access for Native-Serving Schools

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Executive Summary

Today, 60,000 K-12 Native students attend federally-supported schools that do not have the broadband infrastructure required for digital learning in the classroom. To close this gap, Native-serving schools need to overcome barriers to the following conditions: access to scalable infrastructure, sufficient bandwidth, affordable connectivity costs, and Wi-Fi networks that can support 1:1 learning.

The federal E-rate program is a funding source that can be leveraged to address many of the challenges in K-12 connectivity for Native-serving schools. E-rate pays for an average of 90% of connectivity costs for federally-supported Native-serving schools today, and specific areas of the E-rate program can be further leveraged to connect underserved schools to fiber and to improve the Wi-Fi networks in schools.

To address the remaining gaps in connectivity for federally-supported Native-serving schools, we recommend that the following actions be taken:

1. **ENSURE THAT ALL NATIVE-SERVING SCHOOLS ARE CONNECTED TO A SCALABLE BROADBAND TECHNOLOGY BY FULLY FUNDING FIBER UPGRADES.** 262 Native-serving schools lack the fiber connections needed for digital learning. We estimate that 95% of the federally supported Native-serving schools who currently lack fiber can be upgraded for a one-time cost of $501 million. A federal investment of $82 million will enable the E-rate fund to cover the remaining $431 million. Additionally, the FCC should ensure that it continues the current suspension of a program rule requiring high-cost builds to be amortized over multiple years.

2. **CONDUCT A WI-FI NETWORK NEEDS ASSESSMENT FOR NATIVE-SERVING SCHOOLS.** Many Native-serving schools lack the technical expertise to determine how to effectively spend their E-rate budgets to upgrade their Wi-Fi networks. The Bureau of Indian Education (BIE) should immediately fund a technical assessment of Native-serving schools Wi-Fi networks to enable these schools to utilize the $89 million of E-rate Wi-Fi network budget to upgrade their networks for digital learning. Many Native-serving schools are at risk of losing these funds if they do not start utilizing their budget in the coming school year.

3. **CONTROL THE COST OF ACCESS FOR BIE-PROCURED SCHOOLS.** The BIE procures broadband services for 77 school sites across the country. Rural schools in this category pay 23 times more for connectivity than similarly-situated non-Native-serving schools. If the BIE moves off of the federal Networx contract vehicle and seeks out the best local options for broadband service, $13 million per year in savings could be realized. These savings, if realized over a seven year period, would provide a sufficient amount of funding to address the $84 million required to construct fiber to all of the federally supported Native-serving schools in need.

Photo: National Indian Education Association (NIEA)

Over the course of the last decade, schools across America have been taking advantage of technology in the classroom to transform teaching and learning. Robust classroom technology allows teachers to personalize learning experiences, provides students equal access to compelling educational materials, and fosters 21st century skills for America's youth. Access to these digital opportunities is critical for America's Native students, but requires adequate broadband infrastructure as a prerequisite.

Today, 60,000 K-12 Native students attend federally-supported schools that do not have the broadband infrastructure required for digital learning in the classroom[1]. This paper discusses how we can bridge the gap to provide all Native students in federally-funded schools access to the connectivity they need to take advantage of a 21st century education.

[1] The analysis in this report only covers Native students who attend BIE schools or schools that receive federal assistance through the Impact Aid program. According to National Center for Education Statistics (NCES) 2015-16 data, there are 299,534 American Indian/Alaska Native students who attend traditional K-12 schools not supported by BIE or Impact Aid.

Broadband requirements for 21st century learning

In order for students and teachers to take advantage of digital opportunities in the classroom, the following conditions must exist:

1. Connections to scalable broadband infrastructure, such as fiber optics
2. Sufficient bandwidth to support digital learning
3. Affordable connectivity costs
4. Wi-Fi networks that can support a 1:1 student to device ratio

In this report, we will examine how federally supported Native-serving schools are performing against benchmarks in each of these areas. Given that there are a variety of distinct broadband procurement models for Native-serving schools, we will examine each performance area across the following categories of school type:

BUREAU OF INDIAN EDUCATION PROCURED SCHOOLS[2]

The Bureau of Indian Education (BIE) is an agency within the Bureau of Indian Affairs in the United States Department of the Interior. The BIE procures broadband services for 77 schools across the country[3], representing 8.8% of all federally-supported Native students[4].

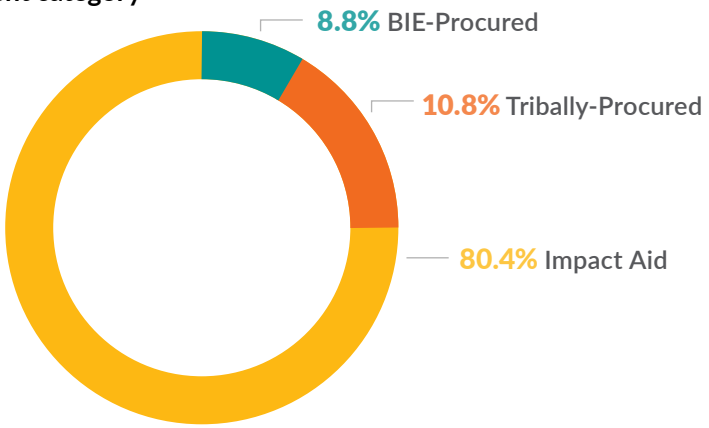
TRIBALLY-PROCURED SCHOOLS

In addition to the schools it procures broadband services for, the BIE provides funding and resources to 78 schools that make their own local broadband procurement decisions[5]. Schools in this category represent 10.8% of all federally-supported Native students.

IMPACT AID SCHOOL DISTRICTS

Traditional K-12 public school districts whose boundaries include Indian lands receive federal assistance through the Impact Aid program[6]. The majority (80.4%) of all federally-supported Native students are served by schools in this category.

Percentage of federally supported Native students served, by broadband procurement category



[2] For the purposes of this report, BIE schools will be categorized as BIE-procured or Tribally-procured based on their model for broadband procurement. This categorization does not align perfectly with BIE's definition of BIE-operated and BIE-grant. Some BIE-grant schools have, as part of their contract with BIE, allowed BIE to continue procuring connectivity services for them.

[3] According to the BIE website, 183 schools are supported by their agency. However, because some of these facilities are co-located or are non-instructional sites, this report will consider the population of sites that require a broadband connection for instruction to be 155.

[4] Because current enrollment information for all BIE schools was incomplete or unavailable to the authors of this report, BIE school population data is based on enrollment figures from the Universal Service Administrative Company.

[5] See footnote 3.

[6] https://www2.ed.gov/about/offices/list/oese/impactaid/whatisia.html

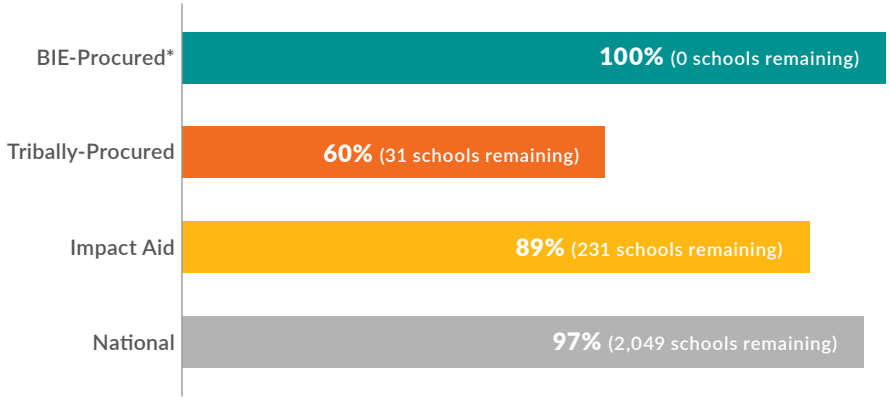
Connections to scalable broadband infrastructure

While there are a number of technologies that can be used to deliver broadband access, the only technology that can support current and future bandwidth needs for most schools is fiber optics. This is because where other technologies, such as cable, DSL, and T-1, are limited by the wire itself in terms of the maximum amount of bandwidth that can be delivered, fiber-optic lines can have their bandwidth capacity increased by simply upgrading the electronics connected to each node point. Not only is fiber superior from a technology standpoint, but it is also the most cost-effective technology[7]. Fixed wireless or microwave technology is a second-best option, but the relatively high cost of service as well as the susceptibility to weather and challenging geographical features (e.g., mountains or tall buildings) make fiber the best solution.

TECHNOLOGY	MAXIMUM BANDWIDTH (TYPICAL)
Dial Up	0.5 Megabits per second (Mbps)
T-1	1.5 Mbps
DSL	50 Mbps
Cable	250 Mbps
Fixed Wireless/Microwave	1,000 Mbps
Fiber	**100,000 Mbps**

Access to fiber for Native-serving schools is an area where tremendous progress has been made, but there remains a gap between Native-serving schools and traditional K-12 schools. Amongst BIE-procured sites, all locations are either already connected or are expected to be connected by the 2019-2020 school year[8]. Nearly 40% of Tribally-procured schools, or 31 schools, are not connected to fiber. Only 11% of Impact Aid schools are lacking fiber, but this translates to 231 schools that need to be upgraded, given the large population of schools in this category.

Percentage of schools connected to fiber



*Already connected or scheduled to be connected by 2020

[7] https://www.educationsuperhighway.org/wp-content/uploads/2014/11/Connecting-Americas-Students-K12-E-rate-Spending-Report-April-2014.pdf

[8] Conversation with BIA on April 17, 2018

Sufficient bandwidth

If fiber connections represent the roads over which digital information can travel, bandwidth represents the information itself, encoded into bits and bytes that are sent across our information highways. Schools need a certain amount of bandwidth to support meaningful interactions with technology in the classroom. While specific bandwidth needs vary from school to school based on the technology applications that teachers and students are pursuing, the Federal Communications Commission (FCC) in 2014 adopted a minimum bandwidth recommendation for all K-12 institutions of 100 kilobits per second per student (kbps/student)[9].

Impact Aid and BIE-procured schools are performing in-line with or better than national trends for this metric. Tribally-procured schools are lagging behind the national trend slightly (89% vs. 94%), but this translates to less than 10 schools that are not meeting the FCC goal.

Percentage of districts meeting 100 kbps/student*

*BIE-procured and Tribally-procured attainment is reported at the school level.

For schools not meeting the 100 kbps/student bandwidth target, cost is an especially important factor.

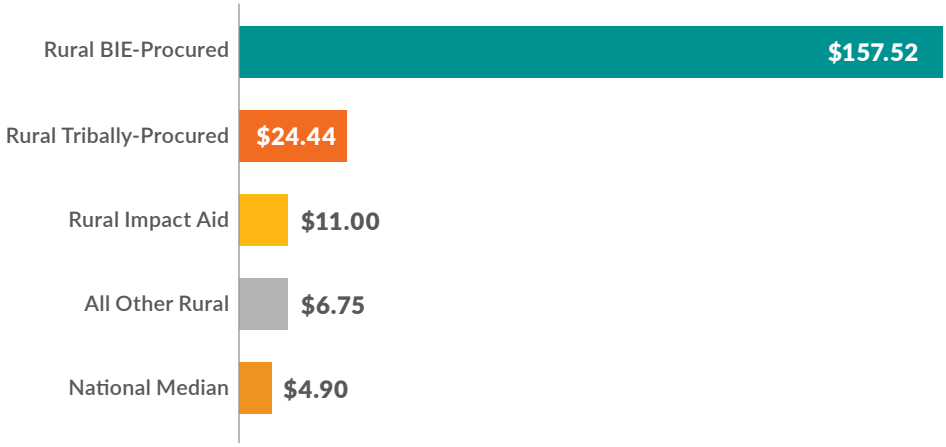
Affordable connectivity costs

One of the primary barriers preventing schools from upgrading their Internet access to keep up with bandwidth demand is affordability. This is especially true for Native-serving schools. Many of these schools are located in remote and sparsely-populated regions, which makes delivering broadband a high-cost endeavor.

Native-serving schools pay higher costs for broadband than traditional K-12 public schools, even when accounting for locale. Rural schools across the nation pay a median cost per megabit per second (cost/Mbps) of $6.75. In comparison, BIE-procured schools in rural areas pay 23 times this amount, with a median cost/Mbps of $157.52. Rural schools in the Tribally-procured and Impact Aid categories fair much better, with median cost/Mbps of $24.44 and $11.00 respectively, but they are still paying higher costs than traditional K-12 schools.

[9] https://www.fcc.gov/general/summary-e-rate-modernization-order

Median cost/mbps by district type



BIE-procured schools purchase their Internet services from a federal procurement vehicle called the Networx contract. This purchasing behavior is the biggest reason why BIE-procured schools pay significantly higher rates than Tribally-procured and Impact Aid schools.

While Tribally-procured and Impact Aid schools receive much better rates than their BIE-procured peers (largely because they are not obligated to purchase from an expensive master contract), they still pay higher rates than traditional K-12 schools, even when controlling for locale. This trend could be a result of many Native schools being in extremely remote locations. Amongst traditional K-12 school districts that do not serve Native students, 24% of rural schools are in a census-defined area classified as "remote," meaning that the school is at least 25 miles from an urban area and at least 10 miles from an urban cluster. This figure jumps to 62% for Native-serving rural schools. Service providers charge higher rates to smaller, more isolated communities as a result of both the high investment required to extend broadband to these areas as well as the relatively tiny amount of customers that the fixed costs of delivering service can be spread across.

Wi-Fi infrastructure

Fiber, bandwidth, and Internet affordability are all important factors in bringing connectivity to school buildings, but the job is not done there. Bandwidth must be transferred within school buildings to student and teacher devices in the classrooms. This last step requires robust Wi-Fi infrastructure inside K-12 schools. Cabling, switches, and Wi-Fi access points are examples of the infrastructure required to support digital learning in the classroom.

To our knowledge, there has been no comprehensive assessment of the sufficiency of Wi-Fi infrastructure in Native-serving schools. Such an assessment, involving a technical study of the network components used to deliver connectivity within the school, is required to determine the quality of internal connections that exist in these institutions.

Estimating the costs to connect the remaining Native-serving schools

For Native-serving schools not currently connected to fiber, the largest obstacle in most cases is the one-time construction cost needed to install fiber between the school facility and the nearest Internet service provider office. Once fiber has been installed, the recurring costs of service are relatively low and are driven by operations and maintenance requirements as well as periodic upgrades to electronics at the node points of the fiber circuit.

It is estimated that 31 Tribally-procured school buildings will require new construction to be connected to fiber. We estimate the one-time cost of connecting the remaining 31 facilities to be $12 million[10].

For Impact Aid schools, an estimated 231 sites require fiber construction and we estimate that 95% of these sites can be upgraded for a one-time cost of $501 million. The remaining 5% of sites not included in this estimate represent a small portion of the fiber builds needed in Alaska that would require extremely high costs[11]. These remote sites may be better-served by high-speed microwave connections instead of fiber.

E-rate provides funding for Native-serving schools

The federal E-rate program was established in 1996 as a means to ensure that K-12 schools and libraries can obtain high-speed Internet service at affordable rates[12]. The program, which is overseen by the Universal Service Administrative Company (USAC), discounts the cost of broadband services using a formula based on the level of poverty and the urban/rural status of an entity applying for funding. Nearly all Native-serving schools take advantage of the E-rate program, receiving an average discount rate of almost 90%.

In funding year 2017, which corresponds with the 2017-2018 school year, Native-serving schools had E-rate funding approved for $197 million worth of broadband services, receiving $171 million from the E-rate program to cover these costs, while contributing $26 million in local matching dollars.

Not only does the E-rate program discount the monthly recurring costs of broadband services, but it also has rules in place to fund the new construction of broadband infrastructure such as fiber optics. Native-serving schools that still lack fiber can get the one-time costs of infrastructure buildout funded at their discount level. Additionally, E-rate has a provision for funding the one-time construction of broadband networks at an even higher level if a state (or in the case of BIE schools, a tribal or federal government entity) provides matching funds[13]. By taking advantage of E-rate matching funds, we estimate that the Universal Service Fund could cover $431 million of the $513 million estimated to connect all of the Tribally-procured schools and 95% of the

[10] To calculate the distance of Internet access builds, we calculate the distance between the school district office and the closest service provider point of presence. Once the unscalable campuses are identified, we use industry benchmarks and our in-house expertise to develop the total cost to build fiber.

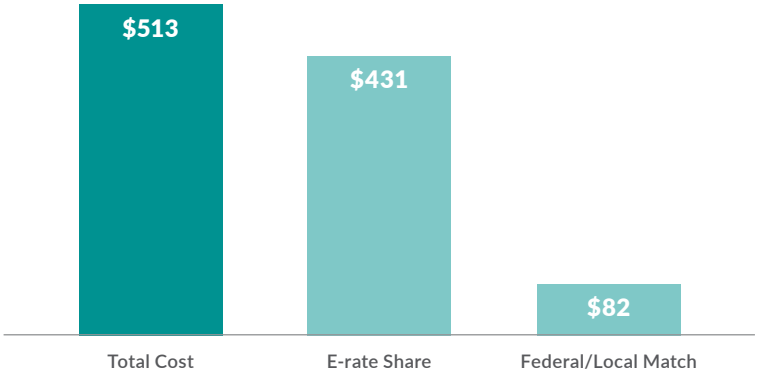
[11] 13 of the 103 fiber builds needed in Alaska fall into this category.

[12] https://www.usac.org/sl/about/getting-started/default.aspx

[13] https://www.usac.org/sl/applicants/befo-reyoubegin/state-matching-provision.aspx

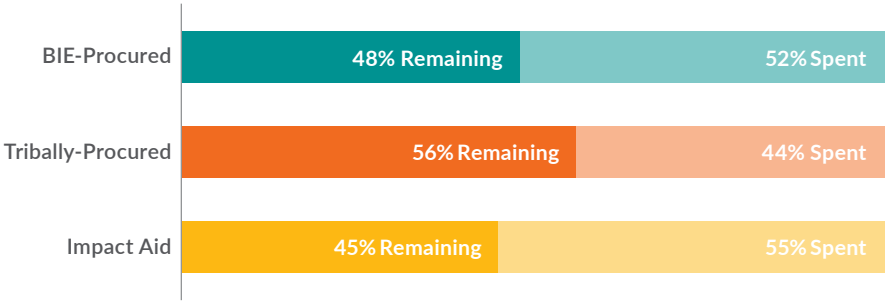
Impact Aid schools that need to be upgraded. At least $37 million of the remaining funding needed would have to come from an eligible matching source, leaving $45 million to be funded by the schools locally.

Cost to connect 95% of Native-serving schools to fiber ($ Million)



E-rate provides funding for Wi-Fi networks in schools as well. Every E-rate eligible school is given a 5-year inflation-adjusted budget of $150 per student (or a flat budget of $9,200 for schools with less than 62 students) to spend on their internal connectivity. While we do not know the quality of the internal network components that currently exist in Native-serving schools, we can get a sense of the level of Wi-Fi network investment that has occurred by analyzing the amount of funding that Native-serving schools have requested from the federal E-rate program.

Category 2 funds remaining by district type



As the chart shows, roughly half of the available internal network budget has been accessed by Native-serving schools. There is still $89 million in Wi-Fi budget that can be taken advantage of[14]. Furthermore, many Native-serving schools have not spent any of their E-rate eligible Wi-Fi budget[15], indicating that these schools either are not aware that the funding is available or do not have the technical or procurement expertise to take advantage of the money.

[14] This is the amount of funding that remained after the 2016-2017 E-rate funding cycle.

[15] 44% of BIE-procured schools, 26% of Tribally-procured schools, and 11% of Impact Aid schools have not drawn down any of their Category 2 (Wi-Fi) E-rate budget.

Recommendations

1. ENSURE THAT ALL NATIVE-SERVING SCHOOLS ARE CONNECTED TO A SCALABLE BROADBAND TECHNOLOGY BY FULLY FUNDING FIBER UPGRADES

There are 262 Native-serving schools that currently lack fiber connectivity. We estimate the one-time cost of upgrading all of the remaining Tribally-procured and 95% of Impact Aid schools to fiber be $12 million[16] and $501 million respectively, for a total one-time cost of $513 million (all BIE-procured schools are either already connected to fiber or scheduled to be upgraded over the next few years). An investment of $82 million from an eligible government entity would enable the E-rate program to cover the remaining $431 million to put nearly all of the Native-serving schools across the country on a scalable, future-proof connection[17].

A number of the builds required to connect the remaining Native-serving schools to fiber have an estimated one-time construction cost that is greater than $500,000. In 2014, an E-rate modernization order issued by the FCC suspended a requirement to amortize non-recurring costs in excess of $500,000 across a multi-year period[18]. The suspension of this amortization requirement is scheduled to be reviewed prior to July of 2019. To ensure that Native-serving schools can be connected to fiber without delay, we also recommend that the suspension of the amortization requirement be extended to allow all of the fiber builds to Native-serving schools to be completed.

2. CONDUCT A WI-FI NETWORK NEEDS ASSESSMENT FOR NATIVE-SERVING SCHOOLS

Digital learning in the classroom requires robust internal connections, but we cannot evaluate the readiness of Native-serving schools in this area without taking inventory of the network assets that currently exist in each building. A technical assessment of Wi-Fi technology should be conducted for Native-serving schools. Not only would an assessment help us to understand the investment needed to bring 1:1 connectivity to every Native-serving classroom, but it would also provide key inputs into the procurement process that schools will need to undergo to upgrade their internal networks. Insights gained from such an assessment will help direct the $89 million of Wi-Fi network budget available to Native-serving schools under the E-rate program.

3. CONTROL THE COST OF ACCESS FOR BIE-PROCURED SCHOOLS

The United States General Services Administration (GSA) is responsible for bidding and managing the Networx contract from which BIE-procured schools have been required to purchase their

[16] This $12 million does not take into account the funding required for the BIE-procured schools that are already scheduled to be upgraded to fiber in the next few years.

[17] The E-rate program can provide $394 million to support these fiber builds based on the current discount rates of schools in need, however, an eligible matching fund of $37 million will raise the E-rate contribution to $431 million. The remaining $45 million of out-of-pocket costs to Native-serving schools to complete the builds, while relatively small compared to the total build cost, still represents a significant barrier for cash-strapped schools. A government entity could fund the local match in addition to the E-rate eligible matching fund for a total of $82 million.

[18] https://www.fcc.gov/general/summary-second-e-rate-modernization-order

broadband services. The stated goal of the Networx contract is "to use the purchasing power of government to drive down prices and reduce costs for agencies." Federal government agencies collectively purchased almost $2 billion worth of services through the contract in FY 2017[19], and the purchasing vehicle may very well have delivered on its goal for a majority of those purchases. In the case of Native-serving schools, however, the contract appears to fall considerably short of providing cost-effective services to its users.

While the remote location of many BIE-procured schools makes broadband delivery more costly, it is not a factor that justifies the exorbitant monthly recurring costs that BIA and E-rate are paying for these services. BIE-procured schools in rural areas pay 23 times more in monthly recurring costs than non-Native-serving school districts in rural areas, and there are many instances of more affordable services being offered to districts that neighbor high-cost BIE-procured schools. For example, San Ildefonso Day School, a BIE-procured institution in New Mexico, is paying $14,182 per month for a 100 Mbps lit fiber circuit from Verizon via the Networx contract. Kha'p'o Community School, a Tribally-procured school that is a mere 15 minute drive away, is paying $1,026 per month for a 150 Mbps lit fiber circuit from a local service provider. Kha'p'o is paying 93% less per month than Santa Clara for 50% *more* bandwidth. Similar examples for other BIE-procured schools are not hard to come by.

Another significant challenge with the Networx contract is that the BIE is required to do business largely with a single service provider, Verizon. Because Verizon does not have telecommunications assets in every Native-serving school location that demands it, the provider is often times forced to subcontract the work to one or more third parties, adding costs with each layer of administration. Taos Day School, another BIE-procured school in New Mexico, wanted to upgrade to fiber Internet service last year. The local provider, Kit Carson, has existing fiber assets near Taos Day School and was willing to connect the school at a reasonable rate. However, due to the requirement to conduct business through the Networx contract, the BIE could not work directly with Kit Carson. Instead, the broadband connection had to be subcontracted through multiple service providers: first to another provider in New Mexico that had an existing business relationship with both Kit Carson and Verizon, which then subcontracted the work to Kit Carson. Taos Day School is still connected via Kit Carson's fiber, but instead of paying $170 per month for the service (the price that nearby Taos Charter School is paying for service from Kit Carson), they are paying $1,600 per month.

If the BIE were to procure Internet services outside of the Networx contract for the schools it operates, huge savings would be realized. If BIE-procured schools are able to achieve the median cost of Tribally-procured schools (which would not be an outrageously ambitious

[19] https://www.gsa.gov/technology/technology-purchasing-programs/telecommunications-and-network-services/networx

target), they would collectively save $13 million per year. These savings, if realized over a seven-year period, would provide a sufficient amount of funding to address the one-time matching funds required to construct fiber to all of the Tribally-procured and Impact Aid schools in need.

The Office of Management and Budget (OMB) rescinded its guidance for all federal agencies to purchase off of the Networx contract in July of 2017, and currently there is no similar guidance for agencies to purchase from another procurement vehicle[20]. Furthermore, the Networx vehicle is scheduled to be retired in the spring of 2020. As such, BIE should start pursuing the best-cost local broadband service options for its schools, potentially yielding huge savings versus the services currently being purchased through the Networx contract.

[20] https://itmodernization.cio.gov/report/network-modernization/

Appendix

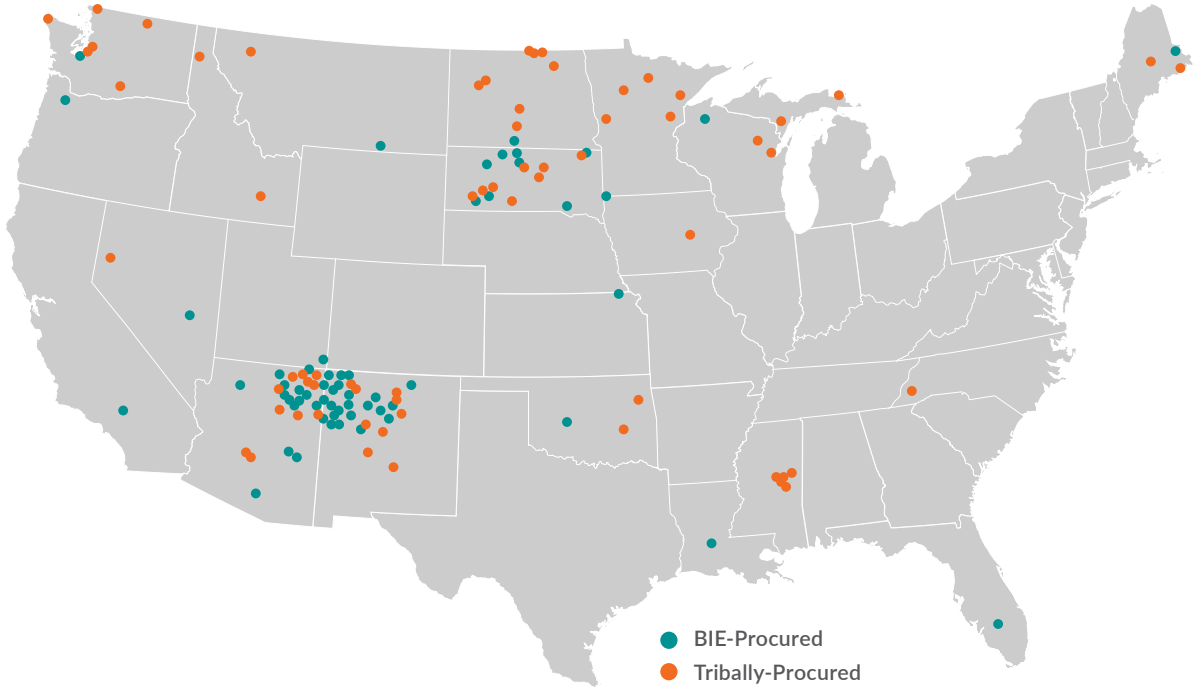


Table of builds/funding needed by state (BIE and Impact Aid)

STATE	FIBER BUILDS	MATCHING FUNDS REQUIRED ($M)
National	**262**	**$174.3**
95% of Nation	**250**	**$82.1**
AK[21]	90	$37.2
AZ	47	$9.1
CA	32	$7.3
FL	1	$0.2
MI	5	$1.6
MN	4	$0.5
MT	12	$3.9
ND	7	$0.9
NM	12	$2.5
NV	17	$15.4
OK	3	$0.2
OR	4	$0.3
SD	5	$1.5
UT	1	$0.5
WA	4	$0.5
WI	2	$0.004
WY	4	$0.5

[21] Builds and match fund quoted for 95% of campuses. For additional 5%, add difference between national and 95% of nation

About EducationSuperHighway

EducationSuperHighway is the leading non-profit focused on upgrading the Internet access in every public school classroom in America. We believe that digital learning has the potential to provide all students with equal access to educational opportunity and that every school requires high-speed broadband to make that opportunity a reality. Our work focuses on catalyzing federal and state action on K-12 broadband initiatives and accelerating upgrades in school districts by connecting them to competitive service provider options.

We are currently working with governors in 30 states covering more than 25 million students and providing technical and procurement support to hundreds of school districts. Our Compare & Connect K-12 online tool helps schools, state leaders, and service providers view broadband services and bandwidth information for school districts nationwide so they can get and deliver more bandwidth for their broadband budgets. As a non-profit, our tools and services are offered free of charge. EducationSuperHighway is funded by national philanthropic organizations, including the Chan Zuckerberg Initiative and the Bill and Melinda Gates Foundation, and our mission is supported by America's leading CEOs. To learn more, visit educationsuperhighway.org.