Cable And Rural Broadband

How Cable Plays a Critical Role in Closing the Digital Divide

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1. Abstract

Cable was birthed in rural America. Cable grew up in rural America. Cable is still rooted in rural America with many rural American households serviced by a cable operator. The US is facing a broadband equity crisis in which nearly 20% of Americans, primarily in rural communities, do not have access to reliable broadband Internet. Cable operators are uniquely positioned to solve this problem once and for all.

This report will explain why rural broadband, like rural electrification in the 1930's and universal telephone service in the 1950's, is the most important societal technology issue of our time.

The report will further explore why delivering broadband to rural Americans is perceived as a challenging engineering and fiscal problem and will explain how innovative approaches to engineering, materials, construction practices, and business modeling can overcome those challenges. The advantages and disadvantages of these innovative approaches will be discussed.

Today, funding sources have expanded to include federal and state grants, broadband funds, and county and municipality initiatives which, when coupled with public / private partnerships, can easily tip the balance to a faster return on investment. Finally, the paper will discuss the financial opportunities and incentives that enable universally accessible broadband Internet to become a reality.

2. Introduction

What began as a pragmatic tool to enable researchers to communicate and collaborate more effectively has, today, become an essential tool for everyone's everyday life. Access to the Internet is as essential as electricity or the telephone and is more widely used for news and information than television and radio. With 90% of employment applications being submitted online, the Internet is an essential tool for seeking employment. For those currently employed, the number of people using the Internet to work from home has increased dramatically during the pandemic. While many private education programs were already exclusively using the Internet to deliver their curriculum, during the COVID-19 pandemic, the Internet became the essential tool for public education institutions. COVID-19 also brought about large increases in the use of telemedicine

However, an estimated 14 million to 160 million homes and businesses in the US do not have adequate access to the Internet. With an echo from the 1940's and rural access to electricity, 90% of those without access to the Internet live in rural areas.

In the 1930s electricity providers refused to deliver electricity to rural Americans. In the 1940s, telephone companies, and television broadcasters also refused. The cost was perceived to be too high to build each of these essential utilities and communication tools to rural communities. Cable, though, is rooted in bringing service to those that would not otherwise have it. Beginning in 1949, the pioneers of cable created cable to deliver television programming to rural America when no one else would.

Today, Cable faces another opportunity to serve its communities and to expand its networks. Many cable operators have been reluctant to build broadband services into rural communities due to poor internal rates of return (IRR). Conditions have changed, though, and Cable is well positioned to help eliminate this gap.

3. The Broadband Gap

The literature and media make frequent references to the "Digital Divide", but what is this Digital Divide?

Generally, the Digital Divide refers to the gap between those that have access to information and communications technologies (ICT) and those that do not. In the past, the discussion about the Digital Divide was focused on access to computers and technology education. Recently, this is most often applied to describe lack of access to the Internet at broadband speeds, which is also referred to as the Broadband Gap.

The Broadband Gap, though, is not simply a technical or technological one. Those that lack access to broadband Internet are directly and negatively impacted because they are unable to fully benefit from educational, economic, and healthcare resources available on the Internet and they are unable to fully participate in the political and social aspects of their community, nation, and the world.

These are compounding disadvantages. Those that do not have access to the Internet are most likely to already be economically and educationally disadvantaged and their inability to reap the benefits of unencumbered access to the Internet creates a situation in which they are unable to pull themselves up and, instead, are simply drawn deeper into the chasm.

Some might be skeptical about the impacts of this Digital Divide. Consider that in 2015, 80% of Americans used the Internet to search for and apply for employment [1], but in 2020 reliable broadband Internet access was not available to tens of millions of Americans. Further, rural populations, less educated populations, low-income populations, and minority populations are less likely to have broadband access [2] and, therefore, do not have equal access to employment resources.

Education was in the spotlight during the COVID-19 pandemic. Prior to the COVID-19 pandemic, it was already well known that academic performance was better among those that have ready and reliable access to the Internet. According to a study by the Quello Center [3], students with no access to the Internet at home or who rely on a mobile phone for home Internet access will typically be ½-letter grade behind those students that have reliable Internet access at home. According to the US Census Bureau's Household Pulse Survey [4], an estimated 2.5 million households with school-age children reported their Internet access was not reliably available for education purposes. With a virtually nationwide switch to online education in the United States, lack of reliable broadband Internet access caused significant impacts on academic achievement and disproportionately impacted rural populations and low-income and minority families.

Estimates range from 14 million to 160 million [5] Americans that lack Internet access at broadband speeds. This is a wide range that reflects the lack of accurate and standardized methods to identify the unserved.

Download and upload speeds are the most used standards for fixed broadband service. In the United States, the Federal Communications Commission (FCC) definition is the most referenced standard for broadband. The FCC's definition has evolved over time, as demonstrated in Table 1, and as of July 2021 the FCC defined broadband Internet access as a service that delivers 25Mbps downloads and 3Mbps uploads.

Table 1 - History of Broadband Definitions in the US

Year Published	Source	Download Speed	Upload Speed
2021	US Treasury Department (minimum build-to, proposed)	100 Mbps	20 Mbps
2021	US Treasury Department (Eligibility)	Less than 25 Mbps[1]	Less than 3 Mbps
2018	USDA ReConnect (Build-To)	25 Mbps	3 Mbps
2018	USDA ReConnect (Eligibility)	Less than 10 Mbps	Less than 1 Mbps
2015	FCC	25 Mbps	3 Mbps
2010	FCC	4 Mbps	1 Mbps
1996	US Telecommunications Act	200 Kbps	200 Kbps

The FCC launched the Rural Digital Opportunity Fund (RDOF) program in 2019 and used Form 477 data, self-reported by Internet providers, to identify census blocks eligible for funding. This analysis resulted in the maps shown in Figure 1, and an estimate of 2,552,251 households without 25/3Mbps Internet access using a terrestrial network.

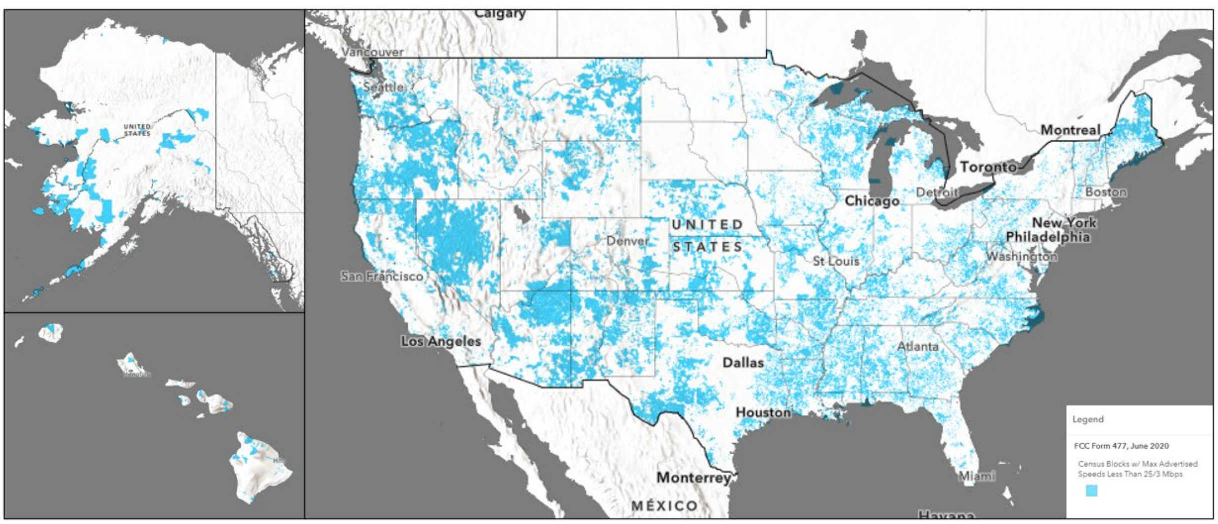

Figure 1- Census Blocks with maximum advertised terrestrial speeds less than 25/3 Mbps(FCC Form 477, June 2020)

With the introduction of the broadband requirements, including allowed overbuild of DSL networks[1], from the US Treasury and proposed legislation, the US has implicitly set the standard of broadband to be fiber-based or cable-based. This significantly changes the picture to show an estimated 10.6 million households without access to broadband.

[1] US Treasury has authorized the use of ARPA funds to overbuild DSL and older DOCSIS networks even though they might deliver 25Mbps/3Mbps.

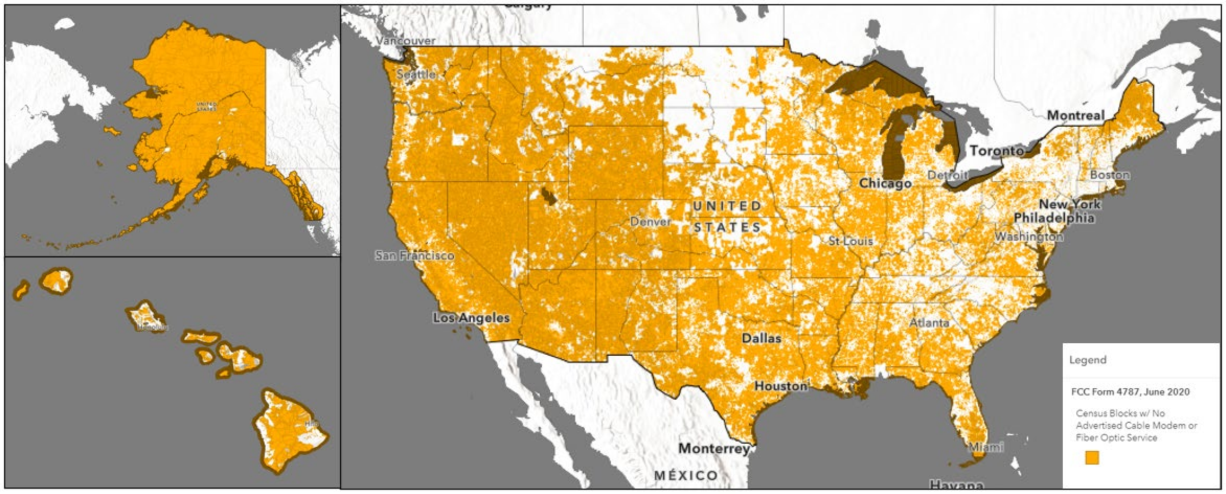

Figure 2 – Census Blocks with no advertised Cable Modem or Fiber Optic Internet Service (FCC Form 477, June 2020)

The US Treasury, in its guidance on use of American Rescue Plan Act (ARPA) funds, also empowered communities and governments to consider a wide range of information other than the FCC Form 477 as evidence that broadband networks were inadequate. These include data from other federal agencies like the National Telecommunications and Information Administration (NTIA), which recently released the Indicators of Broadband Need mapping application [6]. The NTIA map brings datasets together from the US Census (the American Community Survey), Department of Education, NTIA, Ookla Speed test results, Measurement Lab (M-Lab) speed test results, and Microsoft Broadband Usage Statistics.

A recent non-profit study [7] of Loudoun County, Virginia is an example of the significant difference these new data sources can make. Using Form 477 data, the FCC disqualified the entire county from the Auction 904: Rural Digital Opportunity Fund, presuming that all locations in the county have access to the Internet at 25/3Mbps (see Figure 3).

However, the local study shows that nearly 9000 households and businesses do not have access to the Internet at 25Mbps or higher (see Figure 5). Their study further shows that, on average, those households receive download speeds at 15Mbps or lower while paying almost 3 times more per month for Internet service than those that have access to cable-modem or fiber-based Internet access. This disparity between published coverage data and actual broadband accessibility is just one example of many that indicates that broadband coverage is significantly overestimated in the US.

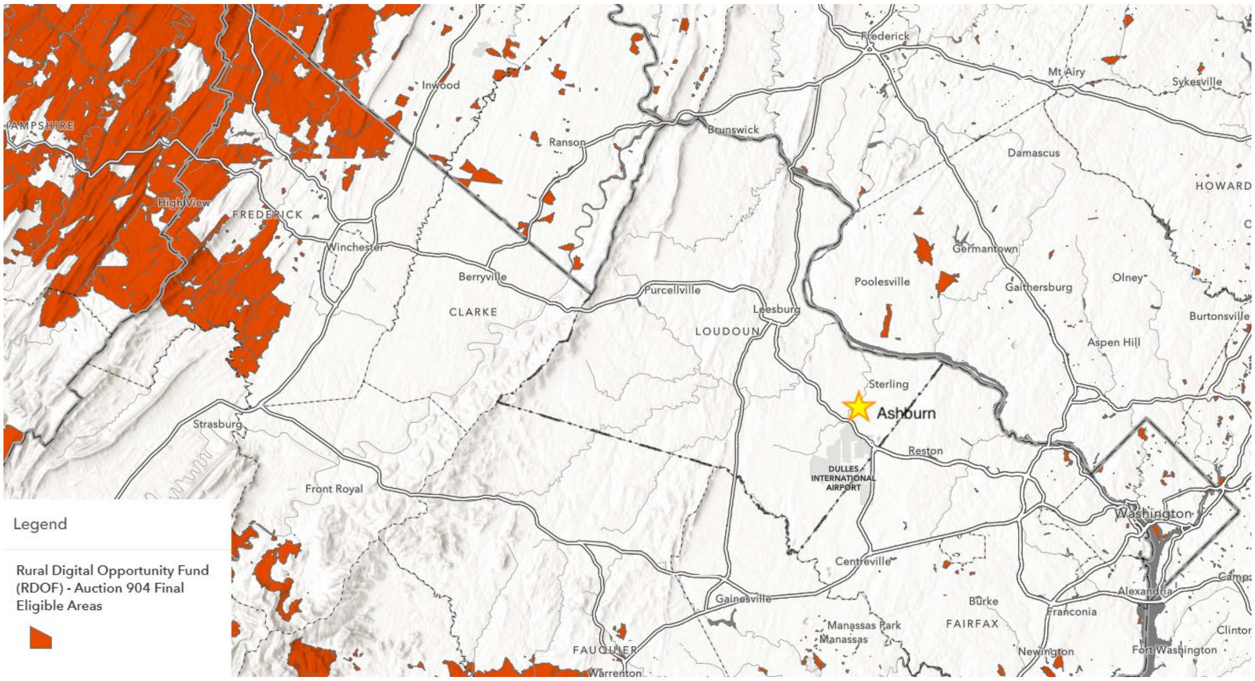

Figure 3 - RDOF Eligibility for Loudoun County, VA and Surrounding Areas

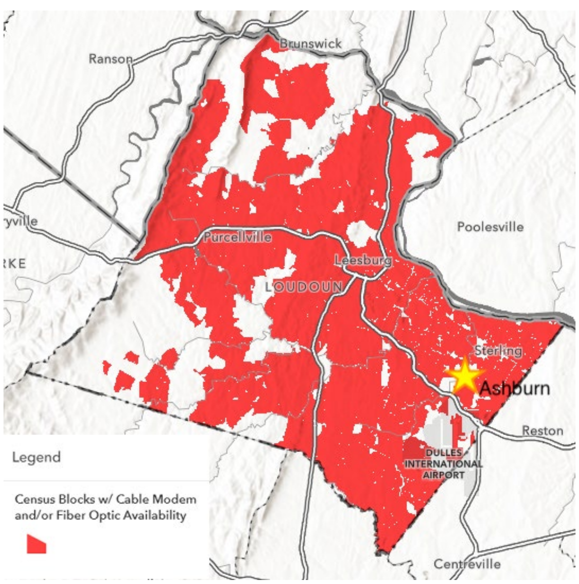

Figure 4 - Form 477 Data indicating accessibility to fiber or cable-based broadband in Loudoun County, Va.

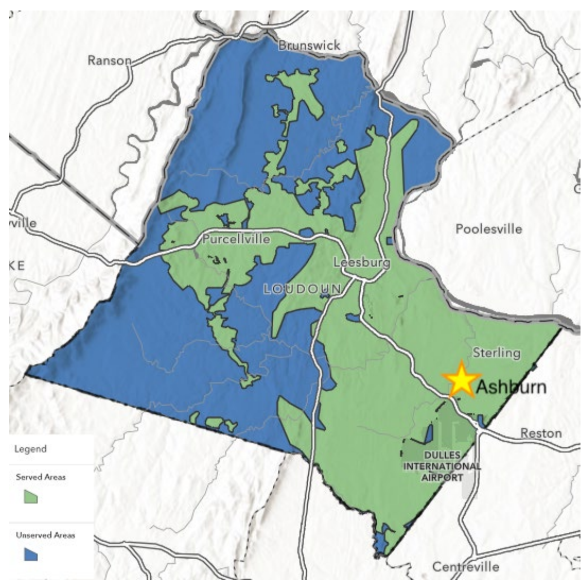

Figure 5 - Locally curated research indicating no broadband coverage (blue shaded areas) in Loudoun County, Va.

With estimates ranging from 14 million to 160 million homes and businesses that lack adequate access to broadband Internet, the available data clearly supports the claim that broadband access is severely lacking in rural areas.

4. Enabling Cable to Expand its Rural Footprint

Cable and other Internet providers have traditionally avoided serving rural areas due to technical or financial criteria. Based on business requirements and goals at the time, those criteria might have been perfectly valid. Conditions have changed and qualification criteria need to be re-evaluated.

Existing US cable franchise areas have very high penetration rates. Subscriber growth is slowing and is often driven only by churn between providers.

For US operators, there are four primary areas of company growth:

1. Growing penetration/stealing share for existing products
2. Introducing new products (e.g., mobile)
3. New home construction in existing footprint
4. Expanding footprint (mostly into underserved markets)

The most often cited reason for not building rural Internet access is that it is too expensive, but what are the factors that drive cost, and what are the characteristics of "rural" networks?

4.1. Construction dominates cost

It's important to understand when constructing rural broadband networks that build costs are dominated by construction labor. Materials and electronics, even sophisticated networking equipment, make up a very small portion of the network deployment costs. Construction is commonly outsourced to third-party contractors. Entering into these third-party relationships, it's important to obtain competitive pricing while at the same time not compromising on build quality. Often cable operators will be able to leverage numerous such relationships that they already have in place as part of their ongoing needs.

4.1.1. Logistical Factors

Logistics related to construction contribute significant overhead to the construction process. Before beginning construction, the operator must acquire permits from right-of-way owners such as local and state departments of transportation, easements where no existing access rights exist, and utility permits to connect to utility poles. Construction and safety permits must also be acquired. The application and permitting processes and requirements can be unique for each jurisdiction and can be tedious and require expertise in the specific jurisdiction.

These factors can be mitigated by considering cost sharing opportunities, reducing the number of times to "go to the well", building relationships with the permitting agents and agencies, and by coordinating construction with other utilities.

Previously, construction of new network infrastructure was planned on a 1-year cycle. This is no longer an effective strategy.

A one-year cycle was predicated on a "do-it-yourself" approach in which the operator designs, plans, and constructs the network as an independent and autonomous entity. This do-it-yourself approach is not cost effective for rural networks. Cost effective construction will require the operator to share the cost of trenching and boring. Municipalities are loath to have their roads disrupted and having each utility or communications provider running independent digs means multiple disruptions and more risk to the municipal infrastructures (like water and sewer).

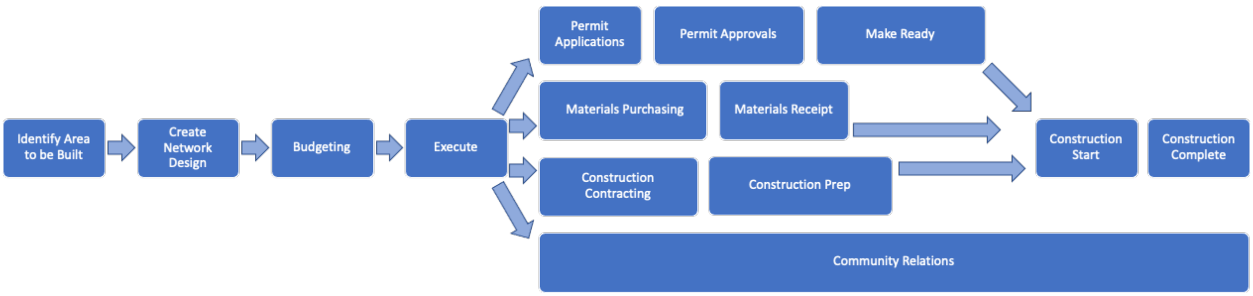

Figure 6 - Typical 1-year planning and construction cycle

Another factor to consider is availability of labor and materials. The industry is already experiencing shortages in skilled labor and materials, especially for fiber builds. As federal and state funding for broadband expansion ramps up in 2021 through 2024, these shortages will only get worse. The cable operator will need to order materials at least one year out, perhaps entering risk-buy situations. Recent experience has shown that even when pre-ordered, materials might not be delivered on time. Most publicly supported broadband expansion programs impose 2-year deadlines, so without flexibility in the cable operator's processes, network designs, materials choices, and construction practices, operators could find themselves facing penalties due to supply-chain issues.

All of this means that a 5-year planning cycle will be a necessary cost reduction strategy. This allows the operator to be opportunistic in construction – keeping an eye open for infrastructure projects where constructions costs can be shared (e.g. laying conduit alongside new water and sewer infrastructure, or coordinating water and road crossings with bridge and overpass replacements). With the federal funding for infrastructure being distributed in 2021 through 2024, these opportunities will be at a peak.

Becoming aware of potential cost-sharing opportunities will require planners to build relationships. Relationships with jurisdictional personnel are already a necessity to streamline permitting processes. Cable operators will need to foster new relationships in local and state planning offices and with planning teams in the various utility companies and possibly competitive broadband providers. These relationships will be critical to discovering future infrastructure actions that can be leveraged for the benefit of the cable operator through cost reduction and building goodwill among the participants. In fact, such relationships and coordination might become the new regulatory norm due to legislation introduced in 2021 [8, 9, 10].

Operators will often have choices to make in selecting which markets they chose to build. When a strong partnership is formed with the localities (both local and state), it can help foster an environment that facilitates and streamlines network construction. In the same manner, uncooperative localities can be a major obstacle to a successful build – and operators use this local cooperation criteria when selecting the areas that they chose to invest in.

Another factor will be the availability and willingness to take advantage of symbiotic relationships. As an example, Central Virginia Electric Coop (CVEC), responding to requests from its members to deliver broadband Internet access, started an initiative to offer zero-fee pole attachments to Internet providers. Through this program, CVEC formed a strong relationship that brought fiber-based broadband to 37,000 co-op members in rural Virginia [8] and also accelerated its smart-grid deployment. While the partner was not a cable operator, opportunities like this will be available to those cable operators that are alert and willing.

4.1.2. Improved Construction Techniques and Tools

Once the planning is complete construction can start, but it’s not so simple as hanging or burying some cable. The art of network construction includes a variety of skills and requires an equally varying set of tools.

Advances in fiber cable have made it possible to fit more fiber strands into smaller and smaller cables. Ribbon cable makes it possible to fit, for example, 144 fibers into the same size cable as 72 fibers of loose-tube fiber. Unarmored cables are also available and can be a measured-risk for cable operators. These options can save space and reduce weight and wind loads on poles. Ribbon cable, though, has its own challenges since it typically requires special handling and splicing tools. In the past, splitting a ribbon cable in mid-span has not been practical. New tools, though, change this dynamic. Ribbon separation tools are available from multiple sources and enable crews to easily separate fibers from the ribbon. Ribbonizing tools and adhesives are also available to dress and complete ribbon splices. With new splicing kits, it is also now possible to splice whole ribbons or individual fibers.

Tools to bury cable have also advanced. Availability of tools like the vacuum excavator means that manually digging to avoid existing utility lines is no longer necessary. This is a significant time and cost saving tool.

Figure 7 - Examples of Vacuum Excavators[2]

Directional boring has been in use for many years. In the past, though, safely completing a directional bore was dependent on good documentation of existing utility lines (which is often incomplete or inaccurate) and could be quickly thwarted by unexpected geological features. They were also highly dependent on the skill of the operator to know the location and direction of the bit. Today’s boring efforts, though, benefit from advanced tools like electric strike indication systems and proximity detection systems that significantly improve accuracy of the drill, but also reduce risks of injury and unexpected utility damage.

These are just a couple of examples of advancements in tools and techniques in construction.

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[2] Photos courtesy of Vermeerand Vac-Con

4.2. Technology Considerations

Unless an area is directly adjacent to current hybrid fiber-coax (HFC) infrastructure, a service area expansion is typically going to best be supported by the deployment of an all-fiber network. Build costs are equivalent to HFC, and the result is a much more extensible, more fault tolerant, and less expensive to operate network.

For cable operators, while making a change to an all-fiber delivery, it will be important to continue to offer video services and leverage the substantial investments that have already been made in the video space. IP Video technology has matured, enabling cable operators to deliver nearly equivalent video services over fiber, albeit with some new challenges in service delivery. Video CPE and service activation, to name two, can look quite different from current practices.

Just as cable operators have started to embrace the push of some electronics deeper in the network (i.e. Distributed Access Architecture), the same movement is occurring within all fiber network architectures.

From a timing perspective (circa 2021), 10Gbps symmetrical PON (XGS-PON, or 10G-EPON) has become the technology of choice. Previously, the Optical Line Terminal (OLT) device was a monolithic modular chassis designed to be deployed in an environmentally stable environment like a data center. Recently, though, the remote OLT has become an enabling technology for lower-cost network builds. The OLT is now available and commonly used in several remote configurations, including node OLTs, outdoor cabinet OLTs, as well as compact OLTs designed for multiple dwelling unit (MDU) and high-rise buildings. Such configurations allow for the elimination of high fiber count trunks that must span the long distances to a hub or headend. These well-placed remote devices can also eliminate reach restrictions, since PON networks have distance limitations, often as low as 20km. Lastly, remote OLTs can eliminate or limit the needs for headend space or avoid the need for small electronics huts. All of these serve to save on construction cost.

Figure 8 - Traditional OLT Deployed Remotely

Figure 9 - Modern Remote OLT

Another enabler for lower-cost network builds is availability of many types of data, electronically, from so many sources. These include geocoding resources, address verification databases, geocoded census and consumer demographics, electronic network inventories (locating cable routes), satellite imagery and detailed topographical and soil-type maps.

In the past, with so much data available, subject matter experts would need to be employed to analyze the data and planners would need to interpret summaries provided from several sources to make build-out decisions. Often in-the-field surveys would need to be performed to verify the findings or to collect data that was otherwise unavailable. These processes often took months to complete. Today's modern planning and design tools, though, allow designers and planners to aggregate massive amounts of data, perform measurements and calculations, perform address density calculations, measure distances, and quickly run cost estimates simply by snapping out polygons on their computer desktop.

4.3. Workforce Challenges

Maybe one of the most significant concerns for expanding broadband service into rural areas is finding skilled labor. Especially with increased funding and mandates from the federal and state governments, demand for a workforce capable of building outside plant will be increasing and the existing workforce is already stretched.

Most operators no longer maintain dedicated construction crews. Instead, they might retain crews responsible for plant maintenance, and often will retain a contractor for repairs and hire other contractors to perform initial builds.

It will not be enough to have access to workers skilled simply in the art. Those workers will need to be trained in sound safety practices. Without this, the operator will be at risk for code violations, on-the-job injuries, or liability risks post-project completion. Skilled labor will be easiest found with a contractor.

With the growing emphasis on building fiber networks to previously unbuilt areas, a dearth of pop-up fiber construction outfits has surfaced. Often these crews are learning on-the-fly and have no first-hand experience nor quality training from the industry or from the manufacturer of the equipment they have chosen to use.

A reputable and quality network construction contractor will maintain continuous training in the art and safety for its employees. The contractor will have experience constructing infrastructure in the regions of interest. They will also be familiar with the safety protocols and permitting protocols of those regions and have the financial backing and stability to absorb changes in project schedules and unforeseen circumstances "on-the-ground".

For these reasons, choosing the least expensive contracting option on a per-job basis is not necessarily the best decision. Since longer-term planning is of growing importance, part of that planning will be to build relationships and retainers that ensure quality contractors are available and that they are able to plan their workforce development to match the operator's projected demand. These relationships are secured by committing to 5-year build plans and by forming long-term contractual agreements with contractors and suppliers.

Construction is not the only area of concern for the workforce, though. There are many connected processes that support construction. For example, prior to beginning construction, locators must be dispatched to locate and mark existing infrastructure (electrical, water, sewer, etc.). City, county, and state regulating offices must keep up with permitting and inspection volumes. These agencies might need to increase staff and provide education related to broadband to support increased volume of builds.

Another issue that operators must be prepared to manage is variations in regulations among jurisdictions and variations in enforcement within the same jurisdiction. The former is much more manageable and can be mitigated during the planning and permitting phases of a project. Variations in enforcement are caused by varying interpretation of regulations among inspectors or region-specific leadership. Such variations, though, often do not appear until after the project has begun and can result in construction activity being halted (while workers continue to be paid) and the project being delayed.

Anecdotes abound about such situations. One story related to the authors described a fiber project that required construction along a state right-of-way. The state regulating authority's (department of transportation, or DOT) safety rules made the use of an attenuator truck (crash truck) optional. During construction in one region, the local DOT personnel allowed the project to proceed without an attenuator truck being present. As the project moved into a neighboring region, the DOT personnel in that region would not allow construction to continue until an attenuator truck was present. The impact was a delayed project and additional cost for the truck and personnel to operate it.

A consistent and accurate inventory of broadband infrastructure is as important to bridging the digital divide as a complete record of serviceable locations (e.g., the locations of households and businesses). Historically, telecommunications companies have used an assortment of information systems – some developed in-house and some purchased – that were never designed to work together. When these systems were implemented, there was no perceived requirement for information sharing. Today telecommunications companies operate networks that have equipment from multiple vendors, lease bandwidth and antenna sites from other companies, and manage federal and state funding requirements. Mergers with, or acquisition of, other companies require the incorporation of different systems.

The provision of broadband connectivity is closely tied to geography. Location intelligence is fundamental to all communication services. A geographic information system (GIS) is a system that creates, manages, analyzes, and maps all types of data. It provides for data interoperability. GIS connects data to a map, integrating location data (where things are) with all types of descriptive information (what things are like there). This foundation provides for mapping and analysis that helps users understand patterns, relationships, and geographic context. The benefits include improved communication and efficiency as well as better management and decision making. Using the open data standards of a modern GIS promotes transparency, data sharing, and collaboration.

Dirty data and non-existent data that should have been collected (but was not) adds substantial cost to telecommunication projects. Mobile GIS workflows location-enable field activities, modernize data collection, and facilitate near real-time updates between the field and office. Authoritative geospatial data is key to support the work of broadband development and programs. Telecommunication providers and governmental organizations have a bottom-line interest in ensuring it's collection.

4.4. Financing Challenges

For many years, research has shown those that lack access to broadband Internet are directly and negatively impacted because they are unable to fully benefit from educational, economic, and healthcare resources available on the Internet and they are unable to fully participate in the political and social aspects of their community, nation, and the world. During the COVID-19 pandemic the world came to realize that access to the Internet can no longer be a benefit enjoyed only by urban and higher income populations, but it is an essential service that should be available to everyone.

Unfortunately, by their very nature, unserved and under-served areas are often rural and are expensive areas to build a network. A greenfield fiber build will often cost between $900 and $1200 per home passed, and even costlier for low density areas with costs up to $8000 per home passed. These costs have traditionally not passed the internal rate of return (IRR) tests of an operator. When building a greenfield network, fiber will likely be the best choice, particularly if in a low-density area. If cable operators build in an area adjacent to their current HFC network (aka "edge-outs"), it might behoove an operator to extend their existing HFC architecture.

As cable operators look for ways to grow subscribers, investing in under-served areas begins to be more attractive as a way to capture the pent-up demand for quality broadband. An operator will often enjoy significant service uptake in newly built areas because they have been inadequately served for so long. This helps support the business model around investing in the network build. Additionally, an all-fiber network will benefit from better economics from a total cost of ownership (TCO) point of view.

A major change in the environment for building broadband to rural areas is the availability of funding. Private investors have long been interested in building broadband to support their overall mission, and the changing environment over the past couple of years has made investment in rural broadband much more likely to pay off. Firms like Searchlight Capital [9] [10] [11] and GTCR [12] have been prominently investing in rural broadband because of this potential.

Recently available public funding has played a significant role in the decisions from private investors. It has also played a big role in decisions by some cable operators. For example, Charter Communications won $1.22B from the FCC's RDOF Auction 904 and plans to build broadband to up to one million currently unserved homes and businesses[3].

At the federal level, in the year 2020, the Coronavirus Aid, Relief, and Economic Security Act (CARES) act set aside $100M to be spent on broadband expansion and RDOF allocated up to $20.4B (to be distributed over 10 years) toward broadband expansion. In 2021, the US Congress passed the American Rescue Plan Act (ARPA), a $1.9 trillion economic stimulus program which allocates, through seven different programs, at least $20.3 billion and up to $265 billion that can be used for digital equity programs including broadband physical network buildouts. In addition to ARPA funding, it appears that another $65 billion will be made available in the infrastructure bill that is making its way through the US Congress in August of 2021 [13].

At the state level, 38 out of 50 states in the US have created funding programs specifically to support expansion of broadband service.

[3] Charter, and other Auction 904 winners, are revamping these estimates because the RDOF eligibility maps were based on incomplete data.

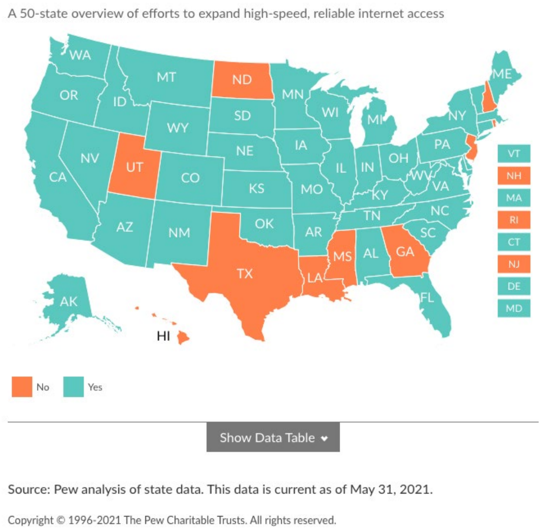

Figure 10 - US States with Broadband Funding Programs [14]

The structure and scope of these funding programs varies from state to state. The ARPA distributes much of its broadband funding directly to states and localities, so states' programs are currently undergoing changes to adapt to this influx of money. For example, the Commonwealth of Virginia's FY2022 budget initially allocated almost $60 million, but with the authorization of broadband funding from ARPA, Virginia will expand this to allocate $700 million over the next 3 years [15]. Further, many counties, towns and cities will receive ARPA funding and have the option to use that money to expand broadband infrastructure.

This influx of funding will change the way cable operators calculate the financial models for building to unserved and rural areas. In fact, these new funding options will directly impact the construction planning cycle because these funding sources impose delivery deadlines with penalties. Cable operators that develop, hire or contract expertise in broadband grant writing will have a distinct advantage over competitive providers that do not.

5. Conclusion

The utility of broadband Internet access has been studied at length and, by all measures, those that have access to broadband Internet are better off economically, educationally, socially, and health-wise. Those that do not have access to broadband Internet are disproportionately affected because they are already more likely to have lower incomes, more likely to live in rural areas that have fewer employment options, less access to basic healthcare, and access to fewer educational support resources.

Lack of broadband Internet access affects tens of millions of people in the United States, and approximately 90% of those affected live in rural areas. This is not a unique story. Rural broadband access has followed a similar storyline as rural electrification, rural telephone, and rural television. Internet access has simply failed to keep up with urban areas because Internet providers have failed to deploy newer technologies into rural areas.

Birthed in the mountains of Pennsylvania, the river towns of Oregon, and the plains of Wyoming, cable's history is rooted in rural communities. Over the last 30 years, cable has stepped up to the plate and delivered advanced services to the communities they serve. Modern-day economics has held back many cable operators from deploying their networks into rural communities.

Any incumbent network operator will be able to leverage advantages in building out rural broadband networks. They bring resources and knowledge to the challenge. Cable operators can bring this and more to the table. This is most profound when a new build area is adjacent to their current networks/footprint. Access networks (or "backhaul") can be a significant portion of both a network build and operation (if using leased fiber connections). As well, simply using existing people, processes, and resources will assist in building and running these networks.

Using a variety of new and even unconventional financial vehicles, these networks can easily be built and operated profitably. As discussed, there are a large variety of options available to enter into public-private partnerships, that not only make for good business for a cable operator, but also help to enable an essential service for these under-served communities.

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