

SPECIAL ISSUE: TEACHING CASES

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Teaching Case

Broadband Connectivity In "Flyover Country"

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Abstract

Every professor (who teaches online or uses online submissions) has probably heard that story about not having internet access at a crucial time. It is kind of like that story about the "dog eating the homework...", but in rural areas, the dog may be lack of internet connectivity.

Broadband commonly refers to high-speed internet access that is always on and faster than the traditional dial-up access. Most urban areas in the United States have broadband and cellular internet services abundantly provided, but adequate broadband in rural areas of the country still do not have enough internet service needed to perform and compete in modern markets. In the 21st Century, the Internet is necessary to complete necessary tasks in communications for education, businesses, health care, and farming communities. This case provides a conversation for a Computer Information Systems undergraduate course, or an introduction to Management Information Systems course, in which this topic is part of the curriculum. The case could be used in other courses to discuss the impact of legislation on business, public/private collaborations, and ethics. It has application for various economics classes or courses bearing on the Internet and connectivity. The case was written to generate discussion and to help students contend with the trade-offs of social and economic realities of business and governmental policies. The emphasis of the case is to provide an opportunity for students to learn about the topics and become knowledgeable about the problems that are presented.

Keywords: 5G Wi-Fi, Broadband, Cellular Connectivity, Digital Divide, Net Neutrality, Internet Service Providers (ISPs), Federal Communication Commission (FCC).

1. INTRODUCTION

Over two decades ago, in 1999, country music artist Keith Urban debuted his hit song "Where the Blacktop Ends", and the song continues to remain popular. The lyrics of the song express the joys of escape to rural life, away from urban grind. The song describes the drive through many counties in Kentucky and other states that are filled with scenic croplands, rolling green pastures, and livestock. Such a drive leaves little doubt that agriculture is king in rural sections of

these regions. An American phrase used to describe these areas is "Flyover Country." The term is also used synonymously with "Flyover States," and both are terms that refer to the interior regions of the country passed over during transcontinental flights. "Fly Over States" is a song by American country music artist Jason Aldean. In May 2012, it became a number one hit, and the song (like Keith Urban's "Where the Blacktop Ends") remains popular.

In the modern world of technology, connectivity is essential to compete. In 2019, rural areas throughout the United States still did not have enough consistent service to adequately operate things like sophisticated GPS (Global Positioning Systems) and fail-proof cell service. Some GPS systems use mobile internet through cellular connections, and modern farming equipment uses technology that needs sufficient broadband in order to work properly allowing periodic software updates to take place. Having consistent internet service also provides marketing information for crops and livestock that could be time-critical for profitable sales and activities to be competitive.

2. THE DOUGLAS FARM

Kylen and Beth Douglas understand all too well about the advantages and disadvantages of living "where the blacktop ends". They own and operate a family farm in Henry County, Kentucky, and they also know all too well how much internet connectivity plays in their family's life on the farm where Kylen grew up. Their only option for connectivity is cell service. They readily admit that there is no other place on Earth they would rather be, but modern farming needs technology, and, on their farm, that does not always happen.

Many farmers need to work off-farm jobs to supplement their income, and in many cases, they need connectivity for that employment. Many who live in rural areas remember listening to their parents and grandparents talk about the advantages electricity and city water made when coming to their part of the world. It would only make sense that sufficient broadband service should be next.

"A lot of times it depends on which hill you're standing on and which way the wind blows as to whether or not I can get service out here," Kylen said, "And that can get frustrating at times, especially when you are really depending on it [cellular connection]." In addition to seeing this issue from a farmer's viewpoint, Kylen also sees it as it related to his second job and career, as an agriculture teacher and FFA (Future Farmers of America) advisor at Franklin County High School. The need for adequate broadband makes that job a little more challenging when trying to work from home, which is something teachers often do.

"I've lived on this farm my whole life except for a few years while I attended college. It is a very traditional farm that includes tobacco, hay, some

of which is organic hay, a smaller feeder cattle operation, and a couple of beef cattle herds along with corn and soybeans," he said, "But even the most traditional of farms rely on good broadband service and once you get away from the interstates, the (mobile cellular) service out here gets pretty sparse."

Beth Douglas, Kylen's wife, takes care of most of the business needs, paper work, and records for the farm while also taking care of their three children. She points out that although the farm is located in an area just outside of the triangle that includes metro areas of Louisville, Lexington, and Cincinnati, the service they need is just not available. "We can get service here but it's not the quality of service you get when closer to bigger cities," she said. "As we use the internet more and more for things like taking online classes, ordering goods for the farm and family, and even working some jobs from home, the need for adequate service grows, as well."

As poor as the service can be at times, it gets even worse if both Beth and Kylen are online at the same time. "It becomes really slow around 6:30 at night when more people are home and using their computers," he said. From a teacher's perspective, Kylen can sympathize with his students who live in the more rural areas and have a difficult time using the internet for school homework. Students in his county have individual access to Chromebooks, and much of their schoolwork is now done via the computer and the internet. "I do have many students that live in rural areas, like I do, so I understand that sometimes, in giving a certain assignment, those students may not be able to do it," he said. "And a lot of our assignments are internet-based nowadays and you have to adapt. But for myself and rural students you have to keep in mind that that service may not be available." Often Kylen has to make the trip into town to be able to complete a task for school or the farm utilizing broadband service and states that it could be just the price for living where he does.

His neighbor and local advocate to improve the rural broadband service in Henry County does not see Kylen's view of the price he pays for where he lives. Janet Grissom had worked for 30 years in Washington D.C. in many public service jobs, including having served as Chief of Staff for Senator Mitch McConnell and in the Whitehouse under the George H.W. Bush administration. She says the lack of broadband service in rural areas is appalling and limits the

opportunities for the businesses and people in those communities.

3. RURAL SOUTH ALABAMA

As one of Alabama's youngest senators and the state legislature's only full-time farmer, Senator Clay Scofield, age 37, has separate careers. His careers have helped him overlap the increasingly wide divide of modernity and traditionalism that exist in Alabama. He starts his day tending to his near 25,000 chickens before putting on a suit to talk to constituents, work out deals in Alabama's halls of power, and in recent years, advocating for high-speed internet that still elude large parts of the state. For Scofield, lack of quality broadband internet connectivity is one of the biggest threats to life in rural Alabama.

"It's something I see as being a growing concern and it's going to continue to put rural Alabama at greater disadvantages as we move into the 21st century even further," said Scofield. "We're seeing that high speed internet is important in the 21st century just as electricity and water are ... So if we expect rural Alabama to be able to compete to be able to educate a 21st century work force, if we want rural Alabama to recruit 21st century jobs, if we want rural Alabama to recruit people to move there instead of moving away, then high speed internet has to be in the mix of utilities and amenities that is offered there."

Around 39 percent of the country's rural population is without access to fast broadband access, defined by the Federal Communications Commission (FCC), as having a download speed of about 25 megabits per second. However, the closer you get to Alabama and Mississippi, the number of those without access increases substantially, according to FCC data. That lack of internet access compounds the poorly functioning education and health systems that exist in some rural communities around the state, and ensures that rural businesses are excluded from the economy, according to state legislators and experts.

"Broadband has emerged as being as important to rural life as the phone service and power," said Dr. Darrell West, the founding director of the Center for Technology Innovation at the Washington D.C.-based Brookings Institute, one of the country's leading think tanks. "And [the] digital divide is widening, where we see that lack of having access to high speed internet is leaving rural students and schools further behind."

As rural populations continue to migrate toward big cities, attracted by the lure of better work and opportunity, rural Alabama is losing its population, according to U.S. census resulting data. Scofield says, "Quality teachers are less inclined to take rural jobs, as are doctors, nurses and other professionals that are key to the success of a small, rural town". (Harriss, 2019).

"The internet has become as basic of a utility as water or electric. Students have to be able to access the internet to do their homework; small business people need it for marketing purposes, farmers need it for their businesses..." Janet Grissom (of Kentucky) said, "But it's a complicated issue and it's not all going to come from the government or the private sector, but it has to be a partnership." Grissom noted that in order for broadband to get to that last mile, it has to remain a priority, noting the sectors that are affected by connectivity include economic development, health care, agriculture, and education (Thornberry, 2018).

4. NET NEUTRALITY

You may have heard the phrase "net neutrality" before, but some people may not know parts of the background and challenges that have led the conversation and how it may affect rural broadband due to some content possibly being blocked. Net neutrality is a set of rules introduced in 2014 that demand equality for all Internet content. To understand the background, one first has to look at the basic history of legislation, and then look at how the outcomes will affect rural broadband in the future.

Net neutrality is the idea that all internet traffic should be treated equally – with no internet service provider (ISP) having the power to favor one source over another.

An open internet helps people everywhere, from doctors in developing communities who need vital medical information to treat patients, to small startups looking to build global businesses, to established Fortune 500 companies providing services to millions of customers. Without a level playing field, certain people will have access to the world of knowledge and opportunity while others will not. This may not be fair to some.

Legislative History in Brief

In 2014, the United States Court of Appeals for the District of Columbia struck down the Federal Communication Commission (FCC) Open Internet rules that required equal treatment of Internet traffic and prevented broadband

providers from blocking traffic that would provide more service to certain sites or charging special fees to companies that account for most of broadband streaming of traffic. The court ruled that the FCC had given service providers the same types of requirements as common carrier telephone services, even though the commission had decided not to classify broadband as a telecommunications service. On February 26, 2015, the FCC decided to reclassify high-speed Internet as a telecommunications service, which prohibits the blocking of content, creation of faster connectivity, or making connectivity slower for some users. The rules applied to mobile and wireless services for phones and other devices, as well as wired lines. The changes also included provisions to ensure services would be available to people in remote areas. The new rules were then endorsed by a decision by the United States Court of Appeals for the District of Columbia on June 14, 2016 (Kang, 2016 & Selyukh, 2016).

In December 2017, the Federal Communications Commission, in a 3-2 vote repealed the legislation deeming broadband internet a Title II utility. In short, the FCC voted to relinquish the ability to regulate Internet Service Providers (ISPs). Congress tried to repeal via the Congressional Review Act in 2018. A vote to overrule the FCC's decision passed the Senate and moved on to the House; however, in the meantime, several ISPs filed lawsuits in an attempt to fight the FCC's net neutrality rollback, as well as a number of state attorneys general. On November 5, 2018, the United States Supreme Court denied an appeal of a lower court's ruling requested by the telecommunications industry. The Supreme Court's decision would not make a huge difference to an ongoing federal overhaul of net neutrality regulations in the short term, but it could set a precedent for future court cases (Corbett, 2018 & Price, 2018).

Outcomes for Rural Broadband

As noted in the opening of this case, rural areas in the United States experience a disadvantage when it comes to broadband infrastructure. This is often termed as a "digital divide issue". As of 2016, 39 percent of rural communities lacked access to true broadband – defined as a minimum download speed of 25 Mbps (Megabits per second) – despite the availability in urban areas. Over ten million U.S. households did not have access to broadband at all, and 46 million rural households had only one provider offering wired 25 Mbps speeds. Internet Service Providers insist that network congestion is a

serious problem and that expanding their services would require higher costs to consumers (Dunne, 2017). Given that the infrastructure needs to be in place for broadband, and those people in the rural areas have to find ways to acquire the backbone media to gain that connectivity, the case for net neutrality is a problem. The need is there, but without telecommunications ISPs on board, there lies a problem that legislation alone might not be able answer. Lack of infrastructure is a separate issue that needs to be solved by local and state governments, but if ISPs can decide content, there could be issues that need to be addressed later. (See Appendix 1 at the end of the case.)

For example, video streaming has accounted for most bandwidth use during peak times of use, where broadband is available. Combined with Netflix, Google YouTube, online gaming, and other access such as Hulu or Amazon Prime, cable providers (such as Comcast, or AT&T/DIRECTV) might block online streaming from other companies to force customers to use the cable company's on-demand movie rental services. Some companies believe government regulations might discourage competitiveness by preventing capital expenditures to grow the demand for Internet and Wireless traffic that needs the infrastructure to provide those services. However, equal treatment of access and prevention from blocking certain traffic to sites might need some regulation. That is the crux of "net neutrality."

Access and streaming issues are already an issue for rural Americans and getting rid of net neutrality may have affected them the most. Rural communities with broadband have potential to experience growth in entrepreneurship. This type of success can help local communities along with the national economy. With gigabit connections, rural software developers can use massive data center capacity anywhere in the country as if it was in their basement. Health-care entrepreneurs can overcome the challenges of rural medicine by connecting patients with specialists in other geographies. Farmers could get products to market using real-time supply chain management. Overall, the country and the citizens could benefit with a better infrastructure.

Kylen and Beth Douglas in the state of Kentucky, and State Senator Clay Scofield of Alabama, are not alone. Kate Vickery and her husband live in Colorado and are horse people.

They also work in technology by developing and designing software. When they moved to Colorado in 2017, they were looking for two things in a new home: wide-open space and a solid internet connection. They finally found a place in Westcliffe, Colorado, a town of around six hundred people nestled in a pastoral valley between two snow-capped mountain ranges.

Kate pondered about where she lives now, "You know you may still have a hard work day, life is still life, but at the end of the day you walk out your front door and you've got mountains and horses and pasture and life is okay." Life is all right for Vickery because, in part, her internet is mostly good. From her home office, she can see through the window to some hills that have a wireless tower on them. That cell tower is Vickery's connection to the internet, but, she said, "If you're on the wrong side of the mountain where you've got the shadow of a hill in the way then you don't have broadband access."

Caroline Fry, advocacy and media manager for Colorado Common Cause, is in the camp for net neutrality. She stated, "What net neutrality protects is for content to operate freely online." She also added that people living in rural communities like Westcliffe were already at a disadvantage when it comes to internet and that made them especially vulnerable. She said they relied more on the web for running their businesses, accessing education, news, health care, entertainment – you name it – but they often had fewer options when it comes to providers. Fry continued, "So there's more of a risk for internet service providers (ISPs) such as Comcast or Verizon to come in and ask them to pay for accessing content." On the other hand, the ISPs could slow down or block website content altogether if no one is willing to pay extra. Fry stated that their daily lives rely so heavily on the internet now that access was an important issue. She said it's a big deal. "It's more than just about do I watch Netflix or Hulu? This is about how do I get the resources I need to be able to participate in our society." Could this be a monopoly issue?

On the other side of the argument of "net neutrality" sits Montana Public Service Commissioner (MPSC) Travis Kavulla. He is on the panel that oversees telecommunications for the state of Montana. He believes that the internet relies far too much on federal subsidies and that content providers like Netflix, Google and Apple were getting a free ride. He would like to see those companies picking up the tab. He

called it a "content sponsorship model of the deployment of broadband." He suggested that net neutrality prohibited sponsorship, which means there is less money for innovation and expanding rural access. He believes that getting rid of net neutrality changes that, and would be good for everyone, urban and rural alike. Some may ask if these content providers are already paying their fair share.

Kavulla is less concerned about preserving an egalitarian world wide web, and he wonders if that would really be a bad thing, "I mean, wouldn't your average rural consumer prefer a high speed broadband network where certain content albeit was preferred over a crappy broadband network where everything is equally slow?" Maybe the answer is already in on that. According to a number of surveys, the vast majority of Americans support keeping net neutrality in place. In addition, states are already taking action. Earlier in 2018, Montana Governor Steve Bullock issued an executive order to keep net neutrality in his state. Idaho and Colorado both have legislative efforts underway to accomplish a similar goal (Budner, 2018).

Meanwhile, back in rural Kentucky, Alabama, Colorado, Montana, and across rural America many are still hoping that maybe soon they will get enough internet reception to get a little work done.

5. CONCLUSIONS

Most undergraduate students are familiar with broadband connectivity, as most college campuses provide superb internet access. However, some may relate to the situations presented in the case, as many students are provided a platform for online classes, and they may have experienced similar connectivity issues. This case presents a situation from which students may learn and analyze broadband platforms, and the issues associated with how the infrastructure is needed and made available. It also provides legal and ethical issues for discussion that may help students to understand how the ability to access internet connectivity through broadband infrastructures affects the economy and businesses. The best course to present the case is in an information systems course that provides content for a more in-depth understanding of net neutrality.

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Appendix 1

BROADBAND

Wide Area Networks (WANs) vary in some types; however, the one we all are familiar with is the **Internet**. Keep in mind that although there are different technologies to compare, either the connection is shared among many customers, or it is dedicated to one customer.

TYPES OF BROADBAND CONNECTIONS

According to the FCC, Federal Communications Commission, the term broadband commonly referred to high-speed Internet access that is always on and faster than the traditional dial-up access (FCC, 2014) Broadband includes several high-speed transmission technologies such as:

- **Digital Subscriber Line (DSL)**
- **Cable Modem**
- **Fiber**
- **Wireless and Wireless Fidelity (Wi-Fi)**
- **Satellite**
- **Broadband over Powerlines (BPL)**

***For definitions of each of these types of connectivity please visit the FCC site:**

"Types of Broadband Connections."

<https://www.fcc.gov/general/types-broadband-connections>

Table 1

Broadband Type	Download Speed Range
Digital Subscriber Line (DSL)	.5 – 15 Mbps
Cable Modem	3 – 15 Mbps
Fiber	up to 1 Gbps
Wireless	up to 128 Mbps
Satellite	varies to 25 Mbps
Broadband over Power Lines (BPL)	Up to 10 Mbps (still limited and experimental)

Types of Broadband and **Table 1** are from ("Types of Broadband Connections," 2014) & (Dilley, 2019).

DIA (Dedicated Internet Access)

If the cable itself or a portion of its available bandwidth is dedicated to a single customer, this is more common for business customers, and comes with a Service-Level Agreement (SLA) guarantee of minimum uptime percentages and maximum recovery times if the service goes down. Bandwidth is symmetrical or synchronous meaning download and upload speeds are the same. This is important for businesses that back up large amounts of data online. The subscription also often includes a number of static addresses to allow for separate hosts of servers to dedicate to resources.

5G (Cellular technology with WiFi access)

One promise for rural communities to access broadband has been for the next generation of technology. 5G (or Fifth Generation) is the next generation following 4G (or Fourth Generation) of networking technology. Similar to how some access Wi-Fi, either through an existing wireless service like satellite, or a direct-wired connection like cable, DSL, or fiber, 5G is able to deliver Internet services via a direct wireless connection. 5G-based Wi-Fi in the context of a 5G network is not the same as the 5 GHz Wi-Fi supported by some routers.

One way this works is through Fixed Wireless Access (FWA), which is a base station that wirelessly connects directly to an end user's location, specifically to a Fixed Wireless Terminal (FWT) on the premises, like a home or business. Another way this works is through mobile devices, like cellular telephones, that are part of an Internet Service Provider (ISP) subscription. You can also use a 5G hotspot to turn your mobile network connection into Wi-Fi for your local devices like a tablet, laptop, or workstation with wireless connectivity.

The technology is not available everywhere yet, but could potentially help bridge the gap for some rural areas in the near future. The promise of 5G-based Wi-Fi is to access fiber-like speeds without the cost of high-speed wired internet in an area that does not currently provide it. A minimum theoretical speed of 20 Gbps (2.5 GBs) per cell means that it is over 10 times faster than 4G, and most likely faster than many types of wired home connections. Another aspect is the extremely low latency standard that 5G networks are required to abide by. This means that everything you currently do on the internet is a lot faster with 5G-based Wi-Fi, like when downloading files, sharing data, uploading videos, playing online games, streaming movies, etc.

Not all companies have upgraded their infrastructure to support 5G technology. Verizon is currently the only major carrier that offers 5G-based Wi-Fi in the United States, but it is only available in a few cities. Its release date depends on many factors, including your location and service provider, but most are looking at 2020 to be the year 5G really emerges as the next big mobile networking technology. (Fisher, 2019)

Many factors including regulations from the government, rural fiber, and logistical strategies are all components in ensuring successful rollout of 5G throughout the U.S., which has the most mobile broadband connections among western nations. At the same time, the enormous geographic size and wildly uneven population density between the coasts has made universal and uniform high-speed adoption difficult. According to FCC data, low-population areas of the U.S. still lag in both access and speed.

Some focus on the promise of accelerated government support for 5G rollout, and for subsidies to build rural backbone networks. Some, however, debate over how best to manage 5G development that has shown potential.

Some people want government to take over construction of a nationalized 5G network, following the model of the interstate highway system in the 1950's. The idea is to build a single, 5G network that mobile operators would lease instead of building their own, competing infrastructure. A single private company, not one of the existing carriers, would have the job of building and operating it under government supervision. Others have strongly rejected the idea of nationalized 5G, as it could create unwanted regulations and tax burdens on citizens who may not have access for several years to come. The debate will continue, and everyone should analyze the benefits as well as the problems associated before deciding. (Downes, 2019).

The industry of specifications has settled on 5G NR ("new radio") as the standard technology to fulfill those specifications. 5G NR is a new way of encoding data through the air which is more efficient than previous generations. It can use wider channels, communicate more responsively with remote servers (lower latency), pack more data into one radio cycle, and address more devices per square mile than 4G can. It does this by using more advanced computing power in your device and in base stations than was available in 2009, when the 4G standard was set. You will almost certainly need a new devices to be able to access 5G, even on existing radio bands. 5G promises multi-gigabit speeds, but has trouble penetrating walls and traveling long distances. AT&T, T-Mobile, and Verizon will all use at least some coverage for rural areas.

Appendix 2

1. **What is your personal experience with internet connectivity, and what area do you relate to (i.e. urban or rural)?**
2. **What some of the problems presented in the case, and how would you identify with the people it describes?**
3. **What are the factors that have helped create this problem?**

Geographic:

Economic:

Technology:

Social/Cultural

Legal/Political:

4. **What problem does Net Neutrality bring to the country as a whole, and how do we go forward?**
5. **What promises does 5G-based Wi-Fi (or other broadband types) have for rural areas, and should it become a government-owned utility?**
6. **What areas of telecommunications and the benefits of internet connectivity do you think students who are going into a business career would need to understand?**
7. **Exercise: Test Your WAN Connection's Speed.**

You can test your own WAN connection to see what the current upload and download speeds are using a bandwidth speed tester, or a speed test website. During the test, data will be sent to your computer and then requested from your computer in order to measure download and upload speeds.

- 1) Go to your browser, then go to speedtest.net, then launch the test. Wait for the test to complete, then write down your results.
- 2) Go to Verizon.com/speedtest, start the test, then record your results. Compare the results and your findings about the similarities and differences.