GIS: The Secret Power Behind Effective Broadband

A Report by Craig Settles

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The novel coronavirus (COVID-19) has exposed the United States' fault lines in our broadband infrastructure. This pandemic has caused broadband networks to groan under the stress of quickly shifting business, schools, and healthcare to online working, teaching, learning and medicine. Worse, the shift has turned a harsh spotlight on the lack of broadband in too many communities.

As a result of this exposure, expect a huge number of broadband projects that will dwarf the $7.2 billion broadband stimulus awarded in 2009 by the federal government in grants and loans.

Congress is pushing for $86 billion for high-speed broadband as part of a five-year infrastructure investment. USTelecom President Jonathan Spalter said in an interview, "A federal infrastructure investment on this scale that leverages private dollars will achieve three bipartisan goals: narrow the digital divide, expand access and make network infrastructure more resilient."

The FCC spends $11.4 billion annually for broadband built by carriers, municipalities and counties, electric co-ops, and small or regional ISPs. Industry leaders and consumer groups are lobbying heavily to increase this amount. The U.S. Department of Agriculture's (USDA's) ReConnect broadband program is a player too. In 2019 they awarded over $1 billion in grants and loans to expand rural connectivity and should repeat that this year as well.

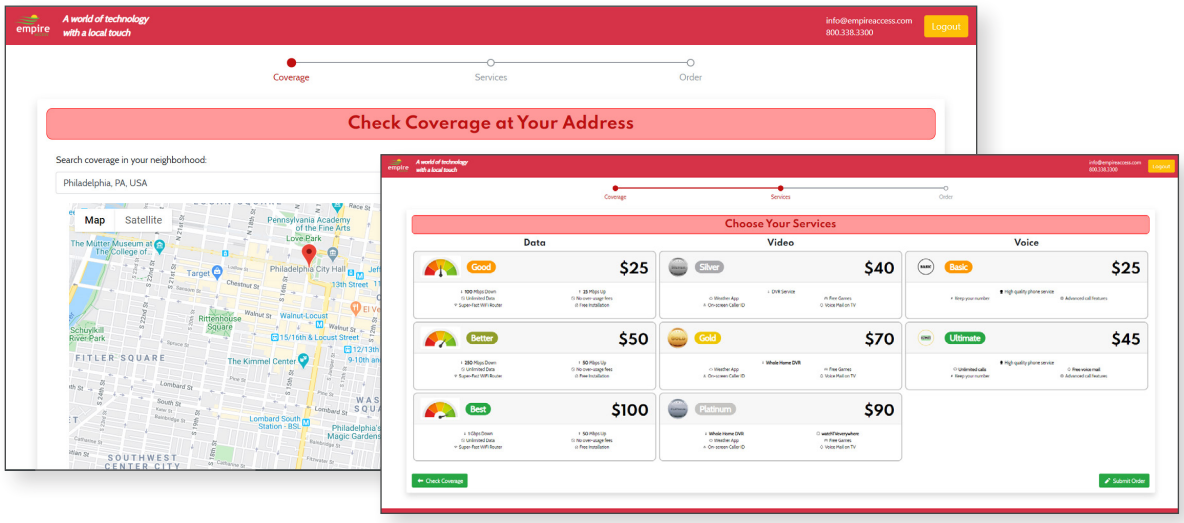
COVID-19 has also exposed a secret to the success of effective broadband: GIS – Geographic Information Systems. Today, advances in GIS significantly accelerate network planning and buildouts. GIS mapping, enables citizens to input data directly into broadband availability maps. IoT, RFID, and other technologies feed into GIS tools that enable carrier, municipal, co-op, and ISP staffs to automatically catalogue, track, and deliver data to design engineers, construction teams, and infrastructure providers.

GIS facilitates not only broadband buildouts but also influences various applications and services that community networks deliver:

- Telehealth, (more so than ever in the face of COVID-19),
- Customer Service and Marketing;
- Digital Inequity

GIS is all about data: how to collect it, manage it, understand it, make it work for you as a broadband service provider.

"GIS allows us to centralize all that data, tie attribute and location information together, analyze it and make intelligent and informed decisions regarding broadband deployments," says Brad Hine, Product Director – GIS & Analytics Solutions for ETI Software Solutions. "In telecommunications, at least 90% of everything an employee will deal with during the day has a location tied to it. So it makes total sense if the information that they work with on is based on location or map intelligence."



GIS Key to Collaboration in Broadband Buildouts

Within customers such as carriers, city or county governments, or electric co-ops, there may be several distinct universes, each with their budgets, objectives, personnel, etc. Every universe has its own silos of data. Then there is usually a feasibility consulting firm, an engineering firm or two, a lead construction company and several sub-contractors, and a backhaul supplier. Each vendor and sub-contractor has its own universe and data silos.

When all the stakeholders are equipped with technology that enable collaboration to be more effective, everyone completes network projects faster, and with better ROI across the board. Without a centralized and coordinated technology, projects can get bogged down due to shipping delays, erroneous forecasting, operations incompatibilities and other preventable occurrences.

Justin Reid, VP for Sales and Partnerships for construction management software vendor Vitruvi explains, "Historically, engineering and construction were two very siloed divisions of an operation. Engineers would send the design over and say, 'Good luck', and construction managers would be like, 'What the heck did you design here? This has nothing to do with reality."

Engineers are focused on engineering tools and workflows and they want the best toolset possible for them. Separately, construction teams and their project managers are equally focused on their needs and the best possible solutions for them. Each solution may be best for their respective needs but do not communicate with each other. A GIS system will take the engineering data and autogenerate the entire construction plan from that data.

While there's a myriad of business processes happening between engineering and construction, at least 90% of the buildout falls within construction's domain which could involve tens of thousands of homes. Until recently much of this was done manually, and the automated elements were captured in systems

that couldn't talk to other parts of the projects. Often, with big broadband projects there might be two main construction firms and several subcontractors.

"You would enter rules and costs for deploying the network, equipment unit costs, the ducts or cables and the sizes," says Kevin Wynne, Head of Comsof Americas, a fiber network planning and design software company. "They'd calculate and optimize the design, plan cable routes, estimate cost per home passed, and select construction equipment. Now all that is automated using GIS."

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> **– Micheal Measels, Vice President, Products, 3-GIS**

"The challenge for service providers is to integrate disparate business processes from within and outside of the organization so there is a single 'system of record' that supports the processes," says Micheal Measels, Vice President, Products, 3-GIS. "The glue [GIS] provides us the opportunity to build a bridge across multiple departments inside the customer account and allow multiple vendors to provide any capabilities to support those processes."

GIS Hooks for Application Collaboration

Broadband builders, especially municipalities, co-ops, and WISPs, need to view themselves as more than "dumb pipes" connecting people organizations and things. There is money and marketing advantage to be made from facilitating apps running across the network. You can generate a fundraising edge when you're delivering healthcare rather than just a connection. And superior customer service tends to trump price wars as a marketing strategy.

More enterprising broadband providers may want to monetize the apps and services that run across the network. As your collaborators build the network infrastructure, see if they also can lay down a GIS foundation with software hooks. With appropriate configurations, your network management ecosystem can lead service providers to apps that generate long-term ROI.

"I advise my vendors and subcontractors that it's a good idea to use non-proprietary open data formats so then everyone can work together," says Wynne. "I also like to work with vendors that have existing integrations with one another's software."

ISE Magazine writes, "The cloud and mobile infrastructure are clearly synergistic and mutually dependent. More applications for both consumer and business run in a cloud, and more access is from mobile devices. The success of this collaborative solution is inescapably dependent on each other. As every aspect of our private and work lives evolve into a cloud-based mobile delivery model, this market is growing at an ever-increasing rate."

Broadband providers need to make sure their core business groups such as marketing and customer service have GIS software hooks that can connect to current and future network apps. For example, if a provider has partnered with a cloud computing company that sells home-office apps, a trigger can be set up to remind customer service reps to refer the app to a subscriber after a service call.

The next section addresses digital inequity. It's hard to claim broadband project success in many places without tackling this issue.

GIS Impacts Digital Equity

After it was clear that we were in a pandemic that would significantly impact the U.S, there was no denying the weak state of broadband in urban low-income and rural communities. When K-12 schools and colleges shifted immediate to online learning, and news headlines proclaimed the value and virtues of telehealth, these weaknesses needed to addressed.

GIS is technology that can be used to right the scales of digital inequity both in urban and rural communities.

Some people might assume that in urban areas, because there are Verizon stores and AT&T store at every mall, everybody's got to be covered. But that's not the case. Ron Deus, CEO of NetX, a wireless ISP (WISP) in Cleveland (OH) observes, "What happens in the suburban and urban areas amounts to redlining. Incumbents' buildouts, upgrades and adoption efforts happen in the most profitable areas first. Areas just a mile or two away become digital deserts."

In 2005, Philadelphia wanted to be the first metropolitan city with citywide Wi-Fi. The main objective was to connect low-income and poor communities. Research showed that Internet access tracked with economic status – access went from 50%-55% up 95% based on the wealth of a community. Things haven't changed much since then.

In 221 large and medium-size U.S. cities, according to U.S. Census data, at least 30% of all households still lacked a wireline broadband connection in 2018. In Detroit, Michigan, 79,000 (30%) of their 266,000 households are without broadband. 74,000 (29.3%) of Memphis Tennessee's 252,000 households lack broadband. Brownsville, Texas, the worst connected city in the U.S., 47% (24,000) of their 51,000 residents lack broadband.

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Pew Research does extensive research continuously and each year releases a study where they have formulated how specific variables in education, age, and household income indicate which people buy or reject Internet access. Community stakeholders can more accurately map and predict deployment costs, raise money and identify resources to increase broadband utilization among underserved and unserved citizens.

Communities should explore wireless, considering the technology advancements being made in wireless and seeing the accomplishments urban WISPs are making. Not too many people want to tear up the streets in urban areas to lay a lot of fiber, but strategically placed fiber can power Wi-Fi and fixed wireless networks in disadvantaged neighborhoods.

"Wireless is the way to go. When people are considering broadband in urban areas, I think of 5G," says Hine. "You want to deliver services to dense areas of people who collectively need massive broadband to get video, high-bandwidth images, and video streaming. At the same time, I'm not really sure that 5G technology is ready for the market yet. I wonder if maybe it's another five to 10 years out."

GIS can search for resources that could support wireless deployments, such as municipal or private-sector dark fiber, residential and commercial rooftops and, and other vertical assets. Anchor institutions such as, K-12 schools, libraries, and corporate and university campuses possibly can share fiber or wireless connections to power wireless in underserved communities.

GIS Tackles Unserved and Underserved Rural Communities

According to a Center for Rural Affairs white paper, "access to broadband for rural households depends heavily on geography. Nationwide, 31% of rural households and 35% of Americans on tribal lands lack access. In Wyoming, Oklahoma, New Mexico, Nevada, Montana, Missouri, Mississippi, California, Arizona, and Alaska, more than 60% of rural areas lack access to broadband."

Broadband is defined as internet connections capable of 25 Megabits per second (Mbps) for download and 3 Mbps for upload speeds. As bad as the national statistics are, some rural communities fare much worse. In rural western Alabama, less than 1% of Perry County's roughly 9,100 residents have high-quality internet at home, so for these residents the homework and health care gaps are veritable canyons.

There are many reasons why broadband isn't available as much as it should be in rural areas. It's not affordable for many, there are data caps on usage, the populations are sparse. GIS tools can help track and address these issues.

Hine has seen telecom companies that have really embraced rural America. "Our company deals with many wireless service providers. They are always challenged in their rural communities to not just deliver to the underserved but also to those entirely unserved. Customers that have to drive to a McDonald's and sit in the parking lot, to get an Internet connection so their kid can do their homework at night."

GIS service providers can look at everybody's service footprint on a map, see the areas that are unserved and then direct where to put up wireless towers in those areas. GIS can help identify locations that offer a clear line of sight to those homes without broadband, or nearby buildings to put place a router.

GIS helps in a two-dimensional way, but also in a three-dimensional way. "You can evaluate from a 3D view where we should put a tower that will serve the most people with the most line of sight connections," says Hine, "Then we can start to serve this are and provide high speed broadband. GIS is absolutely the tool for that."

GIS is probably the only spatial analysis tool that broadband providers can use for this type of work without having to evaluate a terrain by visiting it. This is a huge use case for GIS and telecommunications. It's going to help with telehealth too. For access in many rural areas, people need to connect to the Internet with wireless and they have to be in an area where they have line of sight.

Telehealth and GIS Address the Healthcare Gap

COVID-19 Is changing the way that we view doctors and healthcare. The pandemic transfigured telehealth from a sidebar technology to a change agent that will transform healthcare as we know it. GIS is another critical technology that can impact healthcare, though maybe in a more subtle way.

"With COVID-19, what's the thing that everybody wants to know?" asks Hine. "How many people are infected in my community and where they live, generally, so I know where not to go. GIS is important to telehealth because location is extremely important to every aspect of telehealth, as is also trying to get at all of the data that's attributable to a location."

When coronavirus struck, people became desperate to get telehealth so they could avoid dealing with potentially infected people at doctors' offices. Reality quickly set in as people realized – you can't have telehealth without broadband.

Media articles zeroed in on how weak the countries broadband infrastructure is. At least 30% of rural, and up to 50%-55% of low-income urban communities lack affordable broadband access.

Deploying Broadband for Telehealth to the Home

US Senators want to make $2 billion available to communities, including urban communities, to facilitate deployment of broadband and telehealth together. They also want to eliminate administrative red tape that slows down the ability of front-line providers to obtain broadband connectivity

Senator Brian Schatz (D-HI) is lobbying, along with Senators Lisa Murkowski (R-AK), Angus King Jr. (I-ME) and John Boozman (R-AR), to allocate this money to the next COVID-19 relief bill for broadband expansion. The goal is to append this money to the amount that's currently controlled by the FCC's Rural Health Care (RHC) Program.

The FCC in March authorized $200 million to add to the USDA's war chest, plus the FCC has another $100 million pot of money. However, the lion's share of the current federal money is going to hospitals to improve their fiber networks. How is broadband going to make it to people's homes?

Paladin Wireless in Georgia is a wireless ISP (WISP) and an ETI customer. Similar to many in the US, residents in Paladin's service area were frenzied as school kids, college students, and much of the work force were restricted to their homes. Bandwidth for telehealth was minimal.

Home wireless routers and Paladin's network were slammed by the sudden Internet demands and the underserved were completely in the dark, digital speaking.

In the mist of this craziness Paladin figured out a solution that would enable them to quickly deploy wireless networks without sacrificing security. ETI and GIS would manage the process.

With the GIS capabilities of a product such as ETI's Software's Beamfly and used with LTE wireless networks, communities can get more bandwidth, cheaper, installed faster and with greater reliability. This is particularly beneficial for telehealth used to address addressing chronic illness, home healthcare, mental health and seniors aging in place But with a GIS mapping app, communities can identify specifically what type of telehealth matters to constituents.

"I can see deploying an LTE solution for emergency Wi-Fi access across neighborhoods using quick and ruggedized set-ups based on our existing network technology and frequency access," says Casper Faust, Field Operations Manager at Paladin. "It's similar to how your smartphone can do a personal, secure hotspot." But instead of getting a little hotspot, a person plugs a device straight into a home Wi-Fi router that enables it to become a super-powerful router that's sped up by the network's LTE connection.

Making Telehealth Reality

In both rural and urban communities, the broadband that drives telehealth likely can be a combination of wireless and wireline. Paladin's rapid deployment strategy can be woven into a fiber strategy.

10 Minnesota towns and 14 townships in Renville and Sibley Counties had Hiawatha Broadband Communications (HBC) create a fiber ring around the area. HBC deployed wireless everywhere and started generating revenue while they worked on a long-term FTTH solution. When HBC finished the fiber buildout, the wireless infrastructure become a redundant backup.

Since everyone gets sick at some point, telehealth should generate widespread interest. To execute hybrid wired/wireless, start with a GIS map to pinpoint your various technology and other resources that can facilitate telehealth. Then map out what types of telehealth that citizens want or need.

"Vallejo, California is one of our oldest customers," says Alissa Sklar, Vice President of Market of GIS Planning. The city has built its own fiber network. "For telehealth purposes, I can map out where the physicians' offices and add map layers such as fiber access that the offices can tap into. It seems there is fixed wireless access in the northern part of town, not where doctors are, but they may be neighborhoods of potential patients."

Telehealth isn't just chatting with physicians. Telehealth means using intranets and Internet networks to observe, diagnose, initiate or otherwise medically intervene, administer, monitor, record, and/or report on the continuum of care – everything that's done to get you healed. After that, then plot out your broadband deployment or enhancement based on the continuum of care you likely will need to support.

"GIS makes it possible to for all data to be completely shareable," says Sklar. "Demographic data to place in a map can indicate populations with chronic illnesses or locations of environmental triggers for certain diseases. GIS goes hand-in-hand with telehealth."

Sometimes the economic health of a community should also be considered. GIS Planning offers a service called ZoomBusiness that was designed during the coronavirus pandemic. A town or city can generate interactive GIS maps that show a local view of stores, restaurants and services. Owners can add details such as changed hours, delivery or curb-side pickup options, promotions and gift card stimulus programs.

Layer the maps with constituents who have other broadband needs, use other GIS tools to help buildout the hybrid infrastructure, and then use a product such as Beamfly to manage both indoor and outdoor wireless routers. Beamfly also can help manage fiber networks. Strategies for building out broadband are continually evolving, but this hybrid idea is a good starting point for your discussion.