The Economic Impact of Low Earth Orbit Satellite Broadband Technology on Mountain Communities

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Economic development concepts such as entrepreneurship, business retention, workforce development, and Main Street retail seem illogical and almost inappropriate when considering current mountain communities. The challenges imposed by the undulating terrain, sporadic winter weather events, seasonal residences, lack of professional services, poor education initiatives, sparse population, and shoddy internet service disqualifies mountain communities from major private investment early in the site selection process. When considering one of these communities from the lens of an economic developer, where would a potential investment have the greatest impact? Is it possible to create an action item that would significantly move the needle from a position of merely surviving to thriving with snowballing momentum? Low Earth Orbit (LEO) Satellite Broadband technology may be the catalyst for long-term, sustainable economic growth in mountain communities.

Internet Service Coverage and Technologies

According to the FCC, the term "broadband internet" may be used to describe internet speeds greater than 25Mbps and is the minimum threshold for most federal funding. Using data collected from the FCC's Form 477 filings, as of 2017, 24% of Americans (78 million people) in rural areas lacked coverage from fixed terrestrial broadband networks offering 25Mbps. Another 14 million lack access to any fixed broadband service whatsoever. [1] Figure 1 below illustrates the lack of availability of high-speed internet service in mountain communities. Notice the large swath of area in the mountain region that is not profitable enough for internet service providers to engage. Figure 2 displays the quantity of Internet Service Providers that offer 25+Mbps. Note the areas in white have no option for 25+Mbps service.

[1] https://broadbandnow.com/national-broadband-map

Map of Internet Service Offerings by Speed in Eastern Tennessee and Western North Carolina

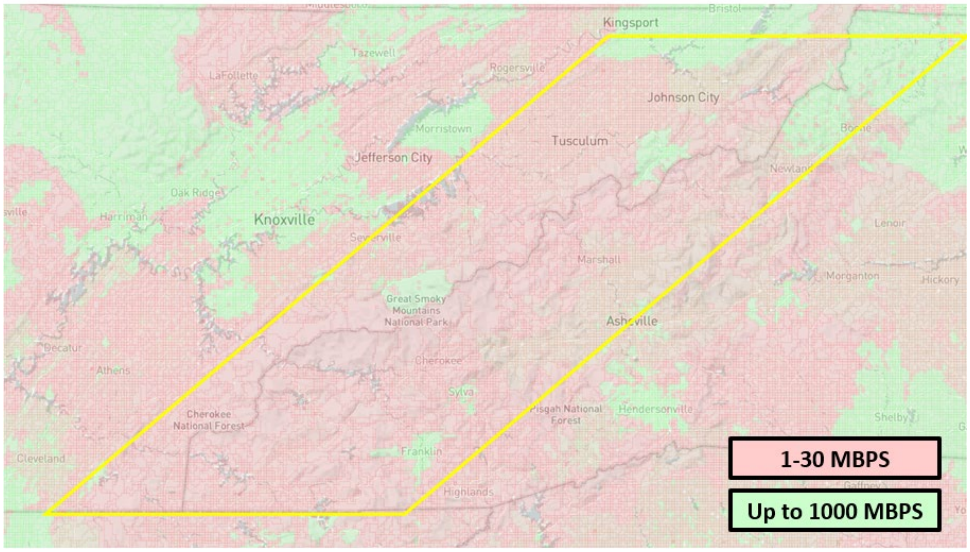

Figure 1

Map of Available 25+mbps Service Providers in Eastern Tennessee and Western North Carolina

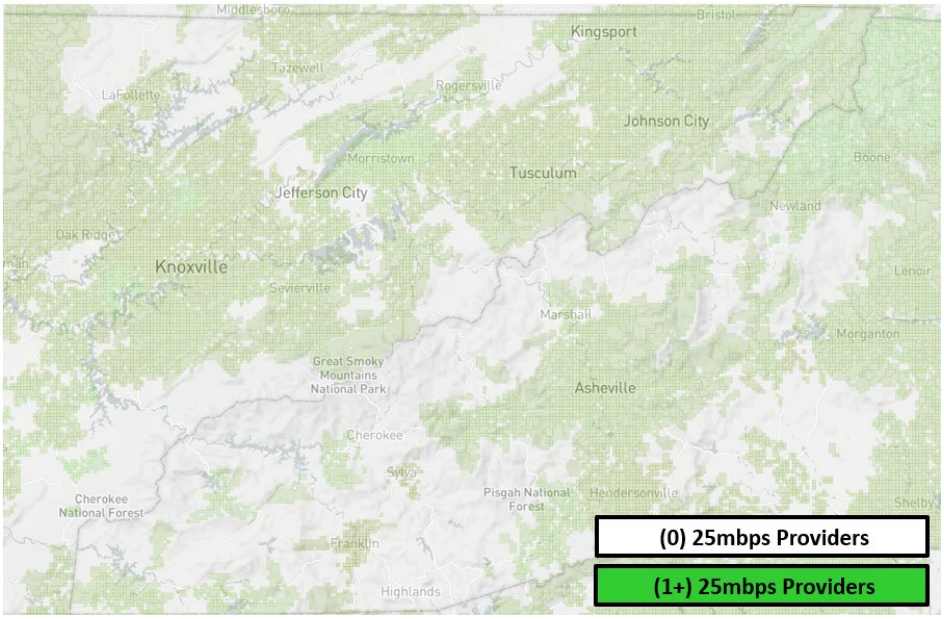

Figure 2

Lately, widespread high-speed broadband coverage has been a priority of the US government and its agencies. There are numerous Rural Broadband Initiatives from agencies like the USDA, FCC Universal Service Fund, US Department of Housing and Urban Development, and the Appalachian Regional Commission with awardable allocations in the tens of billions of dollars. These billions of dollars are currently being invested in technologies like fiber optic rings, 4G towers, and 5G towers.

For mountain economies, the ability to deploy these available technologies range from high cost to cost prohibitive and from inefficient to impossible. The 4G towers, are usually placed in valleys and on mountain tops, where customers need line-of-sight in order to access the towers. Network speeds can vary depending on season. Speeds in the summer months usually hover around 20Mbps due to leaves that obstruct line-of-sight, vacationing tourists that load the network, and the return of seasonal residents to the area. This is not terrible, but not worth next generation money for future broadband needs.

5G towers have a more troublesome complication. Although download speeds range from 100Mbps to 400Mbps in the lab, the proximity to the tower required for optimal speeds is around 500ft with a steep service drop-off as you move further outside the 500ft perimeter. This technology is great for urban areas, but for rural areas, it does not make sense to essentially put a 5G tower on every residential lot and every commercial business in Appalachia.

Fiber optic technology is great on speeds with download speeds up to 10 Gbps or (10,000Mbps). Many low-lying areas in Tennessee have taken advantage of government programs incentivizing fiber deployment and have become Gig cities. Unfortunately, for mountain communities the cost to install the infrastructure necessary for a low density

population, the challenges of trenching in mountain terrain, and the return-on-investment (ROI) would be prohibitive for a realistic expectation of fiber optics in the region.

A new technology has entered the space with a lot of fanfare mainly from its champion, Elon Musk. Low Earth Orbit Broadband technology is a series of satellites that maintain a comparatively low earth orbit and can work together to provide internet speeds around 400Mbps to any customer that can see the sky above. Companies like Elon Musk's Starlink, OneWeb, and Amazon's Project Kuiper are leading the way in launching and linking satellites for their networks. Starlink has plans and approvals to launch 12,000 satellites with services potentially beginning over North America in mid-2020. OneWeb has 2,000 satellites planned with services beginning in 2021 over the Arctic and Africa. Project Kuiper has plans for 3236 satellites but have yet to deploy. The costs of service, although still not officially announced, are expected to be less than those currently available for the same speeds.

(Starlink, 2020)

Economic Challenges in Mountain Communities

Snowbirds exiting Florida to their mountain homes to avoid the scorching summer heat, outdoorsy tourists enjoying the beautiful scenery of the Appalachians, and lifelong mountaineers make up mountain communities. Historically, the elements that have prevented long-term residences are seasonal availability of goods and services, difficulty commuting during winter months, and reliable utilities including internet. As seasonal residents leave for Florida for the winter, businesses sometimes shutdown with them opening back up in the spring. For those staying the winter, goods and services are harder to come by. Everything from mechanics to plumbers are in short supply during the winter. If residents were year-round, the increased demand would drive businesses to become more available even in the winter months, thus improving the availability of goods and services for the region.

Commuting challenges, such as driving down a steep grade during an icy winter or commuting to a workplace for 50min one way with multiple switchbacks, would remain but may be acceptable for those working remotely from home. From a southern facing ridge, a remote worker could live in Pigeon Forge at 3,500 ft and work for a company in Palo Alto, CA with occasional days where a couple of weeks worth of supplies would be sufficient to outlast any frontal weather system Who wouldn't want to work from a mountain top with the gorgeous views of the Appalachians?

Reliability of utilities now becomes the deciding factor for potential remote workers and the significant economic impact that they would bring as a result. The electrical grid is stable in the mountains but downed trees can disrupt power at times. For mountain toppers, an investment into a grid-tied liquid propane (LP) whole house generator ($5,000) is worth its weight in gold to mitigate power disruptions from the grid. When the grid fails to supply power, the generator automatically kicks on to power the home until the grid's power is restored. Although power is also a requirement for remote work, the key is internet speed and availability. With an LEO satellite broadband system like Starlink, the major obstacle preventing sustainable economic growth is remedied.

Shifting Economies in Mountain Communities

Available, fast internet speeds will attract remote workers from all over the world to beautiful Appalachia putting upward pressure on real estate values in the region. With real estate value increases come increased property tax revenues for local municipalities. The increase in property taxes on properties will have mixed effects on residents with low incomes. If property

value rise, there is an increased tax assessment based on the value which is offset by the appreciation in the value of the property when sold. If owners are unwilling to sell, then the property tax burden must be absorbed and could hurt low income families. Rents may rise as a result of people migrating to the region and displacing low-income families, but there is still a lot of land still to fill before that becomes a reality. Larger budgets for local municipalities provides the necessary funds for build outs of infrastructure to keep pace with growth. From roads to schools, county governments will have to be proactive in their ability to plan and budget for the coming growth.

Remote workers with the ability to afford mountain homes with larger price tags will also bring demands for a greater variety of goods and services. Local economies will thrive if there is a strong network of entrepreneurs that are responsive to the needs that are going unfulfilled initially and are quick to respond to those needs. Local and regional municipalities would do well to foresee the opportunities and begin implementing community college programs for tradespeople. Electricians, plumbers, construction workers, mechanics, and landscapers are all trades that will see higher demand. A successful community college program with local apprenticeships would be a good channel for businesses to acquire talent as well as to offer a lucrative career for graduating students to embark upon. Trades are becoming more attractive as the number of college-degreed employees in the workforce is supersaturated. In this game of life, the current debt load incurred from student loans is difficult to recover from the lifetime salary differential between graduates and non-graduates. To assist these budding entrepreneurs, local incubators, accelerators, angel funds, community college programs, and a whole network of financial facilitators that would counsel and advise businesses from startup to success stories.

High-speed internet access is the lifeblood of today's entrepreneurs. Trends suggest that entrepreneurs are increasingly working from home and are resistant to incurring the costs of brick-and-mortar businesses. Access to online advertising, sales, and communication are imperative for their business model. With access to broadband technology, a concentration of entrepreneurs will merge potentially creating a cluster of exciting economic growth if properly nurtured. Creating networking events that serve to bring home-based business owners out to meet with other home-based business owners will facilitate connections that spark innovation and generate tremendous economic momentum.

Distribution channels will change with the new residences. Warehouses and distribution centers will have to move closer to the mountains to meet timely delivery schedules of goods, thus adding jobs to local communities. Delivery services such as Amazon Prime will be paramount. Local delivery, garbage collection, and recycling services also have opportunities for local municipalities or an ambitious entrepreneur to service.

Impacts on Education

The most exciting aspect of high-speed internet availability in mountain communities is the access to almost endless educational resources for its residences. In addition to increased budgets for schools from increased property tax revenues, online learning has become necessary in supplementing classrooms and critical for homeschoolers. Many classrooms use the internet for homework, streaming videos, workplace applications, and the myriad of educational websites available for research. Without affordable, available high-speed internet, students' college-readiness and marketable job skills suffer. In some cases, residents are so far from local schools that a bus ride can easily take over an hour each way causing more parents to consider

homeschooling. Without high-speed internet, online learning options such as YouTube, Easy-Peasy, Time4Learning, and Khan Academy are unavailable making it extremely difficult for homeschooling parents to maintain grade level for their children. The resources available without online learning are usually dated and sometimes obsolete.

Secondary and post-secondary online learning are on the rise as well. Online Bachelor's degrees, certifications, Master's and Doctorate programs facilitate working professionals' schedules and rural residents' commutes. Universities like MIT have created open online learning environments like MITX where anyone may take advanced courses and learn the content without cost. Although no credit will be awarded, the ability to learn is there.

Re-education for displaced workers from industries such as coal would be facilitated by online education. The ability for workers to learn a new career in a different industry and/or sector remotely would bridge the gap for mining communities that are struggling with the transition. Even online education initiatives could be created and applied for through the Distance Learning and Telemedicine Program offered by the USDA's Rural Broadband Program. Loans and grants are available to schools and libraries that currently offer or intend to offer distance learning services.

Effects of High-Speed Internet Availability on Healthcare

Although there are pockets of mountain communities that have great medical care, there is a large swath of people that go underserved. Access to modern healthcare is sometimes unavailable where a resident must drive to the next county over to have a baby or to see a specialist. The advancement in video-conference technology combined with faster internet speeds for streaming video have created a market for Telemedicine programs. Telemedicine

programs, such as Teladoc, allow users access to physicians 24 hours a day via videoconferencing. Doctors can view the patient, ask questions, and even prescribe medicine over online platforms.

The convenience of Telemedicine programs for rural residents is significant. Instead of driving to a local Emergency Room or a not so close one when an unknown issue arises, Telemedicine programs can quickly assess the situation and conservatively recommend whether or not an Emergency Room visit is necessary. Removing unnecessary visits to the ER will decrease wait times for those with real emergencies and should improve hospital care overall. Although Telemedicine programs cannot currently run tests like blood work or a CT scan, they can be ordered by the physician and a referral to a specialist can also be made.

The cost savings from the user's perspective is also significant. For example, a Teladoc appointment is around $32.00 out-of-pocket, depending on plan. The savings from not calling an ambulance and/or visiting the ER because an online physician diagnosed a stomachache instead of the fear of something much more severe is in the thousands of dollars. Those costs, which would normally eat up disposable income or cut into the savings of Appalachians, would be recovered to the benefit of households at every income level.

Re-allocation of Federal Funds to Support LEO Technology

Federal funds have been allocated to various broadband technologies with mixed results. The success of fiber optics in cities like Bristol, Johnson City, and Chattanooga would not be efficient in Waynesville, Sylva, and Maggie Valley. Low Earth Orbit satellite broadband is viable and cost-effective and should get a larger share of funding to incentivize its deployment.

Starlink plans to have its services available to Canada and northern US by the end of 2020. Is it possible to incentivize a priority over Appalachia through the use of federal funds?

The US Department of Agriculture has a Community Connect Broadband Grant and a ReConnect Program. The Community Connect Broadband Grant awards grants to tribes, universities, cooperatives, and private companies with the stipulation that the organization provides free service to an area that is without internet speeds of 10Mbps or better for a period of at least 2 years. There is $1.15 billion dollars available in grants for broadband infrastructure construction, acquisition, or improvement through the ReConnect Program. To be eligible, the rural area must contain 90% of households without access to 10Mbps. Starlink could potentially qualify for either of these.

The Federal Communication Commission (FCC) uses its Universal Service Fund, a tax on existing customers, to fund programs such as the Connect America Fund and the Rural Digital Opportunity Fund. The Connect America Fund (CAF) has funding of $12.29B since 2012. It helps cover the cost of deploying broadband service in areas that are deemed high-cost, rural or insular, where market conditions do not favor deployment with government intervention.[1] The Rural Digital Opportunity Fund is repurposing $20.4B in subsidies over a 10-year period to telecommunications companies through an auction process. LEO technology companies could be incentivized to prioritize mountain geographies to spur economic growth in those regions.

The US Department of Housing and Urban Development administers the Community Development Block Grants. States and cities can use the CDBGs to acquire, install, or improve broadband networks. The Appalachian Regional Commission Project grant program aims to expand access to broadband in the Appalachia region by helping create community broadband

networks that can be used by all sectors. These programs also start at the state level and are supported through state and federal funds.

Conclusion

Mountain communities have historically lagged behind all other regions in their ability to grow and sustain economic prosperity. New low earth orbit satellite broadband technology fills mountain communities with hope to be an integral part of the future economy. It is critical for government programs to be agile enough to pivot into superior technologies instead of inefficient or obsolete ones. It is also vital that local leaders and economic developers position themselves for the new economy that is coming to the mountains. The task of educating its residents of all the conveniences and advantages is no small feat and municipalities will need to create workshops and informational outreaches to fully implement modernization in the mountain communities. The future is coming at the speed of a Falcon 9 rocket.

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