ARKANSAS STATE BROADBAND MANAGER'S REPORT

June 30, 2020

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What is the State Broadband Office?

The role of Arkansas State Broadband Manager is defined in section **§ 25-4-125** of the Arkansas code, as updated by Act 792 of 2019, as follows:

(a) The Governor shall designate the State Broadband Manager.

(b) The State Broadband Manager shall coordinate the state's efforts to expand and improve broadband capacity and availability by:

(1) Serving as a single point of contact for:

(A) State agencies, boards, commissions, and constitutional officers, including without limitation the Governor, Department of Education, Department of Higher Education, and Arkansas State Highway and Transportation Department;

(B) Private businesses, enterprises, and broadband providers;

(C) Nonprofit organizations;

(D) Governmental entities and organizations organized under federal law or the law of another state; and

(E) Individuals and entities that seek to assist the state's efforts to improve economic development, elementary education, and secondary education through the use of broadband technology;

(2) Gathering, compiling, and maintaining information obtained independently or from an individual or entity described in subdivision (b)(1) of this section;

(3) Formulating, updating, and maintaining a state broadband plan; and

(4) On or before January 1 and July 1 of each year, filing a written report of the activities and operations of the State Broadband Manager for the preceding six (6) months with the:

(A) Governor;

(B) Legislative Council; and

(C) Joint Committee on Advanced Communications and Information Technology.

Late in 2019, subsequent to the passage of Act 792 of 2019, Governor Asa Hutchinson appointed Dr. Nathan Smith[1] to the role of State Broadband Manager. In the context of transformation, Dr. Smith also served as part of the leadership team of Secretary of Commerce Mike Preston then and for some time afterwards. Dr. Smith had served until that time as Economic Policy Director at the Arkansas Development Finance Authority (ADFA), and continues to work with the same team that he managed in that role, consisting of Dr. Nicolas Aguelakakis, Senior Economic Analyst, and Clint Moore, Economic Analyst, and fulfill tasks inherited from his previous role, including the annual development of the Area of Opportunity Index that ADFA uses to administer the Low-Income Housing Tax Credit program, and the routine production of workforce analyses that academic institutions use to help them align new and

[1] No relation to the Dr. Nathaniel Smith who leads the Arkansas Department of Health.

reconfigured academic programs with labor market needs. Dr. Smith and Dr. Aguelakakis still serve under ADFA in the AASIS system, but Clint Moore has been formally transferred to AEDC.

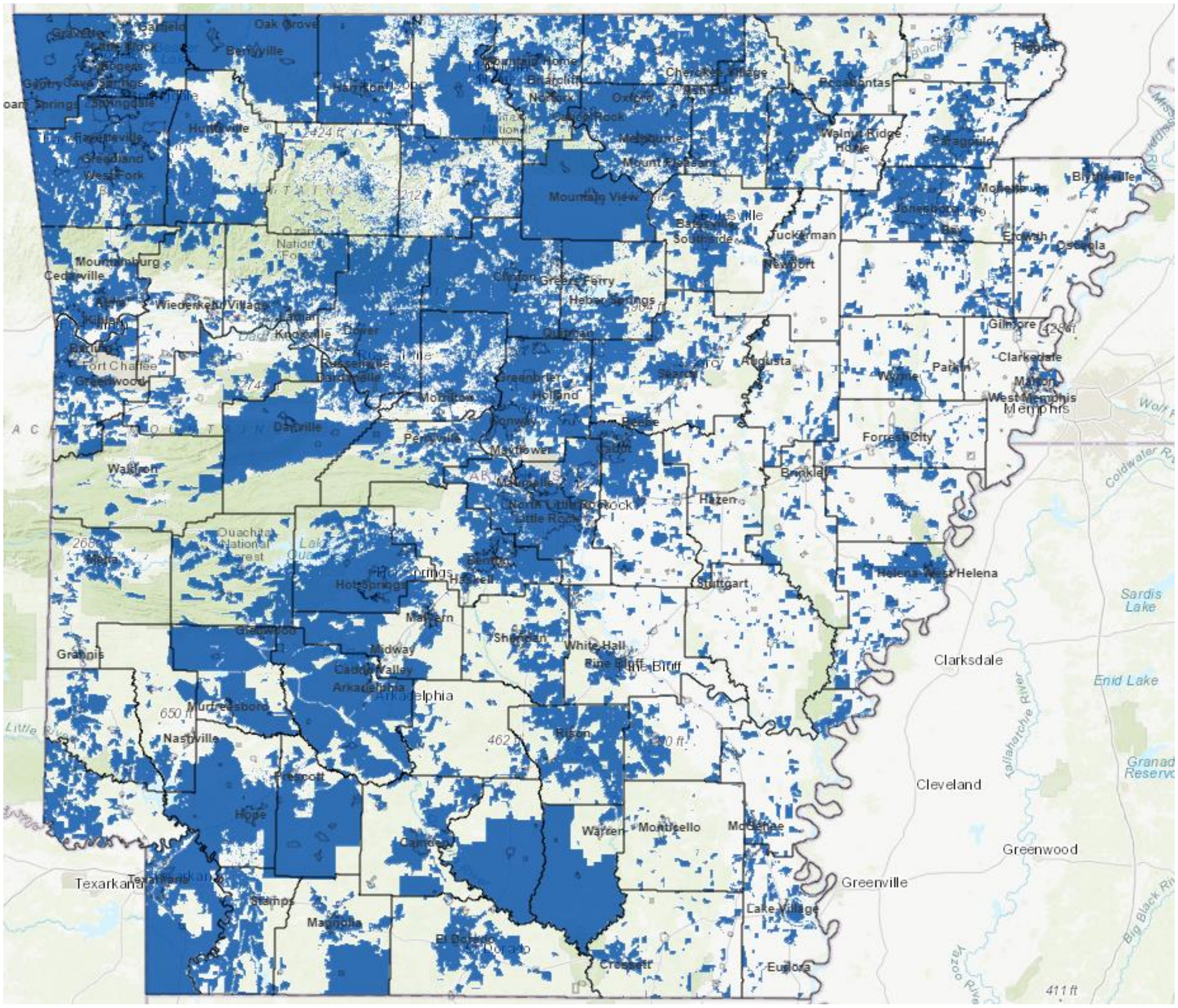
Main Activities of the State Broadband Office in the First Half of 2020

The Arkansas Rural Connect rules were approved on February 19, 2020, and the State Broadband Office was preparing at that time to launch a $25 million round of the grant on March 15, 2020. But those plans were put on hold when a sharp economic downturn caused by COVID-19 reduced state general revenue. Then, with the passage of the CARES Act, $1.25 billion in federal aid was made available for the state of Arkansas to spend on purposes related to coronavirus response, broadly defined.

Some sort of broadband projects were clearly an appropriate use for these funds, given the critical role that broadband connectivity plays in enabling people to telework, access telehealth, engage in distance education, and in general, to meet basic needs in a time of pandemic and social distancing. But the CARES Act required funds to be spent by December 2020, whereas Arkansas Rural Connect was designed to reimburse expenses on projects that would complete deployment by November 2022. Consequently, there was a need to adjust the ARC rules to enable payment in advance and prioritize early deployment. How this should be done took time to clarify and plan for, and involved many stakeholders. Eventually, AEDC posted a new set of ARC Coronavirus Rules intended to give the ARC program the flexibility needed to harmonize its processes with the requirements of the CARES Act. These Rules are in a public comment period at the time of writing. In addition, on June 15, 2020, the CARES Act Steering Committee voted to allocate $19.3 million in CARES Act funds to the Arkansas Rural Connect program.

While executive branch leaders were pursuing clarity about how to use CARES Act funds for broadband, the State Broadband Office, on instructions from the Governor's Office, launched the first round of Arkansas Rural Connect grants on April 27, 2020, on a somewhat accelerated timeline, in hopes that already committed grant funds of $4.7 million would help alleviate broadband deficiencies during the pandemic at least to some extent. Twenty-eight ISPs expressed interest in the grants and nominated liaisons. In accordance with the Arkansas Rural Connect rules, the State Broadband Office collected coverage maps from all Arkansas ISPs who chose to provide them, and combined these maps with information from Form 477 data published by the FCC, in order to create a coverage map suitable for powering the eligibility determinations needed by the Arkansas Rural Connect program. This map is shown in Figure 1, below, and published online at https://broadband.arkansas.gov/ar-rural-connect/targeted-areas/

Figure 1: Arkansas Rural Connect coverage map



In the map in Figure 1, the blue areas <u>either</u> have 25/3 broadband service now, <u>or</u> are scheduled to be provided with broadband service in the coming years as ISPs fulfill their commitments to federal agencies such as the FCC and USDA, according to data provided to the State Broadband Office by Arkansas ISPs or, if they declined to send maps, FCC Form 477 data. Data about the actual quality of broadband coverage is a long-standing and well-known problem to which there are no easy answers, so it is quite possible that some areas are misrepresented in the map, and in fact are either served with 25/3 when the map shows them to be unserved, or else unserved when the map shows them to be served. Communities that want to apply for Arkansas Rural Connect broadband grants, but which are shown to be served on the maps, can collect data to demonstrate that in fact they are inadequately served with 25/3 broadband.

While the COVID-19 pandemic has considerably complicated its rollout, there has consistently been strong interest in the Arkansas Rural Connect program, and the State Broadband Office is expecting to receive, and looks forward to reviewing and funding, many applications for valuable projects that will help to close the digital divide in Arkansas in the coming years. The State Broadband Office is grateful to many companies in the telecommunications industry for their flexibility and steadfast interest as the pandemic has necessitated policy changes.

The statutory task of "formulating, updating and maintaining a state broadband plan" has not been performed in the first half of 2020. The most recent State Broadband Plan is still the one posted in May 2019, which was written before the announcements of the FCC RDOF program, the Arkansas Rural Connect broadband grant initiative, or the Rural Broadband I.D. Expenses Trust Fund. The development process for the Plan at that time, involving extensive engagement with a wide variety of stakeholders, may be worth emulating in future as the State Broadband Office seeks to live up to its statutory duties.

A Pivotal Time for Broadband in Arkansas

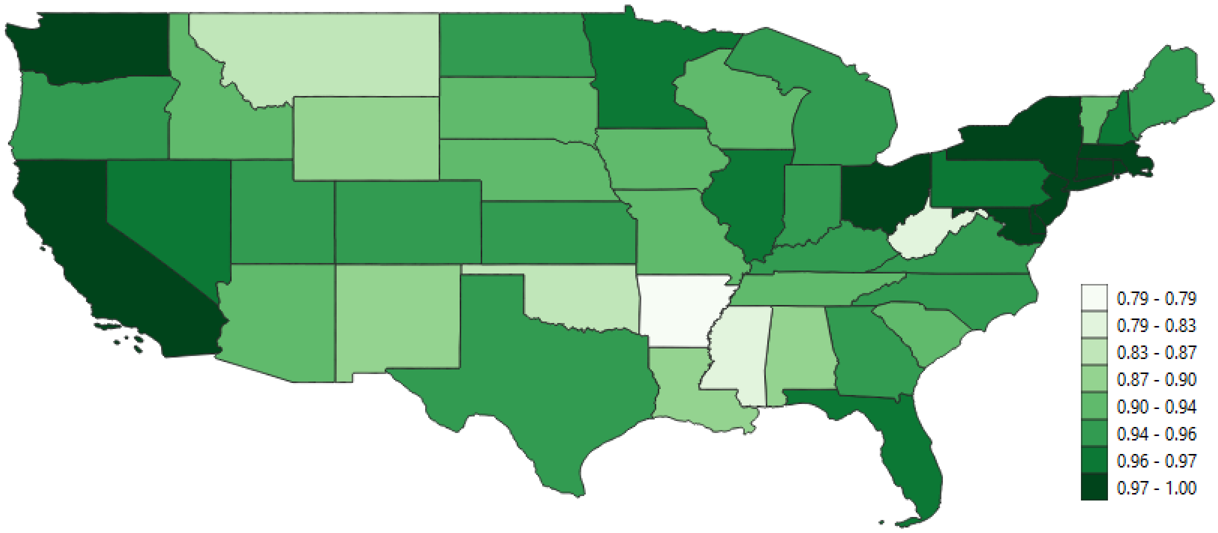
The year 2020 will be critical for closing the digital divide in Arkansas. Four major developments are occurring this year that will shape the future of Arkansas's broadband landscape. First, the FCC's **Rural Digital Opportunity Fund (RDOF)** will overhaul federal universal service in telecommunications in a way that will probably promote more efficient deployment of broadband to rural areas. Second, the **COVID-19 pandemic** temporarily altered online behavior in the direction of far more telework, distance education, and to some extent telehealth. It remains to be seen to what extent some of the changes in habits induced by COVID-19 will persist as the economy reopens, but they are likely to alter the broadband business and make the economic need for broadband more acute. Third, **state involvement in the broadband business** was inaugurated with the launch of the Arkansas Rural Connect program in the spring of 2020. Fourth, the **launch of Starlink** may, if the technology is successful, provide, starting perhaps as early as late 2020 but especially in 2021, a new way for everyone to access broadband through low-earth-orbit satellites. However, the urgency of the need for broadband, and many uncertainties about the efficacy of low-earth orbit satellite systems, provide ample reason to continue deployment of terrestrial communications networks that can meet broadband needs, while hoping that Starlink is successful.

I. Arkansas Continues to Lag in Broadband Deployment (as of June 2019)

BroadbandNow.com recently raised Arkansas's ranking from 50th of 50 to 41st, but the state still lags. BroadbandNow.com says that their "ranking is based on access to low-price plans, wired broadband coverage, and friendliness to broadband competition," so the ranking change may partly reflect a positive appraisal of the broadband policy environment in Arkansas. But in the actual extent of broadband coverage, Arkansas still ranked, as of the last data collected by the FCC in June 2019, dead last, by a substantial margin, as shown in Figure 2.[2]

[2] Throughout this report, the maps are created based on the most recent Form 477 dataset from the FCC. The FCC asks all ISPs twice a year to report their "maximum advertised speed" for each technology and each Census block, separate for consumer and business services. The same data is the basis for the FCC's online broadband coverage map at https://broadbandmap.fcc.gov/#/. However, these maps may differ slightly because the FCC includes only consumer internet service, whereas the maps in this report use both consumer and business service. The maps shown here also differ from the Arkansas Rural Connect coverage map displayed in Figure 1. While there is reason to think that map is more up-to-date than the FCC Form 477 data, it also shows fewer speed tiers, and is not equally consistent across providers since not all providers submitted maps. The FCC Form 477 data provides a less updated but more complete and consist picture of the state broadband coverage in Arkansas.

Figure 2: Share of state population with access to broadband at speeds of 25/3 or greater (Source: FCC: Form 477, June 2016 v1 release)



The bottom ten states for broadband coverage (i.e., availability of internet service at speeds of 25/3 or faster) are shown in Table 1. Arkansas trails the next worst-connected states, Mississippi and West Virginia, by ~4%.

Table 1: Bottom 10 states for broadband coverage

State	Broadband coverage
50. Arkansas	**79%**
49. Mississippi	83%
48. West Virginia	83%
47. Alaska	86%
46. Oklahoma	87%
45. Montana	87%
44. Louisiana	88%
43. Alabama	88%
42. Wyoming	88%
41. New Mexico	90%

Figure 3 shows the share of each state's population that enjoys access to 25/3 broadband coverage from two or more different providers. Broadband competition is almost universal in New Jersey, and is available to most of the population in most states, though often consumers only have a two-way choice between DSL and cable. Meanwhile, in Arkansas, only ~29% enjoy a choice of broadband providers.[3]

Figure 3: Share of state population with access to 25/3 broadband from 2 or more providers

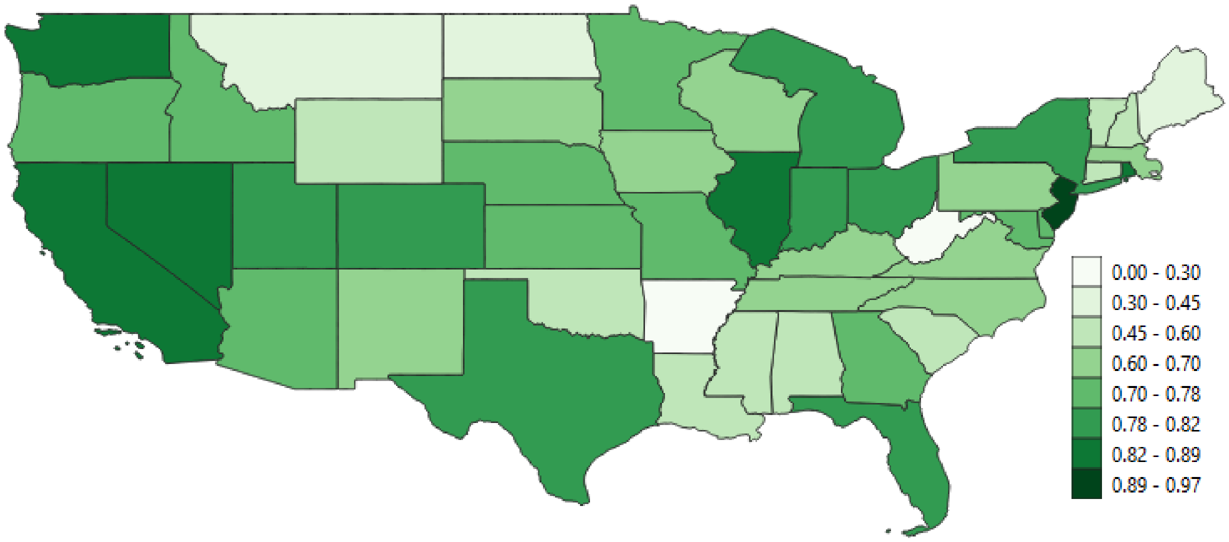


Table 2 shows the bottom 10 states in terms of the share of the population enjoying a choice of broadband providers. Arkansas and West Virginia are almost tied, but the next tier of states, North Dakota, Montana, and Maine, enjoy substantially more broadband competition.

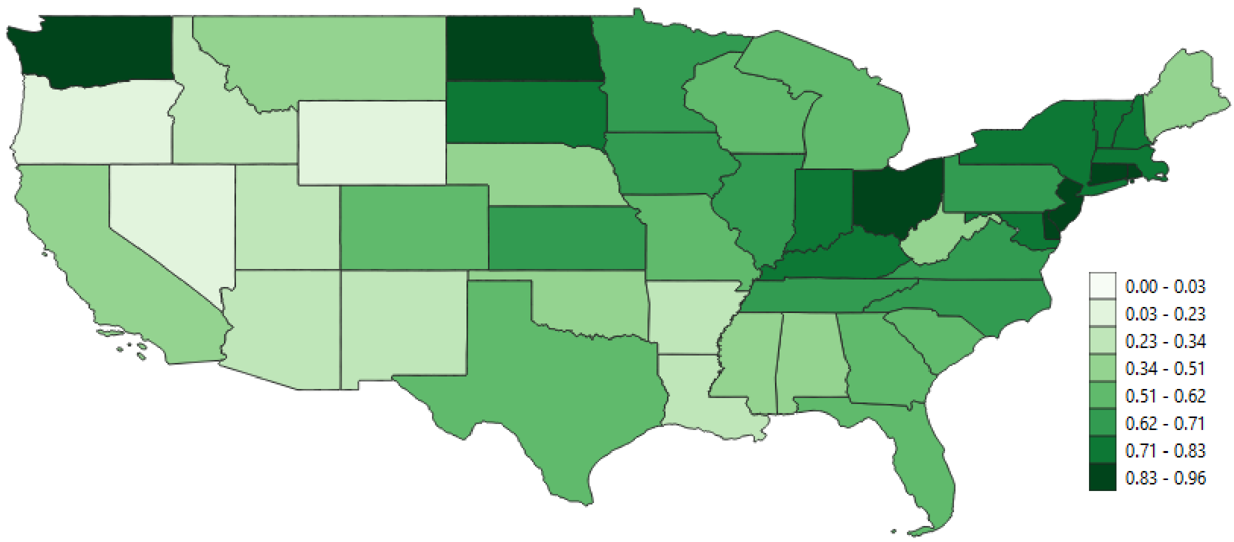
Table 2: Arkansas trails in access to competing broadband providers

NAME	Share with access to 25/3 broadband from 2 or more providers
50. Arkansas	**29%**
49. West Virginia	30%
48. North Dakota	41%
47. Montana	43%
46. Maine	45%
45. Vermont	54%
44. Louisiana	55%
43. Oklahoma	56%
42. Connecticut	57%
41. New Hampshire	57%

[3] The actual percentage is probably less, because FCC Form 477 data collection methods result in overstatements of coverage due to asking about "maximum advertised speed."

Figure 4 shows the share, not of population, but of *territory* that has 25/3 broadband coverage. The share of Arkansas's territory with broadband coverage, at 28%, is much smaller than the share of Arkansas's population that enjoys broadband coverage, at 79%, reflecting the usual pattern whereby population centers get better internet service than low-density rural areas, because low population density raises the costs of deployment per location served.

Figure 4: Share of state territory served by 25/3 broadband



Arkansas ranks low but not last by this measure. The least percentages of land area covered are in states with huge unpopulated expanses of land, such as Alaska, Nevada, and Wyoming.

Table 3: Bottom 10 states for share of land with 25/3 coverage

NAME	Share of land with broadband coverage
50. Alaska	3%
49. Nevada	18%
48. Wyoming	20%
47. Oregon	23%
46. Arkansas	**28%**
45. Utah	28%
44. Louisiana	31%
43. New Mexico	32%
42. Arizona	33%
41. Idaho	34%

Figure 5 shows the share of population with access to broadband coverage at speeds of 100 Mbps download/10 Mbps upload or faster. In all states, most people live in areas with access to broadband at these speeds. But the share is lower in Arkansas than elsewhere.

Figure 5: Share of state population with access to broadband at 100 Mbps download/10 Mbps download or faster

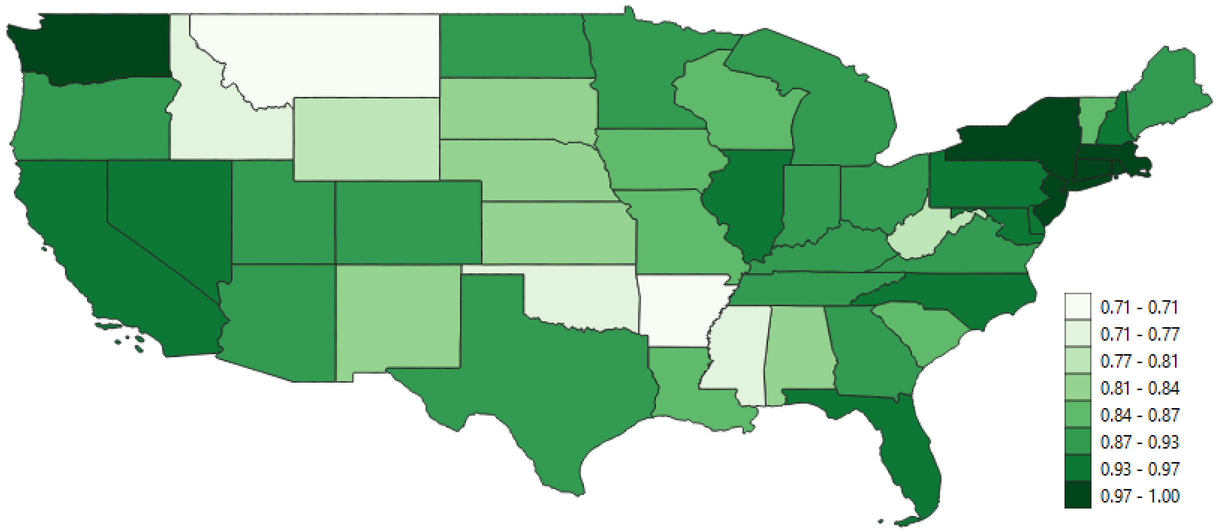


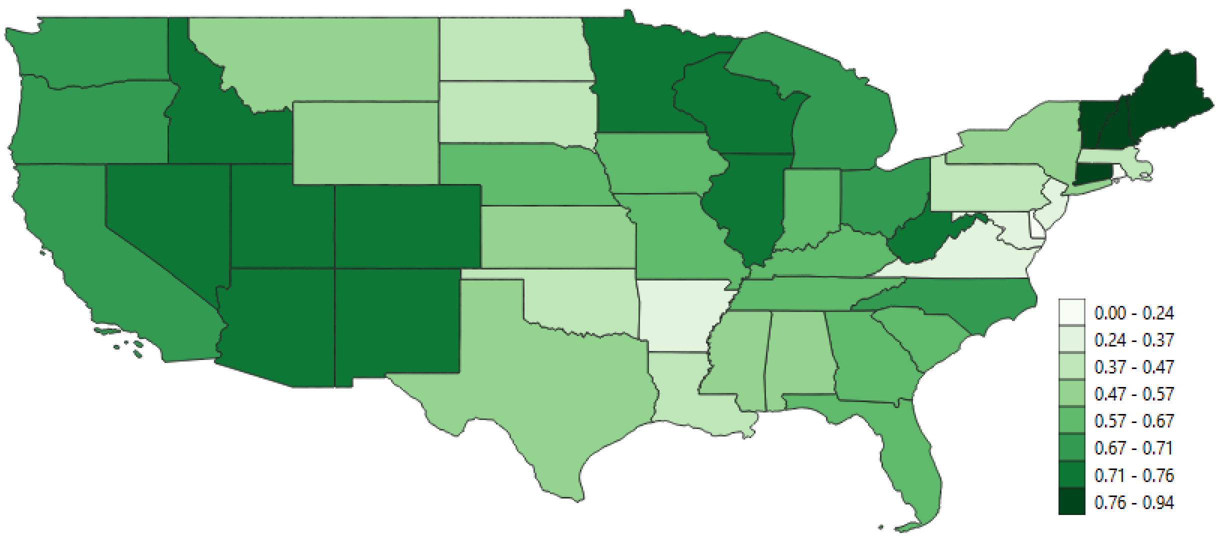
Table 4 shows the bottom 10 states for 100 Mbps+ coverage. Arkansas is last by a 5% margin, behind Montana, while neighboring states Mississippi and Oklahoma, though in the bottom 5, have ~10% of their population enjoying access to 100 Mbps+ coverage, relative to Arkansas.

Table 4: Bottom 10 states for 100 Mbps+ broadband coverage

NAME	Share with access to 100+ Mbps broadband
50. Arkansas	**66%**
49. Montana	71%
48. Mississippi	75%
47. Oklahoma	76%
46. Idaho	77%
45. Wyoming	79%
44. Alaska	80%
43. West Virginia	81%
42. South Dakota	83%
41. Nebraska	83%

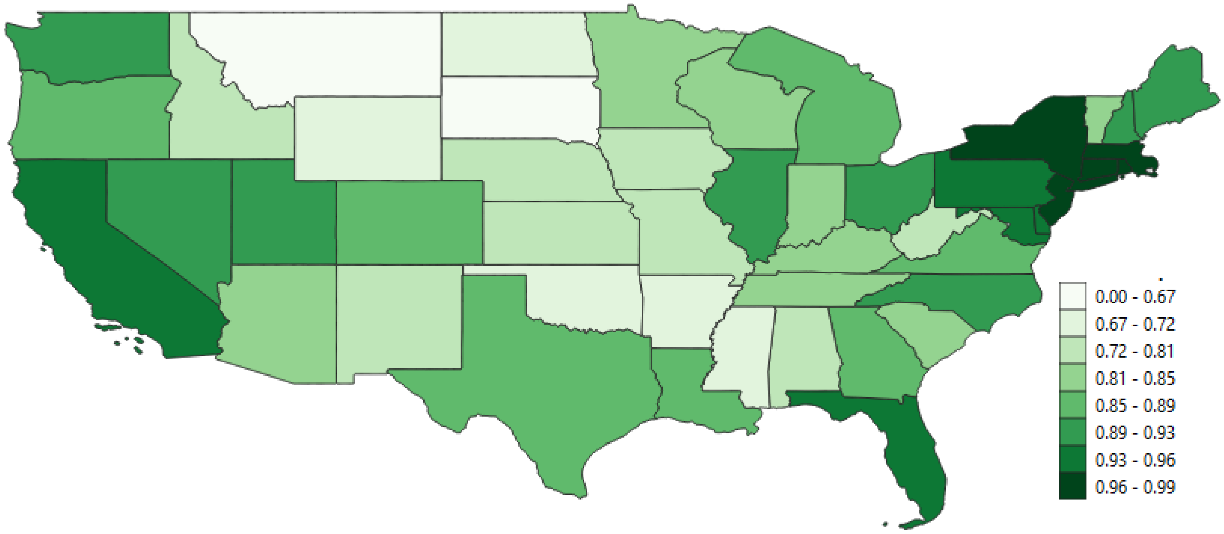
The pattern of access to Digital Subscriber Line (DSL) service, shown in Figure 6, is distinctive because DSL requires a certain degree of investment over and above the legacy telephone wires that it uses to transmit data, so some areas lack DSL because that investment never occurred, but DSL struggles to match the performance of cable and fiber optic internet, so in areas where those are available, it sometimes ceases to be offered. Thus, in Delaware and Rhode Island, less than one-quarter have access to DSL at any speed, but 97% and 99%, respectively, have access to broadband at speeds of 100 Mbps or more. Likewise, New Jersey and Maryland have relatively little DSL, but access to broadband at 100 Mbps or faster is virtually universal. Meanwhile, states like Mississippi (52% have DSL) and Oklahoma (46%) have less DSL than most states do, and are also poorly served overall. Arkansas has much less DSL than other poorly served states, and weak DSL deployment doubtless explains some of Arkansas's digital backwardness. DSL service has been in decline in many areas nationwide, including some in Arkansas.

Figure 6: Share of state population with access to DSL internet service (10/1 or faster)



The most widely available kind of internet service is cable, distributed through the same coaxial copper wires that have long delivered cable TV service. Figure 7 shows the share of the population that has cable internet across the lower 48 states. Cable reaches a large majority of the population in all states, but it tends to be concentrated in population centers, so while access is nearly universal in some highly urbanized states like Connecticut and New Jersey, a band of more rural and/or less densely populated states in the middle of the country, from Mississippi to Montana, have less cable broadband coverage.

Figure 7: Share of state population with access to cable internet service (10/1 or faster)



Arkansas is low but not last by this measure, as shown in Table 5. Below Arkansas are several states with very low population density—Montana, Wyoming, and the Dakotas—as well as (by a slight margin) Arkansas's neighbor, Mississippi, and Oklahoma is only slightly ahead.

Table 5: Bottom 10 states for cable broadband coverage

NAME	Cable internet coverage
50. Montana	64%
49. North Dakota	64%
48. South Dakota	66%
47. Mississippi	68%
46. Wyoming	68%
45. Arkansas	**68%**
44. Oklahoma	71%
43. New Mexico	74%
42. Idaho	75%
41. Iowa	76%

Fiber optic broadband is widely considered to be the "future proof" cutting edge of internet service, but it differs from cable internet in that, since fiber optic technology is relatively new—practical implementations of fiber optic communications only became available in the 1970s, and costs long remained elevated relatively to coaxial copper cables—it lacks the kind of legacy infrastructure to repurpose that cable internet enjoys. The pattern of fiber optic deployment consequently tends to be paradoxical, with some rural areas leapfrogging towns and suburbs because cable was never deployed there. Where cable TV systems exist, the service quality advantage offered by fiber is often insufficient to justify the costs of deploying a new network infrastructure, in terms of what a fiber optic deployer can expect to earn by capturing market share from its cable competitor. Once this is understood, some apparent anomalies in the data, such as the paucity of fiber in urban Illinois, or the advantage in fiber coverage that Oregon enjoys relative to California and Washington, become less surprising.

Figure 8: Share of state population with access to fiber optic internet service (10/1 or faster)

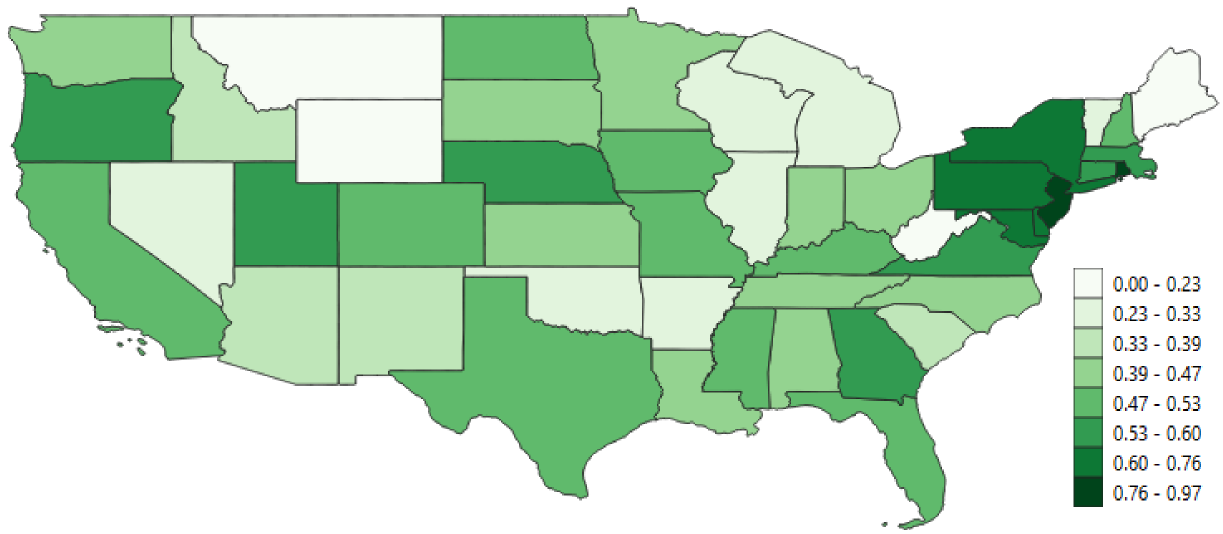


Table 6 shows the bottom 10 states for fiber optic broadband coverage, and it is worth noting that the bottom 10 states for cable and the bottom 10 states for fiber are quite different lists, though there is some overlap. Only Wyoming, Montana, Arkansas, and Oklahoma are in the bottom 10 for *both* fiber optic broadband coverage *and* cable broadband coverage. Other states that are poorly served by one technology are well served by the other. Maine, for example, has little fiber, but 90% of Mainers have access to cable internet. North Dakota is relatively poorly served by cable, but fiber access is high, at 51%.

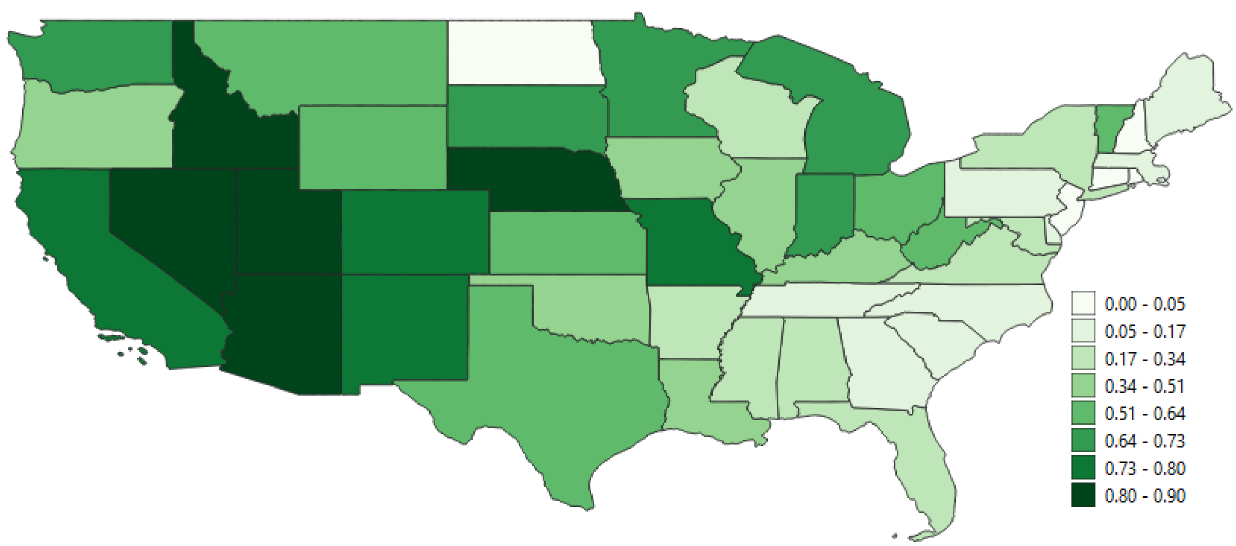
Table 6: Bottom 10 states for fiber optic broadband coverage

NAME	Fiber optic internet coverage
50. West Virginia	16%
49. Maine	16%
48. Wyoming	22%
47. Alaska	23%

46. Montana	23%
45. Arkansas	**25%**
44. Vermont	28%
43. Illinois	29%
42. Oklahoma	29%
41. Nevada	31%

Finally, the share of the population that has access to fixed wireless internet service is shown in Figure 9. The pattern of fixed wireless broadband coverage is very distinctive because fixed wireless tends to be a rural internet technology, not very competitive with wireline broadband technologies where these are available, but able to bring internet service wirelessly to places that lack wired internet service. There is not much fixed wireless internet service in the East Coast urban corridor, which is well served by wireline broadband technologies, but fixed wireless internet service is more abundant in most states of the West and Midwest.

Figure 9: Share of population with access to fixed wireless internet service (10/1 or faster)



Arkansas is not particularly poorly served by fixed wireless in terms of a national ranking. Nineteen states have less fixed wireless coverage than Arkansas does, as a share of population. But fixed wireless coverage tends to be strong where other technologies' coverage is weak, and thus to fill in the coverage gaps left by other technologies. Arkansas, unfortunately, is an exception to this rule. It is in the bottom 10 states for coverage by DSL, cable, and fiber, and it is also in the bottom half for fixed wireless coverage.

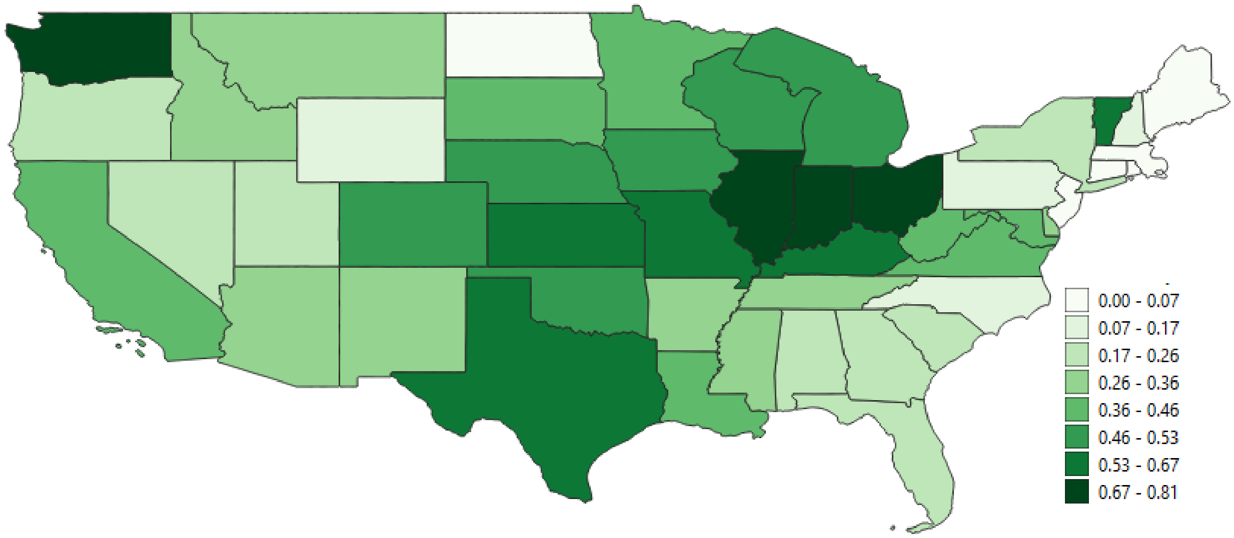
Table 7 illustrates this by taking the bottom 10 states for ***cable*** broadband coverage, and ranking them by the share of population covered by fixed wireless. In most of the states poorly served by cable, the population is fairly well served by fixed wireless, and the two exceptions, Mississippi and North Dakota, have much more fiber optic coverage than Arkansas does. Arkansas is thus unique in being disadvantaged with respect to all four of the major broadband technologies.

Table 7: Bottom 10 states for cable coverage, ranked by fixed wireless coverage

NAME	Fixed wireless coverage
North Dakota	5%
Mississippi	31%
Arkansas	**31%**
Oklahoma	45%
Iowa	51%
Montana	57%
Wyoming	59%
South Dakota	67%
New Mexico	78%
Idaho	89%

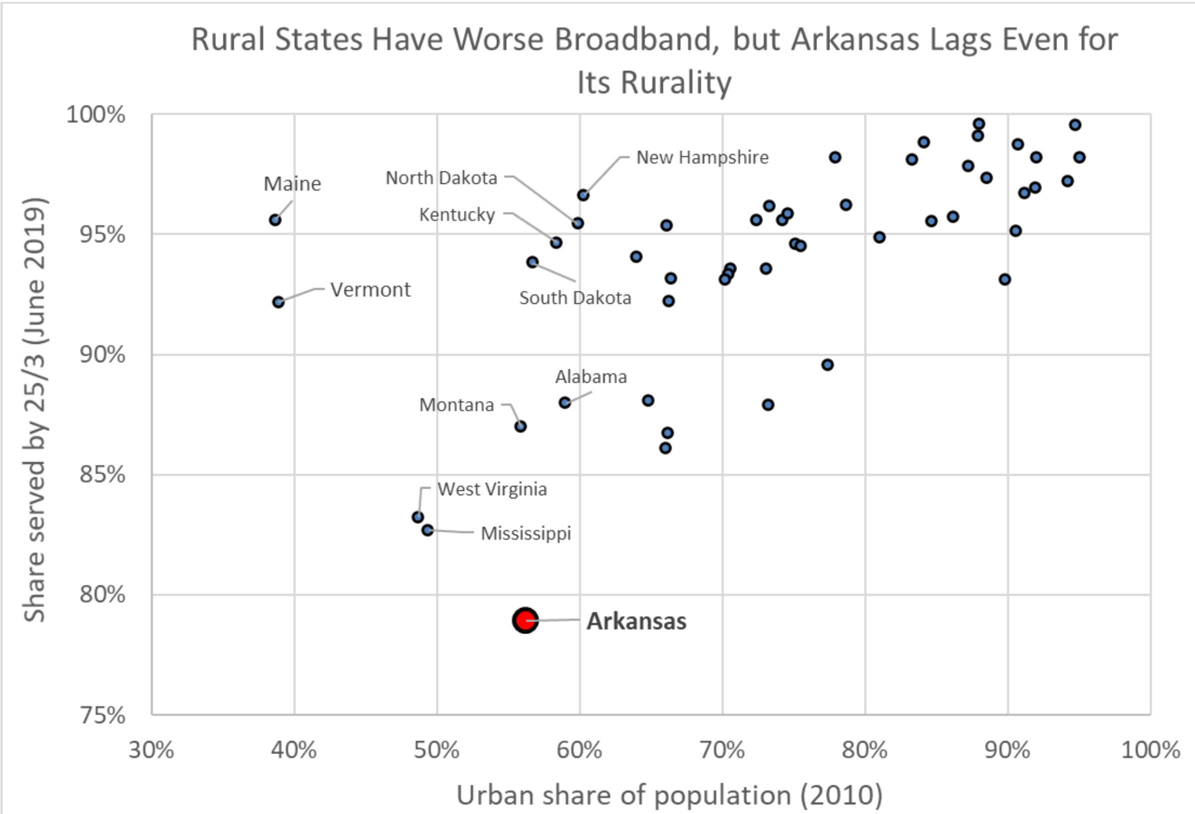
Figure 10 sheds a different light on the reach of fixed wireless broadband by showing the share of the state's *territory* (as opposed to population) that has fixed wireless broadband coverage. The most striking difference between Figure 9 and Figure 10 is that several mountainous Western states—Idaho, Nevada, Utah, Arizona and New Mexico—that look well served in terms of their fixed wireless population coverage, look poorly served in terms of their fixed wireless territory coverage. There are debates about the extent to which fixed wireless internet service is impeded by foliage, but large mountains certainly get in the way. These Western states, however, though have lots of uninhabited land, have more urban populations than Arkansas does, so fixed wireless internet can be deployed where the people are.

Figure 10: Share of state territory with access to fixed wireless internet (10/1 or faster)



Since low population density is often cited as a reason for poor broadband, Figure 11 shows all the states by (a) urban share of population, and (b) broadband (25/3) coverage ratio. There does seem to be a clear pattern whereby broadband coverage is better in more urbanized states. But it is far from an inexorable law. The most rural state in the country, Maine, has good broadband coverage, and all the five states more rural than Arkansas have better broadband coverage than Arkansas. Arkansas is much more poorly served with broadband than its rurality alone can explain.

Figure 11: Rural states' disadvantage in broadband coverage



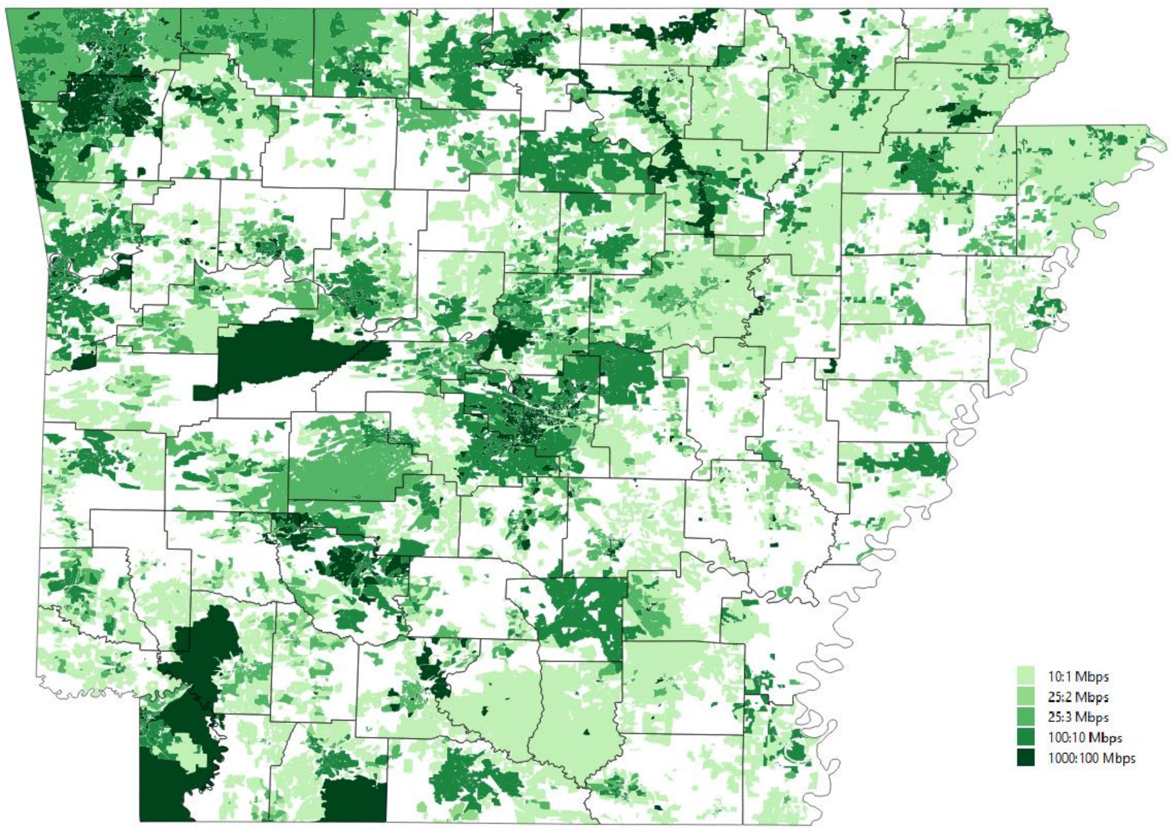
To sum up, Arkansas, as of June 2019, was 50th of 50 for broadband coverage, 50th of 50 for broadband competition, and 50th of 50 for high-speed coverage at 100 Mbps or more, because it is the only state that is in the bottom 10 states for broadband coverage by all three wireline technologies, DSL, cable, and fiber, and also because, unlike some other states that are poorly served by wired broadband technologies, Arkansas is below average in fixed wireless deployment. Its digital backwardness is partly but by no means fully explained by the rurality of its population. Poverty and terrain might be factors as well, but a full explanation for why Arkansas lags the nation in broadband deployment is somewhat elusive.

II. The Broadband Competitive Landscape

Arkansas's broadband competitive landscape features many ISPs, 136 according to BroadbandNow.com, offering service over different but often overlapping coverage areas using different technologies, especially fiber, cable, DSL, and fixed wireless. It may seem paradoxical that with so many companies offering internet service, there is so often so little consumer choice, but of course the reason why is that ISPs don't offer service everywhere, but only in coverage areas that are often quite limited, thus organizing the state into "territories" served by different ISPs, generally with little overlap between the territories of ISPs using the same technology.

Figure 12 shows a statewide map of maximum advertised broadband speed as reported to the FCC in June 2019.

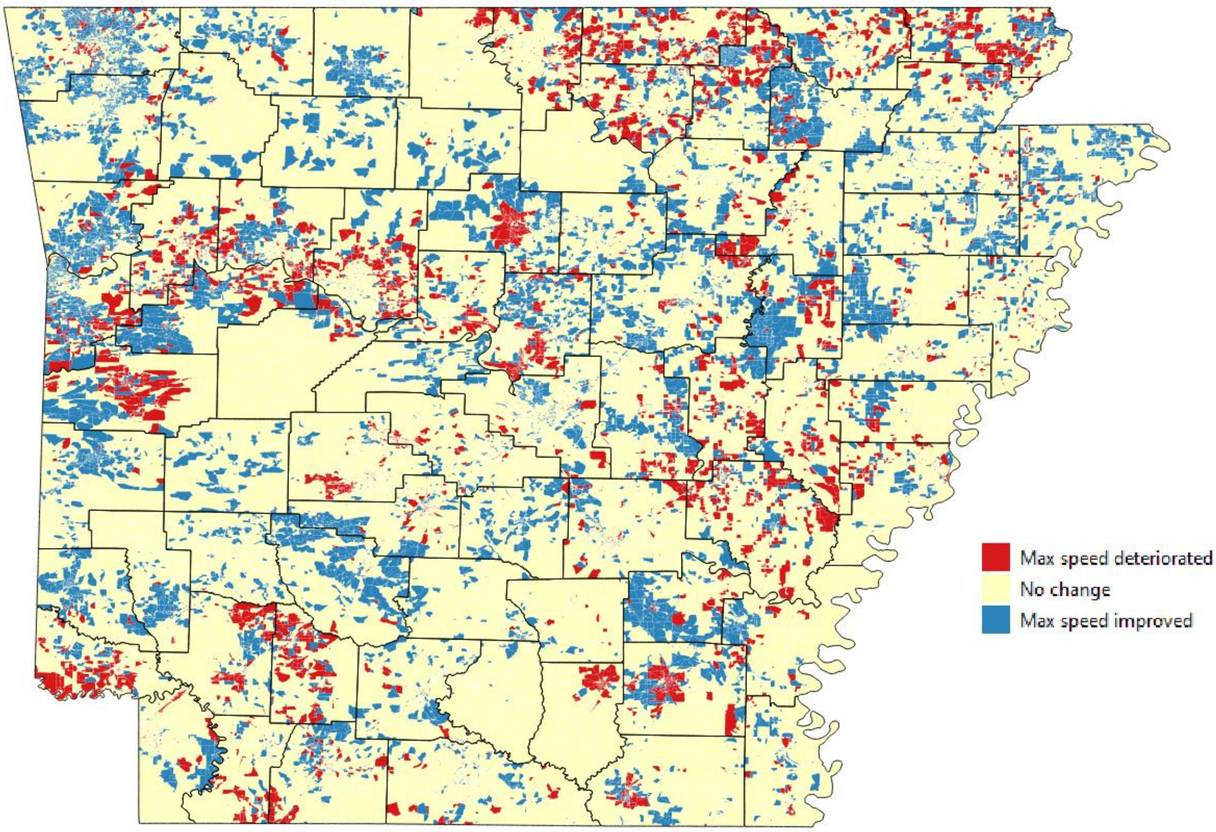
Figure 12: Maximum available broadband speed tier, by Census block



Clearly, (a) broadband tends to be more available in population centers, such as Little Rock, Northwest Arkansas, Jonesboro, and Hot Springs, than in lightly populated rural areas, but also (b) the correlation between population density and broadband speed is very imperfect, with some towns and cities lagging in broadband coverage while some lightly populated rural areas are ahead of the major cities.

The maximum available internet speed improved in many areas between 2018 and 2019, especially in city centers, but it also deteriorated in some, as shown in Figure 13.

Figure 13: Maximum available internet speed improved in some places, deteriorated in others

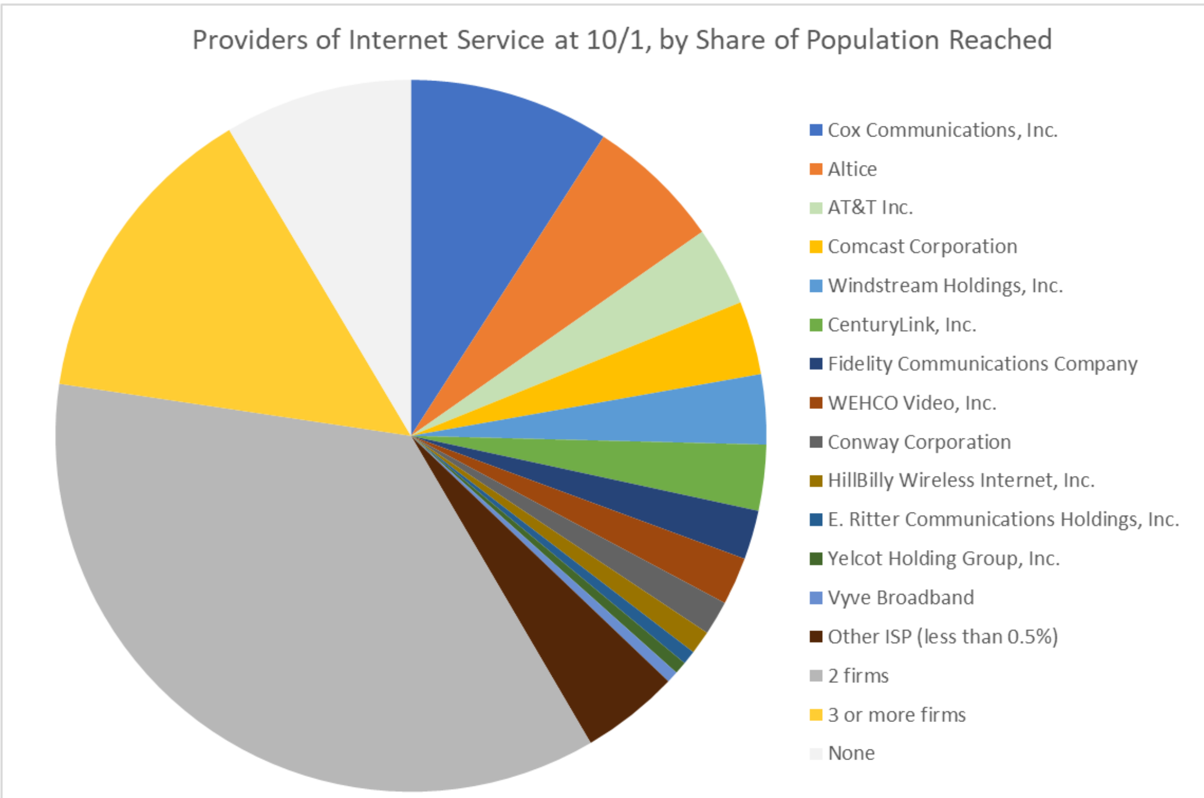


A. Major Internet Service Providers by Speed and Share of Population Served

What are the largest ISPs in Arkansas? The answer varies somewhat depending on what internet speed is being targeted. Cable companies are dominant for middling speeds, faster than 25/3 but slower than gigabit. At 10/1 speeds, phone companies relying legacy on copper networks of telephone wires are somewhat important. At the cutting edge of gigabit speed broadband, available to only a small minority of Arkansans, phone companies become important again, as well as electric coops, municipal utilities, and private networks.

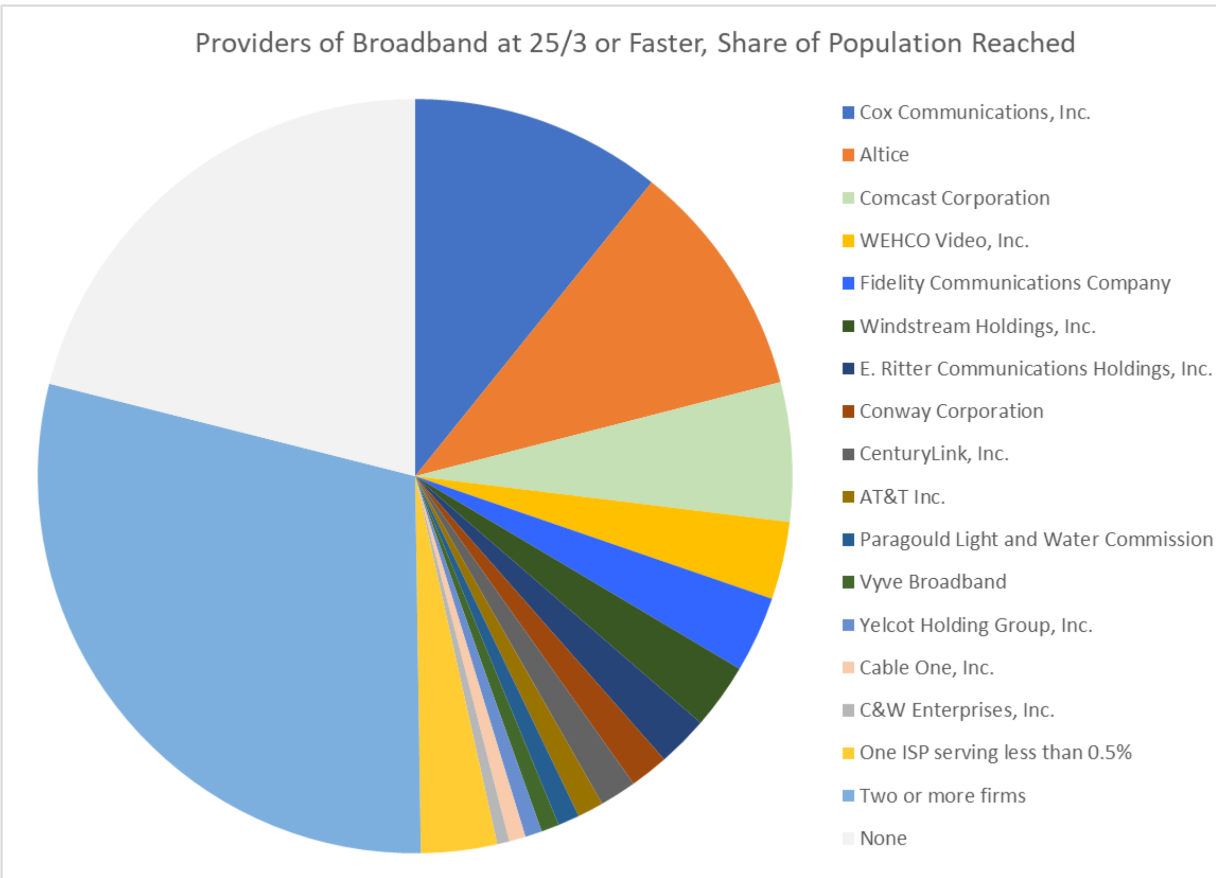
Figure 14 focuses on access to internet service of any kind at speeds of at least 10 Mbps download/1 Mbps upload. About half the population can get internet service from two or more firms, and 14%, from three or more firms. Another 9% cannot get 10/1 service from any ISP. Those who can get service only from one provider most often have access to internet service from cable companies like Cox (9%), Altice (Suddenlink) (6%), Comcast (Xfinity) (4%), and WEHCO (2%). Also serving as sole providers of 10/1 internet service for significant populations are the big price cap phone carriers, AT&T (4%), Windstream (3%) and CenturyLink (3%), while others rely on smaller phone companies or fixed wireless carriers.

Figure 14



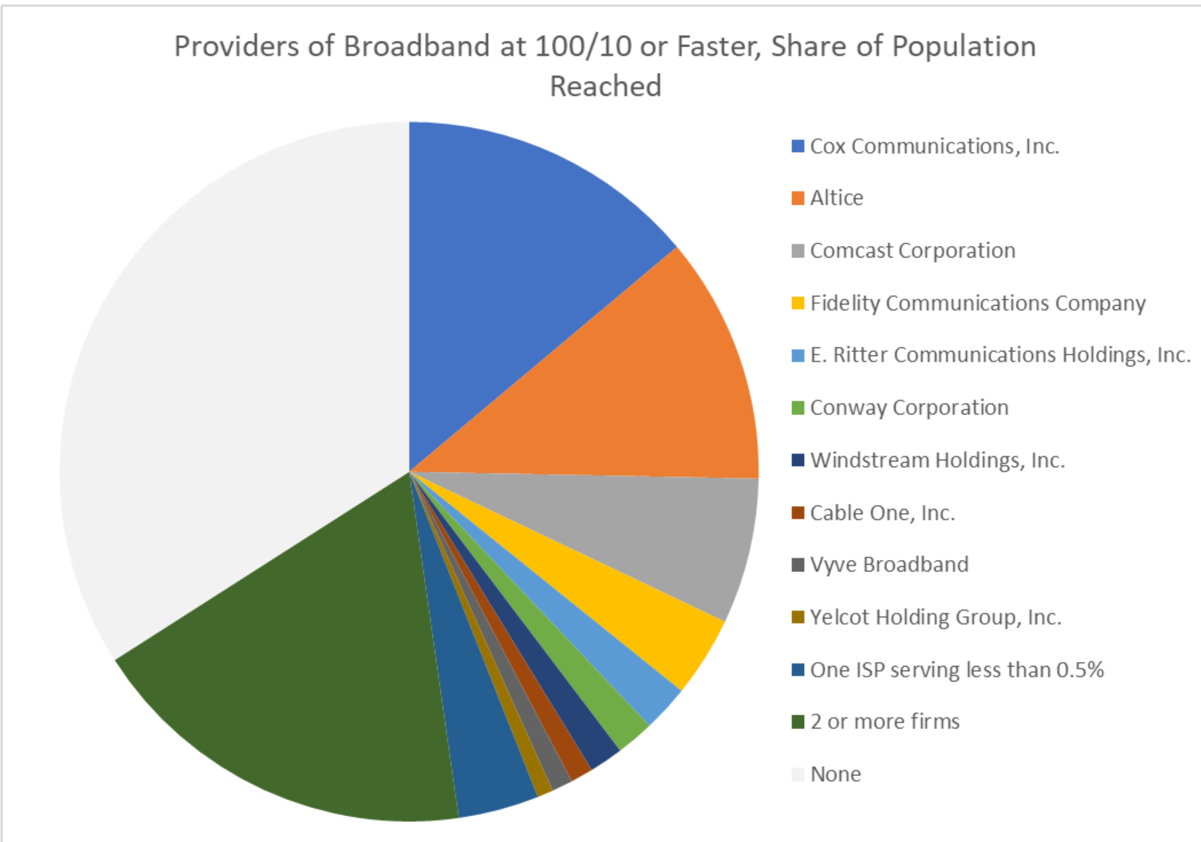
At faster speeds, cable becomes more dominant, as may be seen in Figure 15. Broadband, defined by the FCC as internet service at speeds of 25/3 or faster, is often (29%) available from two or more ISPs, but where it is available from just one, it's usually from a cable company like Cox (11%), Altice (10%), Comcast (6%), or WEHCO (3%).

Figure 15



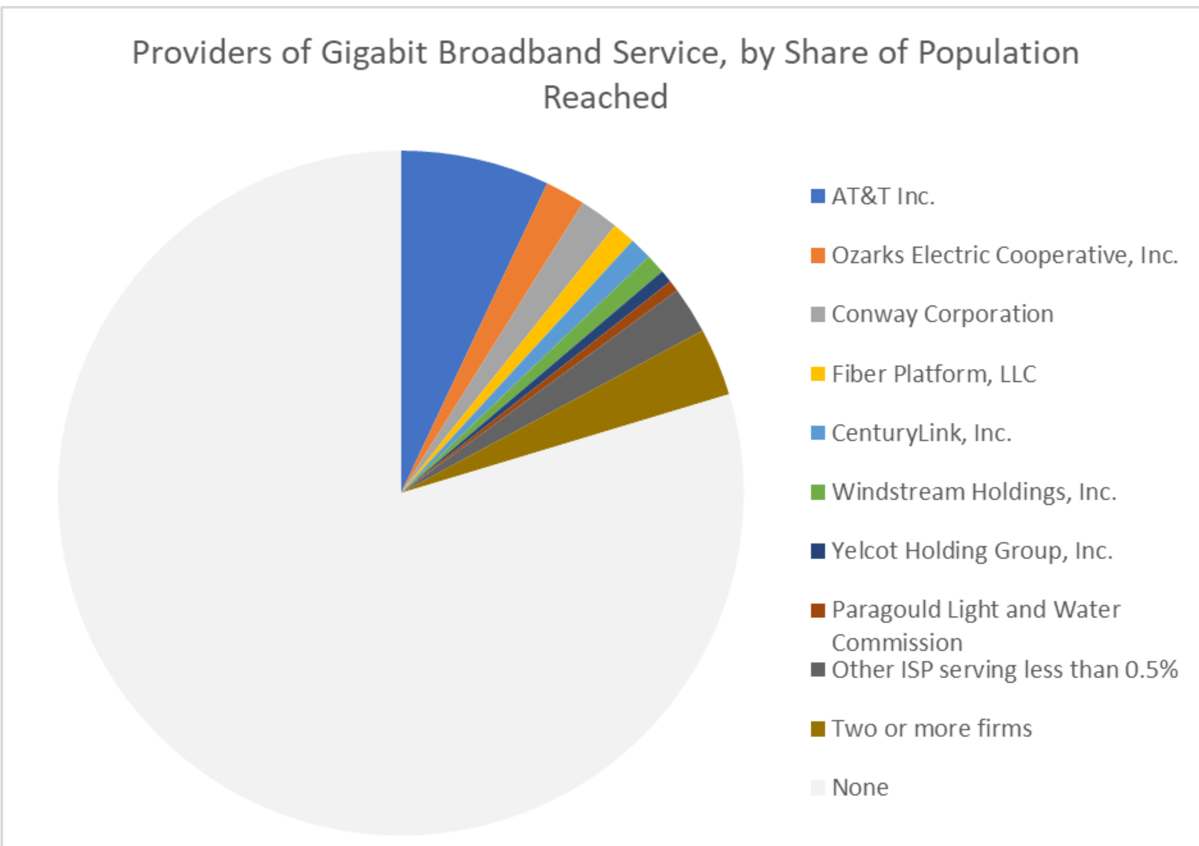
At 100 Mbps speeds, as shown in Figure 16, the share of the population enjoying multiple options falls to 18%, the unserved share rises to 34%, and the list of sole providers is still more dominated by cable companies like Cox (14%), Altice (11%), and Comcast (7%). Most of the population that has any access to 100 Mbps broadband can get it only from one company, and it's a cable company.

Figure 16



Yet at gigabit speeds, as shown in Figure 17, the competitive landscape completely changes, as cable companies disappear from the list. This reflects the basic technological fact that fiber optics have performance advantages over a copper technology such as cable. Most Arkansans have no access to gigabit speed broadband. But the 20% who can get ultra-high-speed internet can get it from a different set of companies from those that provide most of the broadband in the state. AT&T tops the list, as the sole provider of gigabit speed broadband to 7% of Arkansans. Ozarks Electric Cooperative has the second largest coverage for gigabit fiber providers, with 1.9%, followed by Conway Corporation with 1.8%. The 4th largest reach among gigabit providers, Fiber Platform, LLC, does business as United Private Networks and serves business customers in Little Rock and Pine Bluff, as well as in many other states. Conway Corporation and Paragould Light and Water Commission are municipally-owned utilities. Clarksville's municipal utility is also deploying fiber broadband service under the DBA name Clarksville Connect, though its deployments are too recent to show up in FCC maps. Other gigabit speed ISPs are mostly phone companies, such as CenturyLink, Windstream, Yelcot, Lavaca, and Pinnacle Telecom.

Figure 17

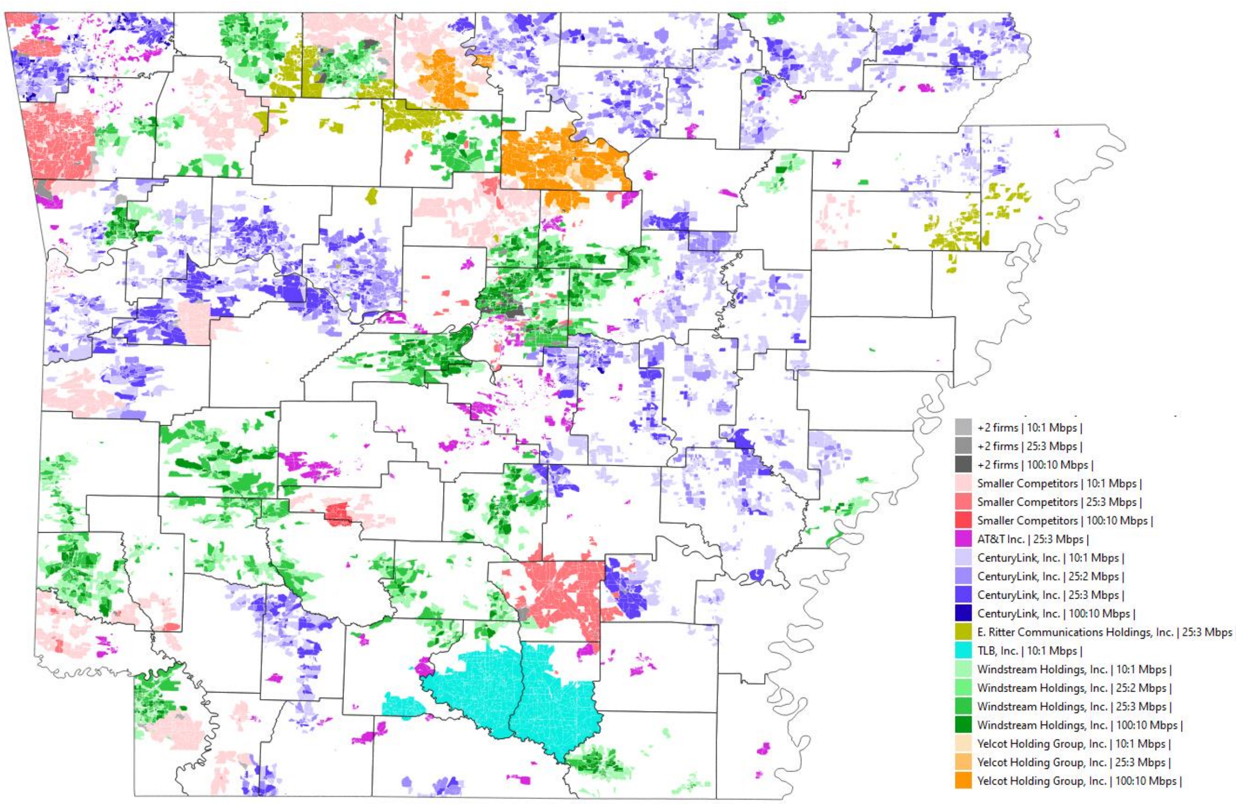


B. Geographic Availability of Broadband Technologies, Speeds, and Providers

The peculiar market structure of the broadband industry is most clearly seen by focusing on each of the four technologies by which broadband internet service is delivered. The three wireline technologies are all territorially organized, reflecting the fundamental economics of network infrastructure, where it is inefficiently duplicative to run multiple sets of the same kind of wires among the whole grid of residences and businesses. Consequently, there is very little competition at the address level between companies that use these technologies.

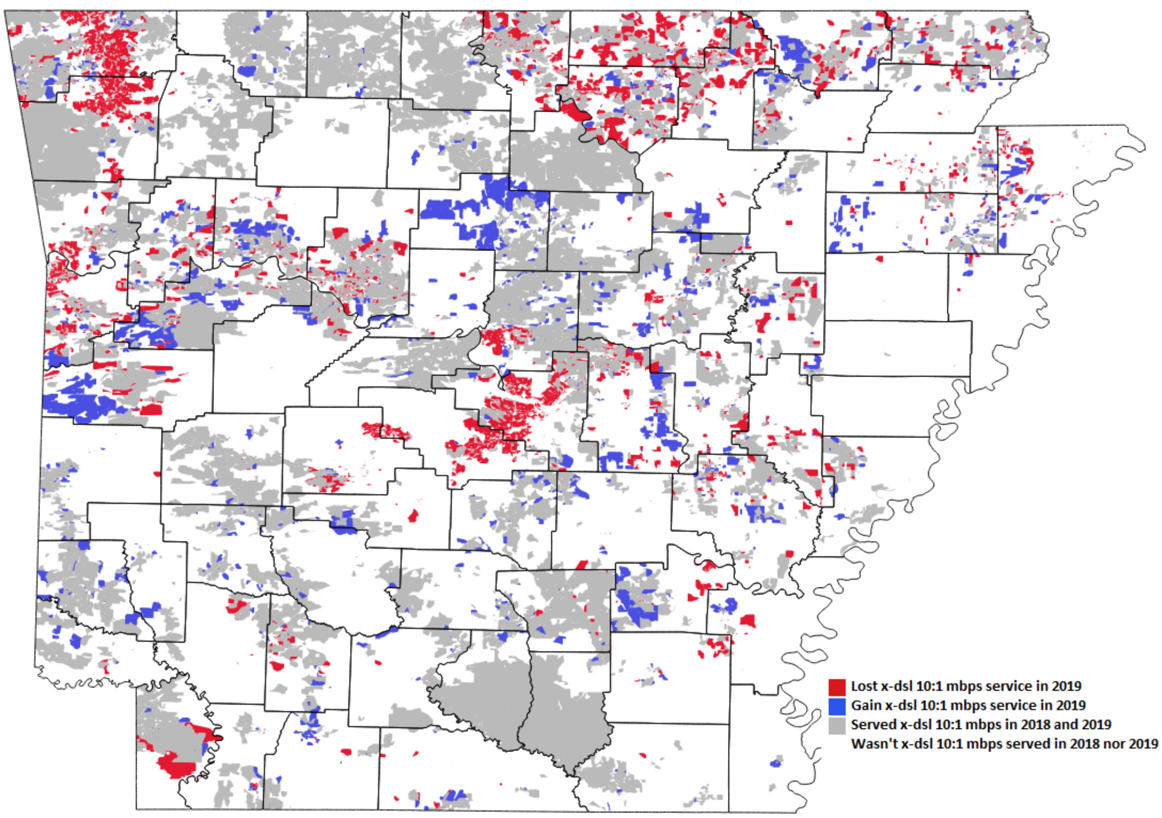
Figure 18 shows the statewide availability of DSL. Interestingly, there is little availability of DSL in the centers of built-up areas like Little Rock and Bentonville. But DSL is widely available in suburbs, small towns, semi-rural and some rural areas, though there are also large rural parts of the state where DSL is not available. Some providers claim to offer speeds of up to 100 Mbps download/10 Mbps upload using DSL technology in some areas, but most DSL service is at slower speeds. A small part of the total area covered by DSL is covered by two or more DSL providers.

Figure 18: Availability of DSL internet service, by company and speed



Between 2018 and 2019, as shown in Figure 19, DSL service expanded in some areas, but there were also large areas of the state where DSL service at speeds of 10/1 or more that was previously available ceased to be offered, or at least providers ceased to report it to the FCC.[4] Losses of DSL service were most striking in urban centers like NW Arkansas, Little Rock, and Fort Smith, but they also occurred in smaller towns and rural areas, especially in North Arkansas. Expansions of DSL coverage generally occurred in more rural areas. To a large extent, the changes are consistent with a pattern of DSL investment occurring where no better options are available, while DSL service is retired in better served areas that no longer need it. But the retreat of DSL is one reason why some parts of the state saw a deterioration in the maximum available speeds.

Figure 19: DSL changes between 2018 and 2019



[4] It's not uncommon for there to be shifts in reported coverage between releases of the FCC Form 477 data, and there are other possible explanations of these shifts that do not involve changes in actual deployment, e.g., discretionary reporting decisions involving interpretation of definitions, fluctuations in network performance over a fixed network, or changes in advertising strategy.

Figure 20 shows the availability of cable internet service statewide. Relative to DSL, cable internet is much more concentrated in population centers, with some, such as the urban corridor in Northwest Arkansas, dominated by a single ISP, while in others, a single urban area is divided into territories controlled by different cable companies. In very small bits of the map, mostly in central Arkansas, two cable companies provide service in the same Census blocks. Cox, Comcast, Fidelity and Vyve offer 100/10 speeds everywhere that they serve. WEHCO offers 25/3, while Altice/Suddenlink speeds range from 10/1 to gigabit, but predominantly 100/10. Almost all cable internet service satisfies the FCC definition of broadband.

Figure 20: Availability of cable internet service, by company and speed

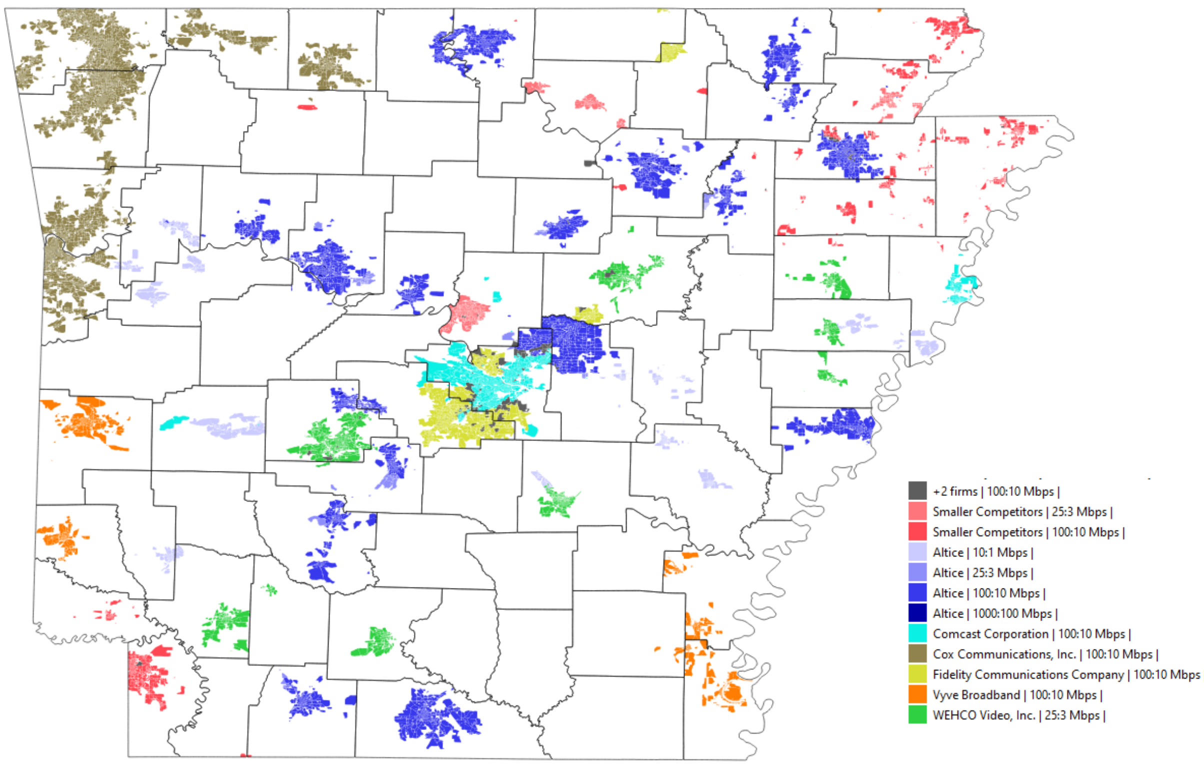


Figure 21 shows the statewide availability of fiber optic internet. While fiber optic internet is available in some urban centers, fiber coverage does not blanket the urban map like cable coverage does. At the same time, there are large areas of rural fiber coverage, provided by companies like Spectracomm/Arkwest, Southwest Arkansas Telephone Company, South Central Connect, Yelcot, and ARK-O. Fiber optic internet usually offers gigabit download speeds, reflecting the inherent high capacity of fiber optic cable. Some Census blocks have two fiber providers, mostly in city centers.

Figure 21: Availability map of fiber optic internet, by company and speed

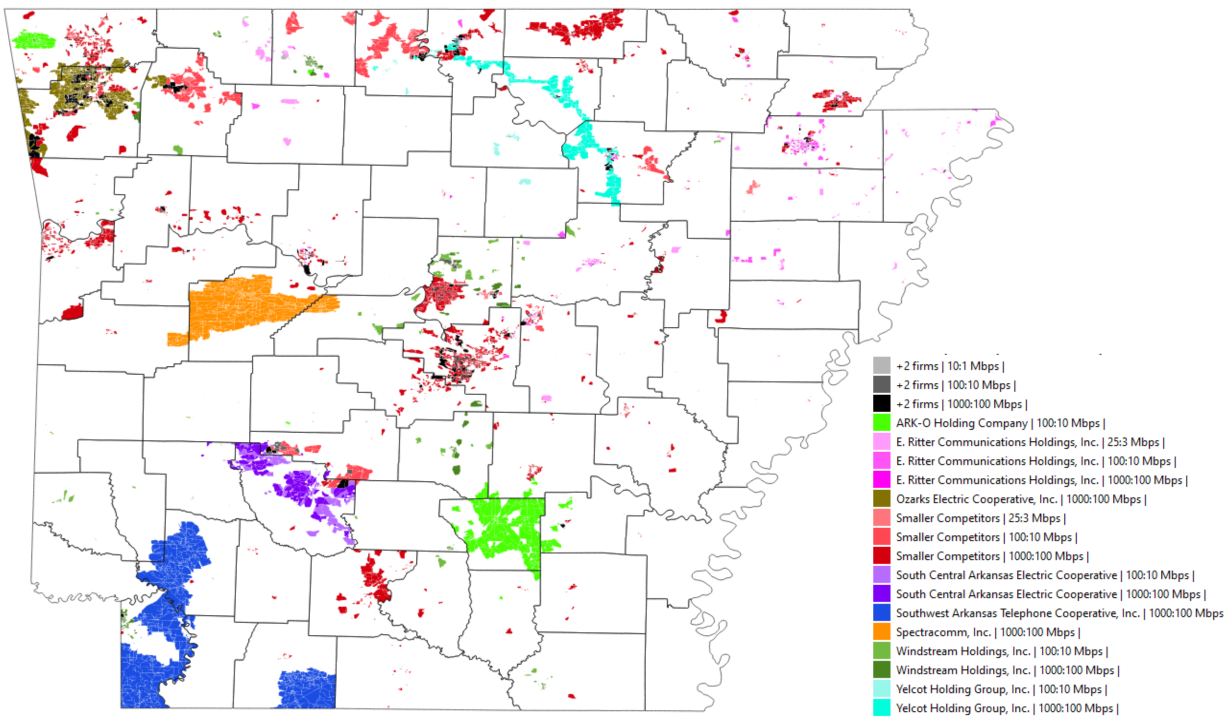


Figure 22 shows the statewide availability of fixed wireless internet service. Fixed wireless service is about equally divided between offering speeds in the 10/1 tier and speeds in the 25/3 tier. Fixed wireless provide some urban coverage, but their strong suit is serving large rural land areas including many small towns. The most fixed wireless coverage is provided by AT&T, Hillbilly Wireless, Total Highspeed, City Wireless, C&W Enterprises/Wireless Etc., and Aristotle. In contrast to wireline broadband technologies, there are large areas, especially in NE Arkansas, where service is available from two competing fixed wireless providers.

Figure 22: Availability of fixed wireless internet service, by company and speed

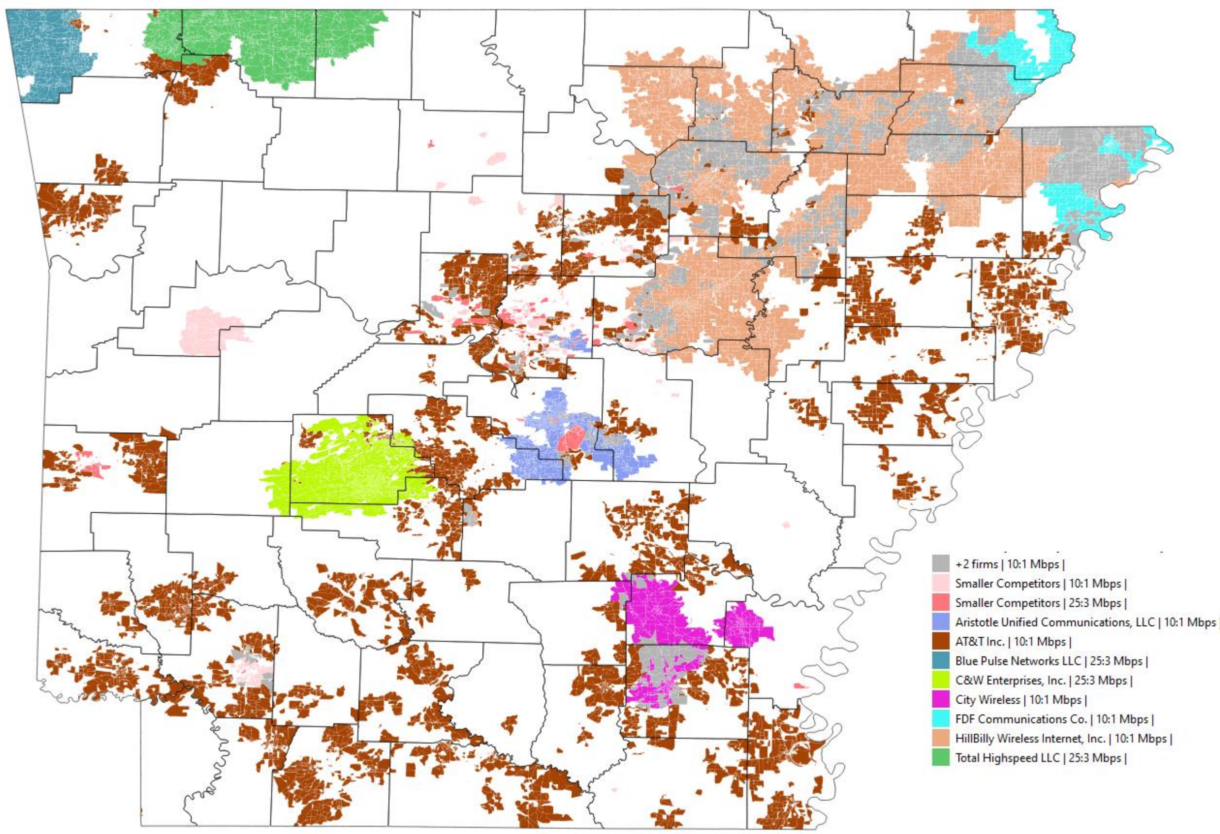
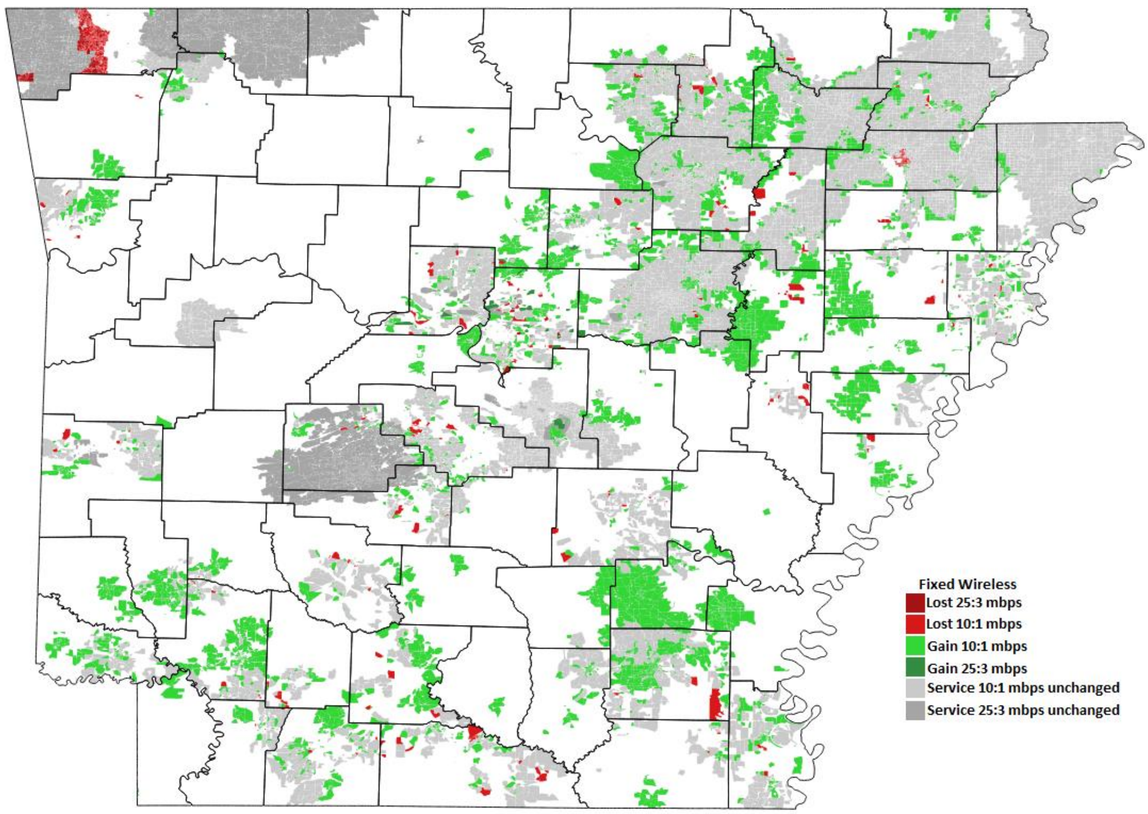


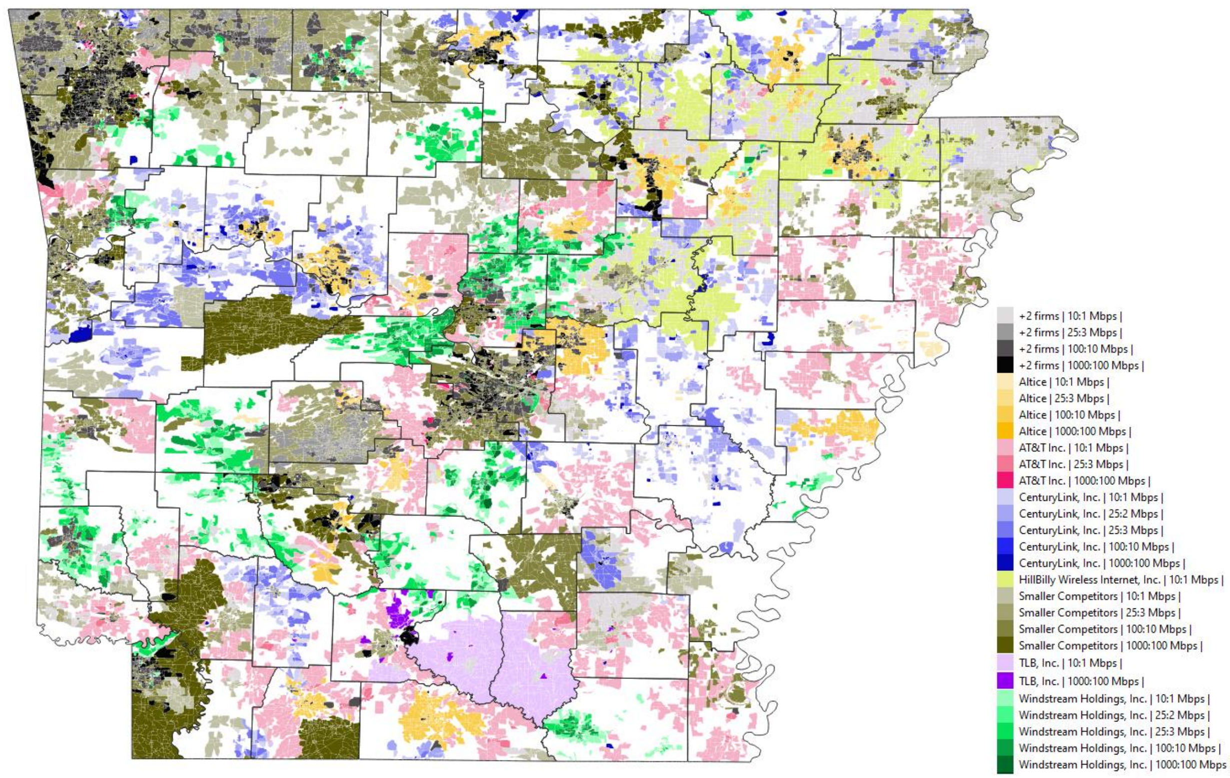
Figure 23 shows how fixed wireless coverage changed between 2018 and 2019, and the contrast with Figure 19 is striking. Unlike DSL, fixed wireless is expanding in many areas and retreating in very few. Most of the gains, however, are at 10/1 rather than 25/3 speeds, so fixed wireless expansion is not doing much to increase Arkansans' access to FCC-defined broadband. But fixed wireless companies seem to be giving quite a few more Arkansans access to internet service of some kind.

Figure 23: Changes in availability of fixed wireless internet service, 2018-2019



When all technologies are put together, as in Figure 24, the map looks more competitive, with large parts of Arkansas's larger urban areas, and some rural areas as well, enjoying a choice of providers. Much of Little Rock, NW Arkansas, Mountain Home, Texarkana, Hot Springs, Fort Smith, and Jonesboro are well served by competing providers. In rural areas, it is more common to have a single provider available, usually a phone company using DSL or a fixed wireless provider.

Figure 24: Arkansas's overall broadband competitive landscape, all technologies, by company and speed



The scarcity of competition in internet service provision resembles utilities like electricity, water, and sewage. However, broadband is not regulated like other utilities. Many companies that provide broadband are involved in legacy regulatory frameworks like those governing telephony and electricity, and substantial subsidies are used to promote broadband deployment, but there are no regulations that systematically seek to ensure universal access and fair pricing of broadband internet service.

III. Federal Broadband Programs

Many federal agencies provide at least some funding for broadband. A guide compiled by the National Telecommunications and Information Administration (NTIA) lists the following agencies that might assist the development of broadband in Arkansas in some way:

- Department of Education

- Department of Transportation
- Department of the Treasury
- Department of Labor
- Delta Regional Authority
- Economic Development Administration
- Federal Communications Commission
- Department of Housing and Urban Development
- Institute of Museum and Library Services
- National Science Foundation
- Small Business Administration
- Department of Agriculture

By far the most important programs, in terms of funding levels and relevance, are the Rural Digital Opportunity Fund (RDOF) program and the ReConnect program from the USDA.

A. The Rural Digital Opportunity Fund

The FCC's Rural Digital Opportunity Fund program represents the most ambitious and sophisticated attempt to date by the federal government to close the digital divide. It grows out of the FCC's long quest first to establish and then to maintain universal service in telecommunications. But as the rise of the internet and the consequent need for broadband service has made past successes obsolescent, the FCC has had to adapt its programs to meet new needs.

Background: Universal Service and Competition

Since the Telecommunications Act of 1934, the Federal Communications Commission (FCC) has sought to secure universal access to communications services through a system of regulatory requirements and supportive subsidies.

The phrase "universal service" originally referred to the goal of enabling people subscribing to different companies' telephone services to call each other, as they were often unable to do in the early years of telephony. This was inconvenient and inefficient in many ways, yet it created an incentive for companies to expand their networks, since by adding customers, they increased the value of the network to existing customers. Phone companies cross-subsidized high-cost customers by charging low-cost customers more than it cost to connect them, but the low-cost customers benefited from being able to call the high-cost customers. Establishing interconnections among networks eliminated this incentive for expansion, so "universal service" regulations, programs, and subsidies stepped in to play a similar role. Based on this reasoning, universal charges are officially regarded as "not taxes."

The Telecommunications Act of 1996 reformed the telecommunications industry in an attempt to make it less monopolistic and more competitive. Yet straightforward deregulation, leaving government with no role other than enforcement of property rights and contracts, was unappealing because of an element of "natural monopoly" in wireline telecommunications technologies: it is generally inefficient for multiple systems of physical telephone wires to connect the same locations. Nonetheless, by 1996, technological change was giving rise to competition *between technologies* rather than between companies using similar technologies. Some business districts were served with fiber optic cable, for example. The 1996 law recognized "Competitive Local Exchange Carriers" (CLECs) and gave them rights to interconnectivity that helped them to expand. Meanwhile, the historic telephone companies became "Incumbent Local Exchange Carriers" (ILECs), which are still responsible for routing calls, and have "carrier of last resort" obligations to supply landline phone service on request, and in return for these responsibilities, have received most federal universal service subsidies.

But the RDOF program is likely to change that. Instead of relying on ILECs to deliver broadband, RDOF makes providers compete with each other through a reverse auction. In each census block group that RDOF targets, the FCC will seek to purchase from providers public interest obligations to provide broadband, prioritizing both cheapness to the federal taxpayer and quality of service.

Regulation and Subsidies in a Time of Technological Change

The FCC has faced the unusual challenge of administering legacy regulation and subsidy programs at a time when telecommunications has been experiencing revolutionary technological change. Traditional landline telephone service, delivered over "twisted pair" copper wires, still exists, and is available at nearly all addresses, though a slight majority of people, especially among younger demographics, no longer bothers to subscribe. Meanwhile, a new world in communications has emerged.

Cell phones, now called smartphones have become handheld computers, are cheaper, smaller, and packed with features and functions, and a leading symbol of technological change comparable to cars in the mid-20th century. In the 2010s, the share of the US population owning a smartphone rose from about one-third to over four-fifths. Survey research has found that most people check their smartphones at least hourly, and some air public concerns about "smartphone addiction."

However, cell phone companies do not claim coverage everywhere, and data collected as part of the "challenge process" for the Mobility Fund-II auction in 2018 proved that actual mobile data coverage is worse than the providers tend to claim. Landlines may still meet important needs in areas where cellular coverage is poor.

An explosive increase in the quantity, quality, and searchability of internet content has resulted in online activity revolutionizing multiple economic sectors, partially crowding out activities like talking on the telephone, watching TV, and shopping, and reshaping everyday behavior and culture. Enabled by broadband deployment and faster, higher bandwidth internet connections, video streaming has increased. By 2019, it accounted for 60% of global data usage.[5]

The first Data-over-Cable Service Interface Specification (DOCSIS) was implemented in 1997, and evolved into the DOCSIS 3.1 standard used today, which is claimed to support download speeds of up to 10 Gbps. DOCSIS has transformed the cable industry, which is now by far the largest supplier of fixed broadband, having long since eclipsed dial-up and DSL.

In the face of rapidly changing technology, the FCC pivoted from supporting voice technology to support broadband deployment as well when it launched the Connect America Fund in 2011, which focused on providing more internet access through the traditional ILECs. This approach left little room for market competition to reveal which companies and technologies were actually best positioned to deploy rural broadband. The RDOF program makes rural broadband deployment more competitive, while still

[5] https://www.ncta.com/whats-new/report-where-does-the-majority-of-internet-traffic-come

seeking to make progress towards a goal of universal service, now reinterpreted to emphasize broadband as well as voice.

The Connect America Cost Model

Central to the way the Connect America Fund has been administered over the past decade is the Connect America Cost Model (CACM), which, as the FCC notes, "estimates the cost to provide voice and broadband-capable network connections to all locations in the country,"[6] taking into account geography and terrain, network topology issues, and technological trends. In the Connect America Fund Phase II program, the CACM determined what offers of support were made to ILECs to deploy broadband at speeds of 10 Mbps download/1 Mbps upload. ILECs were free to decline the funding and the associated obligation to deploy internet service, and they did so in many areas.

In the RDOF, the Connect America Cost Model plays a different role. Instead of determining support offers, it determines the "reserve price" that the FCC will use as the starting point for its auction. The reserve price represents the maximum amount of support that the FCC is willing to offer for a given area. Starting from the reserve price, the FCC will scale down its offers until a national auction budget clears.

The Reverse Auction Process

The RDOF fulfills the pro-competitive ambitions of the 1996 Telecommunications Act by allocating universal service support funds to communications companies through a "reverse auction," whereby the FCC will seek to buy commitments from companies to fulfill certain public interest obligations to supply broadband, using the competitive pressure of the auction to get both low costs to the government and a high quality of service. The RDOF program will allocate upwards of $20 billion for this purpose over ten years, of which about $16 billion will be allocated through a "Phase I" auction starting on October 29, 2020. The CACM will be used to set "reserve prices," which represent the maximum amount of funding per location that the FCC is willing to supply for a given area.

The sum of all reserve prices for the targeted areas exceeds the auction budget. Together, all the reserve prices total to $2.904 billion in annual support, or $29.04 billion in ten-year support. But the auction budget is only $16 billion, about 55% of the sum of the reserve prices. The difference will be made up by some combination of (a) bidders accepting less than the reserve price support, (b) bidders getting less support because they offer lower service tiers, and (c) some areas dropping out and not getting funding because no bidders will be willing to provide broadband for the (service tier adjusted) level of support that is offered by RDOF at the point where the national auction budget clears.

So while it is likely that most areas targeted by RDOF will get a winning bidder and broadband deployment over the next six years, some areas will probably be left out.

An important piece of the auction design is service tiers and weights, by which the FCC favors high-bandwidth, low-latency deployments, while still allowing ISPs using slower, cheaper technologies to compete.

[6] https://www.fcc.gov/document/connect-america-cost-model-cacm

Service Tiers, Weights, and the Quality/Cost Trade-Off

The trick to targeting low cost *and* high quality of service *at the same time* is that the RDOF defines service tiers and penalties/advantages for offers of lower/higher service tiers, shown in Table 8.

Table 8: Performance tiers and "weights" (penalties) for bandwidth in the RDOF auction

Performance Tier	Speed	Usage Allowance	Weight
Minimum	≥ 25/3 Mbps	≥ 250 GB or U.S. average, whichever is higher	50
Baseline	≥ 50/5 Mbps	≥ 250 GB or U.S. median, whichever is higher	35
Above Baseline	≥ 100/20 Mbps	≥ 2 TB	20
Gigabit	≥ 1 Gbps/500 Mbps	≥ 2 TB	0

In addition, there is a scheme for incentivizing low latency, shown in Table 9:

Table 9: RDOF performance tiers and weights for latency

Latency	Requirement	Weight
Low Latency	≤ 100 ms	0
High Latency	≤ 750 ms & MOS of ≥4	40

Any bidder in the FCC auction must apply for a specific service tier, and satisfy the FCC that is capable of delivering service that satisfies the standards of that service tier.

During the auction, bidders will iteratively make offers to provide broadband to target areas, of which the minimum size is the Census block group, for some fraction of the reserve price associated with the target area. Such offers will be adjusted for the "weight" associated with the service tier before being compared, so that to stay in the auction, the support level that a bidder offers to accept as a share of the reserve price ***plus*** the weight associated with its service tier must match the offers of other bidders in its service area. A "descending clock" will iteratively set the support level lower, eliminating bidders unwilling to accept the new support level, until (a) a national auction budget clears, and (b) there is only one bidder at the top service tier in each target area.

Example. An example will help to elucidate how the weights are applied. Suppose **Telecom A** and **Telecom B** are competing for RDOF subsidies to provide broadband to Target Area C, which has 1,000 residents and a reserve price of $1,000 in annual support per resident, so that the maximum support that can be allocated is $1,000,000. Telecom A proposes to deploy Gigabit tier, Low Latency service. Telecom B proposes to deploy Baseline tier, High Latency service. The "weight" associated with Telecom A's bid is therefore 0, while Telecom B's "weight" is 75. Now suppose the auction is underway, and the "descending clock" is at 80. That means that if Telecom A bids 80 to stay in the auction, it will be offering to provide gigabit, low latency broadband to Target Area C in return for 80% of the reserve price, or $800,000 per year. But if Telecom B bids 80, it will qualify for 80-75=5, that is, 5% of the reserve price, or $50,000 per year, to supply 50/5, high latency broadband. If the national budget clears and both Telecom A and Telecom B have bid 80, then Telecom A will win RDOF support because it offers superior service at a price that is competitive with Telecom B when adjusted for service tier. In this way, the FCC incentivizes high quality deployments, while still including lower-tier broadband providers in the auction, in order to put competitive pressure on higher-tier providers, and provide service where no higher-tier provider is willing to serve at a price the FCC can afford.

Timeline and Outcomes

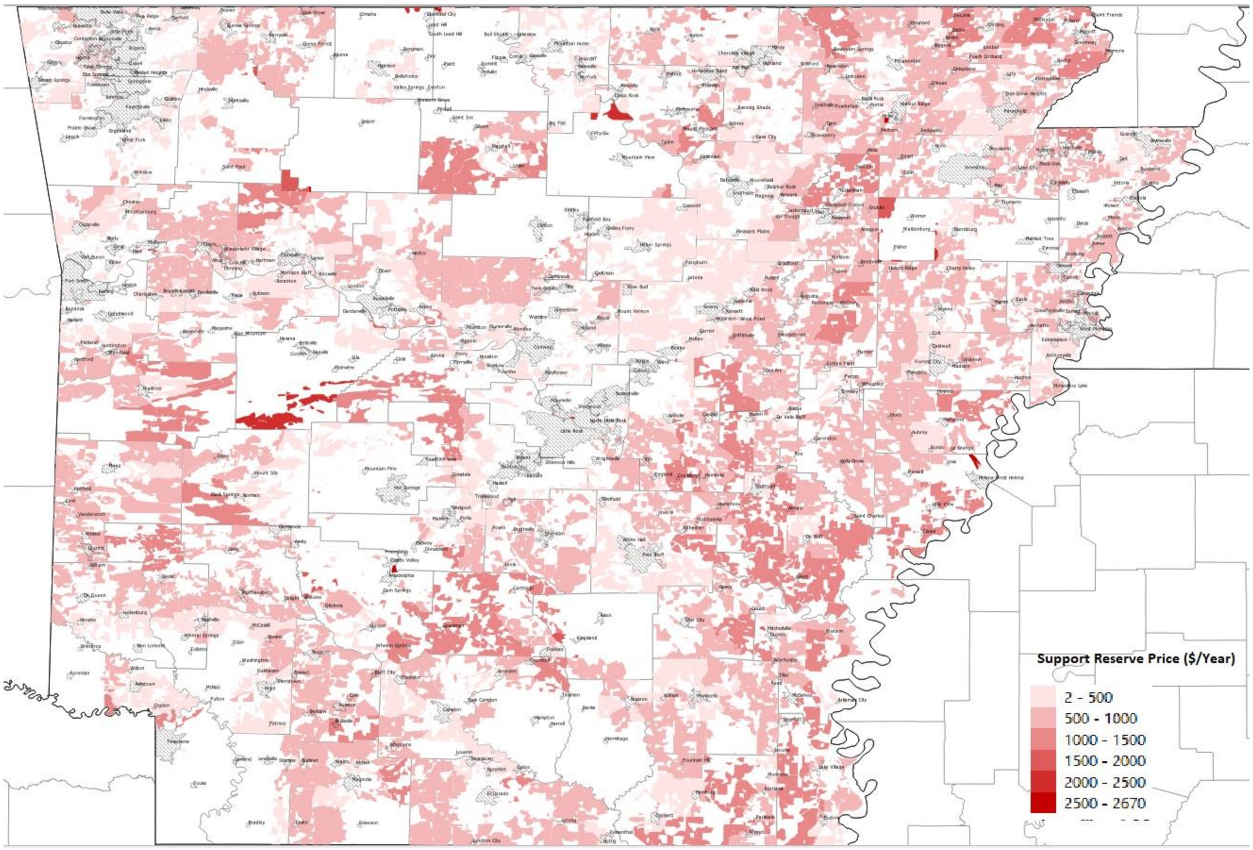
To participate in the RDOF auction, ISPs must complete a short-form application by July 15, after which they can participate in the auction starting on October 29, 2020. If they win, they must then complete a long-form application before they can receive funds. Winning bidders must quickly provide voice service, which hopefully will prevent a service disruption for traditional landline users, though they will see a change in the company providing these voice services. Over time, the manner in which voice services are provided may change, e.g., with wireless voice service or VOIP replacing traditional landline telephone service over copper wires. Some ISPs have expressed concerns about participating in RDOF because of the obligation quickly to provide voice service.

Meanwhile, many public interest obligations to provide broadband will be created, and enforced by the FCC, that did not previously exist. Winning bidders will have three years to deploy to 40% of locations in the territories they win, then will be expected to deploy to another 20% in each of the subsequent years, which should lead to complete buildout after six years. Since the minimum tier is 25 Mbps download/3 Mbps upload, rural residents in areas that get a winning RDOF bidder will get internet service satisfying the FCC definition of broadband within the next few years.

Funding Allocation Maps and Tables

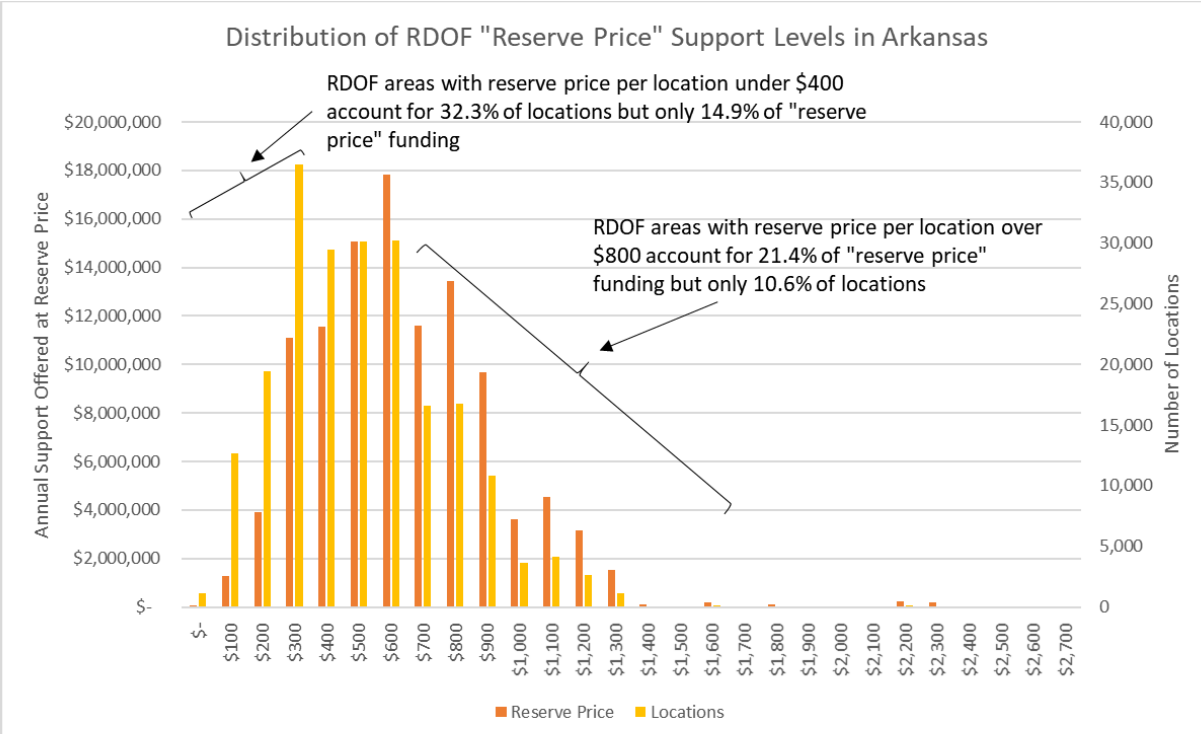
RDOF will target a large part of the territory of Arkansas, as shown in Figure 25. However, the RDOF targeted areas Every county has at least some area that will be included in the auction to get RDOF support, though not all will necessarily have a winning bidder.

Figure 25: RDOF targeted areas in Arkansas, colored by "reserve price" support level



The distribution of "reserve price" support levels across the map of Arkansas results in a pattern whereby a substantial majority of the funds are targeted to serving the minority of the population that is most difficult to serve, while a lot of areas that seem easier to serve, based on the FCC's Connect America Cost Model, still qualify for funding but at lower levels, as shown in Figure 26.

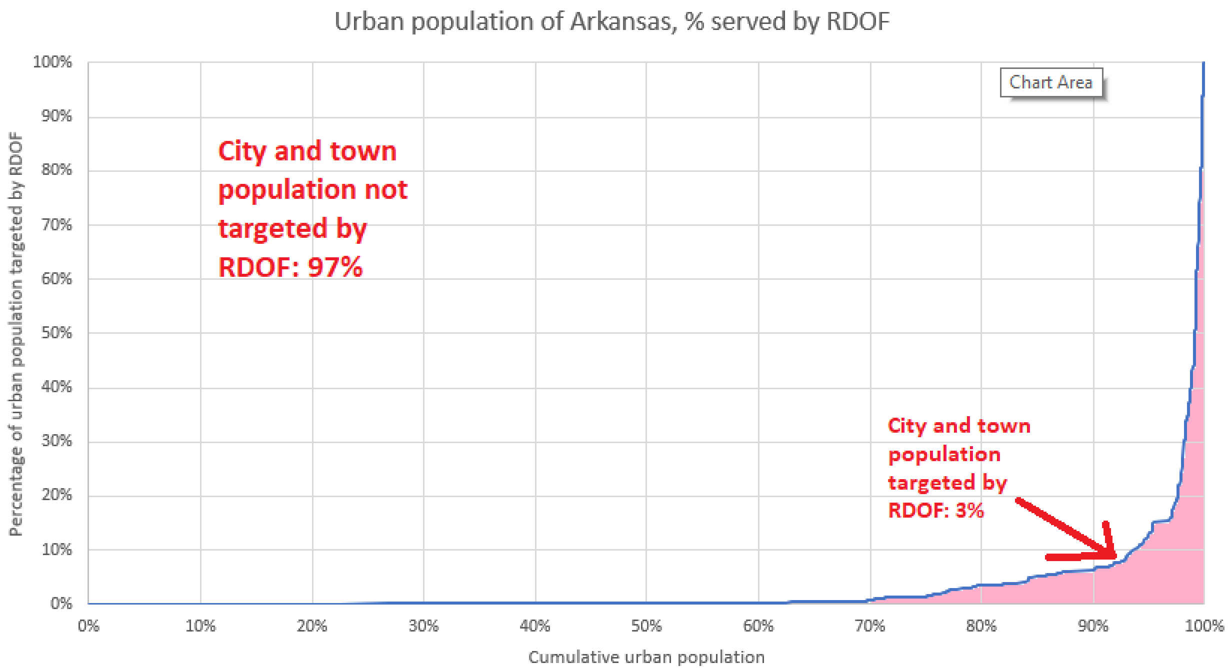
Figure 26: RDOF will allocate more funds to areas that are harder to serve, according to the Connect America Cost Model



Most of the locations that qualify for the highest levels of funding are in Yell, Stone, Newton, Poinsett, Cleveland, Arkansas, Desha and Searcy counties. Average support levels are lower in Washington, Benton, Pulaski, Baxter, Greene, Cleburne, White, Jefferson, Faulkner, and Sebastian counties.

RDOF tends to target rural, low population density areas. Figure 27 shows the share of population served in Arkansas's towns and cities. A very small minority of towns qualify for substantial RDOF support, but the vast majority quality for none or very little. Overall, only 2.9% of Arkansas's population living in towns and cities are eligible for RDOF.

Figure 27



B. USDA ReConnect

The US Department of Agriculture (USDA) Rural Utilities Service (RUS) Broadband e-Connectivity Pilot Program, also known as ReConnect, was launched in 2018 with $600 million in funding. A second round was announced in December 2019, and the application window closed on April 15, 2020, after being extended by a month because of the COVID-19 pandemic. Each USDA ReConnect round so far has awarded $200 million in grants, $200 million in loans, and $200 million in 50/50 loan/grant combinations.

Unlike the FCC RDOF program, the USDA does not pre-define the areas that applicant ISPs must offer to serve. It is up to applicants to find areas that are eligible for funding by, and competitive on, USDA ReConnect criteria. Critically, the USDA looks for projects that offer to serve areas where 90% of the population (it was 100% for pure grant applications in the first round) lack access to internet service even at 10 Mbps download/1 Mbps upload speeds. ReConnect awardees are required to deploy internet service at 25 Mpbs download/3 Mbps upload speed. USDA ReConnect's scoring rubric also incentivizes

In the first round, ReConnect awardees included electric cooperatives, local governments, and especially telephone companies. Grants per household connected were generally between $3,000 and $6,000, but some cost well over $10,000 per household connected. Most projects were for fiber-to-the-premise projects, capable of much exceeding the FCC's definition of broadband as 25/3, with some projects asserting that they expect to achieve speeds of one gigabit per second. Other awardees, however, plan to use fixed wireless. These are generally the cheapest projects, e.g., costs were a little over $1,000 per household for a project to serve the Pueblo of Acoma in New Mexico and a project to serve an area around Peach Springs, Arizona using fixed wireless.

Arkansas had two USDA ReConnect winning projects in the first round, both in North-Central Arkansas. One was a 100% grant award, described on the ReConnect website as follows:

Applicant: Mountain View Telephone Company

Location: Arkansas

Total square miles: 98

Funded Service Area Households: 702

Award amount: $3,750,000

This Rural Development investment will provide Mountain View Telephone Company with the opportunity to use $3,750,000 received in ReConnect Program grant funding to deploy a fiber broadband network project with approximately 97 miles of fiber, including drops at customer locations, inside wire and a Calix Giga center for each customer. The funded service areas include 702 households spread over 98 square miles.

The other was a 50% loan/50% grant combination project, described on the USDA ReConnect website as follows:

Applicant: Yelcot Telephone Company

Location: Arkansas

Total square miles: 24

Funded Service Area Households: 548

Award amount: $3,455,910

This Rural Development investment will provide Yelcot Telephone Company with the opportunity to use $1,727,955 received in ReConnect Program loan funding and $1,727,955 received in ReConnect Program grant funding to deploy a fiber to the home project with approximately 61 miles of fiber. The funded service areas include 548 households spread over 24 square miles.

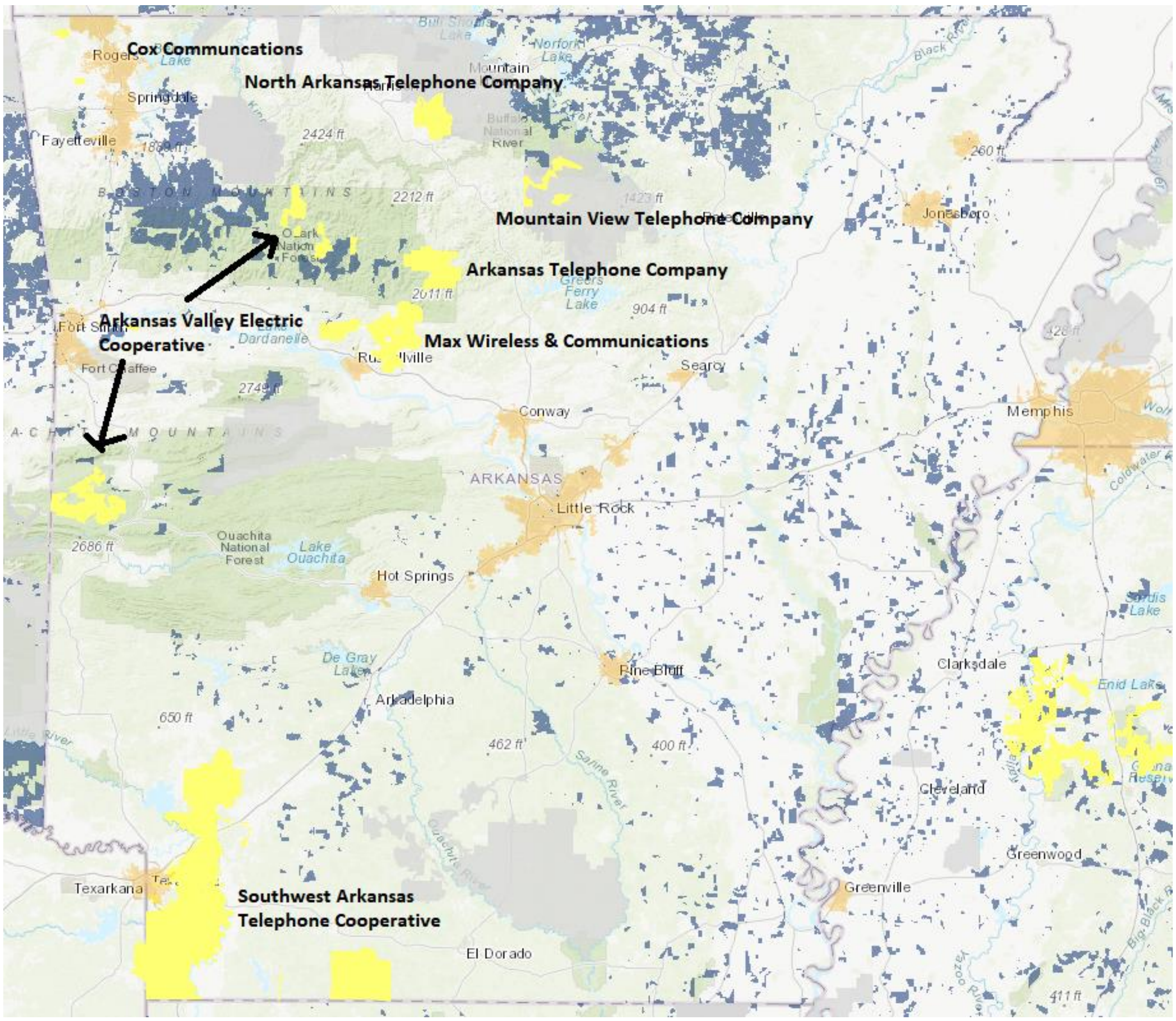
Seven companies applied for USDA ReConnect projects in the 2020 round:

- Northern Arkansas Telephone Company, with a project near Everton, AR
- Arkansas Valley Electric Cooperative, with a project involving disparate territories from just north of Mena, AR to parts of the Boston Mountains

- Southwest Arkansas Telephone Cooperative, for a project near Magnolia and Texarkana, AR
- Max Wireless & Communications, LLC, for a project near Dover, Scottsville, and Hector, AR
- Mountain View Telephone Company, for a project near Alco, AR
- Cox Communications, for a project near Gravette and Springtown, AR
- Arkansas Telephone Company, for a project near Scotland, AR, near Fork Mountain and Cromwell Mountain

The applicants and their proposed funded service areas (PFSAs) are displayed in Figure 28.

Figure 28: 2020 USDA ReConnect applicants in Arkansas



Awards are expected to be announced prior to the opening of the RDOF auction on October 29, 2022.

IV. State Broadband Grant Programs

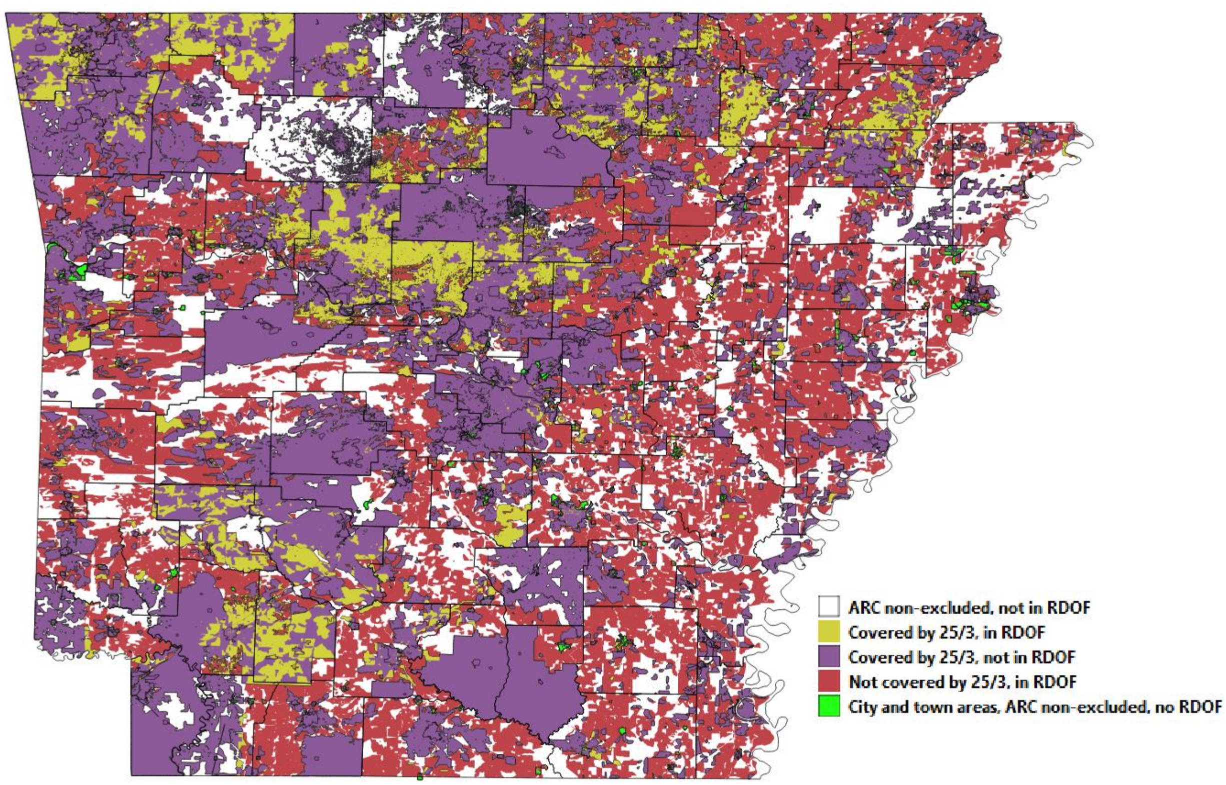
Two state broadband grant programs have recently been established: (a) Arkansas Rural Connect, and (b) the Rural Broadband I.D. Expenses Trust Fund.

A. Arkansas Rural Connect

The Arkansas Rural Connect broadband grant initiative was first announced late in 2020, and the first funding round was launched on April 27, 2020, after legislative approval of the rules. When the COVID-19 pandemic hit, the plans were changed so that Arkansas Rural Connect would be funded, over and above $5.7 million already appropriated, with federal coronavirus aid allocated to Arkansas through the CARES Act. An emergency rule was passed to enable funds to be spent quickly, consistent with CARES Act requirements that funds be spent by December 31, 2020. This requires Arkansas to prioritize projects that are amenable to very fast deployment. See the introductory section on the activities of the State Broadband Office for more information.

The targeting of Arkansas Rural Connect is somewhat different from that of the FCC's RDOF program, as shown in Figure 29.

Figure 29



Purple areas in the map in Figure 29 are covered by 25/3 or scheduled to be served by federally funded projects, according to the maps used to administer the Arkansas Rural Connect program, and not eligible for RDOF. The yellow areas are served by 25/3 but targeted by RDOF nonetheless. The large red regions of the map are targeted by both RDOF and the Arkansas Rural Connect program. White regions are rural areas targeted by Arkansas Rural Connect but not by RDOF, while the small green specks on the map represent parts of cities and towns that are not covered according to ARC maps, and therefore can contribute to the eligibility of ARC projects, while at the same time they are not eligible for RDOF support.

B. The Rural Broadband I.D. Expenses Trust Fund

The Rural Broadband I.D. Expenses Trust Fund was created by Act 139 of 2020. It allows local entities, defined as counties, cities, towns, or unincorporated communities, to apply for grants to conduct broadband due diligence business studies in support of applications for broadband funding from the FCC, the USDA, and other federal agencies. The fund will be administered by the Institute for Digital Health and Innovation (IDHI).

V. Broadband and the COVID-19 Pandemic

Modern economies are characterized by extremely dense networks of specialization and trade, which enable people to meet most of their needs, e.g., for clothing, food, shelter, health care, education and entertainment, by transacting with private businesses and other organizations, and to meet them much more efficiently than they could on their own. Specialization and trade typically involves a lot of face-to-face transactions. In March 2020, face-to-face interaction suddenly became dangerous because of the COVID-19 virus, and this caused an enormous macroeconomic shock as schools and workplaces closed down. Fortunately, in the age of the internet, it’s possible to conduct more services and transactions than ever online. So the COVID-19 pandemic became a crash course in the possibilities of a virtualized world. Office meetings gave way to Zoom meetings, classrooms gave way to Google Classroom and other Learning Management Systems, and sit-in restaurants gave way to takeout and delivery, often delivered by online services like GrubHub and Uber Eats.

At the time of writing, the rate of new COVID-19 cases and deaths nationally has retreated somewhat from its peak in April, and a reopening of the economy is underway in many states, including Arkansas, but COVID-19 is still a threat, and there is still a strong need for social distancing and other behavior changes (relative to habits pre-pandemic) to inhibit virus spread. Taking activities online that would ordinarily have been done through face-to-face transactions is often a good way to inhibit virus spread with little or no disruption or productivity loss. Of course, this depends on broadband being accessible and affordable.

In the coming months and years, it will be seen <u>how lasting pandemic-induced changes in society’s use of the internet will turn out to be</u>. Will education transition to a heavier use of online tools and apps, replacing a lot of face-to-face class time with distance education? Will people shop online more, and rely more on delivery to get merchandise, compared with trips to the store? Will people want to telework more, and if so, will organizations accommodate such preferences? Will telehealth lastingly gain market share as a means of delivering medical services? Will friends, family and communities transition permanently to a larger share of their interactions being mediated by the internet? The answers to these questions will shape the future of digital connectivity, and may make the need for broadband, already widely held to be a necessity rather than a luxury, even more intense.

A. Telework

For decades, the possibility that most of the work that takes place in offices could be relocated to people's homes has been widely recognized, but very little realized. According to Global Workplace Analytics' annual State of Remote Work report, before March 2020, 80% of workers said they would like to work from home at least some of the time, but only 3.6% of the US workforce actually teleworked half of the time or more."

Recent polling data, however, helps us to quantify the widely known surge in telework that has taken place as a result of the COVID-19 pandemic. From mid-March to early April, according to Gallup, the share of Americans whose employers offered them flex time or remote work rose from 39% to 57%, and 62% said they had worked from home during the crisis, double the previous rate. Three in five of those working from home during the pandemic said they would prefer to continue working remotely as much as possible, while 41% wanted to return to their office or workplace.

The future of broadband will depend in part on the future of telework when the COVID-19 pandemic eventually subsides. In general, the more that organizations shift permanently to telework, the more important broadband access will be. In some cases, it may be even harder for areas with poor broadband coverage to retain population, as residents wanting to work from home will relocate to places where they have broadband for telework. But areas with good broadband and a high quality of life will have new opportunities to attract residents with jobs that allow them to work from home.

If the shift to telework lasts, it represents an important opportunity to improve Arkansas's economic competitiveness. Relative to major coastal cities like New York, Boston, Washington, DC, Los Angeles and San Francisco, Arkansas has a far lower cost of living but few well-paid, upwardly mobile jobs. Telework could enable Arkansans who have left the state in search of economic opportunity to return home without sacrificing their professional success. Some parts of Arkansas might attract teleworkers who want to relocate away from expensive big cities to beautiful places with a mild climate and plenty of cheap housing and land. But teleworkers can only settle where high-speed broadband connectivity is available.

Telework also has benefits for the environment. 28% of greenhouse gas emissions in the United States come from the transportation sector,[7] mostly from gasoline-powered cars and trucks.

Hitherto, enabling telework has been a minor motive for promoting broadband deployment. In future, it deserves to be given more weight, especially if the temporary telework revolution of spring 2020 lastingly changes people's habits of going to the office.

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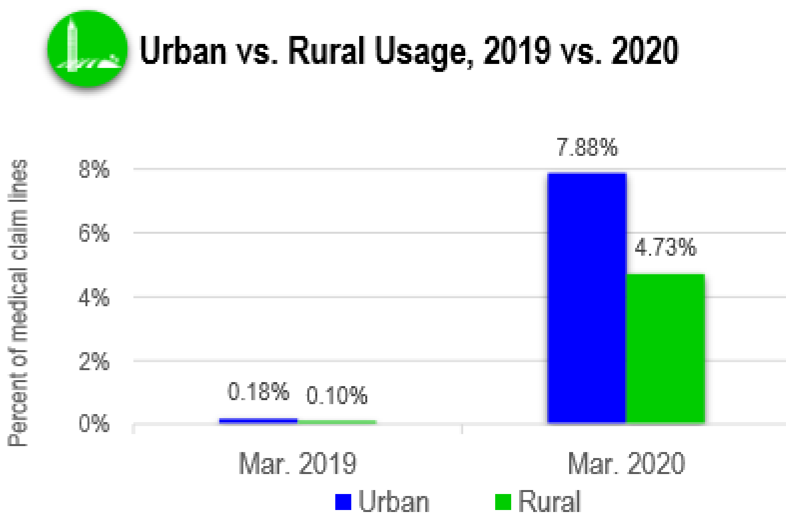
[7] https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions#:~:text=The%20primary%20sources%20of%20greenhouse,share%20of%20greenhouse%20gas%20emissions.

B. Telehealth

Medicine has been slower to move online than other services, because it has an inherently physical aspect—urine samples, etc.—but some aspects of medicine can be done remotely, such as verbal consultations and remote patient monitoring. Early in the pandemic, journalists reported a surge in demand for telehealth services,[8] and Figure 30 supports the claim, albeit the surge in demand still left telehealth accounting for only a small part of billable medical service activity. (No more recent data is available.) By far the top telehealth diagnosis continues to be "mental health conditions."

Figure 30: More insurance claims were for telehealth services in March 2020 than a year earlier (Source: FAIR Health Monthly Telehealth Regional Tracker, March 2020[9])



While the March 2020 surge in telemedicine was concentrated in urban areas, rural areas may stand to benefit more from telehealth because rural residents tend to live further from medical providers. But to the extent that telehealth requires high-quality broadband connectivity, many rural areas are held back.

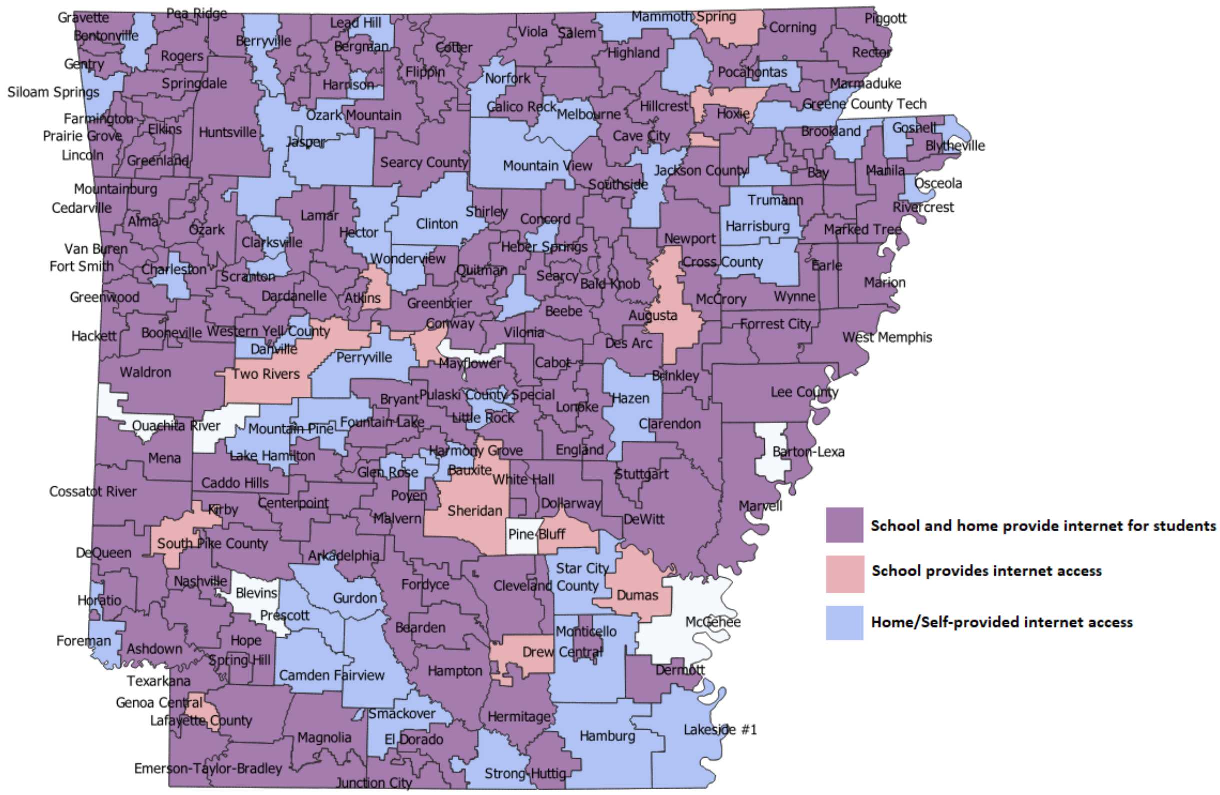
C. Distance Education

All public schools in Arkansas were ordered physically closed by Governor Asa Hutchinson on March 15th, 2020, in order to prevent the spread of COVID-19. On April 6th, it was announced that they would remain closed for the rest of the year. Physical school closures did not put a stop to Arkansas public schools' efforts to educate children, however. Schools organized distance education programs through Learning Management Systems like Google Classroom, Edmodo, Canvas, and Schoology. College campuses, too, closed their doors and relied on online platforms to continue learning. Of course, this created a greatly heightened need for broadband in order to carry on the work of educating the young.

[8] https://www.statnews.com/2020/03/17/telehealth-services-overwhelmed-amid-coronavirus-pandemic/
[9] Available at https://www.fairhealth.org/states-by-the-numbers/telehealth

Figure 31, based on a survey of superintendents conducted in June 2020 by the Arkansas Department of Education, that most school districts made some efforts to help their students get internet access during the COVID-19 school closures.

Figure 31: Most school districts report providing internet access to students during the COVID-19 pandemic



Many superintendents gave further details on what their school districts did to help students get access. A common response was to provide wi-fi areas or hot spots where students could access the internet.

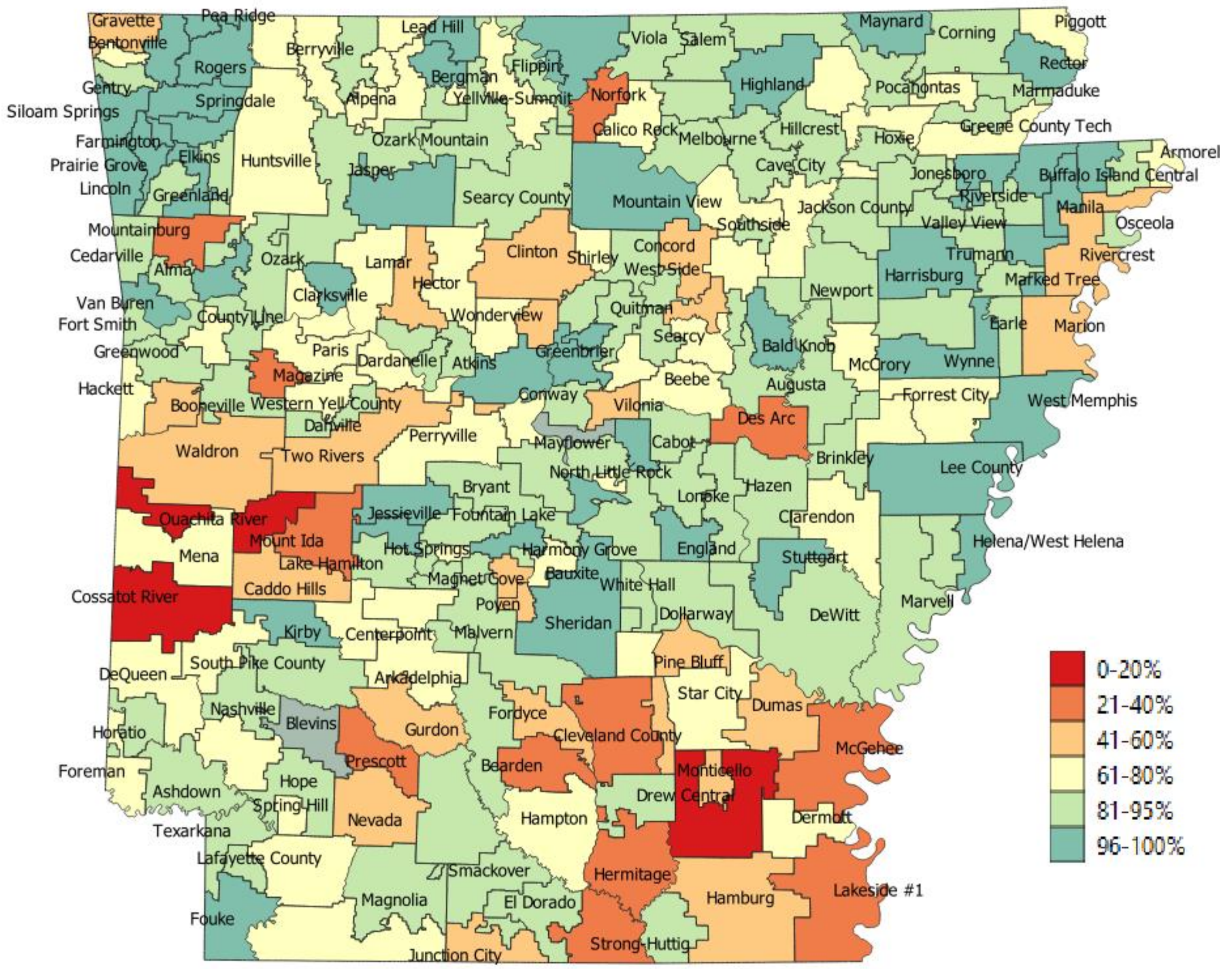
> School provided hotspots for areas with cellular signal. However, a significant portion of our student body have no access to internet, even cellular service. This is our largest concern.
>
> Hot spots will be placed at local churches throughout the various communities in the district.
>
> Public hotspots in communities where students reside (Information will be updated and provided often)
>
> We are purchasing mobile hot spots for those students that do not have internet access.
>
> We've purchased hotspots that we plan to put on buses and park in the neighborhoods for students to have access.
>
> Hotspots in school parking lots. Some LTE capable Chromebooks.
>
> We will expand wifi where possible. We are considering wifi on buses and hotspots.

> We are working with Ritter to push our wifi out. We will have to place devices on local water towers and devices at the home to receive the signal.

While public wi-fi hot spots, libraries, school parking lots, and so forth seem to have served as an educational lifeline for many, it seems clear that this solution involves considerable inconvenience for students without home internet access, and places them at a disadvantage, and might involve public health risks too, if students have to concentrate in the same physical location to access wi-fi. The feasibility of these solutions is also contingent on the weather. Students sitting in a parking lot in cars with closed windows are safe from spreading COVID-19, and in April or May the heat is less of an issue. But when the school year begins in August and September, it will be too hot to sit in a parking lot in a closed car doing homework.

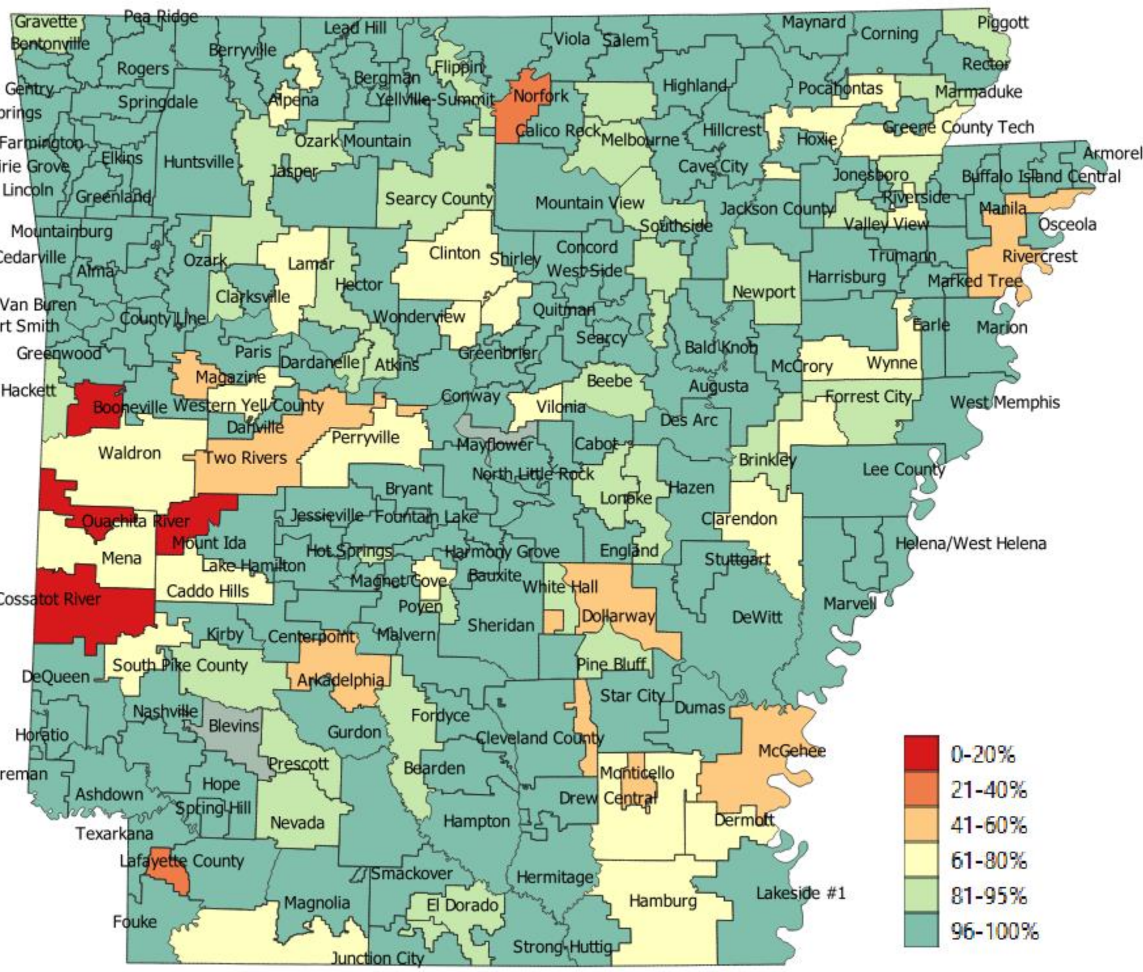
For educators, too, distance education depends on a degree of broadband connectivity that is often unavailable. Figure 32 maps superintendents' answers to a question about whether educators in each school district have enough broadband connectivity to provide education remotely. Clearly only a small minority of school districts think their educators have universal or near-universal broadband access. While *most* superintendents think *most* of their educators have adequate broadband, there are many districts where this is not the case.

Figure 32: Select the percentage (to the best of your knowledge) of educators in your district that have broadband connectivity capable of delivering education remotely. (Answers by school district)



That broadband in particular really is the bottleneck that gets in the way of effective delivery of distance education is underscored by Figure 33, which shows superintendents' answers to a question about how many of their educators have sufficient *devices* to deliver distance education. A large majority of superintendents think all or nearly all of their educators have the devices they need. Device prices have fallen sharply in recent decades, making it relatively easy to supply this need, but broadband connectivity is a harder problem to tackle.

Figure 33: Select the percentage (to the best of your knowledge) of educators in your district that have devices capable of delivering education remotely. (Answers from superintendent survey)



D. Online Shopping

A recent study by PitchBook, a financial consulting company, analyzed recent developments in grocery delivery, and projected that a 65% surge in grocery delivery and pickup between March and May 2020 would not be reversed, but rather lead to continued growth through a feedback loop between adoption and improvements in customer service and technology.[10] Some pioneering grocery store chains are opening "dark stores" that have no customers but focus on fulfillment of online orders. Online grocery shopping is yet another broadband use case, seemingly inessential in normal times, but valuable to public health as long as the pandemic lasts.

[10] "Delivery Technologies are Reshaping the Grocery Industry." May 2020. MorningStar/PitchBook. https://pitchbook.com/news/reports/q2-2020-pitchbook-analyst-note-delivery-technologies-are-reshaping-the-grocery-industry

E. Online Worship

Early in the pandemic, many religious leaders ordered or encouraged local churches to close their doors temporarily, for the safety of their members and/or to comply with guidelines and directives issued by governments. A poll in early April 2020 found that only 7% of Protestant pastors were holding church meetings.[11] According to a poll by the American Enterprise Institute in March,[12] at a time when only 12% of worshipers were still being offered normal services by their places of worship, another 57% had online services only. The survey found that, while participation in online worship was not universal, there was swift adoption by many:

> More than half (53 percent) of white evangelical Protestants report that they attended a remote worship service or watched an online sermon. Considerably fewer black Protestants (36 percent), Catholics (34 percent), members of non-Christian religious traditions (25 percent), and white mainline Protestants (23 percent) report having participated in an online religious service.

The way the internet enabled people to keep worshiping communally during the pandemic underscores how critical broadband has become to society.

VI. Low-Earth Orbit Satellites for Broadband Delivery

Later in 2020, SpaceX is expected to begin providing a new kind of satellite broadband service with much lower latency.

Satellite internet is already well established as the most widely available type of internet service, available almost everywhere except on the north side of tall hills, where rising ground blocks the southern sky. But currently available satellite services shoot from geostationary orbit, over 22,000 miles from the surface of the Earth at the equator, more from the Northern Hemisphere. For interactive online applications, each interaction involves a trip to geostationary orbit with a signal, back to earth with the signal, then back to geostationary with response, and back to earth again—four trips of over 22,000 miles. Even at the speed of light, that trip creates half a second or more of latency, unimportant for some applications, such as watching a movie, but crippling for others, such as videoconferencing or gaming.

Low-earth orbit (LEO) satellites can be much closer. The atmosphere is about 300 miles thick, and very thin in its upper reaches, so that above 200 miles, it is possible for satellites to stay in orbit. Hence LEO satellites have the critical advantage of being close, and of relaying signals fast. Against this, LEO satellites cannot be geostationary, and lack line of sight access to such a large proportion of Earth's surface. They have limited range and are constantly moving relative to the ground. Consequently, far more of them are needed to provide continuous coverage even to a single point. The challenge of LEO satellite internet involves deploying huge fleets of satellites, which cover limited areas and are

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[11] https://www.christianheadlines.com/contributors/michael-foust/93-percent-of-americas-churches-have-stopped-meeting-poll-shows.html

[12] https://www.aei.org/wp-content/uploads/2020/04/APS-Mar-2020-Report-PDF-Online-Version.pdf

constantly moving, but which together weave a web of coverage over much or all of the Earth's surface. Some companies are now rising to that challenge.

SpaceX is working on deploying a constellation of LEO satellites called Starlink. At the time of writing, over 400 of these satellites have been launched, of an approved 12,000. SpaceX CEO and founder Elon Musk has said that he expects Starlink internet service to be offered in the northern United States and Canada in 2020, and to more and more areas—hopefully culminating in nearly worldwide coverage—in the course of 2021.

Low earth orbit solves the latency problem that has afflicted satellite providers heretofore. Indeed, signals traveling to and among satellites at the speed of light should be able to arrive at their destinations faster than signals in electronic form traveling along copper wires. With its light-speed transmission, LEO satellite broadband is likely to rival fiber optic internet for latency. But it is not clear how much bandwidth and data Starlink will be able to offer users, given the limited capacity of its satellites. Users will also need their own satellite dishes to receive the signal.

Other players in the LEO satellite broadband space include Amazon's Kuiper project. A recent study by CoBank[13] raises some doubts about LEO satellite broadband's chances of success, but suggests that Amazon is the strongest contender to deploy satellite broadband because of its access to capital and its ability to bundle satellite broadband with existing services.

The FCC RDOF rules permit LEO satellite broadband providers to compete in the auction in the Low Latency tier, but Chairman Pai's statement stresses that "any such application will be given very close scrutiny" because RDOF "is not a technology incubator to fund untested technologies," and warns that "a new technology may sound good in theory and look great on paper."[14]

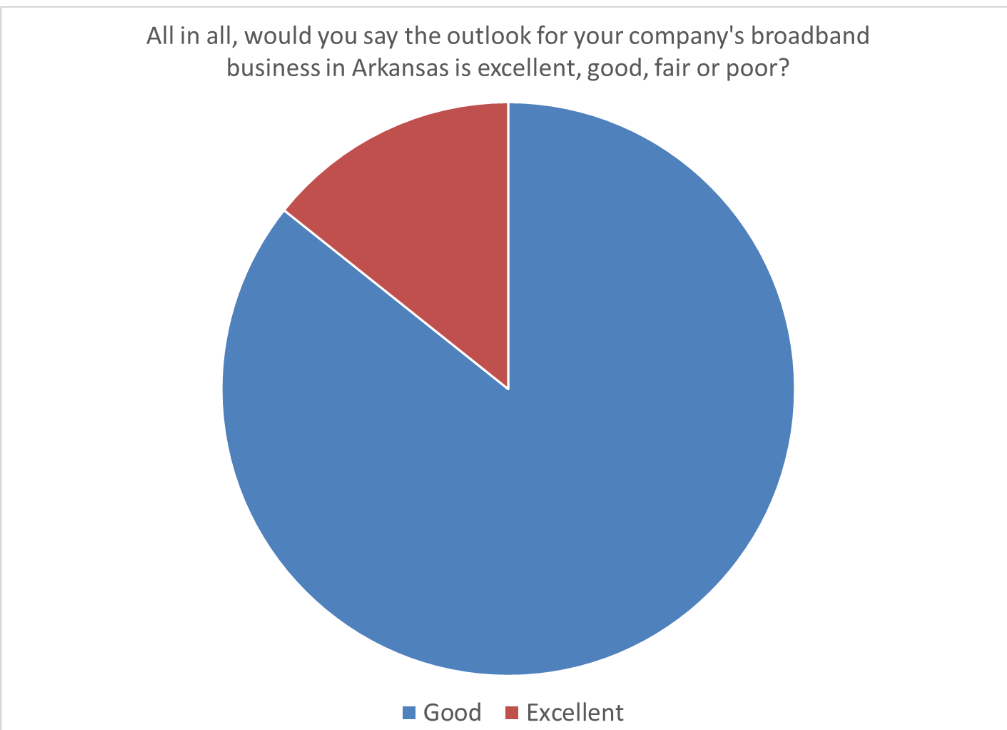
[13] "LEO Satellite Broadband Expectations Need to Come Back to Earth" https://www.cobank.com/knowledge-exchange/communications/leo-satellite-broadband-expectations-need-to-come-back-to-earth
[14] From FCC Chairman Ajit Pai's statement on the adoption of procedures for the RDOF auction. https://docs.fcc.gov/public/attachments/FCC-20-77A2.pdf

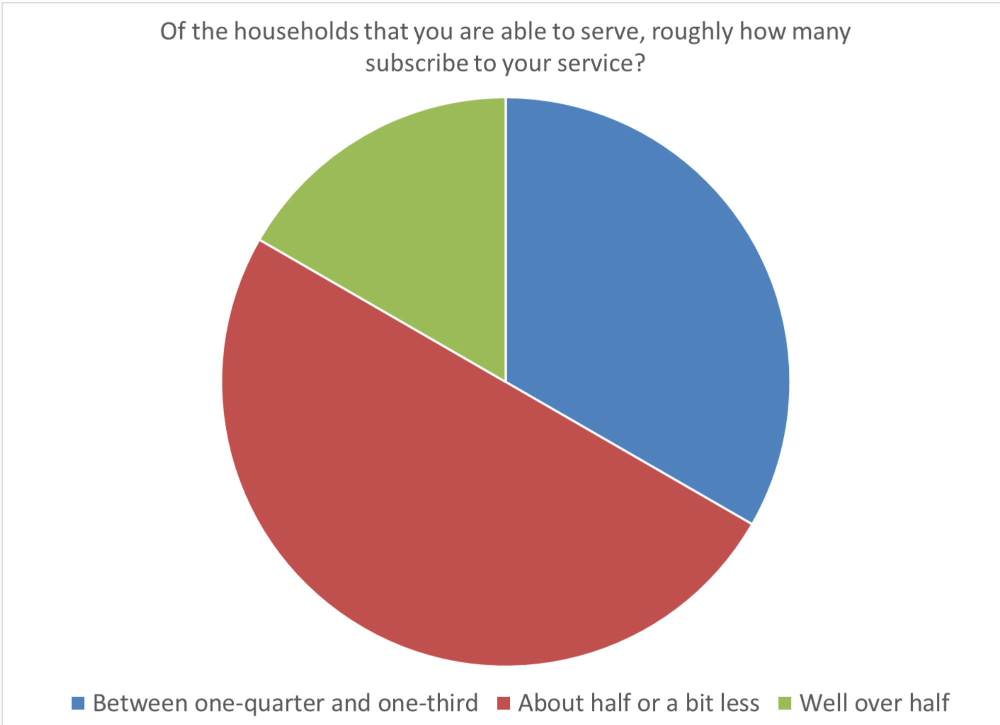
APPENDIX A: ISP Survey Results

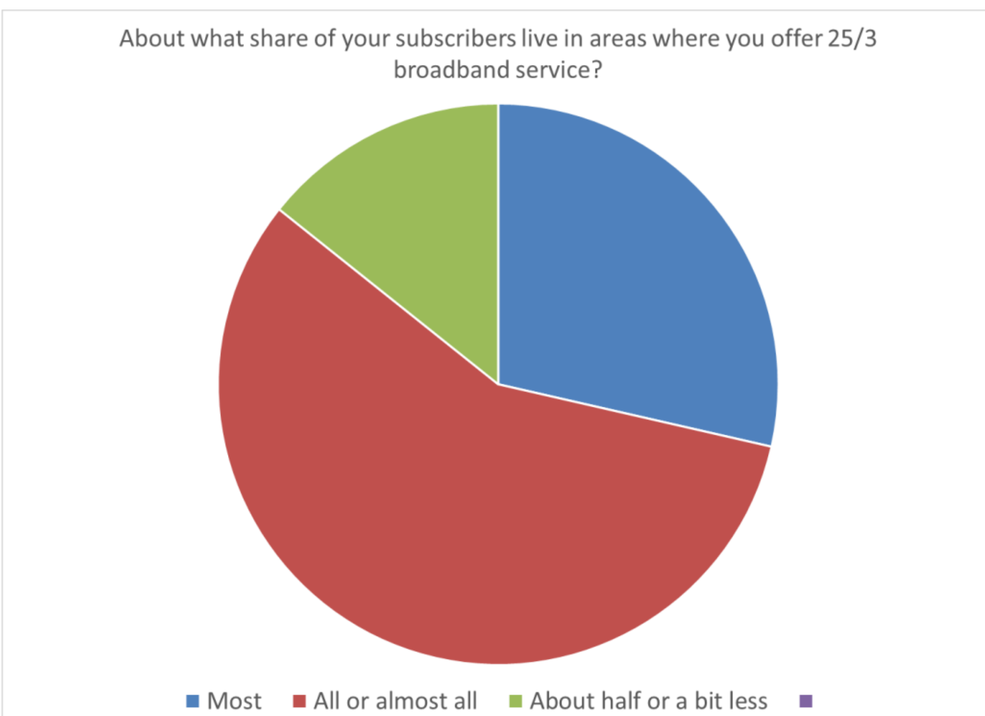
A survey was circulated to ISPs in late June, and the results of the survey are shown here. Response rates were unusually low, so none of the results should be interpreted as representative or scientific. Nonetheless, some suggestive patterns emerged.

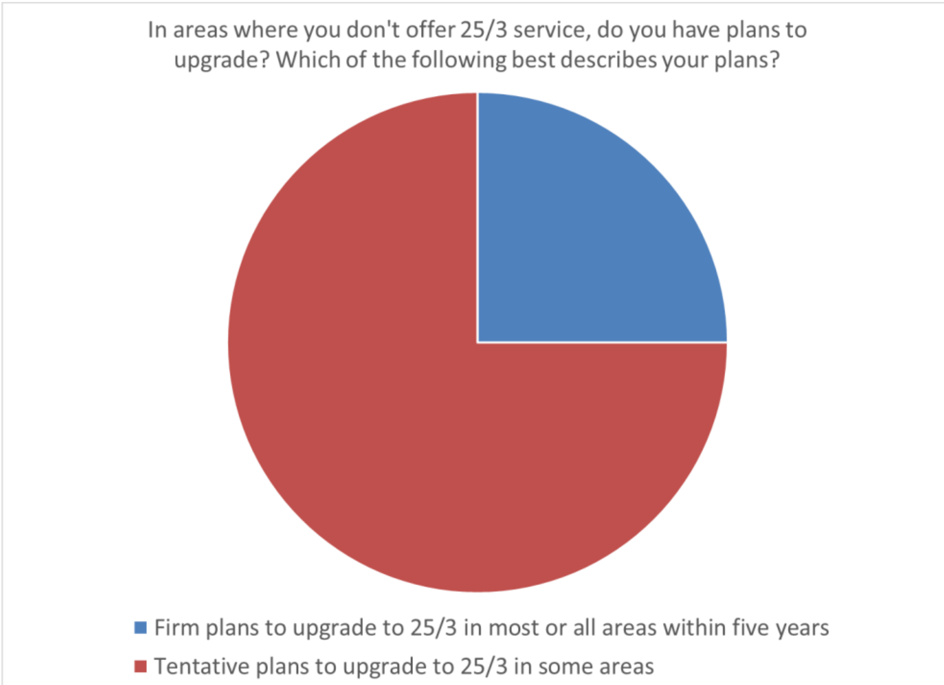
Business is good for ISPs, which have become lifelines during the COVID-19 pandemic. All have seen data usage increase, dramatically in most cases, and most have seen a moderate increase in their subscriber base. All the ISPs that responded to the survey have firm or tentative plans to expand their networks and expand their coverage areas, though in the latter case tentative plans predominate. The top barriers to expansion are the cost of pole attachments and low population density, followed by lack of financing.

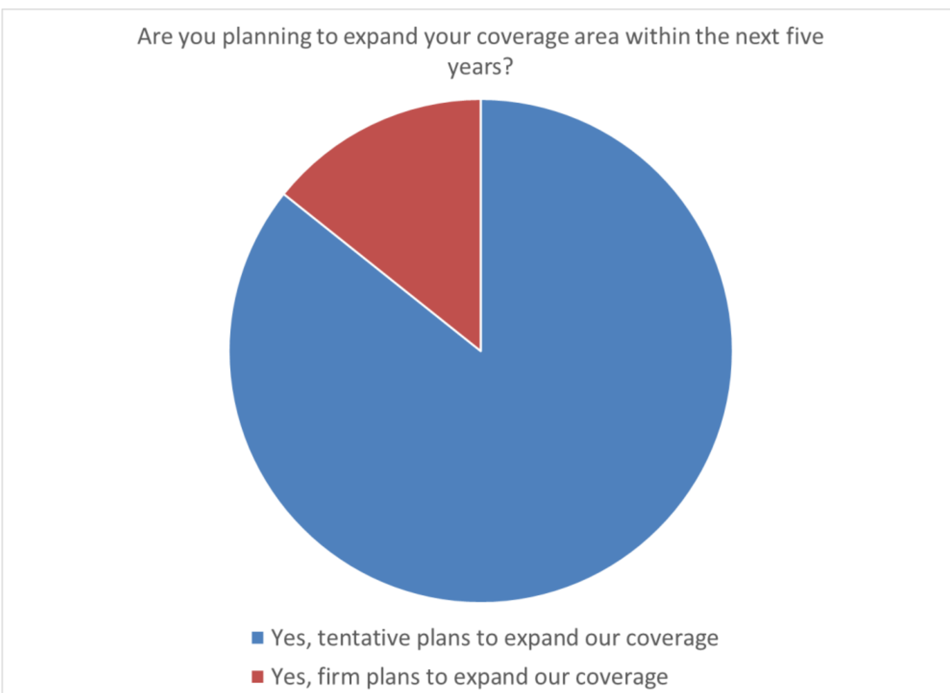
Most ISPs that responded to the survey do not have firm plans to participate in RDOF, though all were at least considering at the time they responded. The most common reason for not participating is that the requirements for participation in RDOF are too burdensome, while others find the levels of support offered by RDOF insufficient. Some of the responding ISPs participated in the USDA ReConnect program, while others could not find eligible areas to apply for, and one did not know about the program.

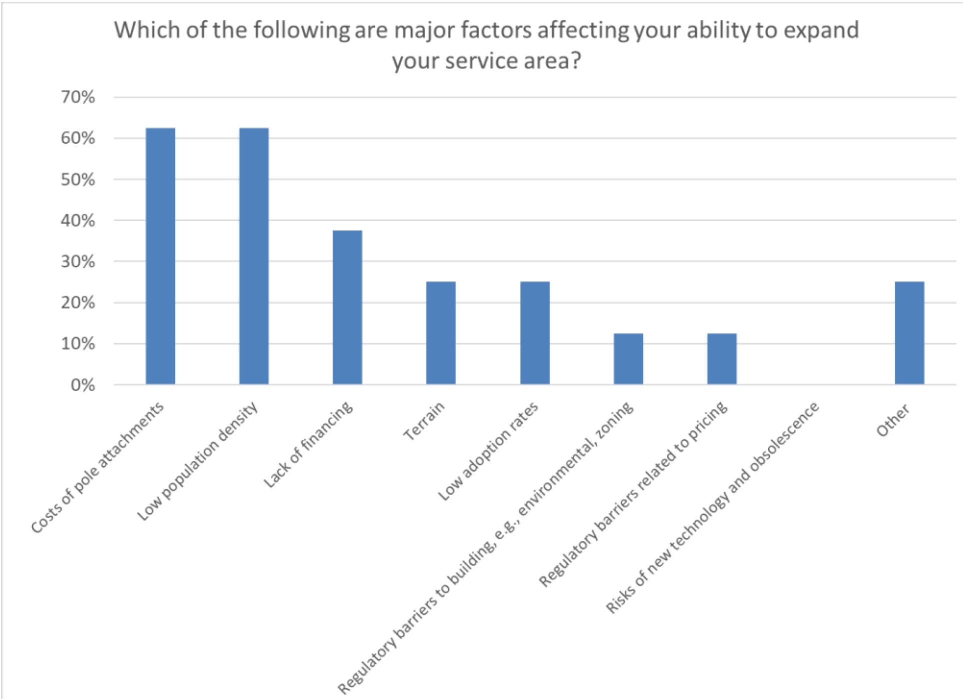


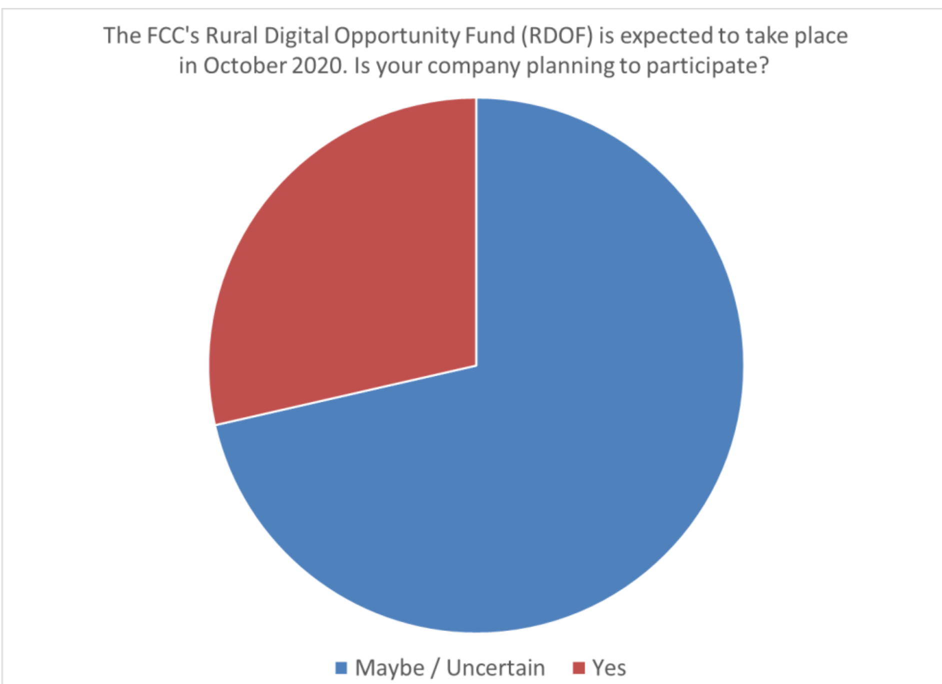

Of the households that you are able to serve, roughly how many subscribe to your service?
Between one-quarter and one-third
About half or a bit less
Well over half

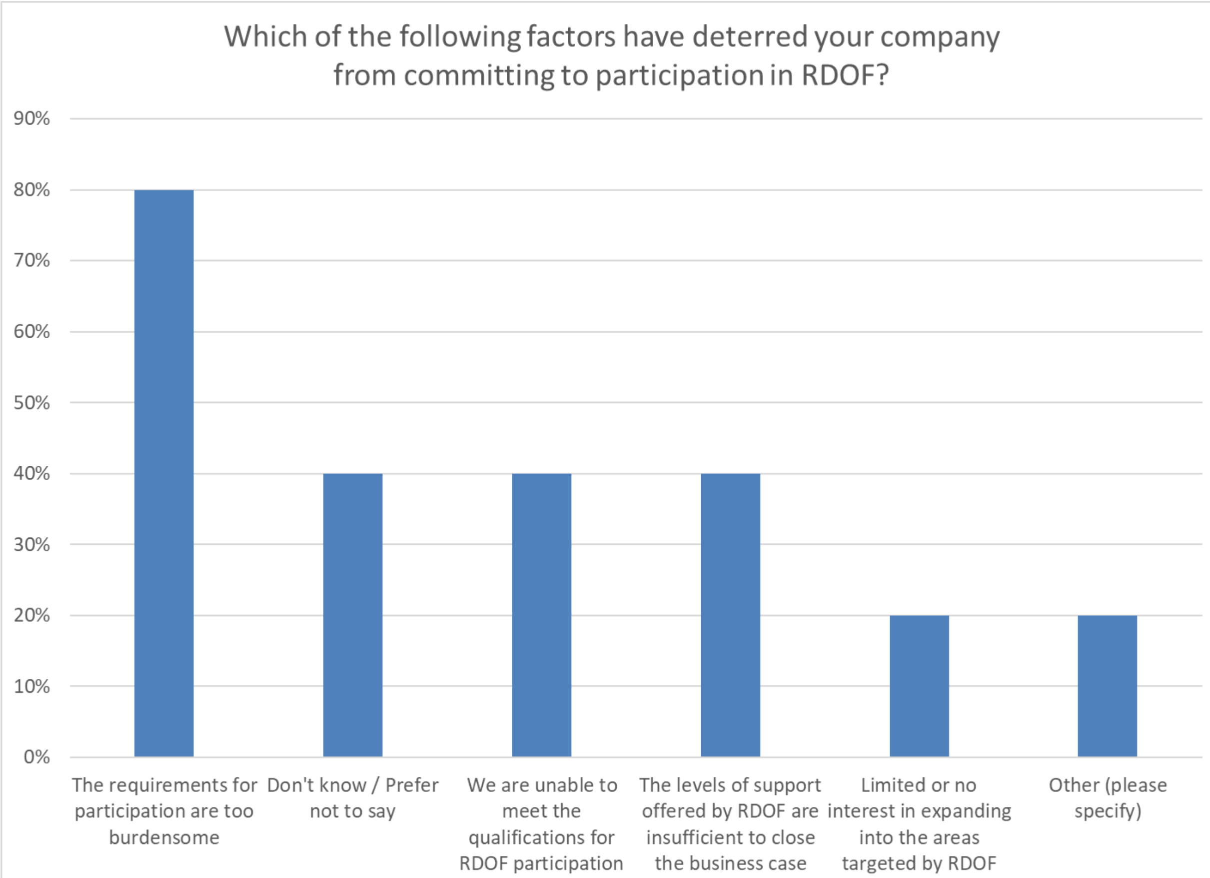

About what share of your subscribers live in areas where you offer 25/3 broadband service?
Most
All or almost all
About half or a bit less

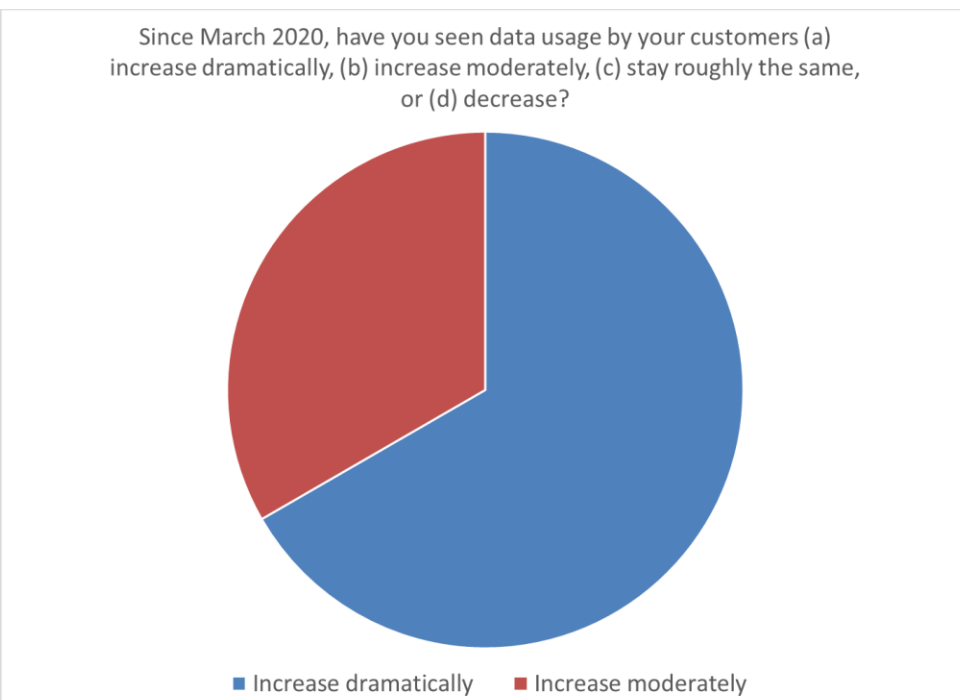

In areas where you don't offer 25/3 service, do you have plans to upgrade? Which of the following best describes your plans?
Firm plans to upgrade to 25/3 in most or all areas within five years
Tentative plans to upgrade to 25/3 in some areas

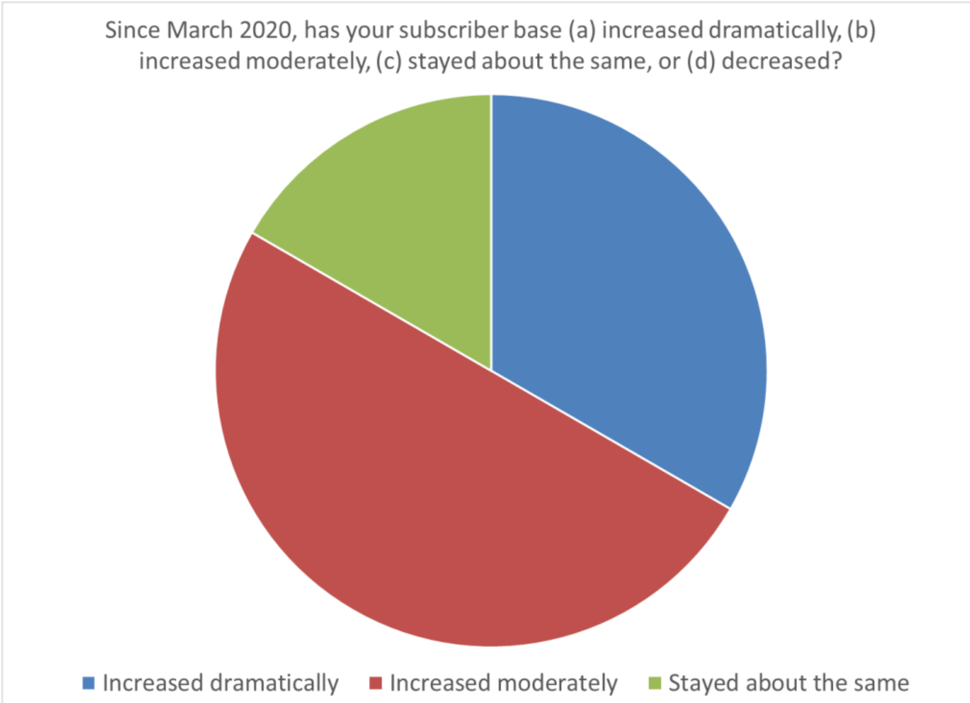

Are you planning to expand your coverage area within the next five years?
Yes, tentative plans to expand our coverage
Yes, firm plans to expand our coverage

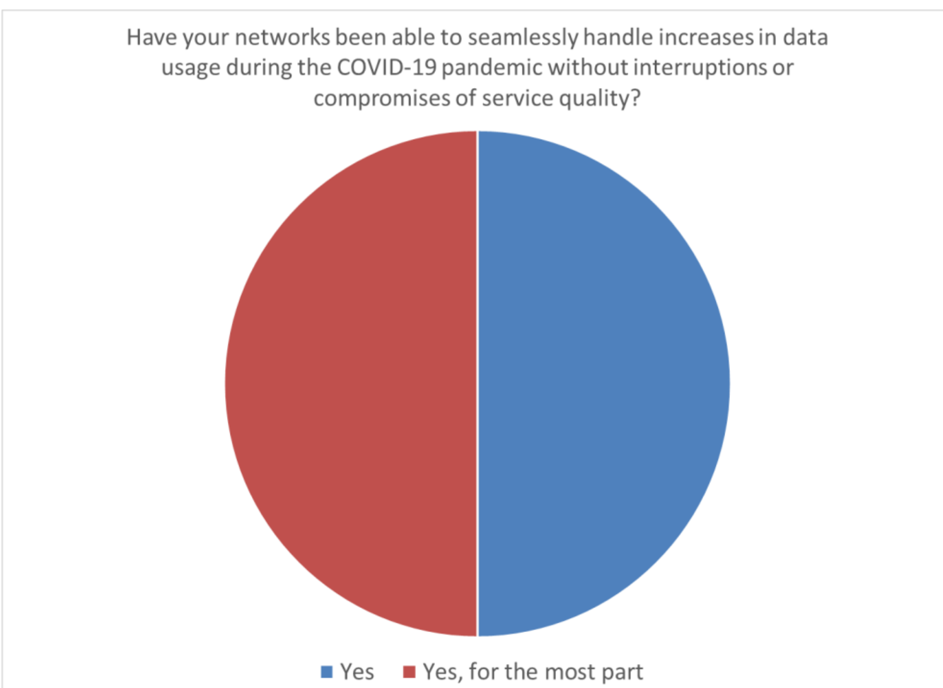

Which of the following are major factors affecting your ability to expand your service area?
70%
60%
50%
40%
30%
20%
10%
0%
Costs of pole attachments
Low population density
Lack of financing
Terrain
Low adoption rates
Regulatory barriers to building, e.g., environmental, zoning
Regulatory barriers related to pricing
Risks of new technology and obsolescence
Other

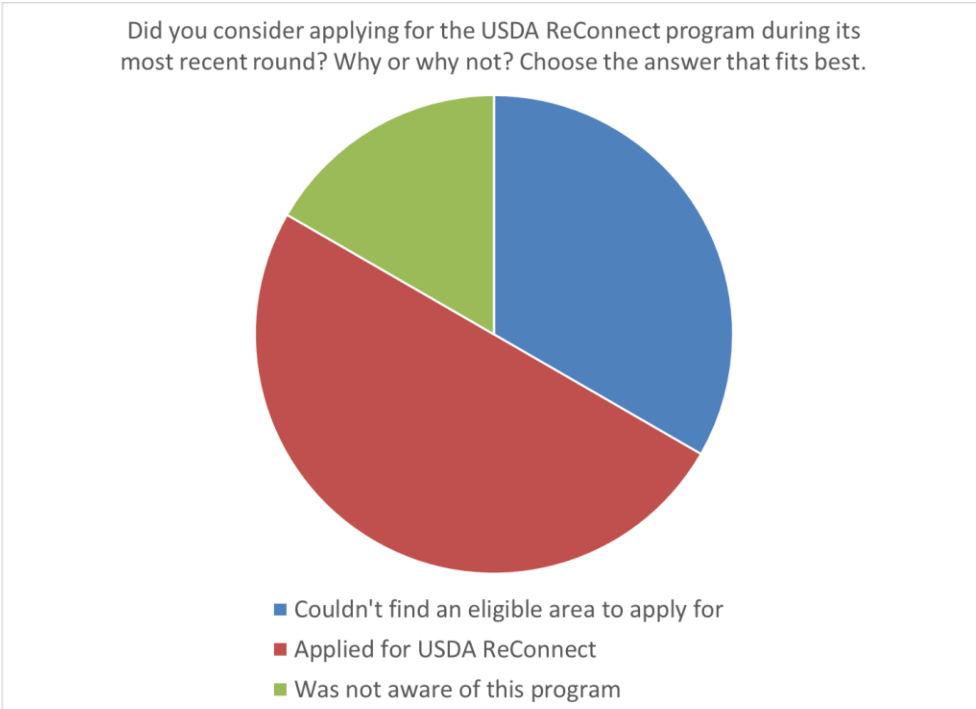

The FCC's Rural Digital Opportunity Fund (RDOF) is expected to take place in October 2020. Is your company planning to participate?
Maybe / Uncertain
Yes


Which of the following factors have deterred your company from committing to participation in RDOF?
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
The requirements for participation are too burdensome
Don't know / Prefer not to say
We are unable to meet the qualifications for RDOF participation
The levels of support offered by RDOF are insufficient to close the business case
Limited or no interest in expanding into the areas targeted by RDOF
Other (please specify)


Since March 2020, have you seen data usage by your customers (a) increase dramatically, (b) increase moderately, (c) stay roughly the same, or (d) decrease?
Increase dramatically
Increase moderately


Since March 2020, has your subscriber base (a) increased dramatically, (b) increased moderately, (c) stayed about the same, or (d) decreased?
Increased dramatically
Increased moderately
Stayed about the same


Have your networks been able to seamlessly handle increases in data usage during the COVID-19 pandemic without interruptions or compromises of service quality?
Yes
Yes, for the most part


Did you consider applying for the USDA ReConnect program during its most recent round? Why or why not? Choose the answer that fits best.
Couldn't find an eligible area to apply for
Applied for USDA ReConnect
Was not aware of this program

Open-Ended Questions

Has your company made any special efforts to help K-12 students get access to broadband for distance education during school closures? If so, please describe.

For years we have offered a low-cost service for households with at least one K-12 student who participate in a government assistance program. During this time we have rapidly expanded the program to include 4 free months of internet and revamped our sign-up policies to create a fast-track system to connect families quickly.

We offered anyone in our servicing area 25/3 for 6 months at $25 a month

yes, we have opened several wireless access points in our communities

Yes, we have revamped in increased the speed to our "Student Connect Program" which is discounted from our normal pricing. We have worked with schools in our areas to figure out who needs service and how to get it to them. We have waived all data overages since late March

Yes. We have contacted districts and offered a program where the district can pay for the student's internet service at home - one flat rate per student for the entire school year (10 months), including equipment. we have connected about 500 student addresses with this plan so far.

Feel free to explain any difficulties that your networks have encountered in meeting increased demand for data during the COVID-19 pandemic.

only random issues with copper lines carrying internet

Take rate was more than usual for what we had expected for 2020. We had to add Docsis channels to help on utilization.

Have you made any changes to pricing, payment, and data usage policies to help your customers during the COVID-19 pandemic? If so, please describe.

changes to payments and collections with no shutoffs

New price for 25/3 for $25, waved late fees, didn't disconnect anyone regardless if they had internet, tv, or phone. We don't have any data caps company wide.

-Waived late fees and didn't terminate service for customers behind on their bills. -Provided unlimited data for all residential customers and issued three-month credit for customers already using unlimited service. -Opened free WiFi outdoor hotspots. Doubled download speeds and provided free remote desktop support for low-cost internet and basic internet packages. -Created special, reduced price packaging with no annual contract or qualifications to help low-income customers and others adversely impacted by coronavirus challenges, like college students and senior citizens. -Various offers and packages to support our business clients as well.

we bumped all our 15m customers to 30m at no charge/increase and waived all data usage overages

Yes. We eliminated all data usage overage charges for the months of March-May. We also set up a payment deferral plan, where upon customer request, we would not suspend service for non-payment or charge a late fee through June 30. In July, all past due balances are being split into smaller monthly payments (5), so the customer can get back on track without the fear of being disconnected due to a 4 month balance.

What policy changes would you like to see the state make in order to promote more extensive deployment of broadband?

Make ready cost and pole attachment keep most providers from extending out. I wish we had more of a partnership than a competitive environment for extending broadband to the truly under served.

Pole attachments. They are a large part of the overall cost equation. Pole rental, while important, is only one piece of it - permitting and make ready work can be very cost prohibitive.

We primarily serve rural areas, so the ARC Grant is a great help. One of our challenges is always justifying the construction cost to extend our current service area, when it could be a mile or more before we reach the next serviceable address. Deploying broadband throughout the farmlands of Lee County, for instance, is expensive and unjustifiable with private funds. Any help the State can provide to subsidize this cost is greatly appreciated.