Arkansas State Broadband Plan

Issued by the Office of Arkansas Governor Asa Hutchinson

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Introduction

Sometimes technological change alters the way the social contract is understood.

Before the 1880s, no one had electricity, in the sense of a wire running into a residence powering light bulbs and other electrical devices. Over the next few decades, electricity came to be considered a necessity. Today, virtually 100% of Americans have it, and universal service obligations ensure it is available to virtually every inhabited residence.

Similarly, broadband has become so essential to the modern American way of life that government can't be indifferent when people lack access to it. In Arkansas and across the nation, broadband is used by students to complete their homework. Broadband is essential for patient access to telehealth services. Broadband is used for countless functions in daily life ranging from public safety and emergency response to shopping for necessities or Christmas presents. Broadband is used by citizens to transact with government, e.g., to pay taxes, renew driver's licenses, report on work and job search activities to retain eligibility for unemployment benefits or Medicaid, or find out where to vote. In some cases, broadband availability may save taxpayers money by enabling people to get cheaper health care or find jobs and get off welfare.

Economic development depends on rich networks of specialization and trade, and these networks depend on transport and communications networks, of which broadband has become a crucial part. Areas lacking broadband service are at a disadvantage in achieving modern knowledge and productivity, and often experience job losses, economic deterioration, and out-migration. The geographical barriers creating a digital divide in Arkansas can be mitigated if universal or near universal access to high-speed internet becomes a medium-term policy goal.

Governor Asa Hutchinson has targeted a goal of seeing 25 Mbps/3 Mbps broadband deployed to all population centers in Arkansas over 500 by the year 2022. Section I provides more details about this goal, how close Arkansas is to achieving it and the means by which it can be achieved.

Throughout this report, the recommendations of the FCC's Broadband Deployment Advisory Committee (BDAC) were regularly consulted as a source of ideas for how broadband policy in Arkansas might be adjusted to move closer towards national best practices and accelerated deployment.

Section II of the Broadband Plan for Arkansas describes the competitive landscape for broadband services. While many internet service providers (ISPs) operate in the state, most Arkansans have far fewer options for high-speed[1] internet, and many have one or none. Competition is usually *between technologies*, rather than between companies using the same technology. Many legacy regulations, such as those governing pole attachments or cross-subsidizing rural telecoms, affect broadband supply, and most of these affect some broadband providers and not others. The broadband business is far from perfectly competitive, and the concept of natural monopoly is relevant to some aspects of the space, especially the utility pole networks that deliver most DSL, cable, and fiber connectivity to homes and businesses. However, broadband service in general does not look like a natural monopoly business. This conclusion weakens the case for government involvement in broadband provision.

Nonetheless, **the federal government is responding to unmet demands for rural broadband by subsidizing investment** through many different channels. The Federal Communications Commission

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[1] Where "high speed" is defined to include low latency.

(FCC) has been re-allocating spectrum through auctions, channeling traditional "universal service" support to high-cost areas, and deploying new auction mechanisms such as the recently completed Connect America Fund (CAF) II Auction 903 and the upcoming Mobility Fund (MF)-II. Most recently, FCC Chairman Ajit Pai has announced his intention, if he gets the blessing of his fellow Commissioners at the FCC, to repurpose CAF II funding that expires in 2020 with a phase-out in 2021 to stand up a "Rural Digital Opportunity Fund," which would allocate $20.4 billion over 10 years to deploying rural broadband through reverse auctions.

The U.S. Department of Agriculture (USDA) has administered a variety of programs funding broadband deployment, to which the large ReConnect program was recently added. Several other federal agencies are involved in supporting rural broadband deployment as well. This influx of federal money limits the need for Arkansas to provide fiscal support for broadband deployment, beyond the already-existing Arkansas High Cost Fund.

This plan suggests that the focus of state government should be upon:

- Accessing and leveraging federal programs to the fullest extent;
- Designing and administering smart regulations that treat all stakeholders fairly while encouraging deployment and competition;
- Reforming the governance of existing state-owned assets, such as dark fiber, towers, and public rights-of-way, so that private companies and other non-governmental organizations can utilize them to deliver broadband;
- Educating the public about the value of broadband;
- Marketing ongoing and expected progress in broadband deployment to businesses to encourage investment in Arkansas;
- Exploring all avenues for making broadband affordable for the citizens of Arkansas

Section III describes federal government programs that have been instrumental in deploying broadband to rural Arkansas in recent years, and that are expected to continue driving broadband deployment in the years to come.

Section IV lays out plans for a State Broadband Office, which Governor Hutchinson plans to create, to be tasked with helping Arkansas citizens, companies, and municipalities utilize federal programs, while overseeing ongoing public policy deliberations to treat all stakeholders fairly while incentivizing deployment.

Section V discusses the Arkansas High Cost Fund, which handles large quantities of funds and is highly valued by rural telecom companies, who in turn play an important role in supplying broadband to many parts of rural Arkansas.

Section VI describes existing state and federal communications assets, such as the Arkansas Research and Education Optical Network (ARE-ON), E-Link, which uses the ARE-ON network for telehealth, fiber accessible by the Arkansas Department of Transportation (ArDOT), the Arkansas Wireless Information Network (AWIN), and FirstNet. The state network has an all fiber presence in all 75 counties, which is a significant asset for Arkansas.

Section VII, on broadband and education, covers both the use of broadband in education and the ways that education can promote broadband. Arkansas is a national leader in K-12 broadband connectivity and

for incorporating computer science into the school curricula, thanks to which the state can look forward to having a disproportionately coding-savvy population in future. But the full positive impact of these successes can only be realized if good digital connectivity extends beyond the schools to the home. While schools are helping young people adapt to the internet age, the state should also look for opportunities to help adults whose education predates today's digital world to catch up with the technological times and see the value in digital connectivity. Increased adoption within this demographic has the potential to improve their quality of life and strengthen the business case for broadband deployment. Low adoption rates have consistently been a primary barrier to investment by the provider community.

Sections VIII and IX focus on two specific industries, agriculture and health care, where the role that rural broadband can play is especially salient for public policy.

Section X addresses the important issue of broadband mapping. Broadband availability maps are important for policymakers trying to promote universal access. Existing data sources on which maps are based often have serious limitations.

Section XI deals with a key policy issue in broadband deployment: access to utility poles, towers and other key connection points for wired and wireless communication equipment. Utility poles are crucial to delivering wireline connectivity and towers to delivering wireless connectivity. Utility pole networks are a natural monopoly, as are towers in many circumstances. Utility poles are, moreover, generally erected in the public right-of-way. For these reasons, utility pole owners do not and should not enjoy free, unencumbered control of their poles, but are required by law to provide pole access to qualified new attachers. Section XI explains the pole attachment rules in Arkansas and explores what data would be needed to assess how well they are working as means to protect pole owners' investments while encouraging broadband deployment. The potential impact of a policy on "over-the-air reception devices" (OTARD), currently under consideration by the FCC, which, if adopted, might accelerate 5G deployment by facilitating consensual access to private property for installation of small cells, among other benefits, is also discussed.

Section XII explores policy options suggested by BDAC that could accelerate broadband deployment through changes in the codes governing infrastructure projects and construction of new buildings.

Section XIII explains how Act 813 of 2017, which permits public-private partnerships for purposes of infrastructure investments, and Act 198 of 2019, which allows municipalities to apply for funding from grant and loan programs to create broadband service and offer it to the public, give governmental entities in Arkansas new options for responding to citizen demands for broadband.

In the years ahead, Arkansas should upgrade its broadband policymaking apparatus, so that it can make the best use of federal broadband programs and state assets to encourage and facilitate competitive broadband deployment by private companies, or perhaps occasionally by public entities. Policy should be just and reasonably stable, while remaining flexible enough to adapt to a changing technological frontier and a changing social contract. A light regulatory touch, astutely used, and coupled with skillful use of federal programs, should suffice to meet Arkansans' demands for better broadband while minimizing the expenditure of new state resources.

I. THE GOVERNOR'S GOAL FOR BROADBAND: 25/3 BY 2022, IN POPULATION CENTERS OF 500 OR MORE

To assist with prioritization in a complex policy space, Governor Asa Hutchinson has put forward a goal for broadband penetration in Arkansas that might be achieved by the end of his second term, namely:

Objective: Universal 25/3 broadband access in Arkansas population centers of 500 or more.

This choice of goal recognizes that high-quality broadband penetration is easier to achieve, from a business perspective, for more concentrated urban populations, than in the countryside where residences are more spread out and wireline connections need to be longer. At the same time, a single statewide goal helps to overcome regional inequities.

How close is Arkansas to meeting the governor's goal today? While any answer to that question must be accompanied by a caveat that the best available broadband mapping resources leave a good deal to be desired in terms of data quality—this issue is further discussed in Section X—the ADFA Economic Policy Division's best attempt to answer the question is shown in Figure 1:

Figure 1: Towns meeting (green) and not meeting (red) the Governor's goal of seeing 25/3 broadband
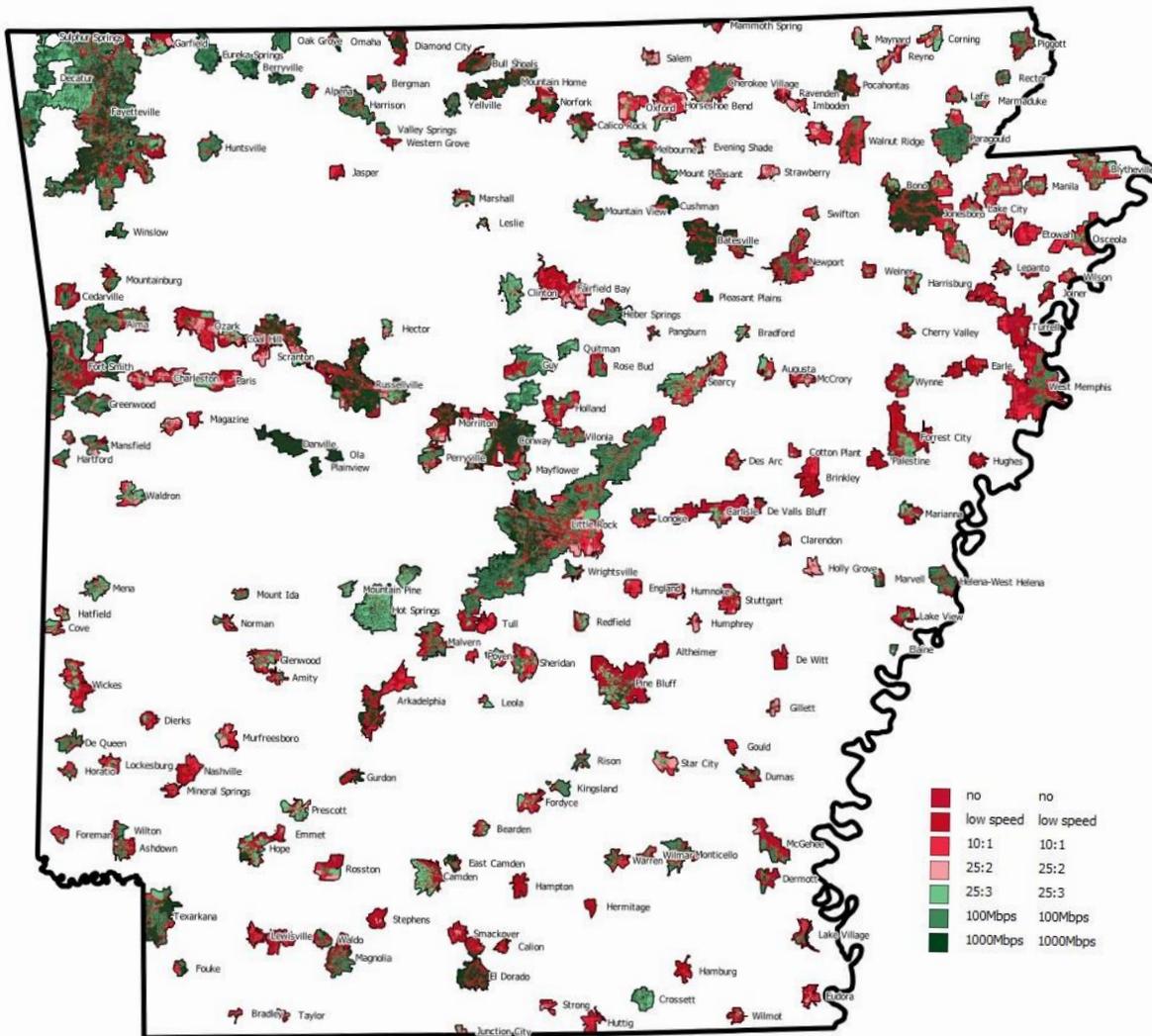
Source: Form 477 Data, created by ADFA Economic Policy Division

Figure 1 shows that many small towns in Arkansas, including Charleston, De Witt, Etowah, Eudora, Fairfield Bay,[2] Gould, Hamburg, Hampton, Harrisburg, Huttig, Lewisville, Mineral Springs, Nashville, Ozark, and Smackover currently fall short, in some or all of their territory, of the governor's goal for broadband speed. Moreover, while broadband speeds tend—though not always—to be somewhat better in Arkansas's larger urban areas, even the urban areas centered around Little Rock, Conway, Jonesboro, Texarkana, Fort Smith, Russellville, and especially West Memphis and Pine Bluff have substantial areas

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[2] As an instance of the limitations of the Form 477 data source, stakeholders knowledgeable about the Fairfield Bay area responded to a draft of the report with information that, contrary to what is shown in the map, download speeds over 25 Mbps are available in parts of that area.

that remained unserved by 25/3 broadband, as of the most recent FCC Form 477 data collection for which data have been published.

Figure 2 sheds a different sort of light on the state's current progress towards meeting the governor's goal. It shows the share of the population, in each urban area, that has access to 25/3 broadband. If the governor's goal were met, all the regions in the map corresponding to population centers would be dark green.

Figure 2: Share of population with 25/3 broadband access
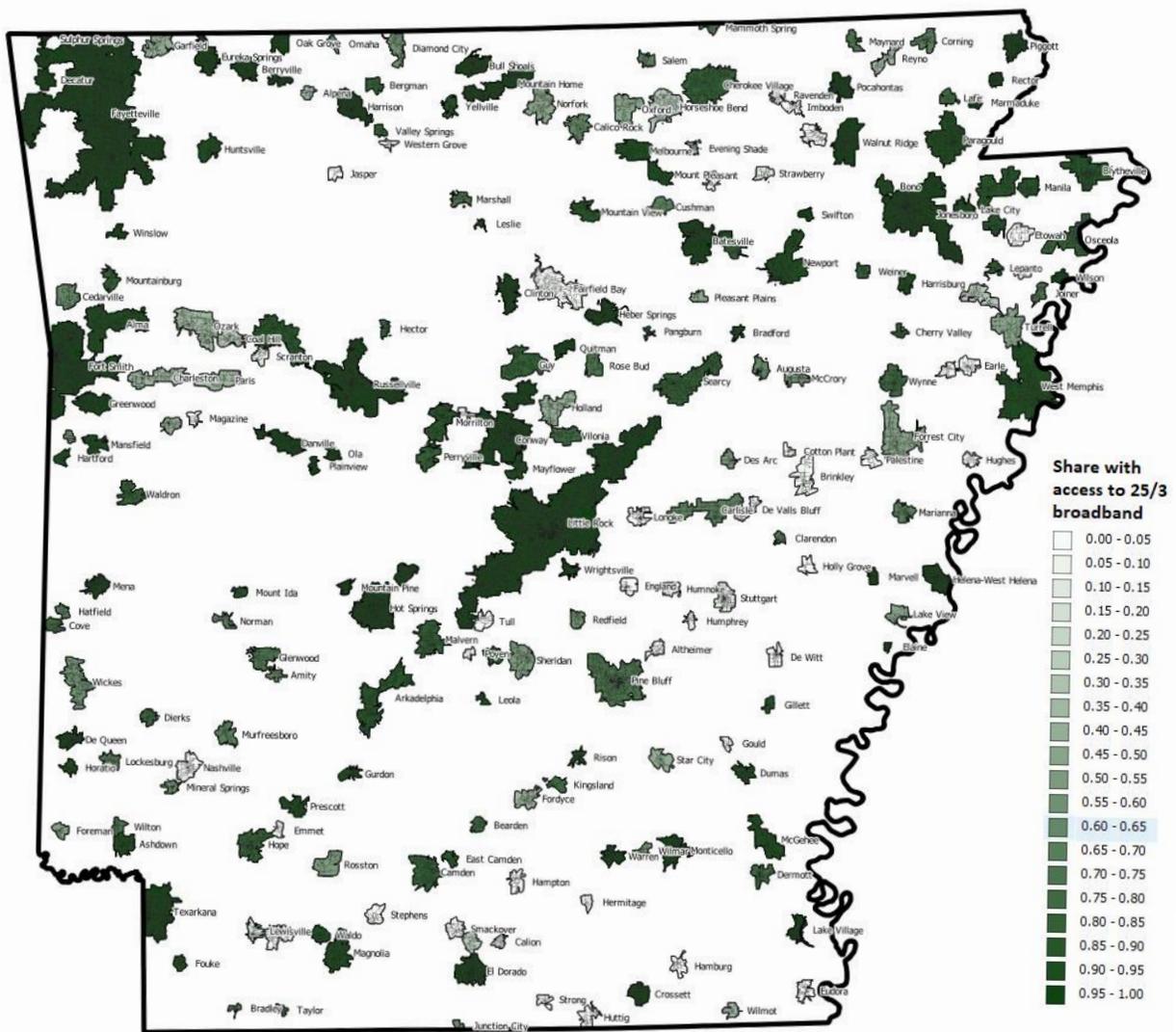
Source: Form 477 Data, created by ADFA Economic Policy Division

Figure 2 contrasts slightly with Figure 1 inasmuch as it makes broadband access problems look slight in the urban clusters centered on Little Rock, Fayetteville, Fort Smith, Jonesboro, Russellville, Conway,

Texarkana, and even West Memphis. It is still a problem in Pine Bluff, but is most striking in many towns in the Mississippi Delta, such as Altheimer, Brinkley, DeWitt, Earle, Eudora, Gould, Hampton, Holly Grove, Hughes, Huttig and Strong as well as some elsewhere in the state, such as Fairfield Bay, Lewisville, Nashville, and Ozark. The difference between the maps reflects the population distribution within conurbations, with Little Rock, for example, having broadband access problems mainly in some of the least populated parts of the metro area, so that the population share with 25/3 access looks strong for the metro area as a whole.

Arkansas has a long way to go before internet service at speeds that meet the FCC definition of "broadband" (25/3) is universally available even in the state's population centers. Fortunately, the trend seems to be in the right direction. Trends favoring faster broadband deployment include:

- Ongoing investment by AT&T, CenturyLink, and Windstream in extending their networks to more areas using FCC money from the Connect America Fund (CAF)—though unfortunately, this investment usually only raises speeds to 10/1, thus falling short of the governor's goal and the current FCC definition of "broadband."
- Recent successes by fixed wireless providers and rural electric cooperatives in securing FCC money through the CAF Auction 903 to deploy in certain hitherto underserved territories.
- Technological improvements to many broadband technologies, including fiber, copper wire, fixed wireless and satellite, that lower investment costs and/or improve the quality of service.
- New federal programs such as USDA ReConnect that aim to close the national digital divide more quickly.
- Ongoing reallocation of spectrum by the FCC that facilitates more investment in, and greater reach of, cell phone networks providing mobile data access.
- Ongoing evolution of FCC policy in the direction of raising speed targets and making the allocation of funding more competitive.
- New state laws that are more favorable to faster broadband deployment.
- Helpful guidance from BDAC on how to make the policy environment more friendly to deployment.

By adapting the policy environment to favor faster deployment, while respecting the rights of incumbents, and by making skillful use of federal programs, Arkansas should be able to make strong progress in the coming years towards achieving the governor's broadband goal.

II. THE COMPETITIVE LANDSCAPE FOR BROADBAND SERVICE

BroadbandNow.com estimates,[3] as of the time of writing, that there are 136 internet providers in Arkansas, yet:

- 641,000 people in Arkansas lack access to a wired internet connection capable of 25 Mbps download speeds;
- 721,000 people in Arkansas have access to only one wired internet provider, with no options to switch; and
- Another 251,000 people in Arkansas don't have any wired internet providers available where they live.

This contrast, between a large number of providers in the state and few or no options available to many particular customers, reflects the territorial nature of internet service provision. Aside from satellite providers, no internet service provider covers the whole state. Some providers have patchwork territories resulting from their peculiar histories.

While BroadbandNow estimates that 100% of Arkansans have access to mobile broadband service, research undertaken last fall by the University of Arkansas Agricultural Extension Service, at ADFA's instigation, and in connection with the FCC Mobility Fund-II (MF-II) challenge process, casts doubt on this claim. Employees of the Agricultural Extension Service drive tested much of the state and found that mobile data coverage in many areas of the state failed to meet even the 5 Mbps standard targeted by the MF-II. (See the case study at the end of Section III.)

While most Arkansans have access to multiple internet service providers, they probably have fewer options for internet service than for most of the other goods and services they purchase. This is unfortunate, since competitive discipline of suppliers is the key means by which capitalist economies make suppliers perform to the satisfaction of their customers, but it is somewhat inevitable, reflecting the cost structure of internet delivery technologies. While limited competition can lead in theory to price discrimination, that does not seem to be a severe problem. Most plans are $100/month or less.

A lack of competition could also reduce the incentive for providers to improve service quality, and it is widely perceived as problematic that much of the state, even where wireline or fixed wireless internet service is available, can only get 10 Mbps download speeds or less, which is insufficient to support some cutting-edge web applications such as videoconferencing and HD video. But the main problem policymakers should try to address is that substantial parts of the state are seriously underserved, and a few areas almost completely unserved, except by expensive, high latency satellite connections. Part of the problem is that it's hard to know the extent of the problem, because of the serious limitations of the best available data sources, as discussed in Section IX. But Figure 3 shows the maximum broadband speeds available across the state, based on the best single data source available, the Form 477 data published by the FCC.

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[3] https://broadbandnow.com/Arkansas

Figure 3: Maximum advertised internet speeds available, by Census block (FCC Form 477 data)
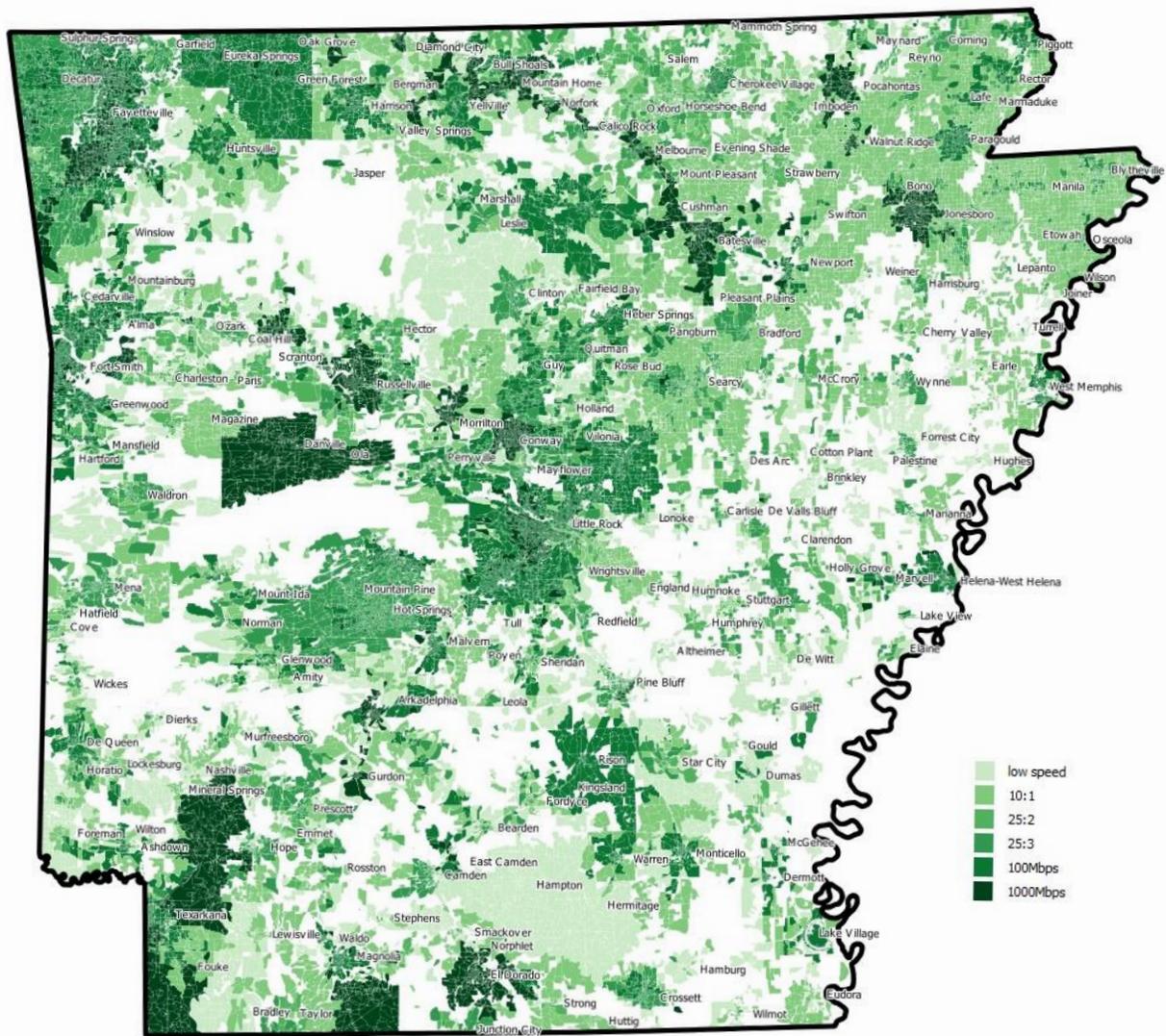
Source: Form 477 Data, created by ADFA Economic Policy Division

Clearly, there are wide variations in broadband speeds across the state. Moreover, the distribution of speeds looks somewhat accidental, with some quite rural areas, for example, enjoying better speeds than some urban areas.

Another way to describe the competitive landscape is to look at the number of competitors offering various speeds. Figure 4 shows the number of competitors offering broadband service at speeds of at least 10 Mbps download / 1 Mbps upload (excluding satellite and mobile data). White areas have no companies offering internet service at this speed. Light green areas have one company offering them, and darker green areas have two or more. Figure 4 shows that large parts of the state are unserved by 10/1, but also, that much of the area of the state that is served by 10/1 has only one option and cannot switch providers.

Figure 4: Number of competitors offering 10 Mbps download/1 Mbps upload service, or better
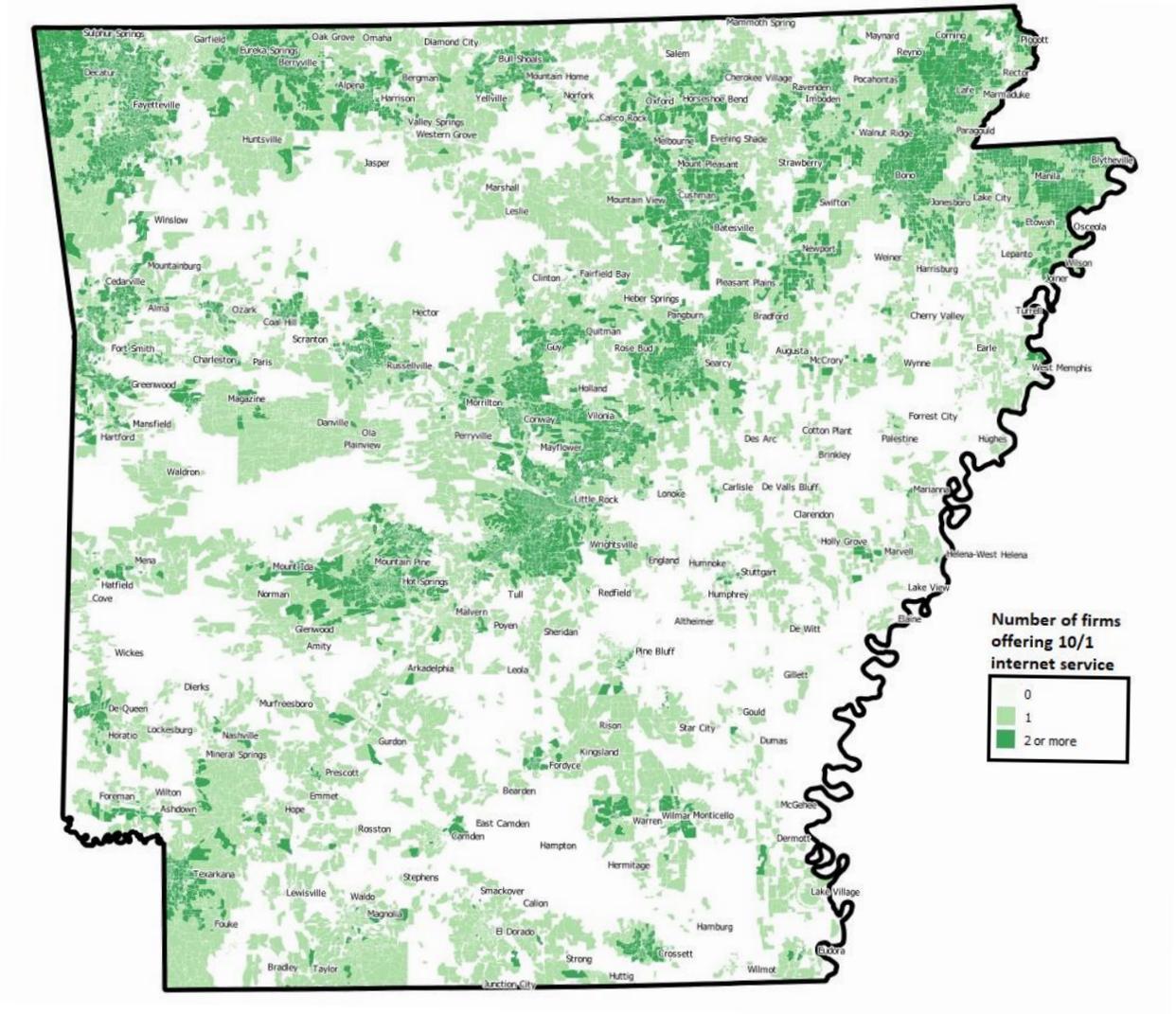
Source: Form 477 Data, created by ADFA Economic Policy Division

Figure 5 shows, similarly, how many competitors offer at least 25 Mbps download/3 Mbps upload internet service in different parts of the state. Of course, areas with 25/3 internet cover a much smaller share of the state than areas with 10/1 internet, though 25/3 access prevails in the larger urban areas. But the map also shows that most areas that have 25/3 access only have one provider, with no option to switch.

Figure 5: Number of firms offering 25 Mbps download/3 Mbps upload or better
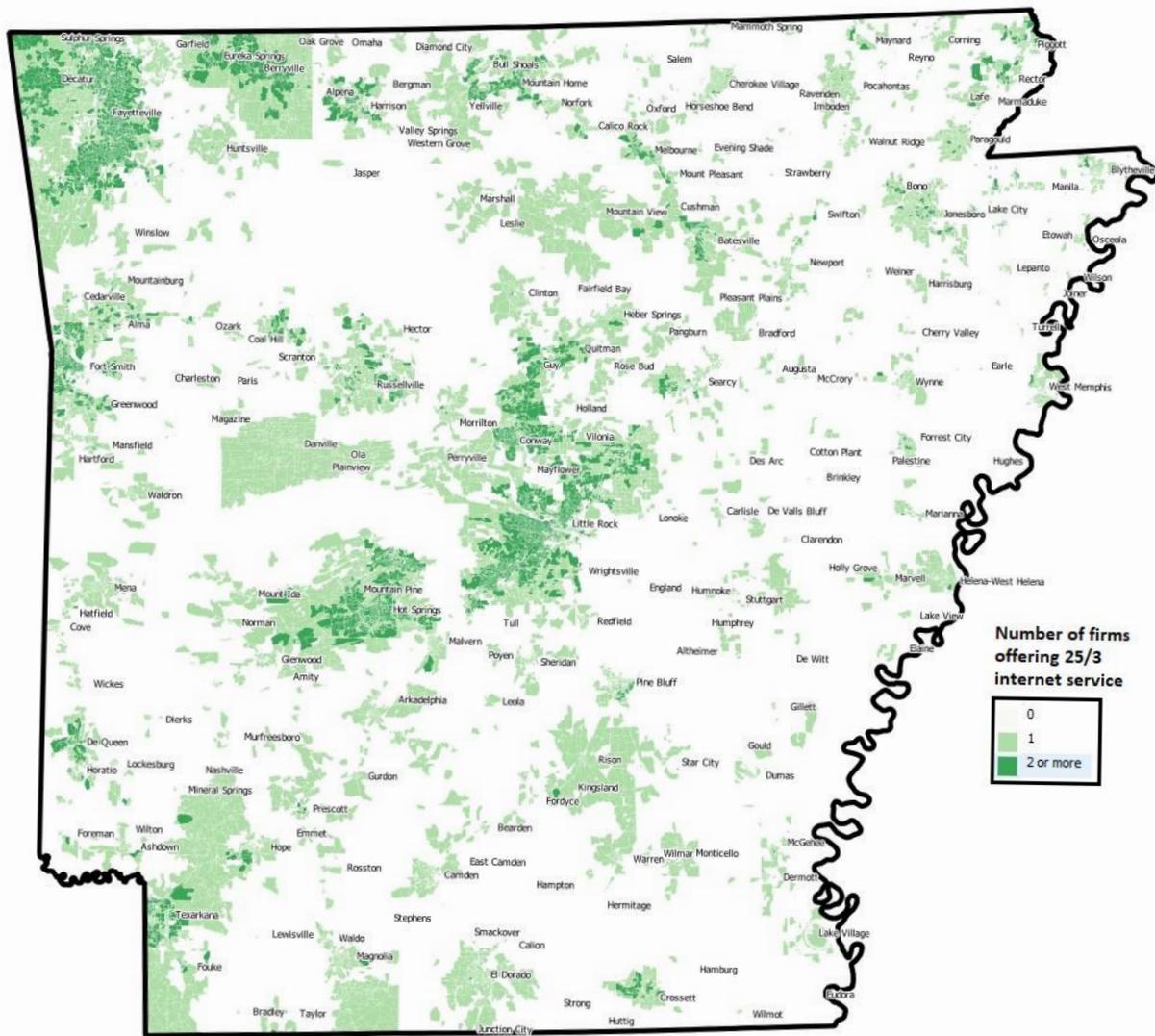
Source: Form 477 Data, created by ADFA Economic Policy Division

This section describes the competitive landscape for broadband in Arkansas, covering technologies, performance metrics, and companies, while trying to shed light on the reasons why some areas of the state are poorly served.

A. Technologies

Internet connectivity is provided by several different technologies. All the technologies basically provide access to the full panoply of resources that the internet has to offer, since while the signal takes different forms, it is translated at the endpoints into the same digital data usable by the same machines. In many cases, therefore, the user experience is similar regardless of which technology is being used. In other

cases, some technologies are better able than others to meet users' needs. For example, satellite connections tend to be poorly suited to playing fast-paced, interactive online games. Currently available technologies used to deliver broadband, defined for the moment in the broadest sense, are:

- Digital Subscriber Line (DSL)
- Cable Modem
- Fiber
- Wireless (Wi-Fi, Mobile, and Fixed Wireless)
- Satellite

While most broadband connections are easy to identify as such, the definition of "broadband" has been a subject of considerable debate. The FCC currently categorizes an internet service as "broadband" if it transmits at a speed of at least 25 megabits/second (Mbps) for downloading and at least 3 Mbps for uploading. The FCC's use of the term is not consistent, however, and sometimes includes other internet services that allow users to originate and receive voice, data, graphics and video telecommunications even if the 25/3 bandwidth criteria are not met.

For some purposes, the definition of broadband only in terms of 25/3 bandwidth is too broad, because it is desirable to exclude services with (a) low data caps and/or (b) high latency. Thus, the USDA ReConnect program, excludes satellite and mobile wireless data from eligibility, as not representing the types of broadband deployment that they want to promote. These access modes tend to preclude common uses of the internet for fundamental technological reasons that are unlikely to be overcome.

Colloquially, "broadband" often seems to exclude mobile data and satellite, and phrases like "fixed broadband" and "wireline broadband" are sometimes used to clarify what people mean by "broadband access" as a policy goal. Yet mobile wireless and satellite connections are probably satisfactory for many users and are amenable to at least some technological improvement that might warrant their full inclusion in the list of broadband technologies.

For example, efforts are underway to deploy a fleet of very low Earth orbit satellites to beam internet.[4] If successful, this technology might mitigate the latency problem with satellite internet to the point where satellite connections are no longer seen as inherently inferior in quality to fixed wireline broadband. Mobile wireless coverage will likely continue to improve thanks to the reallocation of spectrum through FCC auctions, and T-Mobile has recently released a new mobile hotspot device with data plans ranging up to 22 gigabytes (Gb) per month.[5] With such changes underway, the definition of broadband is not only controversial but also evolving.

Competition in the internet service business is most often *between technologies*, rather than between providers using the same technology, because most of the technologies involve large fixed costs in infrastructure (e.g., laying fiber, launching satellites, building towers) followed by lower marginal operating costs. So, while "technology neutrality" is frequently mentioned as a constraint in broadband policy design, understanding the likely impact of broadband policies depends on understanding the characteristics of the major technologies, summarized below.

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[4] http://fortune.com/2018/11/15/fcc-approves-spacex-to-launch-new-very-low-earth-orbit-internet-beaming-satellites/
[5] https://www.tmonews.com/2019/01/t-mobile-coolpad-surf-first-600mhz-lte-mobile-hotspot/

1. DSL
Sources: https://broadbandnow.com/DSL

Digital Subscriber Line (DSL), like obsolete dial-up internet connections, uses telephone infrastructure to deliver internet service. DSL connections tend to be slowed by the nature of twisted pair copper wires; however, advanced versions of DSL such as VDSL2 can deliver fast speeds. Because the telephone network was built out more comprehensively than the cable TV network, some areas have DSL that are unlikely ever to have access to cable internet. Where cable and DSL compete, DSL tends to provide internet service that is lower in performance but somewhat cheaper. Figure 6 shows the territories and speeds of companies offering DSL internet.

Figure 6: DSL availability by company and maximum advertised speed
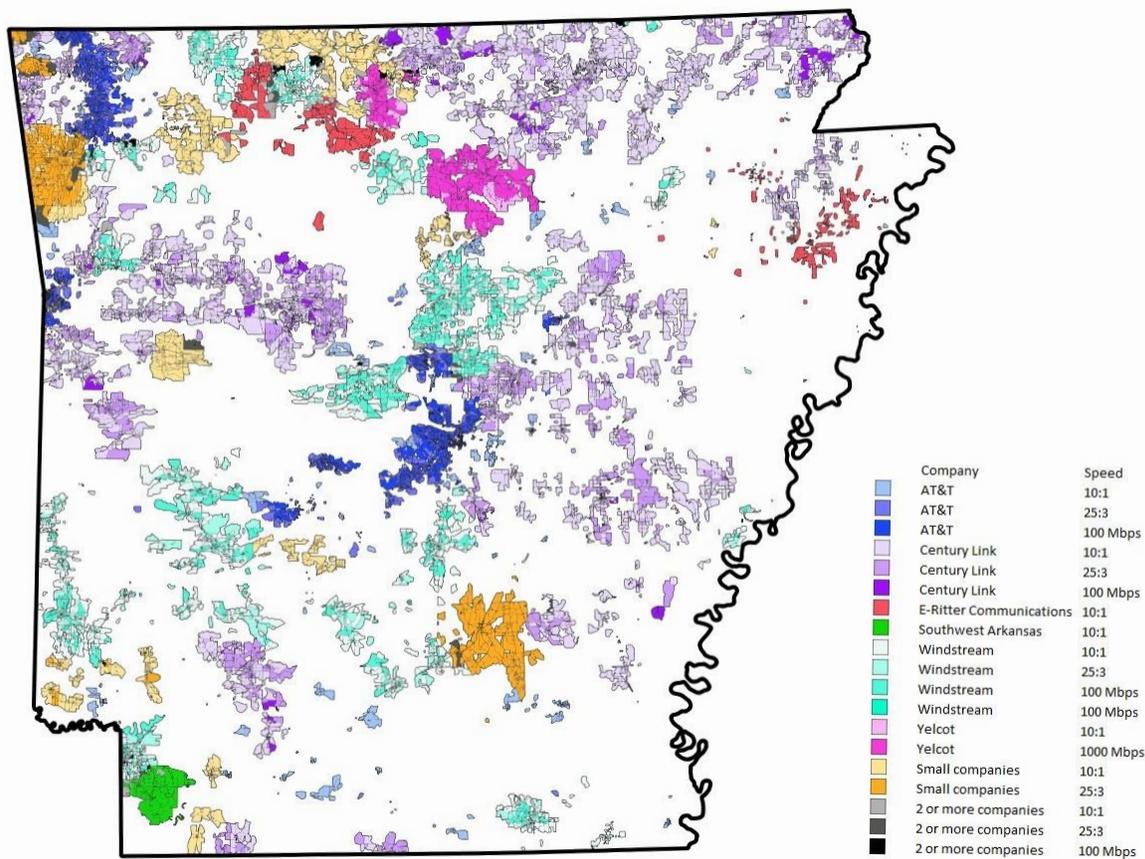
Source: Form 477 Data, created by ADFA Economic Policy Division

DSL internet in Arkansas is dominated by the three big telecom companies, AT&T, Windstream, and CenturyLink, with some presence of smaller local telecoms. It is overwhelmingly monopolistic, in the sense that there are almost never two DSL providers in the same area, and the territories of the DSL providers overlap very little if at all. DSL coverage, though far from universal, is quite widespread and reaches many of the poorer and less populated areas of the state, as well as the larger urban areas. The

most common speed tier offered by DSL is 10/1, though in some places DSL providers offer 25/3 or claim to offer even faster speeds.

DSL technology is likely to continue to be important as a way to connect rural Arkansas to the internet, since the telephone network on which it relies already has nearly universal reach, although further investment, such as local hubs, is required to deliver DSL internet service to consumers. Unfortunately, most types of DSL connections cannot support connection speeds that much online content now demands. There is a risk that further DSL investment will leave users stuck with obsolete technology. This is also a disincentive for ISPs using DSL technology to deploy, since future competitors may intrude with other technologies and capture customers who are not satisfied with DSL service.

2. Cable

Sources: https://broadbandnow.com/Cable, https://www.calcable.org/learn/history-of-cable/

Over $15 billion was spent between 1984 and 1992 wiring America for cable TV, and since the rise of the internet, this valuable grid has been adapted to provide internet service as well. Cable internet is currently the most common form of internet access in the United States, serving an estimated 194 million Americans. The latest cable technology, DOCSIS 3.0, can support download speeds faster than 100 Mbps.

Cable internet uses coaxial cables, composed of a central copper conductor in a sheath of insulating and protective materials. While coaxial cables are made of copper, like the older twisted pair copper telephone wires, their better shielding enables them to transmit more data. Access to cable internet is most common in urban areas.

Figure 7 shows the territories and maximum advertised speeds of cable internet providers in Arkansas. Prevailing speeds for cable broadband are typically at least 25/3 and often range up to 100 Mbps or 1000 Mbps download. However, coverage is less widespread than DSL.

Figure 7: Cable internet providers, by speed tier
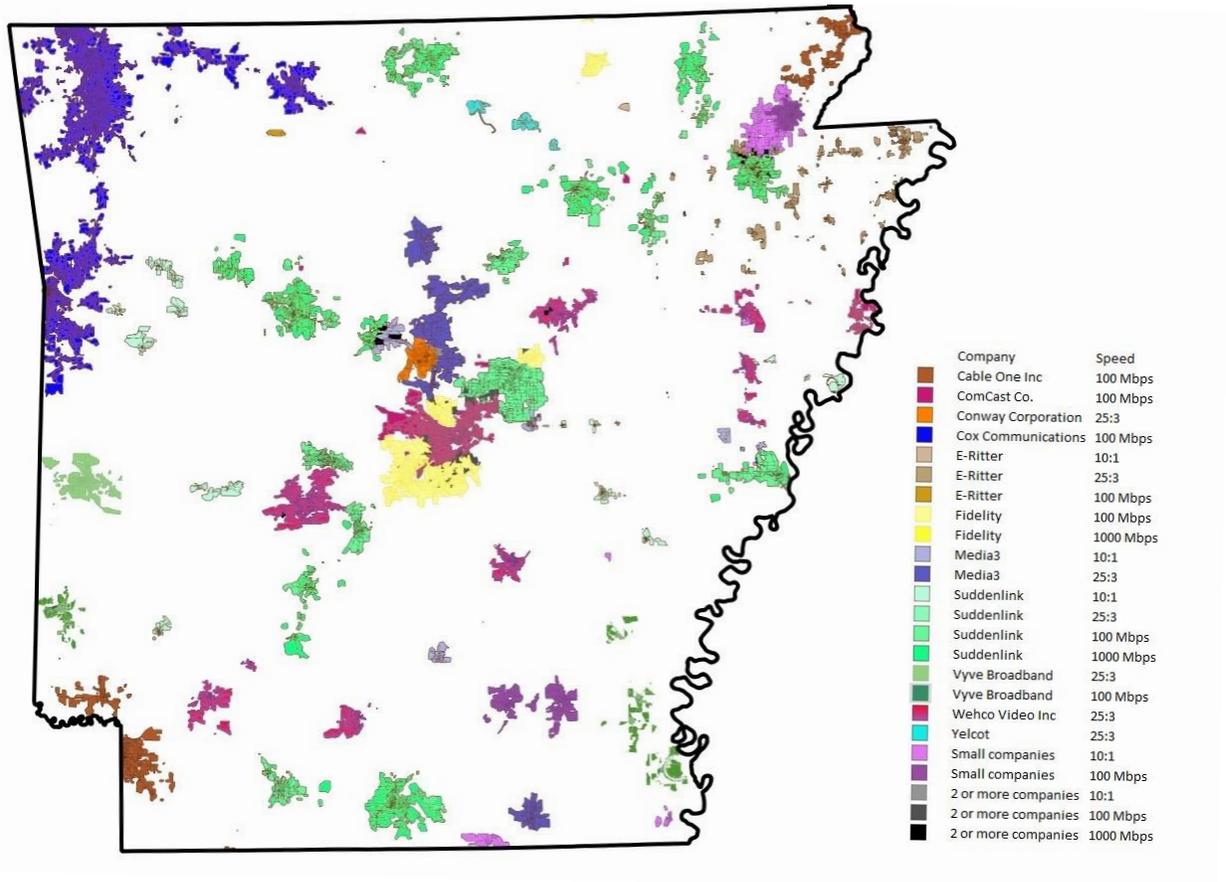
Source: Form 477 Data, created by ADFA Economic Policy Division

Cable technology may not be very helpful in connecting underserved parts of rural Arkansas to the internet. Where a legacy network of coaxial cables does not already exist, the high cost of installing one will typically not be commercially justified, since coaxial cable is similar to fiber cable in cost to deploy, but inferior in performance.

3. Fiber
Sources: https://broadbandnow.com/Fiber

Fiber-optic cables, which can carry enormous quantities of data at the speed of light, are widely considered to be a "future-proof" next generation technology for communications. Fiber internet can offer speeds of 1 Gbps or more. However, by the time fiber optic cable was ready for mass deployment, starting in the late 1970s, huge investments in copper wire for communications had already been made. Historically, too, fiber optic cable tended to be more expensive than copper, with prices reaching something like parity only recently. Today, new cable laid to deliver communications tends to be fiber rather than copper.

There is an ongoing, multifaceted debate about whether, where, and when the performance advantages of fiber justify the investment in upgrading communications networks. Most uses of the internet today do not require the capacity and speed that fiber internet offers, and internet service providers who deploy fiber don't necessarily experience strong demand for the upgraded service. Over time, rising demand for faster speeds and more bandwidth—likely driven by 5G technology and the internet of things (IoT)—and the cost of maintaining copper wire networks, is likely to favor fiber over copper.

While only about 25% of Americans have access to fiber-to-the-home internet, fiber dominates the "backbone" of the internet. When DSL and cable provide the "last mile," they usually rely on fiber to move data most of the distance between source and the destination.

Figure 8 shows the availability of fiber internet service across Arkansas. To date, fiber has been provided more by local companies than by major national telecoms like AT&T and CenturyLink. Its distribution exhibits less of an urban focus than cable. Fiber providers generally offer very fast speeds, such as gigabit service.

Figure 8: Optical fiber internet providers in Arkansas, by speed
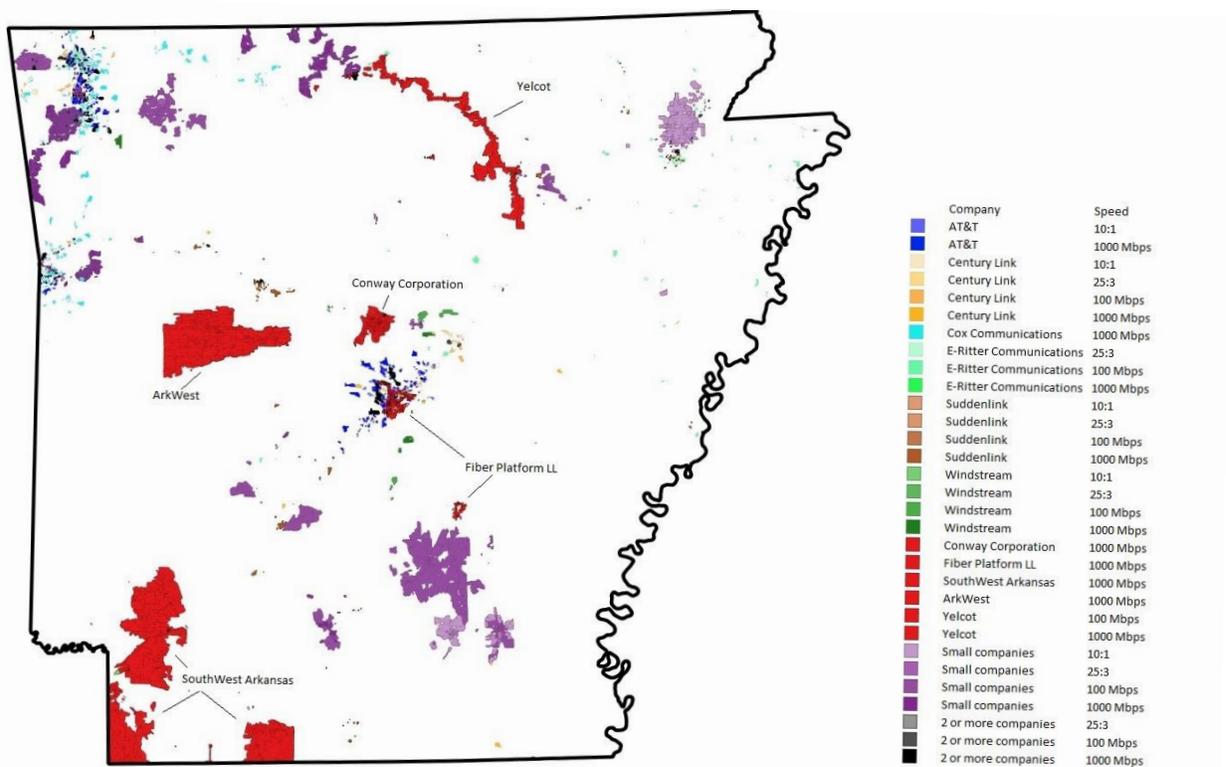
Source: Form 477 Data, created by ADFA Economic Policy Division

Fiber technology has been used to connect some parts of rural Arkansas to the internet, and will be increasingly important in future, since some of Arkansas's rural electric cooperatives have already accepted FCC subsidies in return for commitments to deploy fiber to selected areas over the next few

years. But whether fiber deployment will become universal is doubtful because of the expense involved. Improvements in mobile data and/or fixed wireless, for example, might satisfy demand to the point where it no longer makes sense to incur the fixed costs of deploying fiber to all premises.

A national study commissioned by the FCC in 2017 found that the total upfront capital expenditure to deploy fiber-to-the-premises to all the locations lacking 25 Mbps access would be ~$80 billion, but ~98% coverage could be attained for ~$40 billion. The hardest-to-reach 2% of households would require $40 billion in capital expenditure and $2 billion in annual operating subsidies to sustain. This casts doubt on whether universal fiber access is a reasonable goal.[6]

4. Fixed Wireless

Fixed wireless technology achieves last mile delivery by sending a signal from an access point, such as a tower, to a reception device attached to a consumer residence or business. Unlike mobile data, fixed wireless involves *directional* broadcasting, which enables it to provide far higher bandwidth than mobile data, though of course only to a fixed receiver. Figure 9 shows the distribution of fixed wireless providers across the state.

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[6] As of the time of writing, this document was not available from fcc.gov, but a cached version of this FCC publication could be found here: https://webcache.googleusercontent.com/search?q=cache:S-4222Hza2YJ:https://apps.fcc.gov/edocs_public/attachmatch/DOC-343135A1.pdf+&cd=1&hl=en&ct=clnk&gl=us&client=firefox-b-1-d

Figure 9: Fixed wireless internet providers, by speed

Company	Speed
Aristotle	10:1
Aristotle	100 Mbps
AT&T	10:1
Blue Pulse Network	25:3
CW Enterprises	25:3
HillBilly Wireless	10:1
Total High Speed LL	100 Mbps
Windstream	10:1
Windstream	25:3
Windstream	100 Mbps
Windstream	1000 Mbps
Small companies	10:1
Small companies	25:3
Small companies	100 Mbps
2 or more companies	10:1
2 or more companies	25:3
2 or more companies	100 Mbps
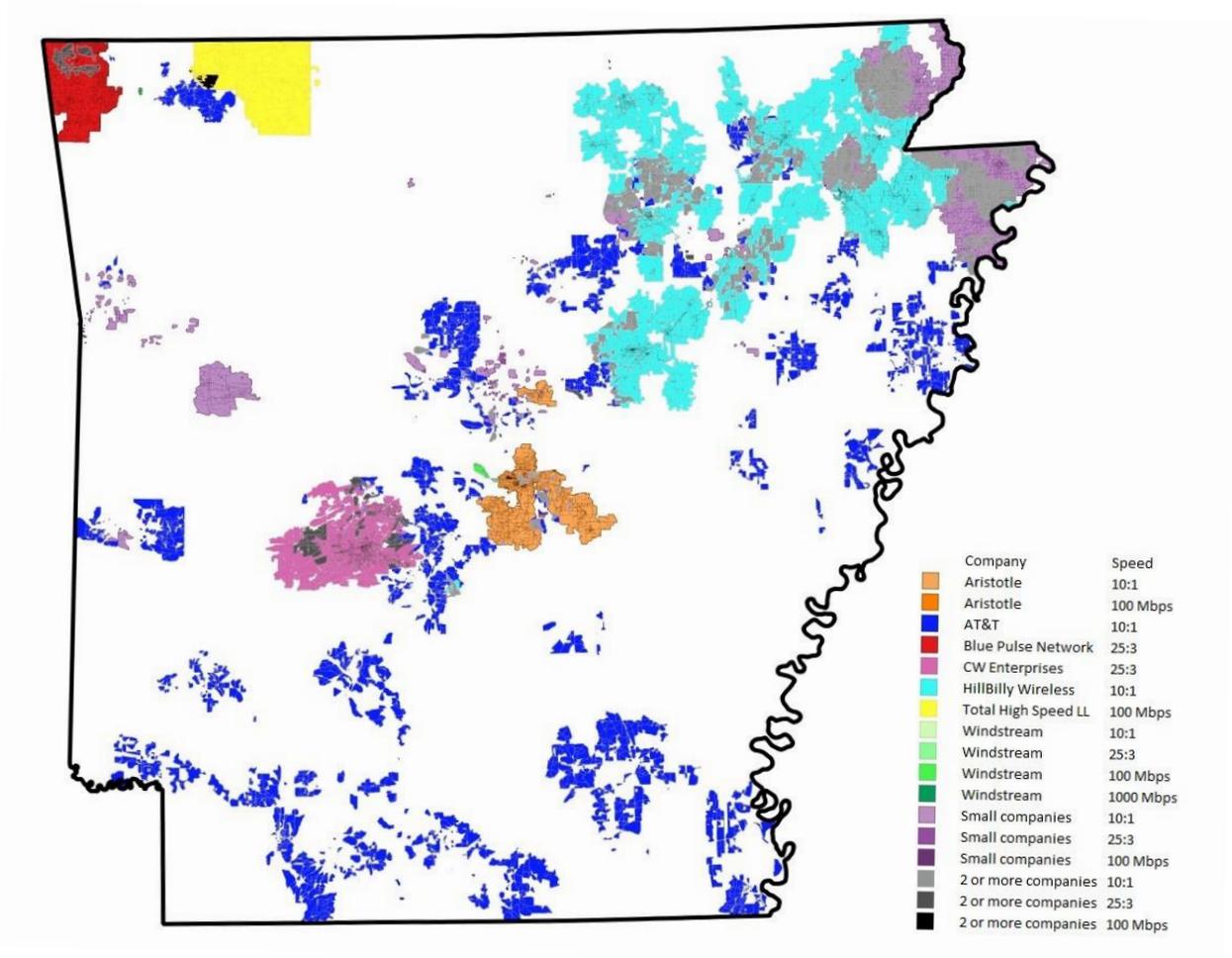
Source: Form 477 Data, created by ADFA Economic Policy Division

One difference between fixed wireless and other internet technologies is that it is less monopolistic. This reflects the nature of the technology, which does not require a "grid" connecting to every home, but instead, broadcasts to an area, making competition less inefficiently duplicative. While most areas of Arkansas that have a fixed wireless provider have only one, there are sizeable areas where, for example, fixed wireless internet from AT&T competes with fixed wireless from Hillbilly Wireless.

Fixed wireless technology is likely to be important in connecting parts of rural Arkansas to the internet, since it avoids the need for investment in an extensive grid, yet can still deliver performance comparable to wired internet service. Some internet providers that use fixed wireless technology, the largest being the ArisWave Consortium, won funding in the CAF II Auction to deploy broadband to parts of Arkansas.

5. Mobile Data
Sources: https://broadbandnow.com/Mobile-Broadband

Over three-quarters of American adults, and rising, now own smartphones, according to the Pew Research Center.[7] Mobile data has the important advantage of being available for people on the move, and not only at home. Consequently, many people have and use mobile data even if they have another internet connection at home. Mobile data is usually used on a smartphone, which, while convenient, has limited features relative to a computer. Many smartphones, however, have a "mobile hotspot" feature which enables the smartphone to serve as a wireless modem and connect a computer to the internet.

Mobile data connections are often adequate in speed (bandwidth) for most uses, but they tend to be inferior in bandwidth relative to wireline connectivity. More importantly, they usually are, and are expected to continue to be, subject to data caps that limit the extent to which they can handle lengthy or high-quality video content. Data caps are needed because of a fundamental scarcity of spectrum. Early mobile data plans sometimes offered unlimited data, and a few plan subscribers continue to enjoy "grandfathered" unlimited data plans from the earlier era. But skyrocketing data usage forced carriers to cap data, generally on a monthly basis, to avoid saturating available spectrum. While wireline ISPs sometimes impose data caps, too, they can be much higher because the capacity constraints of a copper or especially a fiber-optic cable are much less restrictive than the limitations on bandwidth in the air.

While data caps (including "throttling" or speed reductions after usage passes certain thresholds) are unlikely to go away, FCC auctions have reallocated substantial quantities of spectrum from legacy TV broadcasters, for whom it was relatively less valuable, to spectrum-hungry cell phone providers. T-Mobile is the first company to take advantage of the new (600 MHz) spectrum, and in January, it released a hotspot device suitable for use as a home internet connection by users with relatively small data needs. T-mobile customers who buy the hotspot can get (for example) 10 GB for $40/month or 22 GB for $85/month.

Another problem with mobile data is that coverage is geographically incomplete and sometimes unpredictable. This issue attracted attention recently when the FCC, as part of organizing the Mobility Fund II (MF-II) Auction to improve cell phone coverage in rural areas, collected data about coverage from major cell phone carriers, and then allowed competitors and governmental entities to "challenge" the claims of major carriers about the extent of their coverage, by conducting drive tests with apps continuously running speed tests and logging results. The results revealed that mobile data coverage is considerably inferior to what providers claimed. (See the case study at the end of Section III for more details.)

As cell phone coverage in the state improves in future, likely with the help of federal subsidies through the upcoming, though delayed, Mobility Fund II Auction by the FCC, some households may opt to be mobile-only households and forgo wireline connectivity. It's also possible that mobile data could whet consumers' appetite for internet connectivity, and end up boosting demand for wireline connectivity as well. Either way, providers should take likely improvements in mobile data into account as they forecast demand to inform their investment plans.

6. Satellite

Satellite internet involves shooting a signal from a point on Earth to a satellite in geostationary orbit more than 20,000 miles above Earth's surface, which shoots it back. Interactive uses of the internet involve four trips along this route between an input and a response, that is, for example, between when a user clicks on a website and when the clicked button is activated, which causes substantial delays, or latency, even

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[7] http://www.pewinternet.org/fact-sheet/mobile/

though the signals travel at the speed of light. High latency and data caps put satellite internet at a serious disadvantage relative to other technologies. The main use of satellite internet is for remote areas where there are no other options.

While satellite internet is and will continue to be important for giving otherwise unserved areas at least minimum-quality internet access, it cannot, at present, modernize broadband provision.

The role of satellite internet might change in future, however, if "very low orbit" satellites are deployed and organized into a reliable internet service.[8] Very low orbit satellites could escape the latency issues that generally plague satellite internet service. But since they would not be geostationary, providers would face a tricky problem of deploying many satellites at once and switching which satellite provided a customer's signal, as the satellites' positions relative to the surface of the earth continually shift. Despite these challenges, companies like SpaceX are attempting to implement the technology—SpaceX's request to send 4,425 satellites into low-Earth orbit was approved in March 2018—which, if successful, may revolutionize rural internet service.

In spite of its inherent latency problem, current satellite internet technology offers incomparable reach, and provides a key source of competition for other rural internet technologies. Satellite internet providers might benefit if subsidies to broadband provision could be tied to consumers and made portable. In that case, market competition could reveal just how strong consumers' preference for low latency may or may not be.

B. Performance Metrics

The term "broadband" has never had a clear definition, but tends to refer vaguely to high quality internet. While the most prominent performance metric for internet connections is bandwidth, others should be considered as well, such as latency, packet loss, reliability, and security.

1. Bandwidth ("Speed")

The most commonly cited performance measure for internet connections is "speed," the meaning of which is more accurately expressed by the word "bandwidth," since latency is another aspect of the speed of an internet connection. Internet connectivity depends on *flows* of data. A high-bandwidth, or in that sense a "fast," connection can carry large amounts of data, but if it has high latency, a noticeable delay will occur every time information is transferred, as data moves from its source to its destination. A low-bandwidth but low-latency connection could deliver small packets of information without noticeable delays, but would take a long time to move large files.

While the FCC now defines broadband as 25/3, its Broadband Speed Guide, shown below in Table 1, compares typical online activities with the minimum download speed needed to adequately perform each application. It is notable that of common online activities, only high-quality video content actually requires a 25 Mbps download speed. While videoconferencing and Skype calls are also data intensive, the relative scarcity of use cases that demand maximum connection speeds suggests that high bandwidth shouldn't be prioritized over other aspects of service quality. Bandwidth is, however, the most well-known and most frequently-discussed measure of internet performance.

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[8] https://www.fiercewireless.com/wireless/oneweb-raises-1-25b-for-satellite-internet-service

In the past, demand for high bandwidths has steadily escalated as internet content becomes more data-intensive. The problem here isn't simply that people's expectations are rising, but that the speed of connections in the places where most consumers live shapes the decisions of content producers about how to design their websites. A user who was previously satisfied with a connection of a given speed may find, over time, that without an upgrade, the internet becomes more difficult to use, because websites use more data-intensive content. This trend is likely to continue in the future as prevailing internet connection speeds continue to get faster. On the other hand, many content creators have no particular use for most of the bandwidth that they expect most of their users to have. As connection speeds rise, at some point they may outpace the appetite of content creators for generating data-intensive applications.

Table 1

FCC Broadband Speed Guide for Online Activity	
General Usage	**Minimum Download Speed (Mbps)**
• General Browsing and Email	1
• Streaming Online Radio	Less than 0.5
• VoIP Calls	Less than 0.5
• Student	5-25
• Telecommuting	5-25
• File Downloading	10
• Social Media	1
Watching Video	**Minimum Download Speed (Mbps)**
• Streaming Standard Definition Video	3-4
• Streaming High Definition (HD) Video	5-8
• Streaming Ultra HE 4K Video	25
Video Conferencing	**Minimum Download Speed (Mbps)**
• Standard Personal Video Call (e.g. Skype)	1
• HD Personal Video Call (e.g. Skype)	1.5
• HD Video Teleconferencing	6
Gaming	**Minimum Download Speed (Mbps)**
• Game Console Connecting to the Internet	3
• Online Multiplayer	4

Source: FCC Broadband Speed Guide website

2. Latency

Latency refers to the time that information must travel, after transmission is initiated, from its source to its destination. The time needed to perform an online operation depends on both the bandwidth and the latency, and an internet connection that is "fast" in terms of bandwidth, but has high latency, may not be perceived as fast by a user.

Latency is especially problematic for *highly interactive* online functions. A user watching a two-hour movie might not care much if the movie plays one second later than it is sent because of latency, as long as the connection delivers an uninterrupted film experience. For that use case, bandwidth matters more than latency. By contrast, a person editing a document in the cloud relies on a local device to be constantly synced with a remote server, and might be greatly impeded by a high-latency internet connection.

Latency is usually measured in milliseconds, from 10 to 20 ms for typical cable or DSL internet connections to 600 ms or more for satellite connections. A major objective of the impending 5G revolution in telecommunications is to reduce latency, perhaps to 1 ms or less, which is widely considered crucial to the deployment of new Internet of Things (IoT) applications.

3. Packet Loss

Packet loss occurs when one or more packets of data traveling across a computer network fail to reach their destination. This can force an application to reject an imperfect transmission and wait to resend. Wireless connections tend to be more vulnerable to packet loss than wired connections.

4. Reliability

When households and businesses become accustomed to having access to a utility, they often arrange their activities in ways that make them highly reliant on continuous access to it, and vulnerable to severe damage if they ever lose it. Internet service that is *unreliable*, in the sense that it occasionally fails and deprives them of connectivity, may be only slightly disadvantageous for some, while for others—such as people who work from home and routinely face urgent demands and deadlines—it is unacceptable.

Reliability issues differ by technology, with some fixed wireless connections, for example, being subject to "rain fade" in bad weather. However, there are no well-established metrics by which reliability is being regularly measured and compared across broadband technologies.

5. Security

Privacy and security are important concerns among internet users, and while broadband distribution technology isn't the main determinant of the riskiness of people's internet use, it is sometimes possible to capture data in transit, e.g., by tapping the electrical signals emanating from a copper wire. Fiber internet is more secure because it is not vulnerable to this risk.

C. Adoption Rates

Although broadband adoption is on the rise, Arkansans still lag behind a vast majority of the population when turning to the internet for aspects of daily life, according to American Community Survey Reports on Computer and Internet Use in the United States by the U.S. Census Bureau.

The percentage of all U.S. households with either a desktop or laptop computer reached 78 percent, followed by 75 percent with a handheld computer such as a smartphone or other mobile device, and 77 percent had a broadband subscription. Overall, 62 percent of U.S. households had a combination of three (desktop, laptop, handheld device, smartphone, broadband internet subscription).

In Arkansas, 64.2 percent of the population reported having one or more of the following broadband internet subscriptions: DSL, cable, fiber optic, mobile broadband, satellite, or fixed wireless.

Figure 10: Percentage of households with broadband internet subscription by state in 2015 (Released in 2017, no updated report available)

Source: https://www.census.gov/content/dam/Census/library/publications/2017/acs/acs-37.pdf
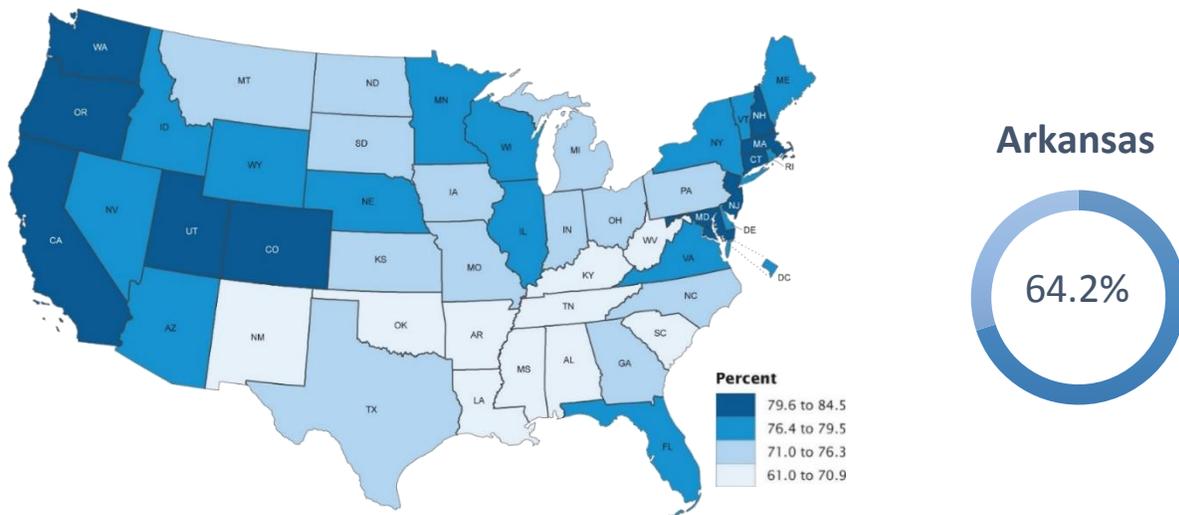
III. FEDERAL FUNDING SOURCES FOR RURAL BROADBAND

As a relatively poor state, and one of the least digitally connected in the country, Arkansas is an appropriate beneficiary of federal programs whose mission is to close the digital divide. Skillful utilization of such programs will be a crucial means for the state of Arkansas to bring broadband access to its citizens.

In June 2017, BroadbandUSA published a guide to federal funding of broadband projects.[9] They identified seven different agencies that, in one way or another, financially support the deployment, adoption, and use of broadband. These agencies are:

- Federal Communications Commission (FCC)
- US Department of Agriculture, Rural Utilities Services (USDA, RUS)
- US Department of Commerce, Economic Development Administration
- US Department of Housing and Urban Development
- US Department of Labor, Employment and Training Administration
- Institute of Museum and Library Services, Office of Library Services
- Appalachian Regional Commission

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[9] Available here: https://broadbandusa.ntia.doc.gov/sites/default/files/resource-files/ntia_guidetofedfunding_062317.pdf

Of these, the most important are the FCC and the USDA. FCC and USDA programs are discussed in more depth below.

A. FCC

The Federal Communications Commission (FCC), a federal agency, and the Universal Service Administrative Company (USAC), a non-profit that administers programs in partnership with the FCC, collect and disburse billions of dollars annually as part of their long-standing mission to regulate telecommunications in the public interest and promote access and innovation. They have long been and will continue to be a major source of financial support for better telecommunications and broadband deployment. Most important here are the Lifeline and High Cost Support programs, including under the latter head the Connect America Fund.

Lifeline Program

The purpose of the Lifeline program is to provide a discount on phone service for qualifying low-income consumers. Since 1985, it has sought to ensure that all Americans have opportunities to connect to jobs, contact family or emergency services, and other consumer needs. The Lifeline program, administered by the Universal Service Administrative Company (USAC)[10] is a part of the Universal Service Fund. In 2016, the program began to include broadband as a support service. The Commission set out minimum service standards for Lifeline-supported services (see Table 2 below).

The Lifeline program is highly underutilized. A national study of Lifeline (Thompson, 2010) found that fewer than one in three eligible individuals take advantage of the program. While conservatives may object to public funds being used to subsidize poor people's broadband, since Arkansans' federal tax dollars will continue to support Lifeline in any case, it is in the fiscal interest of the state, if possible, to raise awareness and get more poor Arkansans to participate in the Lifeline program. By raising adoption rates, this could also strengthen the business case for private companies to invest in broadband infrastructure, resulting in better internet access for non-poor Arkansans as well. Further study might find ways that this could be done.

Table 2: Support levels under the FCC Lifeline program

Date	Mobile Voice	Mobile Broadband	Fixed Broadband	Voice Support Amount (Per Month)	Broadband Support Amount (Per Month)
December 1, 2016*	500 Minutes	Speed: 3G Usage Allowance: 500 MB	Speed: 10/1*** Usage Allowance: 150 GB	$9.25	$9.25

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[10] See USAC's website for information regarding administrative aspects and program requirements.

Date	Mobile Voice	Mobile Broadband	Fixed Broadband	Voice Support Amount (Per Month)	Broadband Support Amount (Per Month)
December 1, 2017	750 Minutes	Speed: 3G Usage Allowance: 1 GB	Speed: 15/2*** Usage Allowance: 250GB	$9.25	$9.25
December 1, 2018	1000 Minutes	Speed: 3G or Bureau Determination Usage Allowance: 2 GB	Speed: Mechanism Usage Allowance: CAF Standard or Bureau Determination	$9.25	$9.25
December 1, 2019	1000 Minutes	Speed: 3G or Bureau Determination Usage Allowance: Updating Mechanism	Speed: Mechanism Usage Allowance: CAF Standard or Bureau Determination	$7.25	$9.25
December 1, 2020	1000 Minutes	Speed: 3G or Bureau Determination Usage Allowance: Updating Mechanism	Speed: Mechanism Usage Allowance: CAF Standard or Bureau Determination	$5.25	$9.25
December 1, 2021	1000 Minutes**	Speed: 3G or Bureau Determination Usage Allowance: Updating Mechanism	Speed: Mechanism Usage Allowance: CAF Standard or Bureau Determination	$0**	$9.25

* Minimum service standards and support amounts will be implemented on the later of December 1, 2016 or 60 days after PRA approval.

** Continued voice support of $5.25 per month in areas with only one Lifeline provider.

*** Fixed broadband providers that do not offer a product meeting the minimum service standards to a particular customer's residence may receive the $9.25 benefit if that customer purchases a fixed broadband offering that meets or exceeds 4 Mbps download and 1 Mbps upload.

Sources: https://www.fcc.gov/general/lifeline-program-low-income-consumers

High Cost Support

The FCC has long subsidized rural communications in pursuit of the goal of "universal service," funding the subsidies by adding charges to customers' phone bills. Figure 11 shows how these subsidies were allocated among funding programs and telecommunications providers for Arkansas between December 2008 and November 2018. Of these programs, several, including Connect America Cost Model-based funding, Broadband Loop Support, and Intercarrier Compensation, are part of the Connect America Fund, the FCC's principal vehicle for subsidizing rural telecommunications in recent years. Other sub-sections describe these programs in more depth, but Figure 11 provides context.

Figure 11: Ten years of FCC subsidies in Arkansas
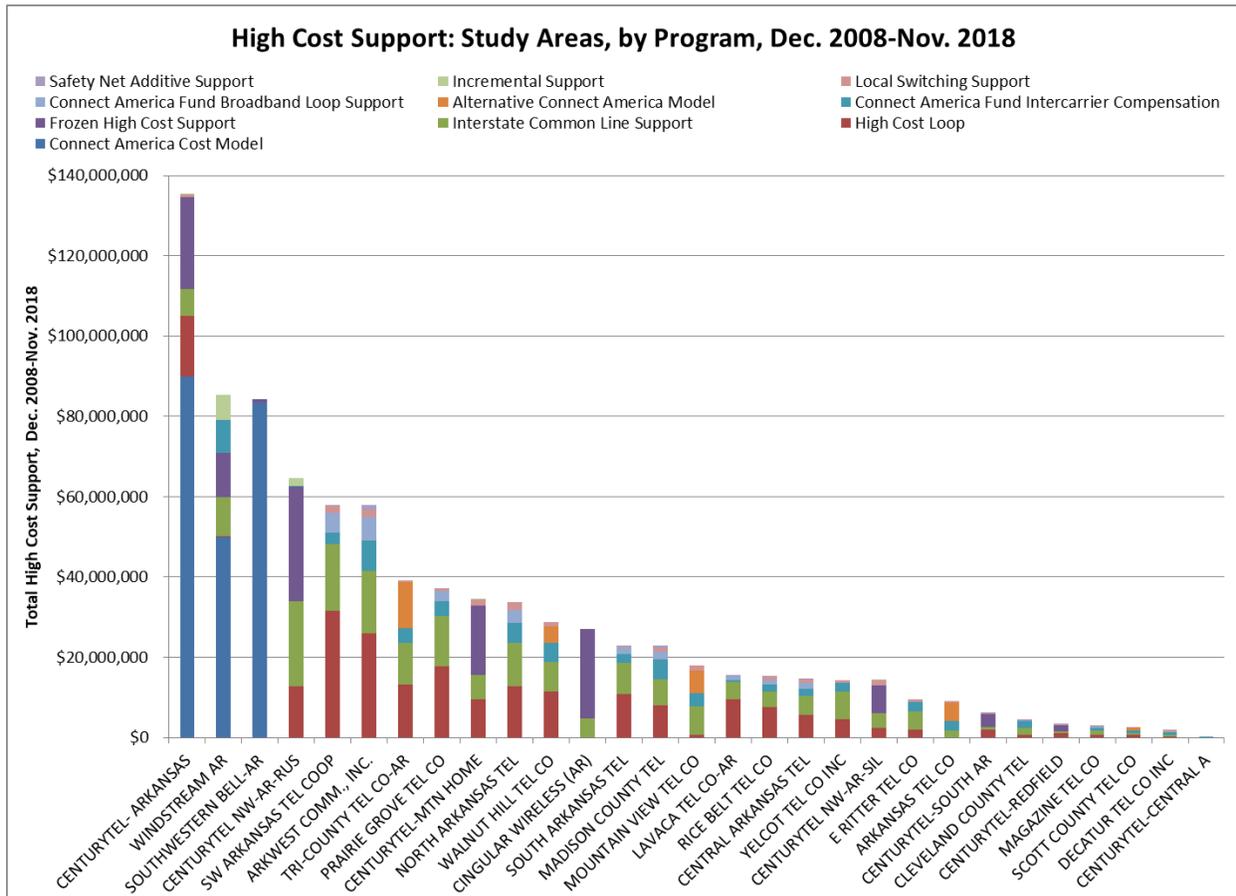
Source: USAC Funding Disbursement Tool, ADFA Economic Policy Division calculations

CACM funding was concentrated on three companies, but many companies receive High Cost Loop and Interstate Common Line Support. The difference is attributed to areas the programs fund. CACM is for price cap areas, and High Cost Loop and Interstate Common Line Support are for rate-of-return areas. Price cap and rate of return refer to two mechanisms for preventing the abuse of market power by companies that enjoy a certain degree of natural monopoly privilege.

The composition of High Cost support has changed over time, with some programs emerging and/or growing even as others shrink or get phased out. High Cost Loop support and Interstate Common Line Support were by far the largest programs in 2008. Both have since declined, with High Cost Loop support reduced to about half its 2008 level, while Interstate Common Line Support appears to have nearly disappeared by 2017. Meanwhile, the Connect America Fund's Connect America Cost Model surged dramatically to become by far the largest funding disbursement channel starting in 2015. More recently, Alternative Connect America Model and Connect America Fund Broadband Loop Support have emerged and become significant components of the High Cost support spend in Arkansas. These historical shifts in the composition of FCC subsidies are shown in Figure 12.

Figure 12: The changing composition of FCC High Cost support
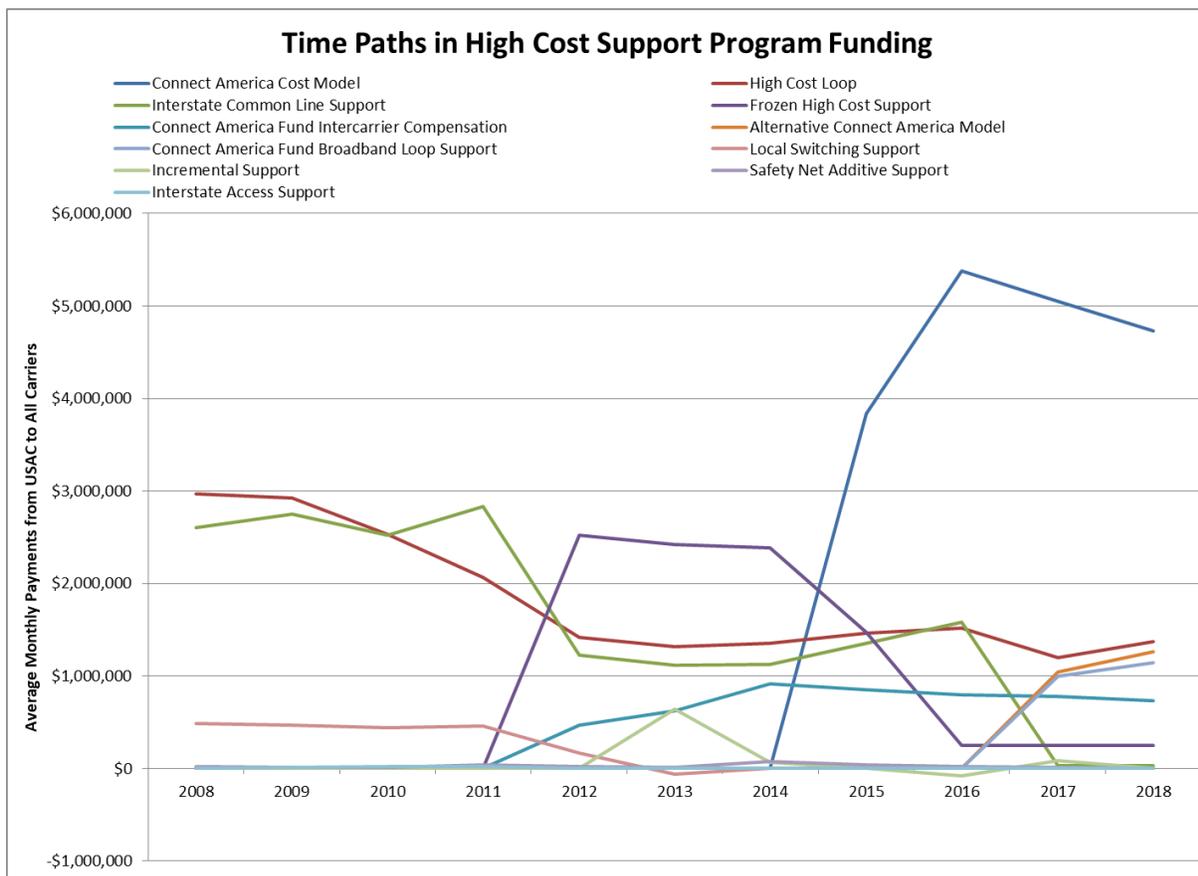
Source: USAC Funding Disbursement Tool, ADFA Economic Policy Division calculations

Connect America Fund Model-Based Support

The Connect America Fund, administered like Lifeline by USAC,[11] is the FCC's $4.5 billion per year national program to expand access to broadband and voice services for areas where they are unavailable. It is the latest chapter in the history of the Universal Service High Cost program, which seeks to realize the "universal service" principle that has long animated telecommunications policy, though its meaning

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[11] For more information regarding CAF II, see USAC's website.

has changed over time. Originally, "universal service" meant connecting the phone networks of different companies so that everyone could call everyone else. (There was a time when people had to have the same telephone company in order to call each other.) Later, the term came to describe the policy of using profits from serving low-cost, mostly urban areas to cross-subsidize telephone and other utility customers in high-cost, mostly rural areas. The CAF I and CAF II programs provide funding to local telephone companies to subsidize the cost of building new network infrastructure or performing network upgrades to provide voice and broadband service in areas where it is lacking.

The transitional CAF I program froze high-cost support for price cap carriers at 2011 levels and provided two rounds of incremental support to spur the deployment of broadband capable networks to unserved consumers. It still handles funds but isn't actively involved in new deployments. CAF II spent most of its budget on "model-based" support to incumbent price cap carriers. This method of subsidizing broadband deployment involved offering to the major carriers a subsidy for deploying broadband that was determined by the Connect America Cost Model, a forward-looking broadband cost projection tool. Carriers had to decide whether to accept or decline this model-based support for particular areas by August 2015. While the carriers' decision processes aren't publicly documented, presumably they accepted funding where they believed the subsidy offered exceeded the difference between costs to deploy and the present value of the net income they would earn from selling broadband to consumers, and declined the funding where this condition did not hold, thus fulfilling their fiduciary duties to shareholders. The CAF II funding provides 10/1 Mbps fixed broadband to consumers in rural and high-cost areas. CAF II is a six-year funding period that required 40% deployment by the end of 2017. The map in Figure 13 shows (in green) the areas where the price cap carriers accepted funding and thus made commitments to deploy 10/1 broadband by 2021.

Figure 13: Where price cap carriers accepted CAF II support from the FCC to provide voice and broadband service

Connect America Phase II

 Accepted PC Funding

 Areas Outside of Phase II Model-Based Support
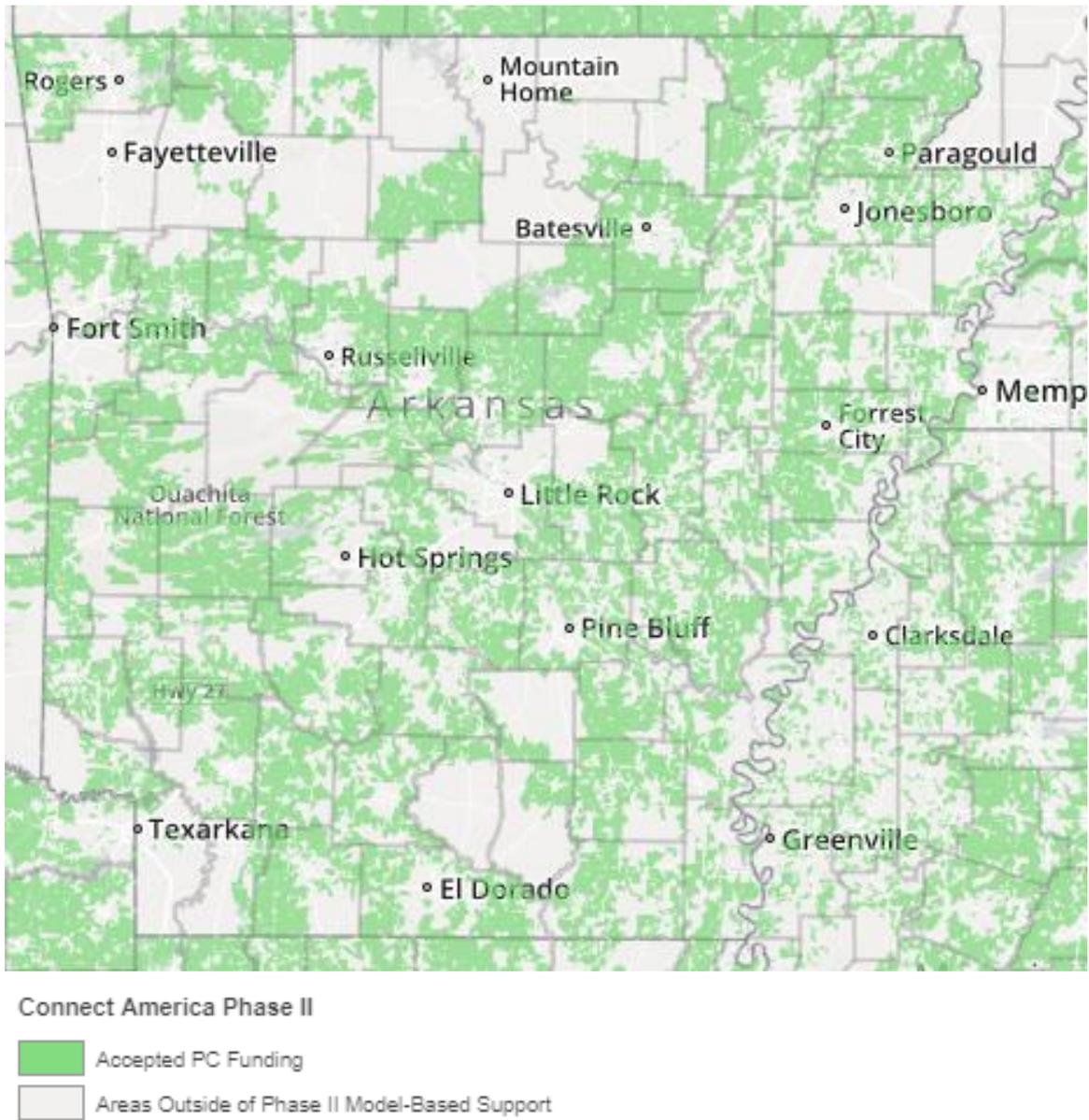
Source: FCC CAF II website

Areas that lack color in Figure 13 are either served by another class of carriers, called rate-of-return carriers, which are not eligible for the offer of model-based support from CAF, but receive support from other universal service high-cost mechanisms; areas declined by price cap carriers; areas where the monthly cost-per-location is above $52 but below $198, but the area was deemed served by an unsubsidized competitor, a subsidized wireline competitor, or was removed from the offer to price cap carriers due to the rural broadband experiments; areas where the average monthly cost-per-location was calculated by version 4.3 of the Connect America Cost Model (CACM) as above $198; and/or areas reported as uninhabited.

Table 3 shows the amounts allocated to particular price cap carriers for Arkansas as CAF II model-based support.

Table 3: Recipients of Connect America Fund Phase II (CAF II) Connect America Cost Model (CACM) based support in Arkansas

Company	Funds disbursed through CACM to serve Arkansas locations, July 2015 through November 2018
CenturyTel of Arkansas (a CenturyLink company)	$89,792,672
Southwestern Bell – AR (AT&T)	$83,499,977
Windstream AR	$49,990,269

Source: USAC Funding Disbursement Tool, ADFA Economic Policy Division calculations

Sources: https://www.fcc.gov/consumers/guides/connect-america-fund-phase-ii-faqs

https://www.fcc.gov/general/connect-america-fund-caf

https://cdn.ymaws.com/www.inbar.org/resource/resmgr/uls/(1)_Lankau,_Heidi-_Federal_U.pdf

https://www.fcc.gov/reports-research/maps/caf-2-accepted-map/

The CAF II CACM program has been the principal channel by which federal subsidies have accelerated rural broadband deployment in recent years. However, the price cap carriers have been criticized, justifiably or not, for the perceived slow pace and inadequate bandwidths of their deployments relative to the volume of federal subsidies they have received.

No assessment is here offered of whether the price cap carriers have provided good value for money in deploying broadband under the CAF II CACM program. Going forward, however, the state should consider seeking more transparency from the FCC and carriers about how decisions are made and money is spent on rural broadband deployment in Arkansas. If it turns out to be true that Arkansans have gotten poor value for money from this federal spending, the state should try to influence the FCC and the providers so that such funds are better used.

That said, backward-looking critiques of subsidy allocations under the CAF II CACM program may have limited relevance in future, if, as insiders seem to expect, the FCC soon phases out model-based support in favor of competitive bidding processes.

CAF II Auction 903

For areas where the price cap carrier declined model-based support, and in certain other areas, the FCC conducted a competitive bidding process, the Connect America Fund Auction 903 (CAF II Auction 903). The CAF II Auction 903 was a reverse auction, where the buyer—in this case, the FCC, which is buying broadband installation services—sets up the auction, and the sellers—such as, in this case, cable companies, telecoms companies, rural electric cooperatives—bid. Nationally, 103 bidders won $1.49 billion over 10 years to provide fixed broadband and voice services to over 700,000 locations in 45 states. Winners will provide 25/3 Mbps to households.

CAF II Auction 903 is described in some depth here, even though its budget was smaller than CAF II model-based support, because (a) there is more information publicly available, and (b) conversations with certain well-informed people suggest that CAF II Auction 903, rather than CAF II CACM, is likely to be the process by which "universal service" financing for rural broadband deployment proceeds after the expiration of CAF II CACM funding in 2021.

The state of Arkansas did very well in the CAF II Auction 903. There were five groups of companies who won, shown in Table 4, most of which committed to gigabit speeds. It finished 10th place in terms of number of locations that will get "broadband," and 4th with respect to gigabit service. All states that won more locations than Arkansas have larger populations than Arkansas.

Table 4: Arkansas winning bidders in the Connect America Fund Phase II (CAF II) Auction 903

Winning Bidder	Annual assigned support	Assigned locations	Tier of service
Rural Electric Cooperative Consortium	$4,084,922	11,934	Gigabit
ArisWave Consortium	$706,900	3,191	25/3
3E8 Broadband Solutions, LLC	$362,185	811	Gigabit
Wisper ISP, Inc	$39,957	102	100/20
Fidelity Communications Company	$4,846	10	Gigabit

Source: FCC CAF II Auction 903 Results, ADFA Economic Policy Division calculations

Rural Electric Cooperative Consortium—This bidder won in eight states—Arkansas, Kentucky, Michigan, Missouri, Oklahoma, Oregon, Tennessee, and Virginia—and will receive $186 million (over ten years) from the FCC auction to serve 66,000 locations. For Arkansas, the funding is nearly $41 million for 11,934 locations. For all locations, they committed to offer gigabit service, resulting in high support levels averaging over $400/year per location, and ranging to over $1,000/year per location. In Arkansas, the locations where the Rural Electric Cooperative Consortium won are in three clusters:

•   North-central: Baxter, Fulton, Izard, Sharp, and Stone counties.

•   Northwest/Ozarks: Benton, Madison, Washington, Franklin, Crawford, Sebastian, Logan, Johnson, Scott, and Pope counties.

•   Southwest: Clark, Nevada, and Pike counties.

The Ozarks Electric Cooperative, the South Central Arkansas Electric Cooperative, and the North Arkansas Electric Cooperative have begun to publicize their plans to offer fiber/gigabit internet service, reaching out to potential customers.

The Rural Electric Cooperative Consortium won every area (141 Census block groups) for which they bid. In 89 areas, they bid against ArisWave Consortium, and won with a price point of 59.99% support. Elsewhere, the main other bidder was Viasat, and the support awarded was either 71% or 78.35%.

ArisWave Consortium—This bidder won in Arkansas, Illinois, Mississippi, Missouri, and Oklahoma, for a total award of just over $12 million. More than half of that, $7 million was for Arkansas, to serve

3,191 locations. (Interestingly, the bidder committed to serve more locations, 3,549, in Oklahoma, though the award, $1.8 million, was much smaller.)

ArisWave Consortium's winning areas were geographically diffuse. The largest number were in southeastern Arkansas—Arkansas, Ashley, Chicot, Cleveland, Desha, Drew, Jefferson, Lee, Lincoln, Monroe and Phillips counties. But they also won areas in central Arkansas—Lonoke, Grant, Pulaski, Saline and Faulkner counties—in northeastern Arkansas—White, Woodruff, Cross, and Prairie counties—and around Fort Smith—Sebastian and Crawford counties.

ArisWave Consortium bid for 391 Census block groups, and won in 265. They lost 89 Census block groups to the Rural Electric Cooperative Consortium, 11 to 3E8 Broadband Solutions, LLC, and two to Fidelity Communications Company. Everywhere they won, ArisWave Consortium committed to 25/3 speeds with low latency. This may be why the average support level, at about $230/year per location, with a maximum of just over $455/year per location, was lower than for the Rural Electric Cooperative Consortium.

3E8 Broadband Solutions, LLC—This bidder only competed in Arkansas, and won $3.6 million in assigned support over ten years, to deliver gigabit service to 52 Census block groups in Craighead (22), Lawrence (12), Greene (8), and Poinsett (7) and Crittenden (3) counties, and 25/3 service to five Census block groups in Crittenden (3) and Poinsett (2) counties. They won in every area where they bid.

Wisper ISP—This bidder participated in all areas eligible for CAF Phase II auction funding, but only won in eight Census block groups in Clay (7) and Greene (1) counties. Elsewhere in the state, Wisper ISP stopped bidding at a price point of 80, causing them to drop out before the national auction budget cleared. In Clay and Greene counties they bid lower, probably because these counties are contiguous with Missouri. They offered 100 Mbps speed and low latency. They won $399,565 over 10 years.

Fidelity Communications Company—This bidder won two Census block groups, one in Pulaski County and one in Saline County, with ten locations altogether. These were the only areas for which they bid. They won $48,470 over 10 years.

Figure 14 shows the geographic distribution of CAF II winning territories.

Figure 14: Areas to receive support for broadband deployment thanks to CAF II Auction 903
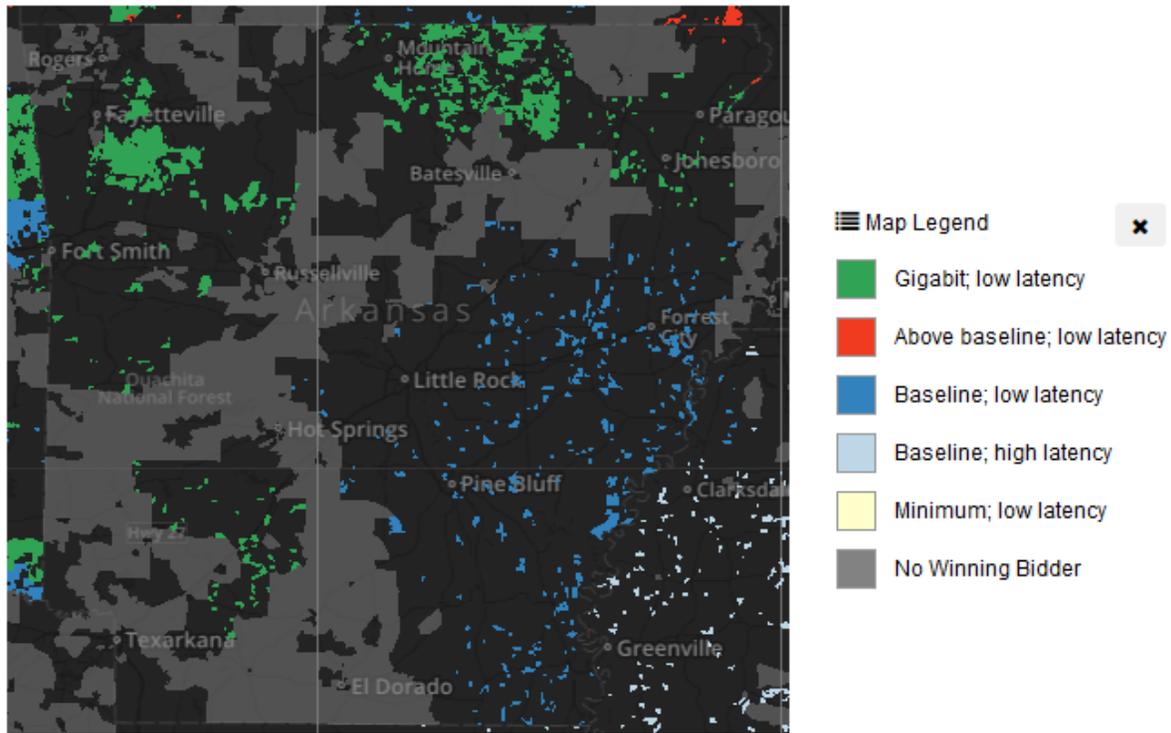
Source: FCC CAF II Auction 903 Website

Auctions are highly regarded by economists as a mechanism for allocating funds in pursuit of specified objectives while incentivizing price discovery and value for money. The FCC has deep experience with auctions, which have long been used as a means for allocating spectrum in the public interest. While the use of reverse auctions to allocate subsidies for broadband deployment is a somewhat novel development in FCC practice, it builds on the FCC's institutional expertise and is likely to continue to be used. Expected or possible future FCC auctions include:

- *Mobility Fund II.* The $4.53 billion MF-II Auction[12] will invest up to $4.53 billion buying commitments from providers to improve cell phone and mobile data coverage in underserved areas nationwide. Maps purporting to show current levels of coverage, to be used for defining underserved areas eligible for MF-II Auction support, were published last year by the FCC. States and telecom companies were invited to "challenge" these maps by collecting data showing that coverage had been overstated. Many states, including Arkansas, participated in the challenge process and showed that, in fact, cell phone and mobile data coverage had been significantly overstated. Following this, FCC Chairman Ajit Pai announced that the FCC would investigate whether wireless carriers violated MF-II rules by submitting incorrect coverage maps. While the original eligibility maps included very limited territory in Arkansas (mostly in the Ozarks and Ouachitas), the challenge process may open larger areas to MF-II funding for better mobile data coverage.

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[12] https://www.fcc.gov/mobility-fund-phase-ii-mf-ii

- *Remote Areas Fund.* While little information is publicly available, well-connected insiders such as former FCC economist Jonathan Chambers, now of Conexon, have suggested that the FCC intends to implement a Remote Areas Fund auction, similar to the CAF II Auction 903 but trying to reach areas that are still unserved. Its budget would include over $500 million left unspent from the CAF II Auction 903.
- *CAF III.* Jonathan Chambers reported at the Conexon blog that "in 2015, the FCC offered price cap carriers six years' worth of funding over a five-year period… That funding ends in 2020, to be replaced by a competitive bidding process." While this information is hard to find published anywhere, it is consistent with what FCC officials have said in conversations with ADFA Economic Policy Division staff. A CAF III Auction, building on lessons learned from the successful CAF II Auction 903, is one form that a competitive bidding process might take.

Participating in FCC auctions is a highly complex business. Going forward, the State Broadband Office should consider efforts to educate Arkansas internet service and communications providers about FCC auctions, and provide technical assistance to those who decide to seek federal funding through such auctions, so that Arkansas can get its fair share, or better, of FCC subsidies allocated through auctions.

A-CAM

Another program under USAC's High-Cost Support program is the Alternative Connect America Cost Model (ACAM). It funds $578 million annually, and the fund has a length of 10 years. ACAM began in January 2017, and it supports voice and broadband infrastructure. ACAM supports rate-of-return carriers that elected to transition to the new cost model for calculating High Cost funding. Carriers must maintain 10/1 Mbps to all locations fully funded by the model, and they must offer 25/3 Mbps to a certain percentage of those locations by the end of the support term.

The ACAM program has tended to balance the CACM focus on big telecommunications firms by providing support to smaller local telephone companies. Areas receiving ACAM funding are shown in Figure 15.

See USAC's [website](#) on ACAM for deployment requirements, filing requirements, and information about the program.

Figure 15: Areas in Arkansas where ACAM funding is available to carriers
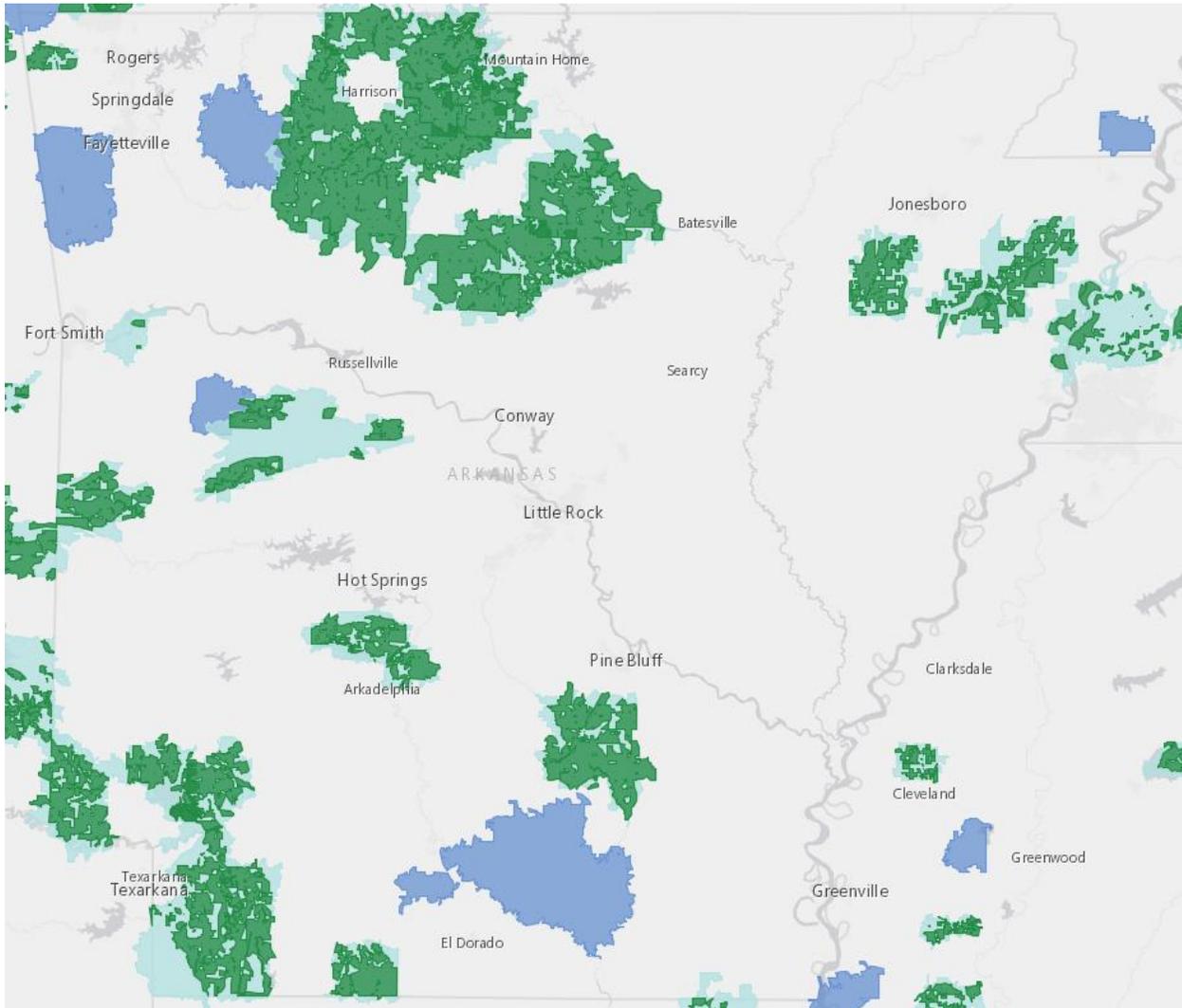
Legend

Funding-Eligible Areas

Eligible State/Carrier Areas

Ineligible State/Carrier Areas

This map identifies the areas that have been determined to be eligible for support for broadband and voice service from the FCC's final Alternative-Connect America Cost Model (ACAM version 2.3). ACAM calculates costs per location in all rate-of-return carrier census blocks for the entire country. Specifically, the map identifies areas served by rate-of-return carriers that are determined by the adopted cost model to be eligible for support.

Areas on the map fall into one of four categories:

Areas shown in dark green on the map are eligible for CAF-ACAM support. An area is classified as "eligible" if the average monthly cost-per-location for that census block, as calculated by the cost model, is above the $52.50 funding benchmark, and is not served by a qualified unsubsidized competitor or by 10/1 Mbps or better service from the incumbent or its affiliate using fiber-to-the-premise (FTTP) or cable.

Areas shown in light green on the map are ineligible areas within those rate-of-return study areas that are otherwise eligible for support. Such areas are ineligible under the decisions adopted by the Commission because either the average cost for the census block is below the funding benchmark, the carrier already serves the area with 10/1 Mbps or better broadband service utilizing FTTP or cable technology, or the area is served by an unsubsidized competitor with voice and qualifying broadband service.

Areas shown in blue on the map are study areas served by rate-of-return carriers that are ineligible for CAF-ACAM support under the decisions adopted by the Commission. Any carrier that reported that it had deployed 10/1 Mbps or better broadband to 90 percent or more of its eligible locations in a state, based on June 2015 FCC Form 477 data that was filed and certified as of March 30, 2016, are not eligible to elect model support.

Empty areas with no color are either located in areas served by another class of incumbent carriers, called price cap carriers, which are not eligible for this offer of CAF-ACAM support, and/or are reported as uninhabited.

Source: https://www.usac.org/hc/funds/acam.aspx

https://www.fcc.gov/reports-research/maps/a-cam-offer-map/

B. USDA RUS

The USDA Rural Utilities Service was founded in 1935 with a mission of helping rural communities to get the modern utilities that were beginning to define modern life in America's cities. Originally called the Rural Electrification Administration and focused on electricity, it began in 1949 to provide loans to support rural telephony as well. Building on its long-established relationships, it continues to seek to modernize rural utilities, usually in partnership with local governments and/or private companies and nonprofits. Compared to FCC programs, USDA programs tend to be less technical and more community-oriented. RUS has five active programs designed to promote rural broadband deployment.

ReConnect

Originally called the Broadband E-Connectivity Pilot Program, the USDA ReConnect program is the newest broadband funding opportunity provided by the USDA. Congress provided $600 million for the program. Through the ReConnect program, crucial rural premises such as homes, community facilities, farms, and businesses may be able to gain access to sufficient broadband coverage.

At the time of writing, the USDA ReConnect funding window is open and some Arkansas internet service providers have declared their intention to apply for funds. We hope this sub-section will be useful to applicants preparing their applications.

The goal of the ReConnect program is to expand broadband access to rural areas without sufficient access to broadband. Sufficient access is defined as speeds of at least 10/1 Mbps. The program has three different options for funding:

1. 100% grant. Maximum $25 million per applicant
2. 100% loan (fixed interest rate of 2%). Maximum $50 million per applicant
3. 50% loan, 50% grant (interest rates set at the US Treasury rate). Maximum $50 million per applicant

Each of the three funding options will have $200 million nationally to disburse. Awardees will provide their coverage area speeds of at least 25/3 Mbps. The deadlines to apply are:

1. For the 100% grant option: May 31, 2019
2. For the 50% loan, 50% grant option: June 21, 2019
3. For low-interest loans: July 12, 2019

The USDA has several requirements that limit eligibility for the ReConnect program. To be eligible, an area must be:

- "Rural," in the sense of not being part of an urban cluster of 20,000 people or more;
- Not a beneficiary of CAF II Auction 903 funds;
- Not a protected broadband borrower service area;
- Not an area with a pending application for USDA support under another program; and
- 90% (for the 50% or 100% loan options) or 100% (for the grant option) unserved by 10/1 broadband.

The USDA ReConnect Mapping Tool has been provided as a resource to help applicants assess the eligibility of proposed service areas. In Arkansas, the colored regions in the map are either ineligible or have limited eligibility (e.g., CAF II Auction 903 winning areas can only receive USDA ReConnect *loans*, not grants, and they must go to the auction winning company). The non-colored regions are *not* necessarily eligible, however. Eligibility depends on the ratio of the population served by 10/1, not shown on the map.

Figure 16: USDA ReConnect map with ineligible territories:
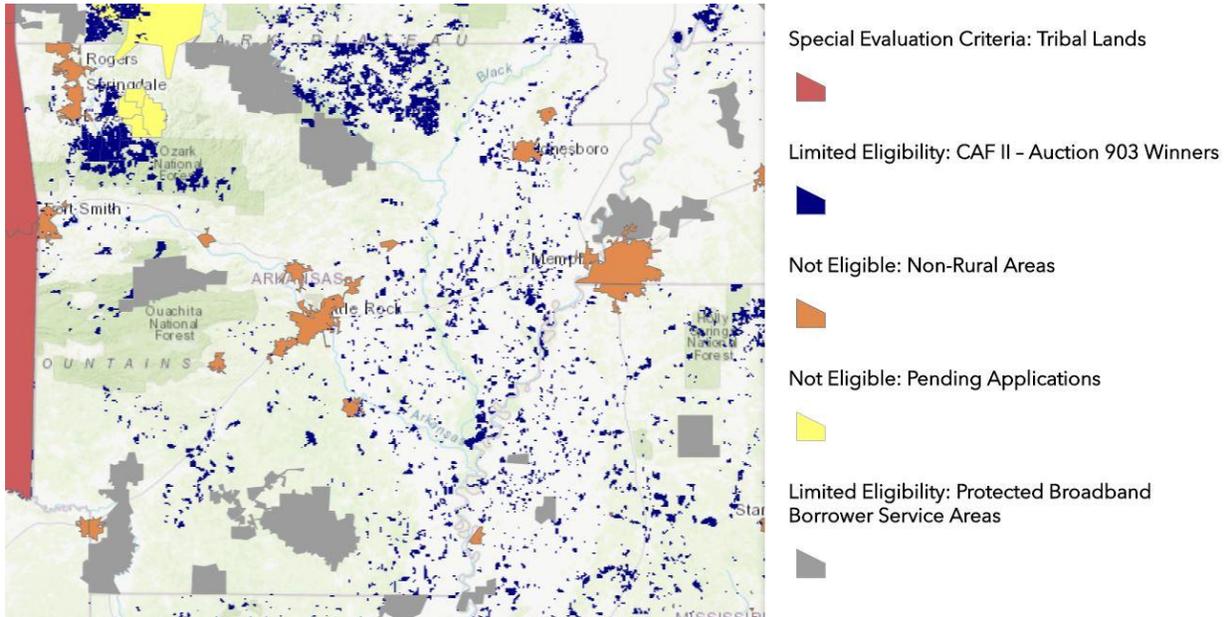
Source: USDA ReConnect Mapping Tool from the ReConnect website

As an aid to Arkansas ISPs who are considering applying for USDA ReConnect, the ADFA Economic Policy Division used Form 477 data published by the FCC, in combination with the shape files from the USDA ReConnect Mapping Tool, to provide a first-pass estimate of which areas in Arkansas are eligible for inclusion in proposed service areas for the 100% grant product. The map is shown in Figure 17.

Figure 17: ADFA Economic Policy Division estimates of which areas are eligible for 100% grant support under USDA ReConnect
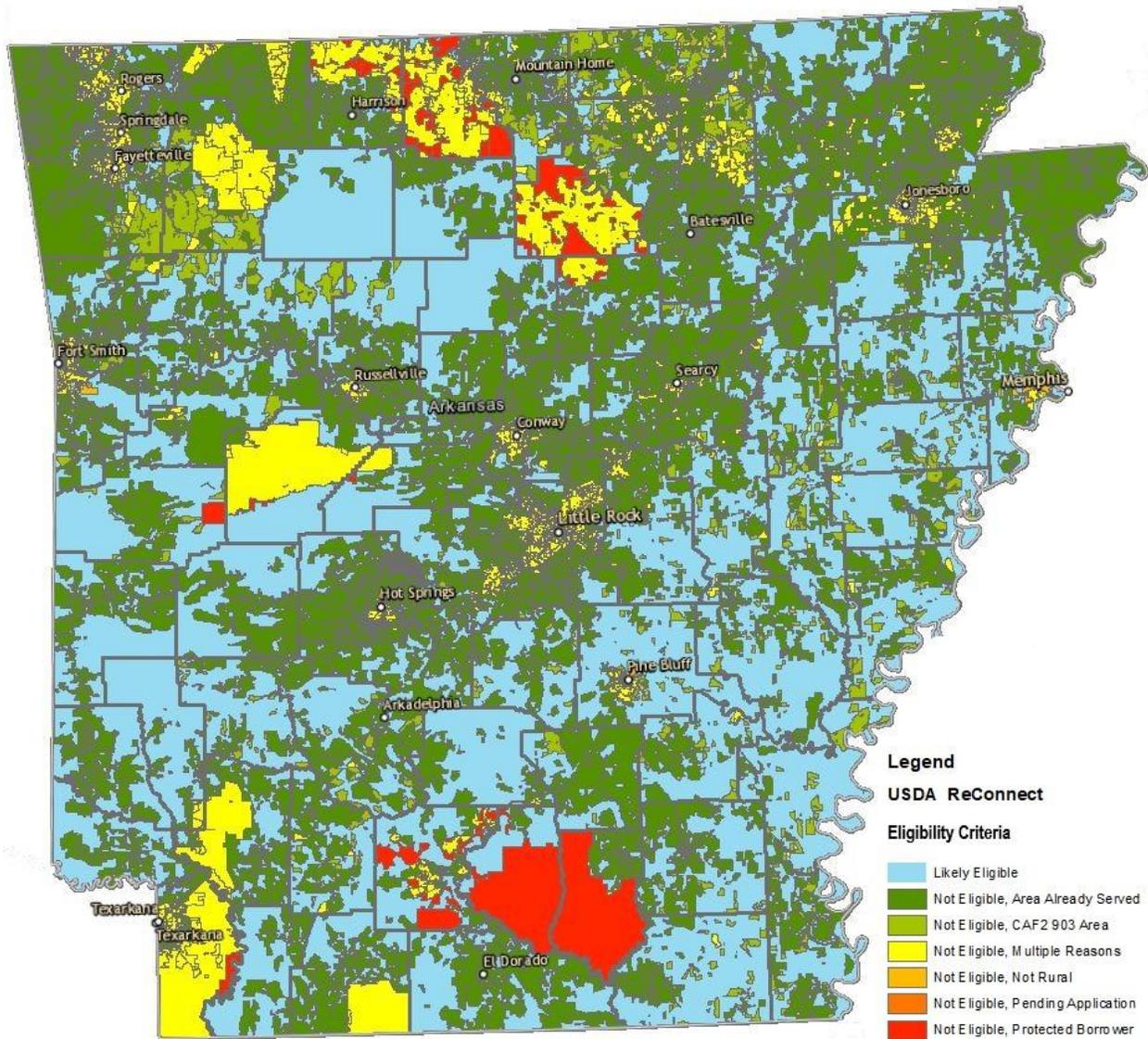
Source: Form 477 data and USDA ReConnect shapefiles, created by ADFA Economic Policy Division

Applicants interested in 100% or 50% loan products could combine the (light blue) "likely eligible" areas in the above map with small pieces of (dark green) "not eligible, already served" areas while staying under the 90% threshold.

While Figure 17 may serve as a starting place, applicants should be warned that the FCC Form 477 data has limitations of which the USDA is well aware, as a result of which they will not take the Form 477 data as fact but instead will do their own investigation of the extent to which a proposed service area is really unserved. Applicants should undertake their own research to confirm that targeted areas lack service.

The 100% grants and 50% loan & 50% grant options of the USDA ReConnect program will be subject to an application scoring criteria for determining where funding will be awarded.

- Rurality of Proposed Funded Service Area (25 points)
- Farms Served (20 points)
- Performance of the Offered Service (20 points)
- Businesses (15 points)
- Healthcare Centers (15 points)
- Educational Facilities (15 points)
- Critical Community Facilities (15 points)
- Tribal Lands (5 points)
- State Broadband Activity (20 points)

In designing high-scoring proposals, internet service providers who want to apply for USDA ReConnect funds face the tricky task of trying to include a lot of schools, healthcare centers and critical community facilities—which tend to be located in population centers—and trying to get a high "rurality" score by defining service areas with low population density.

For more information on the program, see the USDA's ReConnect program website:

https://www.usda.gov/reconnect

Community Connect

The Community Connect Grant program provides assistance to eligible entities to construct, improve, or expand broadband networks, specifically in rural areas. This program focuses on smaller projects, and the maximum grant amount is $3 million. These projects can help rural residents tap into the potential of the internet for jobs, education, healthcare, public safety, and community development. Applications for this program were due on April 15.

For more information on the program, see the USDA's Community Connect Grant website: https://www.rd.usda.gov/programs-services/community-connect-grants

Distance Learning and Telemedicine Grants

There are two funding opportunities under the Distance Learning and Telemedicine Grants program. One is for the program as has been operated annually (referred to as "Traditional DLT") and one is for projects related to prevention, treatment, or recovery for opioid use disorder in rural areas (referred to as "Opioid DLT"). Awards can range from $50,000 to $500,000. Applications submitted under this announcement should address how they will strengthen local capacity to address one or more of the focus areas. For both programs, the following are the focus areas:

1. Prevention—for example, educating community members and care providers or implementing harm reduction strategies to reduce the number of fatal opioid-related overdoses and the occurrence of opioid use disorder among new and at-risk users.

2. Treatment—for example, implementing or expanding access to evidence-based practices for opioid use disorder treatment, such as medication-assisted treatment.

3. Recovery—for example, expanding peer recovery and treatment options that help people with opioid use disorder start recovery and avoid relapse.

For more information on the programs, see the USDA's Distance Learning and Telemedicine Grants website: https://www.rd.usda.gov/programs-services/distance-learning-telemedicine-grants

Rural Broadband Access Loan and Loan Guarantee

The Rural Broadband Access Loan and Loan Guarantee Program furnishes loans and loan guarantees to provide funds for the costs of construction, improvement, or acquisition of facilities and equipment needed to provide service at the broadband lending speed in eligible rural areas. This program is funded through the Farm Bill.

For more information on the program, see the USDA's Rural Broadband Access Loan and Loan Guarantee website: https://www.rd.usda.gov/programs-services/rural-broadband-access-loan-and-loan-guarantee

Telecommunications Infrastructure Loans and Guarantees

This program provides financing for the construction, maintenance, improvement and expansion of telephone service and broadband in rural areas. This program is for areas with populations less than 5,000, and the area must lack telecommunications provider and telecommunications facilities.

For more information on the program, see the Telecommunications Infrastructure Loans and Guarantees website: https://www.rd.usda.gov/programs-services/telecommunications-infrastructure-loans-loan-guarantees

Conclusion

Together, the federal programs described above, some of which have spare capacity, should provide ample resources to close the digital divide in Arkansas in the coming years. Of course, since the mix of federal programs is always changing, federal agencies will need to be closely monitored by broadband advocates and deployers in Arkansas to keep up with the latest opportunities. While federal funding for rural broadband deployment could diminish in future, political trends suggest that it is more likely to increase, with Arkansas, as a lagging state, positioned to capture a growing share of federal funding for rural broadband as other states improve their connectivity and graduate out of eligibility for these programs.

Case Study: The Mobility Fund II Challenge Process

In fall 2018, the University of Arkansas System Division of Agriculture, prompted by Arkansas Development Finance Authority (ADFA) Economic Policy Division, conducted a data collection effort that may serve to establish the eligibility of a substantial part of Arkansas for subsidies allocated by the FCC through the $4.5 billion Mobility Fund (MF) II auction. The MF-II auction will seek to promote better mobile data coverage in rural areas. If cell phone companies compete aggressively for Arkansas territories in the MF-II auction (whenever it occurs), Arkansas's successful participation in the challenge process could yield extremely large returns in the form of federally subsidized investment in better mobile

data coverage in rural parts of the state. In addition, the MF-II challenge process was an informative exercise, which revealed that mobile data coverage is quite poor in much of the state.

The University of Arkansas System Division of Agriculture conducted a statewide assessment to determine areas of the state lacking 4G LTE cellular service as part of the U.S. Federal Communications Commission (FCC) Mobility Fund Phase II (MF-II) program, described above. MF-II funds will only be made available for areas with documentable evidence that 4G/LTE mobile wireless service of at least 5 Mbps download speed is lacking. Initial maps of eligible areas were based on reports of coverage by cellular service provider companies. States could challenge those maps to expand eligible areas.

Partners in this study included the Arkansas Development Finance Authority (ADFA), Arkansas Farm Bureau Federation and Arkansas Geographic Information Systems (GIS). The leadership of the Division of Agriculture first became aware of the MF-II program in late September. Due to the short time frame for collecting and submitting test data (challenge data was due November 26), an engineering firm with experience in the challenge process was hired to support the effort.

Six testing teams comprised on Cooperative Extension Service personnel traveled the state October 29-November 18. Each team was given a set of phones with service plans from Verizon, AT&T and T-Mobile. While there are other cellular service providers in Arkansas, the decision was made to focus on those claiming the most coverage within the state due to time and resource constraints. An app on each phone recorded data as testers drove through assigned counties. Test results were uploaded to a server for analysis at the end of each day.

Test data collected by the Division was submitted and certified on November 21. Collectively, teams gathered data from 15,698 one-kilometer square cells, covered 23,589 miles, and collected 737,172 unique drive test points during the three weeks of testing. Of the cells tested, 22.7 percent (3,567 cells) met criteria to be considered a successful challenge pending FCC adjudication. Although data were collected from an additional 12,131 grid cells, lack of access due to road conditions, private roads, farmland, woodlands, and other barriers impeded efforts to collect data from enough of the grid cell to meet challenge criteria. Overall among test points, 666,780 tested below the 5 Mbps threshold while 114,613 exceeded the 5 Mbps threshold.

On December 7, the FCC launched an investigation into whether one or more major carriers violated the MF-II rules and submitted incorrect coverage maps (https://docs.fcc.gov/public/attachments/DOC-355447A1.pdf). The investigation is in response to test data submitted through the challenge process from Arkansas and other states that shows significantly less coverage than what service providers claim. All post certification activities have been suspended pending completion of the investigation.

Partner Roles

ADFA was the first to become aware of the MF-II program and provided leadership in convening potential partners to get a project started.

The Division of Agriculture was the first to commit to the project and assumed leadership for developing and implementing the data collection plan.

Arkansas Farm Bureau created and administered a survey for constituents to report problem areas and inform testing assignments. This data was shared with the Division.

The Arkansas GIS office provided support in developing initial road maps.

Monty R. Lee & Company was hired by the Division to provide: 1) mapping and training services to facilitate testing by the Division and 2) data formatting and submittal services for the FCC Portal.

IV. STATE BROADBAND OFFICE

In order to help optimize policy and leverage federal programs to expand broadband access and availability in Arkansas, Governor Asa Hutchinson advocates changes in the appointment and reporting of the State Broadband Manager, so that this official will be able to play a more active role than has hitherto been possible. Current Arkansas Code 25-4-125 designates the State Broadband Manager as the Director of the Department of Information Systems. The code reads as the following:

Title 25 - State Government

Chapter 4 - Department of Information Systems

§ 25-4-125. State Broadband Manager

Universal Citation: AR Code § 25-4-125

(a) The Director of the Department of Information Systems is designated 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 Department of Transportation;*
>>
>> *(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.

On April 8, 2019, the Arkansas legislature passed Act 792 "to amend the law concerning the State Broadband Manager." The full text of the Act is as follows:

SECTION 1. Arkansas Code§ 25-4-125(a), concerning the State Broadband 19Manager, is amended to read as follows:

(a)~~The Director of the Department of Information Systems is designated~~ <u>The Governor shall designate</u> the State Broadband Manager.

Henceforward, then, the State Broadband Manager will be a direct Governor appointee. The decoupling of the State Broadband Manager role from the Directorship of the Department of Information Systems should enable this public official to dedicate more sustained attention to the prescribed duties of the office.

V. ARKANSAS HIGH COST FUND

In contrast to the federal government, the state of Arkansas does not have programs that systematically and deliberately subsidize broadband deployment. Nonetheless, one state program does financially support broadband deployment indirectly by helping to fund local telecommunications companies. The Arkansas High Cost Fund (AHCF), established by Act 385 of 2007,[13] is the successor to the Arkansas Universal Service Fund (AUSF), established by Act 77 of 1997,[14] in the wake of the deregulatory Federal Telecommunications Act of 1996. Act 385 of 2007 sought to adjust telephone policy to use better data sources, in order to economize on the onerous financial review involved in administering the AUSF. Statutes governing the AHCF have not been updated since 2007. In general, federal and state universal service programs, funded by charges on consumers' phone bills, have long been motivated by the goal of providing rural customers access to communications services comparable in quality and price to those that urban customers enjoy, even though rural customers are generally more costly to serve.

The AHCF, like the AUSF before it, assesses charges and redistributes "pooled revenues" among telecommunications providers. Both Acts 77 and 385 declare that these charges, paid to the AUSF and then the AHCF administrators by eligible telecommunications carriers (ETCs) but ultimately charged to consumers on their phone bills, are not taxes, for the following reason:

> Because customers of the telecommunications providers that would pay the AHCF charge receive the benefits of a universal network, the telecommunications providers may surcharge their customers to recover the AHCF charges paid by the telecommunications provider. Therefore, the AHCF charge is not a tax and is not affected by state laws governing taxation. (From Act 385 of 2007)

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[13] http://www.arkleg.state.ar.us/assembly/2007/R/Acts/Act385.pdf
[14] http://www.arkleg.state.ar.us/assembly/2019/2019R/Acts/Act77.pdf

According to the latest AHCF support determination document[15] published on December 8, 2018, the AHCF administrator will collect $39.8 million, reallocating almost all of it among telecommunications providers, with $97,540 in administration charges. For comparison, the volume of money involved in these transactions is therefore almost eight times larger than the $5.19 million in annual grant funding awarded to Arkansas ISPs through the FCC's recent CAF II Auction. Of course, the CAF II Auction did not aim for universal service but targeted only certain areas, and some winners lack a proven track record of delivering broadband service.

Act 385 of 2007 contains language connecting the AHCF with the purpose of expanding broadband:

> The AHCF shall also be used to accelerate and promote the incremental extension and expansion of broadband services and other advanced services in rural or high-cost areas of the state beyond what would normally occur and support the Lifeline program to eligible low-income customers.

However, funding determination rules emphasize support the local telephone exchange function associated with traditional landline technology, and do not hold rural telecommunications companies accountable for deploying broadband to new unserved areas. Nonetheless, many have done so, and respondents to a provider survey compiled as part of the State Broadband Manager's Report (published biannually) include several remarks underscoring the need for the AHCF. Asked what the state can do to encourage deployment, providers' answers included:

> *Continue to support the Arkansas High Cost Fund. Without predictable and stable support, companies cannot advance broadband services into remote rural areas. There is no business case a company can make to serve remote rural areas without a support mechanism.*

> *Insure the Arkansas High Cost Fund will continue to help support the advancement of broadband into remote areas where there is no current business case without federal and state support funds.*

> *Maintain the ARHCF…*

> *In our area, broadband service is provided over the underlying telephone network. State funds such as the Arkansas High Cost Fund help support the installation and maintenance of that telephone network. We wouldn't be able to offer, install, maintain or upgrade broadband in our area without these telephone support funds. From a policy perspective, keeping these telephone funds in place will help us deliver, expand, and maintain broadband service to rural areas…*

A study[16] of state high cost funds published by the National Regulatory Research Institute finds that many other states have high cost funds, which serve similar purposes to Arkansas's, supporting local telephone exchanges and insulating providers from adverse revenue trends so as to keep phone service affordable to rural residents. The designs of such funds vary widely, but they are never very simple, because of the inherent complexity of the accounting and incentives issues involved. Other states have no state high cost funds, though telecommunication providers in those states still have access to federal universal service programs.

It seems clear that the AHCF financially sustains broadband service in some areas. It is likely that rural Arkansas would have less broadband, perhaps substantially less, if the AHCF had never existed, and if the AHCF were dissolved, that some rural customers would lose broadband, while in other places, future deployments would be impeded. The AHCF is an important part of ongoing efforts to close the digital divide.

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[15] http://www.arrural.com/ahcf/2019%20Support%20determination%20-%20APSC%20Notice.pdf
[16] https://prodnet.www.neca.org/publicationsdocs/wwpdf/119nrri.pdf

On the other hand, the rationale for and optimal design of a fund supporting a "universal network" of landlines must be affected by the ongoing obsolescence of traditional landline technology for voice, and the suboptimality of traditional landlines for data transmission. As early as 2017, polls were finding that more than half of Americans do without landline phones. At some point, the state should probably conduct a fresh review of the design and operations of the AHCF and consider whether these are still appropriate in greatly changed technological conditions. Reforms to consider might include:

- Greater transparency about how funds are collected and allocated, and why, so that decision makers can answer questions about the (probably substantial) extent to which the AHCF has promoted and will promote broadband deployment, where, and how efficiently. Although ACHF activities are subject to oversight and documented in dockets at the Arkansas Public Service Commission, this information is not in available in formats amenable to further analysis, leaving the purpose, operations, and impact of the AHCF opaque to most stakeholders.
- Requiring rural telecom companies to report offered broadband speeds by address as a condition for receiving AHCF support.
- Elimination of rural telephone companies' obligation to serve as a carrier of last resort by installing new landline phone connections on request in areas where high-quality mobile phone coverage is demonstrated to be available.
- Incorporating the notional AHCF goal of promoting broadband deployment into the metrics by which support levels are determined, with due consideration for how this mission adjustment affects the underlying policy rationale.

If reforms to the AHCF are considered, transitional financing arrangements should be provided for to avoid disrupting service to customers and/or creditors of companies that participate in the AHCF.

VI. STATE ASSETS IN THE BROADBAND SPACE

A number of assets that could be valuable for broadband deployment are owned by public entities and/or located in the public right-of-way, and there has been some advocacy for these assets to be used to help meet demands from the citizenry for better broadband access. However, there are several impediments to the use of such assets, including:

- Agreements by public entities with private partners that in some cases preclude them from using assets in ways that would compete with the private partners.
- Statutes such as Act 1050 of 2011 that prohibit governmental entities from retailing communications services to the public.
- Desires by public entities to reserve excess capacity to meet anticipated future mission-related needs.
- Lack of capacity on the part of public entities to handle complex and/or voluminous transactions with private companies and/or individuals, and/or to govern and make use of revenues that might arise from such transactions.
- Fairness issues and corruption risks that arise when taxpayer-supported entities compete with profit-seeking businesses.

Moreover, it is not clear that state assets such as fiber cable, which are generally part of the middle mile or backbone of the broadband network, could, even if they were somehow made more available to the private sector, meet any critical needs, since the obstacle to deployment is usually at the "last mile." Also,

some of these assets are leased, with vendors not allowing the leased fiber for commercial use. Still, the potential to make better use of assets that are publicly owned or in the public right-of-way to meet demands for consumer internet warrants further study.

ARE-ON

The Arkansas Research and Education Optical Network (ARE-ON) provides a high-speed fiber optic backbone network throughout the state with 1Gb, 10Gb and 100Gb Ethernet connections to its members, affiliates, national research and education networks, regional optical networks and commercial service providers. The network consists of approximately 2,200 miles of long-haul fiber optic cable and about 85 miles of metro fiber in 24 cities in Arkansas and four neighboring states. ARE-ON's core router network consists of nine major nodes connected via 20Gb backbone links with full route diversity to all nodes. ARE-ON's extensive reach allows institutions to connect, collaborate, and innovate within the organization's core agendas: education, research, telemedicine, and emergency preparedness. In addition, the ARE-ON backbone provides optical transport between regions for the Arkansas e-Link Network, a network of over 450 healthcare institutions statewide.

In the past, plans have been discussed to leverage the ARE-ON Network to serve as a fiber backbone by which, with the help of local telecommunications companies, K-12 schools could be connected to the internet. This was disallowed by Act 1050 of 2011, and in any case the service would now be superfluous. The ARE-ON Network does not own most of the fiber that connects higher education institutions, but instead leases fiber from telecommunications companies for long inter-city connections.

E-Link

Arkansas e-Link is the statewide telemedicine network that securely connects broadband and increases bandwidth at over 450 healthcare, higher education, public safety, and research agencies across Arkansas, thus enabling each entity to transmit and receive real-time care and education. Arkansas e-Link represents the $102 million expansion of two existing networks: Arkansas Telehealth Network (ATN) managed by the Arkansas Telehealth Oversight and Management group (ATOM) and the Arkansas Research and Education Optical Network (ARE-ON). Aligning partners from across Arkansas, this project improves broadband resources within all of Arkansas's 75 counties.

As part of the ARE-ON Network, E-Link is bound by the same rules as ARE-ON and is legally barred from providing, on its own or in partnership with private companies, retail consumer internet. Even doctors do not get access to the
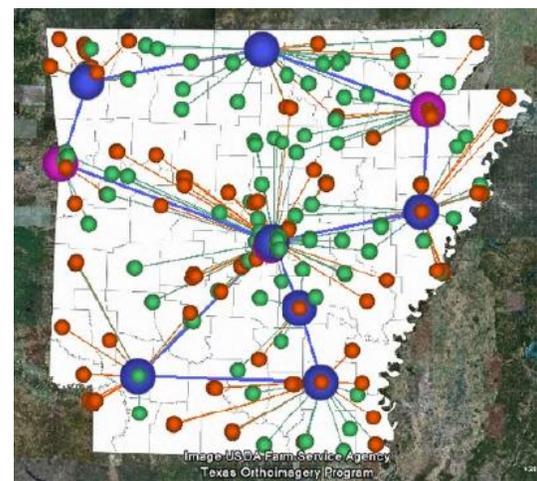
general internet through E-Link, but only to special telehealth networks used for functions like remote consultations.

Arkansas Department of Transportation

Some fiber cable assets are located in the public right-of-way that is managed by the Arkansas Department of Transportation, and agreements with communications companies give ArDOT certain rights of use in these fiber assets.

Arkansas State Network

The Arkansas state network is a private network dedicated for the exclusive use of state agencies boards and commissions within state government. The Arkansas Department of Information Systems (DIS) is legislatively mandated with the powers and duties necessary for implementing and managing the network and is responsible for "conceptualizing, designing, developing, building, and maintaining common information technology infrastructure elements used by state agencies and governmental entities" (Arkansas Code 25-4-105). Over 2,100 governmental sites, including K-12 public schools, are connected to the internet and to the state data infrastructure by the Arkansas statewide network.

The state network is undergoing an upgrade to provide broadband Ethernet services to the state agencies, boards and commissions it serves. This initiative, led by DIS, will enable some agencies with offices in other areas of the state to migrate from T-1 technology to broadband. Agencies with county offices dispersed throughout the state will have the ability to significantly increase bandwidth to the offices with no increase in cost. This initiative will enable DIS to withdraw from the previous network backbone and share a single backbone with the high-speed broadband K-12 network.
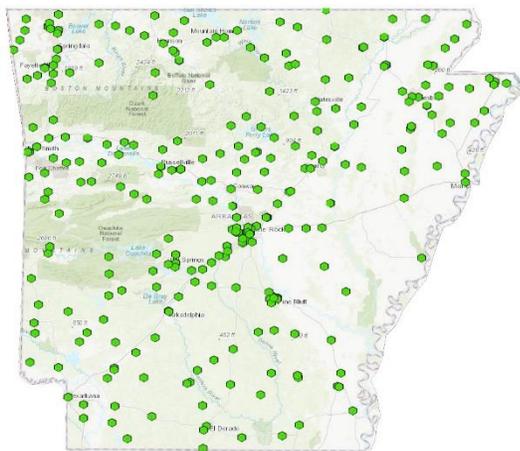
Arkansas Public School Computer Network (APSCN)

APSCN, the private network serving the state's K-12 school system, underwent an upgrade to a high-speed broadband network delivered over fiber between 2015-2017. As a result of the upgrade, the network delivered internet speeds 40 times faster than the previous network. The network delivers a minimum speed of 200 kbps per user. This was double the federal recommendation of 100 kbps per user. Due to its design, APSCN is capable of providing 1 Mbps/user of broadband connectivity.

Arkansas Public Safety Broadband Network (FirstNet)

The First Responder Network Authority (FirstNet) was created by the Middle Class Tax Relief and Job Creation Act of 2012 as an independent authority within National Telecommunications and Information Administration (NTIA), to provide emergency responders with the first high-speed, nationwide network dedicated to public safety. FirstNet is technically a federal asset; however, it plays an important role for

Arkansas emergency responders. FirstNet will develop and operate the new public safety broadband network, which is to be based on single, nationwide network architecture, enabling first responders and public safety officials to communicate within and across jurisdictions. In 2017, Arkansas Governor Asa Hutchinson announced his decision to make Arkansas one of the first states in the country to "opt in" to FirstNet.

Arkansas Wireless Information Network (AWIN)

The Arkansas Wireless Information Network (AWIN) is a statewide, multiple site, digital 700/800 MHz trunked communications system. AWIN provides statewide operations, within the coverage area of the system, for public service entities using P-25 digital 700/800 MHz radios.

AWIN serves the state of Arkansas by providing a reliable, statewide means of communication for the state's first responders. The AWIN system consists of over 100 tower sites scattered throughout the state. Every county in the state has access to the system through their county emergency managers, but most counties have several other authorized users such as the county sheriff or local police departments.

VII. BROADBAND AND EDUCATION

A. Arkansas is a Leader in Deploying Broadband in K-12 Schools

Arkansas has gone from being at the bottom of the nation in K-12 internet connectivity to the top as a national role model. This snapshot of K-12 connectivity by EducationSuperHighway shows the great strides that have been since 2015. An important statistic not reflected in the snapshot is that, at 200 kbps/user, Arkansas doubled the FCC's minimum recommended connectivity of 100 kbps/per user.

Arkansas

To experience the benefits of digital learning, students need access to sufficient bandwidth, scalable broadband infrastructure, and robust Wi-Fi.

BANDWIDTH

Since 2015, an additional

115,425 students can access the Internet at speeds of 100 kbps/student.

Arkansas already did its part in connecting

100% of its students.

School districts at 100 kbps/student

2015	2016	2017	2018
79%	95%	100%	100%

Arkansas Initiative

State leaders upgraded the Arkansas Public School Computer network to provide connections capable of delivering 1 Mbps per student to 98% of school districts in the state.

In three years, median bandwidth speeds have increased by

11.2x

across Arkansas - from 144 kbps to 1.6 Mbps.

How faster bandwidth makes a difference:

2015 144 kbps — 2018 1.6 Mbps

100 kbps/student technology is available to be used for teaching and learning in classrooms

500 kbps/student technology is regularly used for teaching and learning in classrooms

1 Mbps/student technology is prevalent and fully integrated into teaching and learning throughout the school
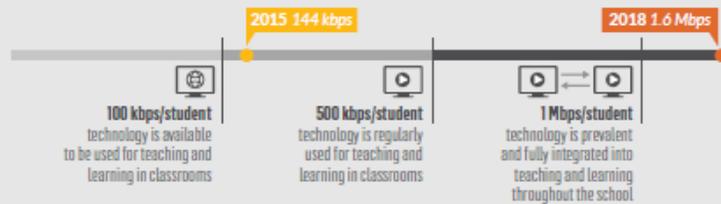
FIBER

729 schools have fiber[1] infrastructure

3 schools still need scalable broadband

Of the 3 **100%** Rural districts
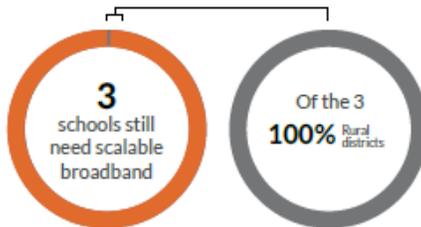
● School districts in need of scalable broadband

AFFORDABILITY & WI-FI

Since 2015, the cost of broadband in Arkansas has decreased by 86%.

This compares to a 72% decrease nationally.

Median cost per Mbps

2015	2016	2017	2018
$14.00	$6.42	$2.22	$1.89

Schools in Arkansas have utilized

$30 M

in federal Wi-Fi funding, but $25 M remains unused.

$8.3 M

must be accessed by 55 school districts as these funds are set to expire this year.

Although Arkansas students are now well-connected in school, too many of them lack broadband access at home. This can limit their ability to do homework when homework assignments involve online research. Students in digitally unconnected homes may also miss out on other learning opportunities that might have supplemented their educations.

B. Arkansas's Coding Initiative is Preparing Young Arkansans for Life in the Digital Age

Coding is an increasingly valuable job skill, and programmers are in high demand. Yet schools nationwide have lagged in incorporating computer coding into school curricula. Fortunately, Arkansas is a national leader in K-12 computer science education.

Arkansas was the first state to pass comprehensive legislation requiring every high-school in Arkansas to offer high-quality Computer Science (CS). ADE with the assistance of the Arkansas CS Task Force developed and adopted a comprehensive strategic plan for CS that continues to be updated and serves as a model for other states implementing CS initiatives.

Enrollment Growth

Schools have increased student enrollment from approximately 1,000 students taking high-school CS in 2014/15 to over 8,000 enrolled in 2018/19. Approximately 1,100 Arkansas high-school students are taking more than one CS course in 2018/19.

Curriculum Development

Arkansas was the first state to meet all nine of Code.org policy suggestions for CS Education. It was the only state to meet all 10 policy recommendations in the BNY Mellon State of the States CS Report. Arkansas established a national model for the CS flex credit, which allows CS to count in place for math and science. Its High School CS Standards and Courses were written with state and national tech industry representatives and input and co-adopted by both the Arkansas Department of Education (ADE) and Arkansas Department of Career Education (ARCareerEd). Arkansas is the first state to write and mandate grade specific computer science standards for all K-8 students.

Funding

State funding of $15 million has been allocated to the CSforAR Initiative with the majority of funds going to developing new CS teachers. Approximately $4 million in outside financial support has been provided to Arkansas to support the #CSforAR / #ARKidsCanCode initiative. ARCareerEd has awarded approximately $1 million in state and federal funding to schools to expand high quality career related CS pathways including robotics, mobile application development, and cyber security academies

It is ironic that even as Arkansas is a national leader in computer science education, it is near or at the bottom of the list for digital connectivity. Poor digital connectivity threatens to weaken the impact of the Computer Science Initiative, since internet access is crucial for giving young programmers to develop and use their skills.

C. Opportunities in Online Education

Since 2007, and especially since the breakthrough year of 2012, there has been an explosion of low priced or free high-quality education resources, often referred to as Massive Open Online Courses or MOOCs. Coursera, edX, and Udacity, all founded in 2012, made that year a landmark because all were founded by Ivy League professors and produced courses in partnership with top universities. The vision of free education attracted massive venture capital investment, in spite of a lack of clarity about monetization. Since then, tens of millions of users have been served. Some business models have become less generous over time. The for-profit Coursera, for example, which originally offered all content for free, now offers

mostly paid content, albeit at far lower prices than the college tuition at most brick-and-mortar universities, even those subsidized by tax dollars. Table 5 shows some of the major MOOC platforms.

Table 5: Major MOOC platforms

Platform	Subscribers	Courses Offered	Services
Coursera	30 million	2700+	Online degrees, certificates, business programs, and government/organization programs where you must pay for a certificate.
edX	14 million	1800+	Online degrees, certificates, and professional education where open source is free but not certificates/degrees.
Udacity	8 million	150+	Focuses on Nanodegrees, and has partnerships with industry leaders. The degree cost money per course or a monthly subscription.
Udemy	24 million	80,000+	For-profit platform with main focus being on professional development or personal enrichment where you pay on a per course basis.
Khan Academy	48 million	10,000+ (videos not courses)	Online learning platform with videos, written material, and practice problems. It does not offer certification because all content is free.

Source: Research by Dr. Aaron Johnson, sponsored by the ADFA Economic Policy Division

While MOOCs have reached wide audiences, they don't seem to be transforming education and career paths as was plausibly hoped not long ago. Unlike in many other industries, from bookstores to newspapers to music to advertising, that have been dramatically "disrupted" by online alternatives, in education historically dominant players like the Ivy League universities have remained on top, and the traditionally accredited academic institutions do not seem to have lost much market share to new online alternatives. In part, this probably reflects a lack of recognition by employers of the new kinds of credentials being created by MOOC providers. Surveys suggest that MOOCs are usually used by a set of established professionals that has little overlap with the younger and less professionally established class of people from whom traditional college students are drawn. They are plagued by low retention rates.

Still, for all their limitations, MOOCs are an important educational resource, which can enable people to try out potential fields for further study or pick up specific job skills without incurring debt. They are especially useful to place-bound people who cannot move for education. But to be used, they tend to require good internet connections, since most of the content is in video format.

D. Educating the Public

While broadband *access* means that one or more providers *offer* plans at one's place of residence, broadband *adoption* means that one actually chooses to subscribe. Internet subscription rates for DSL, cable, fiber optic, mobile broadband, satellite, and other services are a typical measure of broadband

adoption. The Federal Communications Commission (FCC) uses Form 477 subscribership data from service providers to measure adoption of 10 Mbps/3 Mbps, 25 Mbps/3 Mbps, and 50 Mbps/3 Mbps fixed terrestrial services. According to the FCC's 2018 Broadband Deployment Report, adoption rates in Arkansas are 44.9 percent for fixed 10 Mbps/3 Mbps, 29.3 percent for 25 Mbps/3 Mbps, and 26.9 percent for 50 Mbps/3 Mbps. According to the Census Bureau's American Community Survey (ACS) Report, *Computer and Internet Use in the United States: 2016*, which relies on data collected from a sample of residents, Arkansas and Mississippi rank at the bottom with 70.9 percent of households having broadband internet subscriptions.[17] For Arkansas, this number is up from 64.2 percent in 2015, which suggests that Arkansas is making progress.

Nationwide, there remains a significant digital divide across segments of the population with different economic, educational, and social characteristics. National ACS data indicates that 48 percent of households have "high connectivity" defined as having a laptop or desktop computer, a smartphone, a tablet, and a broadband Internet connection. However, that same data shows wide disparities in which households are likely to have high connectivity. For example, 80 percent of households with an income of $150,000 or more have high connectivity compared to 21 percent with an income under $25,000. Age of the head of the household also matters. In households with a head who is 35 to 44 years old, 62 percent are considered highly connected. This is significantly higher than those where the householder is 65 years of age and older where only 28 percent are highly connected. Asians are the most likely to be highly connected, while non-Hispanic Blacks were the least likely to be highly connected.

A 2018 study analyzing 15 years of survey data by the Pew Research Center had similar findings.[18] It found that while older adults lag younger adults in adoption, a majority of senior citizens now use the internet. Residents in rural areas are less likely to use the internet than those in suburban and urban areas. College educated adults are more likely to use the internet than those with only a high school diploma. Individuals in households with earnings of $75,000 or more have higher usage rates than those with incomes less than $30,000. African Americans and Hispanics are less likely to be internet users than Whites, Asian, and other English-speaking Americans. However, gaps related to income, educational attainment, race, and ethnicity are narrowing.

The implications of these disparities when considering Arkansas's demographics suggest a digital divide that is hindering quality of life and economic vitality in many parts and populations across the state. The University of Arkansas System Division of Agriculture's Rural Profile of Arkansas 2019 examines social and economic data from a variety of data sources with emphasis on differences in data and trends across the state's rural and urban regions.[19] Average median household income in rural regions in 2016 was approximately $36,000, which was 78 percent of that in urban regions of the state and 65 percent of the U.S. median. In 2016, only 6.4 percent of Arkansans age 25 or older had an associate's degree and 21.5 percent had a bachelor's degree, both below national averages. Slightly more than 19 percent of residents in rural counties are age 65 and older compared to 15 percent in urban areas. The growth rate in this population between 2010 and 2017 was 2.5 percent compared to only 1.9 percent in urban regions. Racially, the nonwhite population in Arkansas grew 8.2 percent compared to 1.5 percent growth in the non-white population. The racial profile of Arkansas based on 2018 estimates show 79.3 percent white,

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[17] https://www.census.gov/library/publications/2018/acs/acs-39.html
[18] www.pewinternet.org/2015/06/26/americans-internet-access-2000-2015
[19] www.uaex.edu/publications/pdf/MP551.pdf

15.7 percent African American, 2 percent two or more races, 1.6 percent Asian, and one percent or less for all other races.[20] Just under 8 percent of the population identifies as Hispanic or Latino.

Purdue University's Center for Regional Development has developed a Digital Divide Index (DDI) using Census tract level data.[21] The DDI ranges in value from 0 to 100; the higher the value the greater digital divide. The index reflects two composite scores, one focused on infrastructure/adoption and the other socioeconomic factors. Infrastructure/adoption variables include:

- Percentage of total 2010 population without access to fixed broadband of at least 25 Mbps download and 3 Mbps upload,
- Number of residential broadband connections with at least 10 Mbps download and 1 Mbps upload,
- Average maximum advertised download speeds, and
- Average maximum advertised upload speeds.

Socioeconomic variables impacting technology adoption include:

- Percent population ages 65 and over,
- Percent population 25 and over with less than high school,
- Individual poverty rate, and
- Percent of noninstitutionalized civilian population with a disability.

Figure 18 shows DDI values for Arkansas. The majority of the state falls into a DDI range of 20-40 or 40-60. Small pockets of the state, primarily in urban areas have digital divide values less than 20. Due to data limitations, the DDI should only be used as a tool to help spark discussion regarding issues and strategies related to broadband access, adoption, and digital inclusion necessary to be successful in the 21st century economy.

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[20] www.census.gov/quickfacts
[21] www.pcrd.purdue.edu/signature-programs/digital-divide-index.php

Figure 18: 2017 Digital Divide Index Map of Arkansas
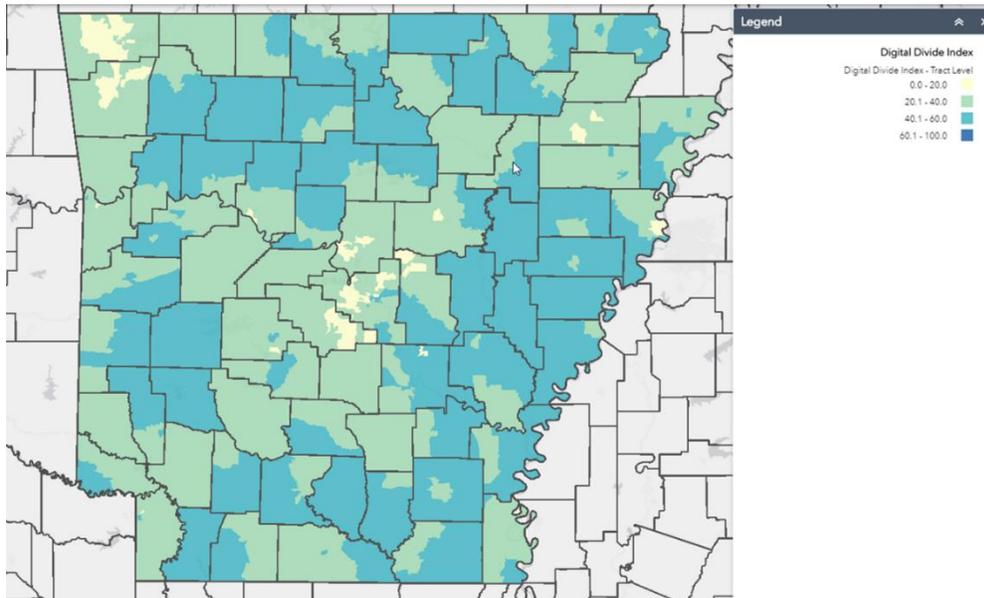
Source: Purdue University

The DDI values across Arkansas and the analysis of Arkansas's demographic data within the context of national research regarding segments of the population most likely to be negatively affected by the digital divide suggest the need for targeted research, outreach, and education in these populations to better understand barriers to broadband adoption affecting Arkansas and to develop effective strategies for helping them get connected.

Pew Research Center studies over the last several years have identified a number of factors that appear to impact broadband adoption. [22] A 2015 survey found 43 percent of respondents without broadband service at home cited cost of a computer, smart device and/or broadband subscription as the primary reason. A 2013 study found the 34 percent of non-users have no interest or don't think the internet is relevant. A 2015 study found that a lack of confidence in using technology, lack of knowledge, and health or physical limitations are frequently cited barriers by older adults. Research by the Benton Foundation exploring barriers to broadband subscription among low-income populations found cost, digital literacy, confidence, and poor understanding of potential uses of the internet as major concerns.[23]

Because barriers to broadband adoption and use vary by segments of the population, addressing the digital divide requires more than simply expansion of access. It requires a concerted effort to demonstrate how the internet can positively impact the life of Arkansans who aren't using it, as well as training and education on how to use the internet effectively for various aspects of everyday life and social and economic well-being. Arkansas has taken important steps to address this need, such as coding and other

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[22] www.pewresearch.org/fact-tank/2018/09/28/internet-social-media-use-and-device-ownership-in-u-s-have-plateaued-after-years-of-growth
[23] www.benton.org/blog/complexity-relevance-barrier-broadband-adoption

digital literacy education at K-12 levels and job readiness and career education programs. However, there is more that can be done.

Strategies to reach digital-vulnerable populations in Arkansas will require engaging public and private entities at the state and local levels. To guide local efforts, the National Telecommunications and Information Administration's (NTIA) BroadbandUSA has developed a Community Connectivity Framework to promote broadband connectivity and tech-savvy communities. [24] It outlines a series of planning steps centered around access, adoption, and community. With respect to adoption, it encourages communities to consider four elements when determining appropriate outreach strategies.

- Adoption and use: Who is using the Internet? Are there digital divides?
- Digital Inclusion: What proactive measures are you taking to ensure digital equity?
- Digital Skills: Do existing programs provide a ladder for residents to gain digital proficiencies - from basics to coding?
- Device Ownership: Do people have access to the devices they need to learn, create, and participate?

Local governments, libraries, community colleges, the Cooperative Extension Service, and other entities that provide high-touch outreach and education at the local level are natural partners in this process.

VIII. BROADBAND AND AGRICULTURE

Agriculture is an important industry in Arkansas, especially in rural areas of the state, and like other industries, it needs to embrace technological change to remain competitive. A great deal of cutting-edge technology has become available to the agricultural industry in the past several years, and Arkansas producers are eager to take full advantage of it. Data acquisition and access is the future of farming. Precision agriculture systems allow producers to analyze data and make decisions in real time about almost every aspect of producing a crop, from land preparation to planting to harvest. Moisture sensors provide producers a way to achieve optimum yield while minimizing water usage. Electronic monitoring systems for livestock, stored commodities, pest management, feed systems, and feral hog control offer more efficient management.

Real time information and access to databases will provide a mechanism for agriculture to be more efficient in all values of agriculture. Programs such as Google Earth have revolutionized farm planning but using this platform as a base raster for real time information and analysis will customize applications at the field level. The poultry, swine and dairy industries are being revolutionized by monitoring environmental data with the opportunity to remotely adjust settings. This somewhat frees the producer from having to be present 24/7 at the installation and able to be more involved with family and community. Irrigation sensors and weather stations can monitor weather conditions that will influence decision-making resulting in more farm revenue and helping preserve social values such as clean water and air. Stubble burning decisions need to have real-time weather information. Soil moisture meters that transmit to the producer's cell phone is now a common practice to effectively irrigate crops. A 20% savings in energy and water is often achieved by irrigated when needed and not by schedule. Animals with RFID tags can be identified by drones or stationary sensors and health and activity monitored with

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[24] https://www2.ntia.doc.gov/files/bbusa_assessment_factsheet_6_21_17.pdf

additional sensors. Feed bunks equipped with sensors can determine the feed intake of individual animals and identify stressed individuals.

Online access for government programs, record keeping, and data analysis platforms is often a requirement to participate and offers efficiency to all parties involved. Millennials do not attend meetings but desire educational programs that are at their convenience. TED Talks and podcasts are common means for information to be conveyed. Educational agencies such as the Cooperative Extension Service are conducting educational programs and creating tools that are delivered by digital media and technology. As the farming population ages, it is essential that these new audiences are reached. Activities such as 4-H and FFA have changed to include more delivery by digital media and in the near future virtual clubs will be commonplace. These cutting-edge technologies and others will ensure that the industry continues to thrive and excel in today's information age.

Arkansas producers have embraced these new systems and tools where possible but access to high speed and reliable broadband is necessary for them to be used effectively and to their full potential. Access to broadband for these technologies will need to be at the field level, not just at farm shops and homes. Raising awareness and providing education on the effective use of broadband-enabled technologies to all sectors of the agricultural industry and residents of rural communities will be a significant need. Arkansas has a strong partnership among agricultural support organizations that can be activated to help educate and build awareness.

IX. BROADBAND AND HEALTH

Forty-one percent (41%) of Arkansans live in rural areas compared to the overall U.S. rate of 14% (U of A, 2019). Furthermore, 73 of the state's total 75 counties are designated as either full or partial medically underserved areas (HRSA) and roughly half of Arkansas' counties are located in the Mississippi Delta, one of the most health disparate areas in the nation (Delta Regional Authority). As of 2018, Arkansas ranked fifth worst in the nation for health disparities (United Health Foundation), and the state recently ranked 4th worst for heart disease, 11th for diabetes, 7th for septicemia, and worst in the nation for teen pregnancy (National Center for Health Statistics). Though Arkansas experiences poor outcomes for many health statistics, some standings such as stroke mortality and infant mortality have improved in recent years thanks to special broadband-based health interventions.

The advent of broadband has opened new avenues for most aspects of life, including health care and overall economic development, especially in rural communities. Broadband has made modern healthcare solutions such as digital health possible, which includes mobile health, health information technology, wearable devices, telehealth, telemedicine, and personalized medicine (LexisNexis). In many cases, digital health helps improve patient outcomes (Wagenen, 2018). For over the past 15 years, Arkansas' patients have had access to a growing list of digital health innovations through our state's resources. So far, these innovations have been restricted mostly to professional settings, in which patients are traveling to their nearest health centers to receive the care of a distant medical specialist. As broadband innovations grow in the healthcare field, however, this is expected to change, with more emphasis on areas such as in-home healthcare through techniques such as remote patient monitoring. These interventions will take broadband the "last mile" into patients' homes.

Estimates show that growth in the global digital health market will rise at a compound annual growth rate of 13.4% between 2017 and 2025, reaching $536.6 billion by the end of 2025 (Quora, 2018). Importantly, to ensure optimum benefits and sustainability, adoption of these emerging digital health technologies require a high level of coordination and interoperability across healthcare sectors. Luckily, through the University of Arkansas for Medical Sciences' (UAMS) e-Link network, Arkansas already has experience with such coordination and interoperability and is well positioned to expand digital health technologies to new healthcare settings, such as in-home, through broadband and to additionally promote overall economic development through broadband.

Formally "Arkansas e-Link," UAMS e-Link is a dedicated healthcare broadband network comprised of spoke and hub sites that run over the Arkansas Research Education Optic Network (AREON) fiber backbone. This network connects over 400 healthcare, research, and education facilities in Arkansas to telemedicine and distance education. UAMS e-Link saturates the state with connectivity, with sites in all of the state's 75 counties. Established in 2010 through National Telecommunications and Information Administration grant funding and Federal Communications Commission Rural Health Care Program reimbursement support, UAMS e-Link positions Arkansas as having one of the largest telehealth networks in the nation.

The UAMS **Institute for Digital Health and Innovation (IDHI)** organizes, manages, and sustains the network by ensuring each eligible site has access to secure, FCC-discounted broadband connectivity; telemedicine technical planning and training; telemedicine equipment; and 24/7 telemedicine technical support. Further, by acting as the network's consortium leader on the FCC Healthcare Connect Fund, UAMS is generating over $4 million in cost savings for its statewide members, the vast majority of which serve rural, medically underserved areas without the means to afford the cost of rural broadband. In 2017, e-Link saw many impressive outcomes (Figure 19).

Figure 19: UAMS e-Link Outcomes

2017	Total
Arkansas e-Link	**Total**
Total Calls	213,569.00
Total Minutes	9,716,446.48
Unique Participants	35,847.00
Audio Minutes	51,773.69
Video Minutes	9,664,670.81
Total Hours	161,940.77

UAMS and Baptist Health Hospital each utilize e-Link for their telemedicine programs. Baptist Health, like UAMS and other hospital systems in Arkansas, was an early telemedicine adopter (Arkansas Hospitals, 2017). It is known as the home of the eICU, which provides instant access to critical care staff for the sickest patients. Baptist has recently expanded its telemedicine reach to population health, increasing access to health care for all Arkansans and providing that care to all Arkansas communities, both urban and rural. According to the Associate Vice President for Patient Services, it is Baptist's goal "to increase health care access in tandem with other hospital systems, physicians, a variety of providers…working across corporate lines to make patients the center of Arkansas health care."

UAMS helped lead the state in telemedicine adoption in 2003 with the creation of the Antenatal and Neonatal Guidelines, Education and Learning System (ANGELS), a high-risk obstetrical telemedicine program administered by UAMS in partnership with Arkansas Medicaid. This program helps Medicaid extend specialty care through interactive video consultation to the hometowns of their rural beneficiaries experiencing high-risk pregnancies. The IDHI manages ANGELS and myriad medical consultation programs that leverage real-time technologies to connect UAMS specialists to patients, hospitals, and clinics in rural locations throughout Arkansas where no such expertise exists. The IDHI has brought over 20 telemedicine and 10 distance education programs to rural providers and patients in Arkansas.

Arkansas Children's Hospital has been actively building its own telemedicine network. Between 2015 and 2016, Arkansas Children's Hospital invested approximately $500,000 on infrastructure to deliver telemedicine (Talk Business, 2016). Children's then piloted their pediatric telemedicine program in schools.

The Arkansas Department of Health (ADH) exemplifies how rural healthcare locations can bring enhanced specialty healthcare services to Arkansas' communities. The health department is currently working with ANGELS at multiple locations around the state to provide telemedicine care to high-risk obstetrical patients and also performs tele-colposcopies at several locations, each supported by broadband technologies through UAMS e-Link. Additionally, ADH participates in multiple distance continuing education opportunities and utilizes telemedicine for emergency preparedness exercises. Each county health department is an e-Link site, helping to improve patient outcomes through broadband in healthcare. The department is a model for how broadband can help bring needed health services to rural areas.

Some of the many telemedicine programs supported through the state's existing telemedicine networks are outlined below in Table 6:

Table 6: Sample of Arkansas's Telemedicine Programs

Managing Hospital	Program Name	Description
Baptist	eSepsis	Rapidly identifies severe sepsis and septic shock through continuous surveillance in emergency departments for early intervention, best-practice adherence, and improved outcomes.
Baptist	ePsych	Provides emergency department, inpatient, and outpatient clinic consults by mental-health providers.
Baptist	eLactation	Helps new mothers overcome the barriers to successful breastfeeding by providing assistance with positioning and technique, recognizing the signs of effective feeding, assistance with breast-pump setup, and answers to common breastfeeding questions.
UAMS IDHI	Antenatal and Neonatal Guidelines, Education and Learning System (ANGELS)	Offers clinical high-risk obstetrical telemedicine consultations, targeted ultrasounds, fetal non-stress tests, fetal echocardiography, 24/7 Call Center to support patients/providers, telehealth scheduling/follow-up, and evidence-based guidelines.

UAMS IDHI	Arkansas Stroke Assistance through Virtual Emergency Support (AR SAVES)	Delivers telemedicine-based vascular neurology consultation in emergency departments across Arkansas by connecting potential stroke patients with specialists who offer evaluation and treatment.
UAMS IDHI	Trauma Image Repository (TIR)	Provides image repository services to Arkansas trauma hospitals for trauma patients who are transferred to expedite treatment, reduce radiation exposure of duplicate imaging, reduce costs, and improve outcomes.
Children's	Pediatric Telehealth	Brings pediatric subspecialty health care and consultation closer to home for families across the state of Arkansas, including clinic visits and follow-up medical care. Programs include those for asthma, cardiology, and speech pathology.

Arkansas' telemedicine programs have led to improvements such as decreased neonatal mortality, improved maternal birth outcomes, decreased stroke morbidity and mortality rates, and improved BMI among school-aged children. The following are 2017 UAMS program outcomes, unless otherwise noted:
- ✓ High-risk Obstetrics (2,750 telemedicine consults)
- ✓ High-risk Obstetrical Call Center (managed 130,507 calls in the call center and 38,364 calls in the appointment center, 500+ maternal transport requests)
- ✓ Evidence-based Guidelines (107 obstetrical and 67 neonatal guidelines total as of March 2019)
- ✓ Physician Call Center (44,390 calls)
- ✓ Emergency Stroke (925 telemedicine consults, 304 tPA administration, and 1,639 community events)
- ✓ HIV (136 telemedicine consults)
- ✓ Retinal Screening (77 newborn telemedicine exams)
- ✓ Colposcopy (1,063 telemedicine consults and 94 high-grade biopsies in 2016)
- ✓ Trauma Imaging (4,575,025 images transmitted)
- ✓ Hand Trauma (713 telemedicine consults)
- ✓ Hospitalized Infant Camera (1,000+ families, 2,600+ individual users served since 2011)
- ✓ Language Interpretation (10,131 telemedicine encounters for interpretation assistance)
- ✓ Online education (Nearly 600 modules added to Learn On Demand)

Future Digital Health Applications

As digital health grows in Arkansas, it will begin to focus on broader applications such as in-home healthcare and on-the-job healthcare through techniques such as remote patient monitoring, real-time video consultations, and use of big data. Broadband provides ways to bring healthcare as close to the patient as possible—not only in their doctor's offices and local hospitals but through personal broadband-enabled devices. Though some Arkansas hospitals already use devices such as iPads and smart phones for consults and even remote monitoring—such as Baptist Health's Diabetes Remote Monitoring Program—generally, this form of digital health is the exception and not the rule for the state.

Broadband-enabled technologies have the significant potential to address chronic disease, recurring hospitalizations, and high-risk patients that take a toll on the healthcare system. Remote patient monitoring (RPM) allows real-time patient monitoring through handheld or wearable devices and smart phone apps without the patient having to visit a healthcare facility and has decreased unnecessary hospital

visits by as much as 25 percent (Health IT Outcomes, 2018; Lowery). RPM saves money and travel time for patients who would otherwise have to travel for care, even if the care was through telemedicine at a local clinic. An important benefit is that it improves quality of life, especially for chronically ill patients, allowing families to spend more time together at home instead of in the hospital. RPM is a promising avenue for future, and even present, digital healthcare and has seen some successes, especially for glycemic control in the diabetic community and monitoring hypertensive disorders in pregnancy (Su, 2018; Lowery).

Much like remote patient monitoring, live, two-way video consults on personal mobile devices allow patients to receive healthcare outside of clinical settings, many times in their homes. These consults also have similar benefits to RPM, saving people time and money. It is an effective way for patients to receive healthcare, including for follow up appointments that typically require clinic visits. Even the model for obstetrical telehealth now includes home-based support, with patients sometimes directing and recording fetal heart rate at home when given the proper tools and training (Magann, 2011). A blend of in-person, remote patient monitoring, and virtual consults are even allowing some hospitals to initiate "hospitalization at home" programs that keep low-risk patients at home during their hospitalization as a comprehensive substitute for acute hospital care. This method, currently explored by UAMS, has shown promise to reduce hospital readmissions, increase cost savings, decrease average length of stay, decrease diagnostic tests, and improve clinical outcomes (Summerfelt, 2015; Hospital at Home).

Digital health transcends the use of technology and includes advanced computing science, such as big data (What You Need, 2019). Big data—basically, extremely large data sets—is gleaned from techniques such as remote patient monitoring and then analyzed to improve patient health and even predict certain health conditions (Tech's Next, 2019). For instance, continuous glucose monitors store patient data and then analyze it to help diabetics predict blood sugar patterns and how certain foods and insulin schedules affect those levels. Healthcare data collection, or the "new gold rush" as some are calling it, is projected to have a compound annual growth rate of 36 percent through 2025, growing faster than in manufacturing, financial services, or media (Kent, 2018).

Arkansas has a rich history of digital health innovation, especially through telemedicine, and is poised to expand digital healthcare technologies through UAMS e-Link, the state's dedicated healthcare broadband network, and other existing healthcare broadband networks in the state. With this expansion, healthcare outcomes will continue to improve for Arkansans, especially for those living in rural areas where help is needed the most.

See Appendix A for more information about broadband and health in Arkansas.

X. BROADBAND MAPPING

Due to a variety of economic, legal, political, and privacy factors, broadband distribution and adoption is generally reported at the granularity of Census blocks. Broadband maps in this report are mostly based on the FCC's Form 477 data. This data is collected from providers twice a year. It has the important advantage of being *highly granular*: data is reported at the Census block level. Other data sources, such as the New America Foundation's Open Technology Institute and the Census Bureau, fall well short of this level of granularity. Nonetheless, the Form 477 data has important limitations, such as the following:

- The FCC only asks providers to report the *maximum* advertised speed that they offer to consumers in a given Census block. If a provider offers a certain speed to only *some* of the households in a given Census block, they are supposed to report the highest speed they offer. Thus, to cite one instance which the ADFA Economic Policy Division team heard about, a provider who had built fiber to a Census block but had only reached a single residence was obliged to tell the FCC that that area was served by gigabit speeds, though this is misleading. The fact that FCC Form 477 data shows maximum advertised speeds causes broadband maps based on this data source to systematically overstate the availability of high-speed internet.
- Providers may not have a strong incentive to report accurately to the FCC. When comparing years, the ADFA Economic Policy Division team sometimes observed unaccountable fluctuations in reported bandwidths, which seemed more likely to reflect inconsistent reporting than actual changes in service tiers.
- If Form 477 data is used for policymaking purposes, it may create incentives for providers to misreport actually available speeds. They might, for example, err in the direction of reporting higher speeds to fend off potential subsidized competitors, or lower speeds, to qualify for subsidies for themselves.
- Form 477 data provides no information about adoption, and therefore fails to provide a market test of the quality of service to supplement mere engineering measures. It would be useful to know, for example, whether satellite internet service, where available, attracts substantial or negligible numbers of customers. Subscribership data is available from the FCC on a confidential basis for state public service commissions.
- Form 477 data does not show other measures of internet connection quality, such as latency, packet loss, or reliability.

While it would be useful to have other data to supplement the Form 477 data, it is difficult to collect it. Market research firms offer phone and mail surveys, as well as (non-representative) online panels, sometimes at affordable prices, but they cannot achieve the level of granularity that Form 477 data offers. Municipalities, electric coops, and other agencies with local influence, may be in the best position to get good data on actual broadband coverage, since they may have contact information for larger percentages of the local population than can be otherwise acquired, as well as an ability to motivate respondents by appealing to their sympathies and self-interest. But they are likely to need a special motive for such efforts, such as to establish eligibility for funding under various federal programs.

Limitations on the quality of information available about broadband access should be borne in mind as a constraint on what policies can be implemented. Methods of targeting funds on the basis of need that make sense in the abstract may prove impossible to implement because of data quality limitations.

The MF-II challenge process, described in Section II, is a good instance of how data collection might prove to be part of the way that federal programs can be better utilized.

If address-specific subscriber data within the blocks, exclusive of any personally identifiable information (PII), could be made available for analysis, the accuracy of broadband maps could be improved. With only a physical address, the data would be anonymized as much as many other governmental or pseudo-governmental datasets. Lacking the aforementioned and redacted PII, the data could become more geospatially accurate while not revealing subscriber identity.

A New Broadband Mapping Initiative

Acknowledging the long-standing weaknesses in available data about the geographic distribution of broadband access, the industry association USTelecom, in partnership with the FCC, is currently

pioneering a new initiative that is hoped to improve broadband data accuracy. The USTelecom Pilot has formed a coalition of companies to create a proof of concept in two states, Virginia and Missouri. Coalition members currently include price cap companies, rural telephone companies, and fixed wireless internet providers. The coalition is open to broadband providers operating in the pilot states.

The pilot project intends to use multiple sources of address, building, and parcel data to develop and validate a comprehensive database of all the Broadband Serviceable Locations in the two states. A vendor will conform address formats, remove duplicates, and using a geo-referencing tool assign a unique latitude and longitude to the actual building where broadband service is most likely to be installed. Customer address lists provided by participating companies will augment the validation process and will be automatically indexed to the final database to facilitate accurate broadband availability reporting. The pilot will also develop and test a mediated crowdsourcing platform that will enable consumers to submit information to improve the accuracy of the database.

The USTelecom coalition has hired CostQuest, the vendor responsible for the Connect America Fund model, to conduct the proof of concept pilot. The pilot will begin in February or March 2019 and will take four to six months to complete. Learnings and results will be shared in the record. It is hoped that the FCC will adopt the proposed methodology and assume responsibility for the project, after which a totally new broadband map could be available in just 12 to 18 months.

XI. ACCESS RIGHTS FOR BROADBAND DEPLOYMENT

Private property rights are a prominent and enduring feature of capitalism, necessarily supplemented by at least some commons or public rights-of-way for transit purposes. New technology often demands new refinements of property rights, and careful redefinition of how public rights-of-way and rights to use of the commons are understood and allocated. This section covers special issues with respect to property rights and access to public rights-of-way that arise because of the technical requirements of deploying broadband, namely: (a) access to utility poles, (b) access to towers and vertical assets, and (c) rights to contract to have telecommunications equipment installed on private property.

A. Utility Poles

In response to a survey conducted in preparation of the Arkansas State Broadband Manager's Report, which was released on December 31, 2018, several providers cited pole attachment fees as a barrier to deployment. Asked the reasons why there are unserved areas, 39% of respondents cited "access to poles or pole attachment fees." One provider offered the following comment on barriers to expansion:

> Rental rates for space on utility poles owned by many electric cooperatives are unjustifiably high. The terms and conditions for permission to contact those poles can be overly burdensome. This works to make broadband expansion projects unfeasible.

General comments on how policy could promote rural broadband deployment included the following:

> The federal government recognized… access to utility poles was necessary for the expansion of broadband services and established rules and regulations (including a fair pricing formula) for the poles owned by public utility companies, but the State's electric co-ops are exempt from that. The Arkansas P.S.C. should require the electric co-ops to give fair access to competitive broadband providers to the unused space on their poles, as well.

The state should ensure all broadband providers, including wireless companies, have streamlined access to rights-of-way, poles, ducts, and conduits… [It should adopt] the Federal communications Commission's "cable" rate to calculate compensation due to pole owners… [expand] pole attachment laws so they apply to all pole owners, including those owned by municipalities that operate electric power systems, and [the Public Service Commission should] adopt rules that encourage a less burdensome negotiations process.

Low priced pole attachment fees and rights of way would also assist with broadband deployment.

It should be noted that ISPs responding to a survey are not tested for their awareness of the state of the law regarding pole attachments, nor their actual readiness to accelerate deployments if laws were changed to facilitate access. Perceptions by ISPs that pole attachment policies are a barrier to deployment would not necessarily translate into an actual acceleration of deployment if their preferences were appeased.

The desire of broadband deployers for easy and cheap access to utility poles is understandable. It also seems likely that it would promote broadband deployment if access to utility poles were cheaper and easier. But it threatens the interests of pole owners, who have made large investments in utility pole networks and face ongoing costs to maintain them, to insure them, and to monitor their safety. The state faces a delicate task in balancing these interests.

Utility poles may be classified by ownership into publicly-owned poles, poles belonging to investor-owned companies, and poles owned by nonprofits, notably the many rural electric cooperatives that operate around the country and power many Arkansas households. Utility poles typically serve multiple purposes, of which the most important are electricity supply and communications. Some utility poles also prove street lighting. Utility poles are not useful individually. Rather, wires are strung *between* utility poles, with many poles generally being needed to carry wires between destinations of interest, such as a power station and a home.

Premises are generally served by only one series of utility poles carrying power and communications wires; more would be duplicative and competitively unsustainable. Utility pole owners therefore tend to be monopoly suppliers of services to connected households. As regulations protect homeowners and other real estate owners against price gouging by monopolistic utilities, so other regulations protect deployers of utility pole-dependent services from price gouging by monopolistic owners of utility pole networks.

In Arkansas, the regulator of pole attachments is the Public Service Commission, and price gouging is prevented by requiring pole owners to permit new attachments, preferably at a negotiated price, but if necessary at a formula price administered by the Commission. The Public Service Commission (PSC) encourages attachers and pole owners to negotiate and come to agreement on their own. If they cannot agree, the PSC will calculate what the attacher must pay to the pole owner in return for being allowed to add an attachment. Ideally, such fees should compensate the pole owner for the expense of maintaining and insuring the poles and provide an adequate return on the pole owner's investment, without unduly impeding deployment of valuable new network services such as broadband.

As technology evolves, different uses of utility poles rise and fall in importance. It has become less common for businesses to have burglar alarms that go right to the local precinct house. The wires that make the landline phone system work still occupy utility pole space, although usage is declining. Meanwhile, cable TV lines were added to the poles, and more recently, in some cases, fiber optic cables. Policymakers face the challenge of designing rules and protocols such that scarce utility pole space is used efficiently, and reallocated from less valued uses to more valued uses as technology evolves, avoiding bottlenecks and lags. Unfortunately, the process of negotiation has no natural equilibrium outcome in situations of "bilateral monopoly," such as when an ISP would be the only deployer of fiber

internet, while an electric company owns the only series of utility poles along which fiber internet can be deployed. In such situations, rational strategic behavior on the part of pole owners and deployers can have perverse effects on the dynamics of bargaining games, resulting in bottlenecks, gridlock, delays and waste. The PSC's formula price for pole attachments helps to prevent such pathological negotiating situations from arising.

The formula applied by the PSC in setting the maximum per pole rate is as follows:

$$Maximum\ Per\ Pole\ Rate = Space\ Factor\ \times Net\ Cost\ of\ a\ Bare\ Pole\ \times Carrying\ Charge\ Rate$$

Where:

(a) $Space\ Factor = \dfrac{Occupied\ Space + \left[\frac{2}{3} \times \left(\frac{Unusable\ Space}{No.of\ Attachers\ (including\ the\ Public\ Utility\ pole\ owner)}\right)\right]}{Pole\ Height}$

(b) $Net\ Cost\ of\ a\ Bare\ Pole = \dfrac{Net\ Pole\ Investment\ \times 95\%}{Total\ Number\ of\ Poles}$

(c) $Net\ Pole\ Investment = Gross\ Pole\ Investment - Accumulated\ Depreciation - Accumulated\ Deferred\ Income\ Taxes$

(d) $Carrying\ Charge\ Rate = Administrative + Maintenance + Depreciation + Taxes + Return$

Further formulas define the elements of the carrying charge rate.

This formula makes attachers pay more in areas where poles are being used more intensively; in places where the original investment in poles was more expensive or recent; and in places where poles are more expensive to maintain. It seeks to ensure adequate compensation for pole owners, with consideration for their original investment as well as ongoing maintenance and administrative costs, without giving them undue scope to profit from their monopoly position as pole owners.

Recently, the Federal Communications Commission (FCC) and the Broadband Deployment Advisory Committee (BDAC) organized under FCC auspices have both made statements in favor of "one-touch make ready" as a pole attachment policy. FCC rulings do not apply in Arkansas, because Arkansas has adopted its own rules and does not leave utility pole regulation to the FCC. Nonetheless, it is appropriate to take note of national trends in (perceived) best practice. However, Arkansas's pole attachment rules also embody sound principles of natural monopoly regulation to facilitate efficient adaptation to technological change. Moreover, the PSC and its rules enjoy the trust of pole owners.

Arkansas should continue to monitor the evolution of pole attachment policy nationwide, and compare the practical effects of its policies on pricing and delays to what happens in other states. If there is evidence that the process of pole attachment approval is inefficient and is causing undue delays and impeding deployment, it should consider emulating policies in other states. Data about the practical implementation of pole attachment policies should be rigorously created and maintained, and made available to parties wishing to advocate changes in pole attachment policy, so that if Arkansas's pole attachment policy is impeding broadband deployment by failing to conform to national best practice, it can be revisited and changed by the legislature.

At this time, however, an evidentiary basis for recommending changes in pole attachment policy is lacking.

B. Towers

Wireless technologies for broadband delivery typically need to attach to towers from which they can shoot a signal over a wide territory. Depending on the wavelength used, wireless signals may need a "line of sight" (an intervening space occupied by nothing but air) to the receiver, generally cannot penetrate hills, and may be impeded by "clutter" such as thick foliage or buildings. A transmitter on a tower or tall building can rise above clutter and reach a wide territory.

Policy can play an important role in facilitating access to towers, and other vertical assets such as tall buildings, by deployers of wireless communications such as cell phone companies and fixed wireless internet service providers.

Many towers are public or quasi-public, e.g., AWIN towers and water towers. Those managing them might benefit from guidance about the appropriateness and design of transactions authorizing ISPs to attach communications equipment to them, or it might be in the public interest to require them to offer access on transparent and non-discriminatory terms with due consideration for safety and cost recovery.

Other towers and vertical assets are privately controlled. In such cases, state policy should avoid interfering with the property rights of private owners, either to require or to prevent the use of such privately-held vertical assets from the being used for broadband deployment.

BDAC studied options for siting communications equipment on land and structures owned by the federal government.[25] Arkansas policymakers should consider seeking to influence federal authorities to harmonize application forms, standardize and publish fee schedules, expedite application review using "shot clock" approaches, and establish a presumption of renewal on leases and easements to encourage investment, among other measures to facilitate the use of federal assets for broadband deployment. It might be advisable for the State Broadband Office to cultivate connections with Arkansas's congressional delegation and federal agencies in order to help expedite applications by Arkansas ISPs wishing to use federal assets for broadband deployment.

Efforts have been conducted in other states, such as Minnesota and North Carolina, to develop inventories of "vertical assets" that might be used for deployment of wireless broadband. The inclusion of a vertical asset in an inventory need not signify that it is actually available for installation of wireless communication equipment, but only that it exists. Rights to access such assets would remain to be established, e.g., by private contract with their owners. By discovering and publishing what assets are available, however, the state could play a "market making" role, facilitating the deployment of broadband through mutually beneficial agreements between tower owners and ISPs.

Over-the-Air Reception Devices (OTARD)

A regulatory change recently made by the FCC should help to facilitate the rollout of 5G by empowering homeowners and other private landowners to transact directly with communications companies to install equipment on their premises. This extends a long-standing rule on "over-the-air reception devices" that was hitherto applied only to small satellite dishes.

To promote TV competition and satellite dish installations, FCC rules currently prohibit any "local law or regulation, including zoning, land-use, or building regulations, or any private covenant, contract provision, lease provision, homeowners' association rule or similar restriction" that materially inhibit the

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[25] https://www.fcc.gov/sites/default/files/bdac-federalsiting-01232018.pdf

installation of satellite dishes or fixed wireless receivers on private and residential property.[26] These are the Over-the-Air-Reception-Device (OTARD) rules, also called the "pizza box" rule because it protects antennas smaller than 1 meter in diameter.

As a result, homeowners and renters are generally free to install a small satellite dish or fixed wireless receiver on their property without needing permission or paying fees. This has helped promote TV and fixed wireless services in the country, and there are somewhere around 30 million protected dishes and antennas installed on private property in the United States.

There are a few exceptions for antenna installations that would pose a safety hazard (an antenna installed above a public sidewalk, for instance) or that would be installed in a historic district or on a historic building. Cities, landlords, and HOAs can have restrictions on antenna installations in those cases.

Until recently, the FCC's current interpretation didn't protect the installation of fixed wireless transmitters and similar antennas, like 5G small cells. But a policy change is being considered which would allow fixed wireless transmitters the same protections that satellite dishes previously enjoyed. A single small transmitter provides many more services—broadband—to more people—several households or a neighborhood—than a single satellite TV dish. Advantages that may be anticipated if this regulatory change is adopted include:

1. It should lead to more competitive broadband services.
2. It should lead to more rural broadband deployment by
    a. Giving fixed wireless providers more siting options
    b. Giving rural ISPs more backhaul options
    c. Giving 5G providers more backhaul options
3. It will put pricing pressure on rights-of-way and pole owners for small cell siting, since more (private property) siting options means companies placing small cells have alternatives. In the long term, reform should eventually de-escalate the debate surrounding "market-based" v. "cost-based" ROW pricing by the FCC and PUCs as it creates a quasi-market for small cell siting.

Arkansas state authorities such as the Public Service Commission should take note of whether the proposed new FCC rule passes, and if so, and make sure that private property owners are given due protection from potential interference by municipalities or homeowners associations with their rights to deploy small cells.

XII. BROADBAND READINESS REQUIREMENTS AND RECOMMENDATIONS FOR NEW BUILDINGS AND INFRASTRUCTURE

The recently completed deliberations of the FCC's BDAC have resulted in a set of model codes and other materials that may now be considered to comprise a kind of best practice for broadband policy. Two policies in particular from their "State Model Code for Accelerating Broadband Infrastructure Deployment and Investment" deserve consideration for possible adoption in Arkansas: (a) "Dig Once" policies that require fiber optic conduit to be laid in conjunction with new infrastructure projects and (b) requirements in building codes that new and modified buildings must be made broadband ready. It is anticipated that adopting these policies would involve statutory and/or regulatory changes by the state,

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[26] See 47 CFR 1.400

county, and/or municipal governments. Further study of implementation options would be needed if a high level consensus were formed that the policies are desirable.

A. Dig Once: Letting Fiber Conduit Piggyback on Other Infrastructure Projects

Dig Once advocates that approval of new infrastructure projects shall be conditional upon those projects including the installation of certain communications network support infrastructure, especially fiber optic conduit. Under this policy, fiber optic conduit would be installed whenever the authorities decided to install, upgrade, or repair water or sewer pipes, or repair or build roads and sidewalks. Under this policy, instead of digging to install pipes and then digging again to install fiber optic conduit, public authorities or utility companies would only have to "dig once." This is efficient, inasmuch as the marginal cost of laying fiber conduit once a trench has been dug for some other purpose is comparatively small.

BDAC suggests that infrastructure developers should receive compensation for the added cost of laying fiber conduit. Of course, ownership of and access rights to the resulting fiber conduit also need to be defined somehow. There are some principled and practical objections to Dig Once, which could be regarded as infringing on the rights of other infrastructure developers, and might tend to retard the development or burden the maintenance of other infrastructure slightly. Against this, Dig Once policies could be expected to accelerate broadband deployment, and might reward other infrastructure developers and encouragement the development and support the maintenance of other infrastructure, with the right compensation arrangements.

Adoption of Dig Once policies in Arkansas, if pursued, should be preceded by adequate consultation with stakeholders and study of best practice models elsewhere.

B. Building Codes and Broadband Readiness

BDAC advocates that, after a set date, buildings which are built new or substantially renovated, such that a building permit is required, should be required to be equipped with sufficient network access points and high-speed network compatible conduits as to meet a standard of "broadband readiness." This should be done to the extent technically feasible and in accordance with industry best practices. There could be exceptions to this for reasons such as security, public health and safety, or conservation or preservation of heritage. Buildings being broadband ready could enhance buildout of broadband to certain places.

In general, building codes raise the question of the appropriate degree of paternalistic interference with private property rights by the government. They are open to the libertarian objection that if private citizens, at their own expense, want to erect a building lacking features the government regards as desirable, that is their own affair. This libertarian objection is weakest when a substandard building poses risks to neighboring buildings, as when a building is constructed in a way that makes it excessively vulnerable to catching fire. A building that is not broadband ready, however, would seem to pose no threat to neighboring buildings.

Broadband readiness as a feature of building codes would therefore need to be justified by second-order arguments, such as possible improvements in the liquidity of future real estate markets if it is not necessary for prospective purchasers to verify the communications sufficiency of buildings erected after a certain date, the protection of investors in new buildings against mistakes that might result from their being insufficiently aware of technology trends, or the need to create a critical mass of demand in order to encourage fiber deployment. An extensive consultation process would be needed to assess the merits and

means of incorporating broadband readiness into building codes, but this could be an important way to move Arkansas into a more digitally connected future.

XIII. RECENT BROADBAND-RELATED STATE LEGISLATION

Broadband policy in Arkansas is governed by certain major laws such as the Telecommunications Regulatory Reform Act of 2013. But these recently passed laws will also affect the policy environment for broadband deployment going forward.

A. Act 198 of 2019

Act 198 of 2019, which became law on February 26, 2019, was entitled "An Act To Amend The Telecommunications Regulatory Reform Act of 2013; To Provide Additional Access To Federal Communications Commission-Defined Broadband Service; To Declare An Emergency; And For Other Purposes." With the general intent of promoting broadband access, Act 198 amended the Telecommunications Regulatory Reform Act of 2013 by adding a new exception to the general rule that "a government entity may not provide, directly or indirectly, basic local exchange, voice, data, broadband, video, or wireless telecommunications service."

The new exception is as follows:

> (b)(5) After reasonable notice to the public, a government entity may, on its own or in partnership with a private entity, apply for funding under a program for grants or loans to be used for the construction, acquisition, or leasing of facilities, land, or buildings used to deploy broadband service in unserved areas, as defined under the terms of the granting or lending program, and if the funding is awarded, then provide, directly or indirectly, voice, data, broadband, video, or wireless telecommunications services to the public in the unserved areas.

The clearest use case for Act 198 would involve a municipality applying for funding to deploy broadband through a federal program such as USDA ReConnect. Plausible interpretations of the language of Act 198 could extend the permission granted to municipalities to a much wider range of activities and scenarios. An important task for the new State Broadband Office will be to unpack the language of Act 198, resolve interpretive difficulties, and educate municipalities on the rights newly conferred on them by the law.

B. Act 813 of 2017

Act 813 of 2017, which became law on April 3, 2017, was entitled "An Act To Create The Partnership For Public Facilities And Infrastructure Act; To Regulate Public-Private Partnerships For Public Facilities And Infrastructure; And For Other Purposes." The act describes what it meant to achieve thus:

> There are inadequate resources to develop public infrastructure and government facilities for the benefit of citizens of the state, and there is demonstrated evidence that public-private partnerships can promoted the timely and cost-efficient development of public infrastructure and governmental facilities; provide alternative and innovative funding sources to governmental entities; and to allow governmental entities to leverage and supplement the developmental cost of public infrastructure and governmental facilities through private funding and participation by the private sector in governmental incentive and tax programs that are not otherwise available to governmental entities.

Sophisticated prescriptions follow which, if widely practiced, might substantially alter state government procurement practices. However, the practical utilization of Act 813 will require rules and regulations to be written by the Arkansas Economic Development Commission (AEDC) and the Arkansas Development Finance Authority (ADFA). If implemented, Act 813 could create new ways for public sector entities to partner with private companies to promote broadband deployment, albeit involving complex accountability issues.

C. Act 999 of 2019[27]

Act 999 of 2019, the Small Wireless Facility Deployment Act, became law on April 17, 2019. It establishes a detailed framework for deployment of small wireless facilities, sometimes called "small cells" and important to the rollout of 5G technology. It seeks to promote "rapid deployment of small wireless facilities" through "procedures, rates, and fees [that] are… fair and reasonable when viewed from the perspective of the state's citizens and the state's interest in having robust, reliable, and technologically advanced wireless and broadband networks."

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[27] The full text of Act 999 is available here: http://www.arkleg.state.ar.us/assembly/2019/2019R/Acts/Act999.pdf

Appendix A: Arkansas Broadband-related Health Initiatives

Arkansas e-Link Network Hub Sites
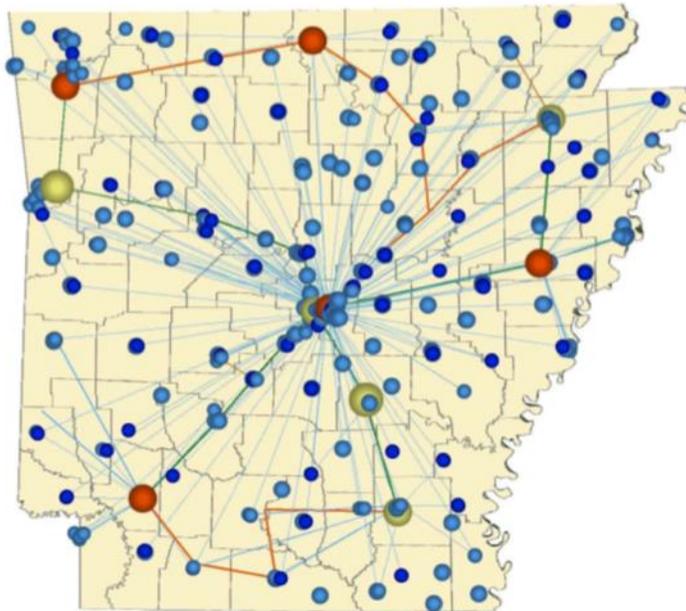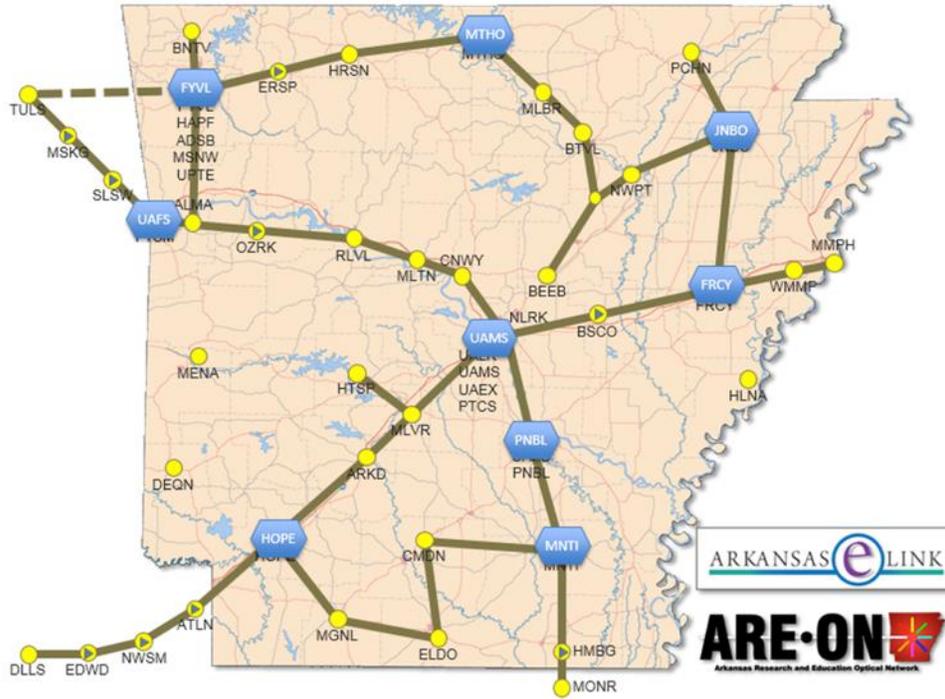
ARKANSAS e LINK

LINKING HEALTH, EDUCATION, RESEARCH AND PUBLIC SAFETY

81-Hospitals
102-Arkansas Dept. of Health Locations
73-Medical Clinics
8-Centers on Aging
22-Two-Year Colleges
11-Four-Year Universities
6-Human Development Centers
12-Kids First
193-Mental Health Facilities (RSPMI)
7-Juvenile Detention Facilities
5-County Jails
4-School Based Health Clinics
524 Total

UAMS® Center for Distance Health
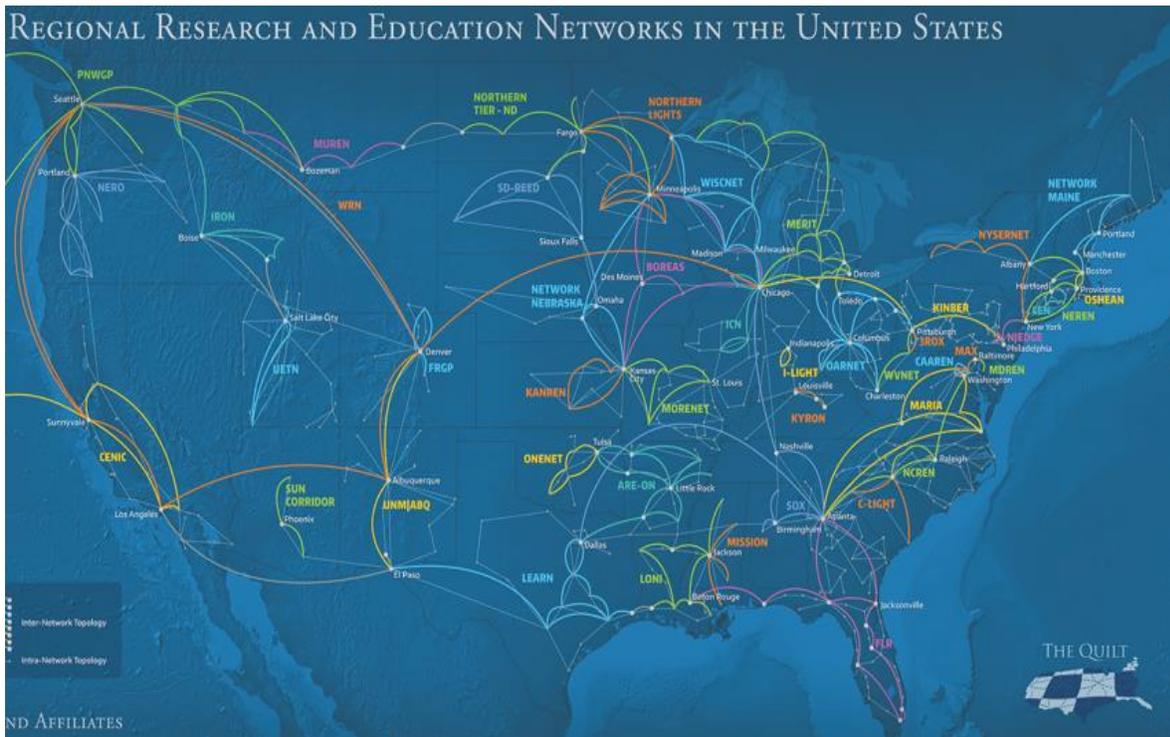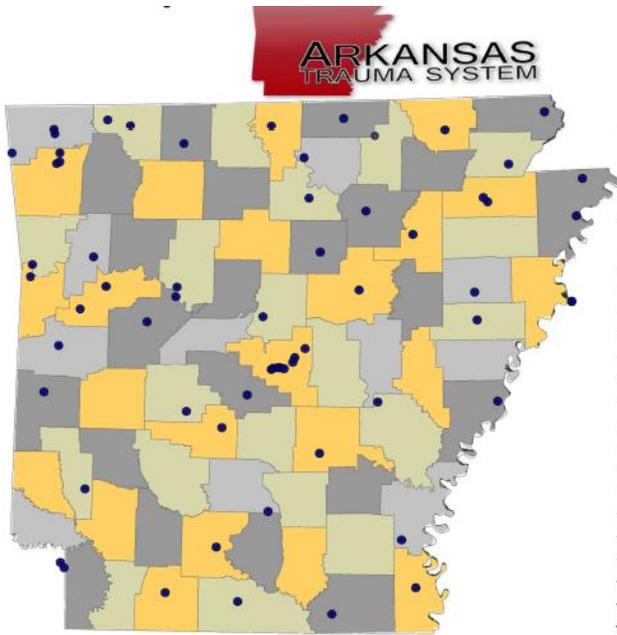
Arkansas Children's Hospital (ACH)	Dallas County Medical Center	Regional Medical Center
Arkansas Methodist Medical Center	McGehee Hospital	Wadley Regional Medical Center
Ashley County Medical Center	Medical Center of South Arkansas	Washington Regional Medical Center
Baptist Health Medical Center	Mena Regional Health System	White River Medical Center
Baptist Health Medical Center – Hot Spring County	Mercy Hospital - Springfield Pediatric Trauma Center	
Baptist Health Medical Center - NLR	Mercy Hospital - Springfield Adult Trauma Center	
Baptist Health Medical Center - Stuttgart	Mercy Hospital Berryville	
Baptist Health Medical Center - Heber Springs	Mercy Hospital Booneville	
Baptist Memorial Hospital – Jonesboro	Mercy Hospital Northwest Arkansas	
Baxter Regional Medical Center	Mercy Hospital Waldron	
CHI St. Vincent Hospital - Hot Springs	Mercy Hospital - Fort Smith	
CHI St. Vincent Infirmary	Mercy Hospital Ozark	
CHI St. Vincent North Little Rock	Mercy Hospital Paris	
Chicot Memorial Medical Center	North Arkansas Regional Medical Center	
Christus Saint Michael Health System	North Metro Medical Center	
Community Medical Center of Izard County	Northwest Medical Center-Bentonville	
Conway Regional Medical Center	Northwest Medical Center-Springdale	
CoxHealth	Ouachita County Medical Center	
Cross Ridge Community Hospital	Piggott Community Hospital	
Eureka Springs Hospital	River Valley Medical Center	
Five Rivers Medical Center	Saint Mary's Regional Hospital	
Forrest City Medical Center	Saline Memorial Hospital	
Fulton County Hospital	Siloam Springs Regional Hospital	
Great River Medical Center	South Mississippi County Regional Medical Center	
Helena Regional Medical Center	Sparks - Van Buren Medical Center	
Howard Memorial Hospital	St. Bernards Medical Center	
Jefferson Regional Medical Center (JRMC)	Stone County Medical Center	
John Ed Chambers Memorial Hospital	Unity Health Harris Hospital	
Le Bonheur Children's Hospital	Unity Health White County Medical Center	
Magnolia Regional Medical Center	University of Arkansas for Medical Sciences (UAMS)	

ANGELS High-risk OB Telemedicine Sites
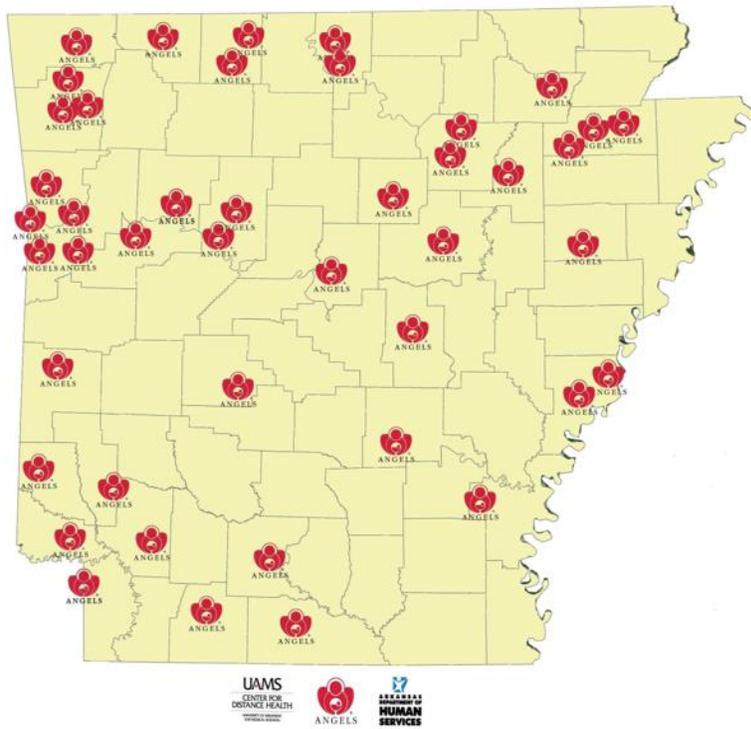
ADH - Baxter County Health Unit	Mountain Home
ADH - Benton County Health Unit	Rogers
ADH - Boone County Health Unit	Harrison
ADH - Carroll County Health Unit	Berryville
ADH - Cleburne County Health Unit	Heber Springs
ADH - Columbia County Health Unit	Magnolia
ADH - Craighead County Health Unit	Jonesboro
ADH - Crawford County Health Unit	Van Buren
ADH - Cross County Health Unit	Wynne
ADH - Desha County Health Unit	Dumas
ADH - Faulkner County Health Unit	Conway
ADH – Grant County Health Unit	Sheridan
ADH - Hempstead County Health Unit	Hope
ADH - Hot Spring County Health Unit	Malvern
ADH - Howard County Health	Nashville
ADH - Independence County Health	Batesville
ADH - Johnson County Health Unit	Clarksville
ADH - Lawrence County Health Unit	Walnut Ridge
ADH - Little River County Health Unit	Ashdown
ADH - Logan County Health Unit	Paris
ADH - Lonoke County Health Unit	Lonoke
ADH - Miller County Health Unit	Texarkana
ADH - Mississippi County Health Unit	Blytheville
ADH - Monroe County Health Unit	Brinkley
ADH - Ouachita County Health Unit	Camden
ADH - Pope County Health Unit	Russellville
ADH - Sebastian County Health Unit	Fort Smith
ADH - Sevier County Health Unit	De Queen
ADH - Scott County Health Unit	Waldron
ADH - Crittenden County Health Unit	West Memphis
ADH – Washington County Health Unit	Fayetteville
Baxter Regional Medical Center	Mountain Home
Fayetteville-PRI NW	Springdale
Helena Regional Medical Center	Helena
Johnson Regional Medical Center	Clarksville
Medical Center of South Arkansas	El Dorado
Mena Regional Health System	Mena
Mercy Ft. Smith	Fort Smith
Millard Henry Clinic	Russellville
National Park Medical Center	Hot Springs
North Arkansas Reg. Medical Center	Harrison
Willow Creek Women's Hospital	Springdale
Sparks Medical Center	Fort Smith
St. Bernard's Medical Center	Jonesboro
UAMS - East	Helena
UAMS Northeast	Jonesboro
UAMS Northwest	Fayetteville
UAMS South Central	Pine Bluff
UAMS South Central	Magnolia
UAMS Southwest	Texarkana
UAMS West	Fort Smith
Unity Health - Harris Hospital	Newport
Unity Health - White Co. Med. Center	Searcy
White River Health System	Batesville

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