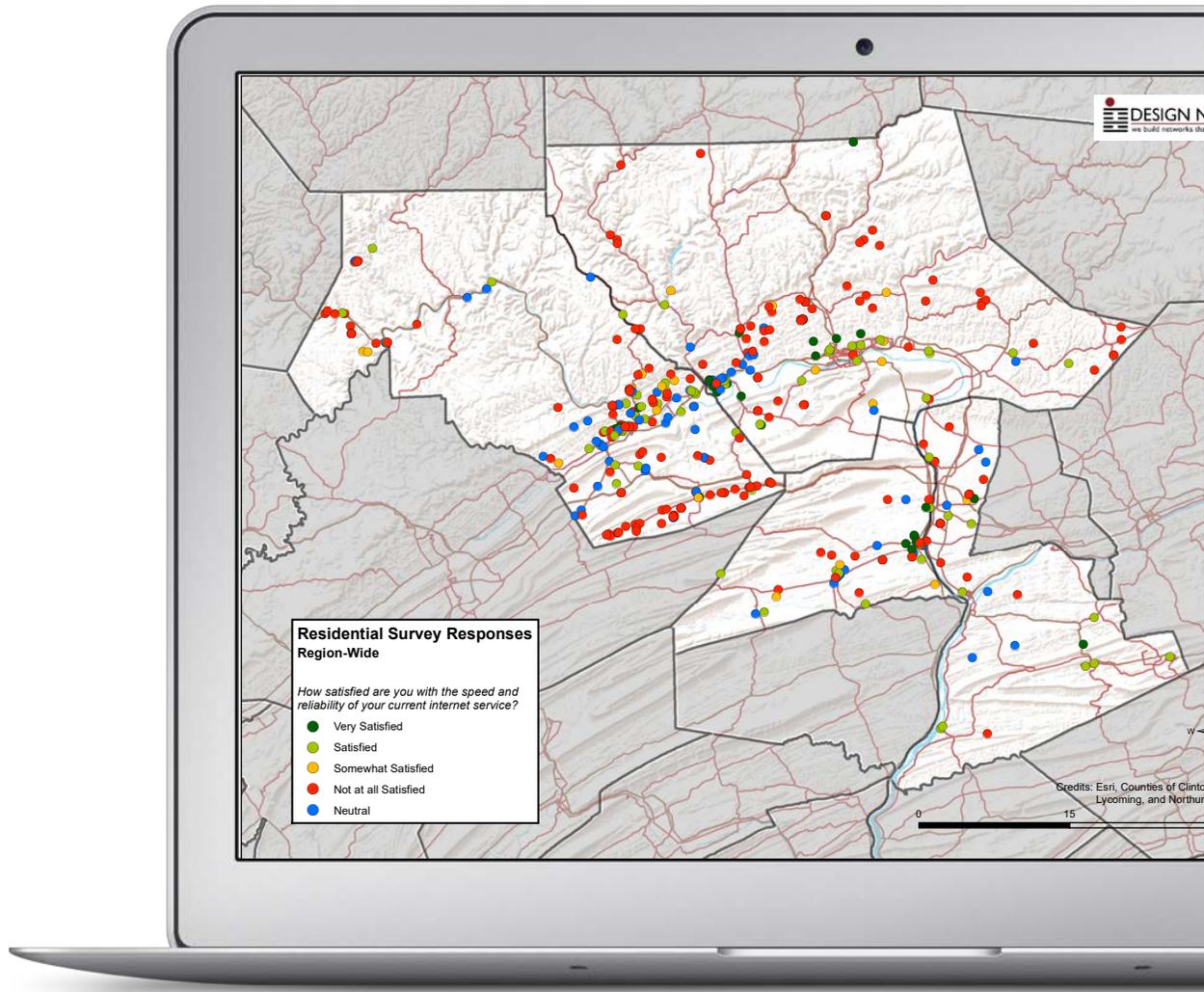


# BROADBAND ASSESSMENT AND PLAN

FOR

Clinton, Lycoming, Northumberland, and Union Counties

A SEDA-COG Initiative



# ACKNOWLEDGEMENTS

This work was supported by:

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### Disclaimer

The telecommunications business is continually evolving. We have made our best effort to apply our experience and knowledge to the business and technical information contained herein. We believe the data we have presented at this point in time to be accurate and to be representative of the current state of the telecommunications industry.

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# 1 EXECUTIVE SUMMARY

A broadband study of Clinton, Lycoming, Northumberland, and Union counties was commissioned by SEDA-COG and completed during the summer and fall of 2019. The study included meetings with stakeholders and interested parties in each county, interviews and meetings with businesses, meetings with county official in each of the four localities, and residential and business broadband surveys. The work included:

- Review of infrastructure assets and a survey of current broadband access, needs, and technology.
- Business and residential broadband surveys to assess current speeds, uses, and likely take rates for new services.
- Maps showing broadband related demographic, fiber and tower infrastructure, speed, and survey results.
- Evaluate existing technologies and recommend best technologies for the area
- Develop cost estimates for implementing technology solutions in three key underserved areas in each county.
- Provide overview of ownership options and provide advantages and disadvantages of each, and legal/regulatory analysis of technologies and ownership options. Include analysis of public and public/private ownership options.

There are six separate documents that comprise the final report materials:

- **Broadband Assessment and Plan** – This report includes a full summary of the survey results, a discussion of future broadband needs, an analysis of current and future technology systems to deliver broadband and Internet, ownership options for county and/or regional ownership of broadband infrastructure investments, funding and grant options for funding broadband initiatives, and legal and regulatory issues.
- **Clinton County Broadband Asset and Service Analysis and Strategies**
- **Lycoming County Broadband Asset and Service Analysis and Strategies**
- **Northumberland County Broadband Asset and Service Analysis and Strategies**
- **Union County Broadband Asset and Service Analysis and Strategies**
- **Map Sets** include a complete set of printable PDF maps for each of the counties

The individual county-level reports include:

- **Asset Maps** – Demographic data, tower and fiber assets in the county, underserved and unserved areas of the county, and geo-coded survey results.
- **Key Area Fixed Point Wireless Projects** – Three underserved areas of the county were identified and a fixed point wireless project for each area is described, including cost estimates and maps.
- **County-wide Fixed Point Wireless Project** – As an appendix, a county-wide fixed point wireless project is described and includes detailed cost estimates and maps. Each of the fiber pilot projects has been located with projected line of sight to a tower in this design.

## 1.1 SUMMARY OF SURVEY RESULTS

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In the summer of 2019, a residential survey and a business survey in Clinton, Lycoming, Northumberland, and Union counties was conducted. Both surveys were available online. Perhaps the most important statistic residential survey is that 68% of respondents report that they have trouble using common Internet services. A total of 405 responses were collected in the residential survey. Not all responders answered every question.

### ***BUSINESS SURVEY***

- 71% of business respondents want better Internet access.
- 94% indicated that the Internet is important to the success of their business over the next five years.
- Only 28% of businesses are "satisfied" or "very satisfied" with their current Internet service.
- 30% of the businesses that responded are home-based.
- 72% of businesses that responded need employees to be able to work from home.

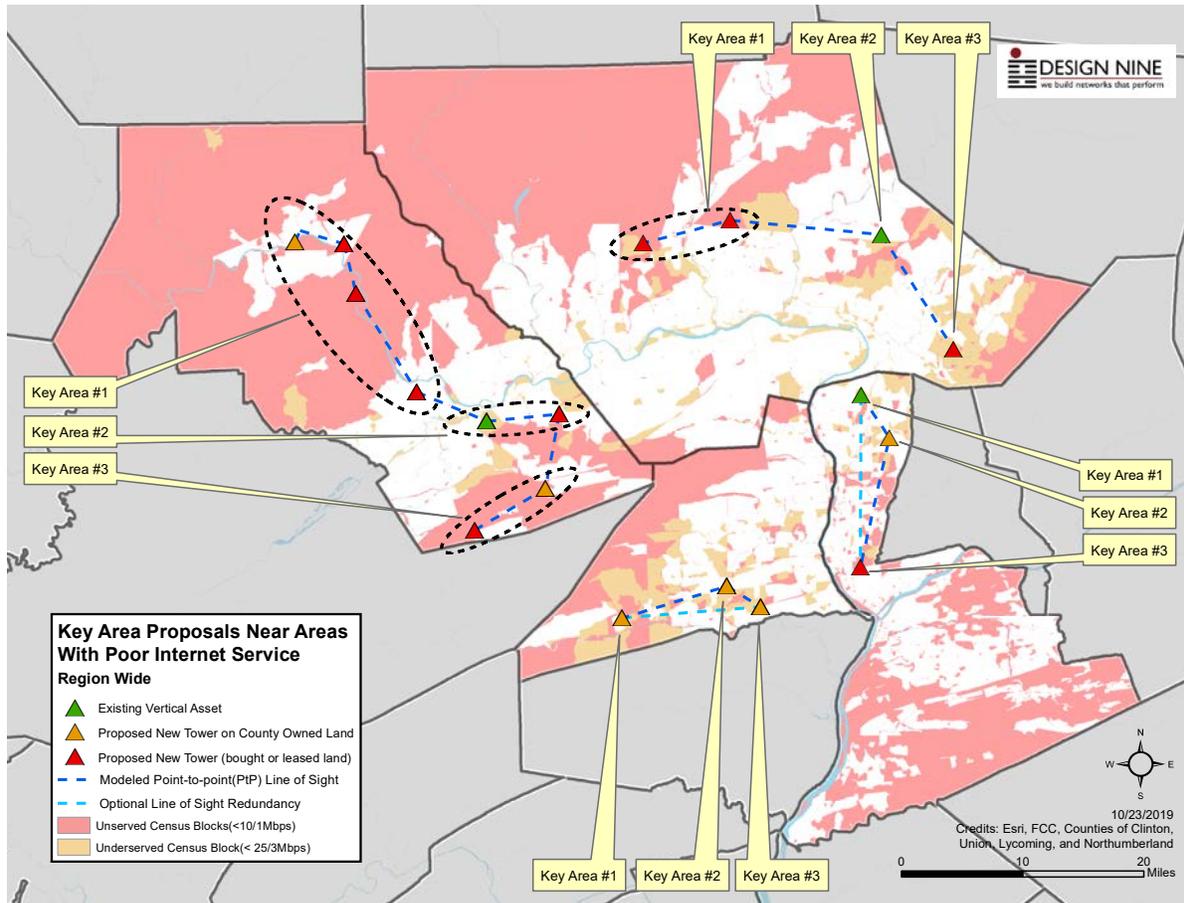
### ***RESIDENTIAL SURVEY***

- 89% of respondents want better Internet service.
- 94% think local government should help facilitate better broadband services and more affordable services.
- 58% of residents are "not at all satisfied" or "only somewhat satisfied" with current Internet service.
- 24% of respondents indicated they have no alternative to their current Internet provider.
- 33% of residents have five or more Internet-connected devices in their home.
- 12% of respondents would work from home if they had better Internet.
- 30% of respondents indicate that availability of broadband Internet is affecting where they choose to live.

A very large number of comments were received, and all of them are listed in the appendices in this report.

## 1.2 SUMMARY OF COUNTY KEY AREA PRIORITIZATION

The map below shows the “key area” projects identified for each of the four counties. The locations were selected based on underserved and unserved areas of each county that could benefit from improved broadband service. Each key area project includes one or more new or existing towers that



are fitted for use by WISPs (Wireless Internet Service Providers). The county governments should seek to work closely with existing regional WISPs to ensure that any new towers are located in areas that are of interest to WISPs, and to the extent possible, agreements with WISPs to use the tower(s) should be obtained prior to constructing new towers or making improvements to existing towers.

The locations identified are not the only places that towers may be needed, and WISPs may be able to assist in identifying other areas in the counties where new towers are needed.

The table to the right shows the estimated costs for the proposed wireless improvements. These expenditures can be phased and built incrementally as funding is developed.

### Key Area Fixed Wireless Project Estimates

SITE	DESCRIPTION
Union	\$570,503
Clinton	\$1,445,460
Lycoming	\$654,790
Northumberland	\$434,623

**Total Estimated Cost** **\$3,105,376**

## 1.3 NEXT STEPS

---

### ***OBTAIN SUPPORT FOR REPORT RECOMMENDATIONS***

Formal letters of support for the recommendations contained in this report should be obtained from each of the four county commissions.

### ***SET PROJECT AND FUNDING GOALS***

SEDA-COG and each county should review the recommendations in this report and set one-, two-, and three-year project and funding goals. These goals should be used to provide guidance on which grants to apply for and which projects and areas should be included in each grant application. The project and funding goals document should be reviewed and updated twice yearly.

### ***EVALUATE A REGIONAL BROADBAND DEVELOPMENT EFFORT***

Regional broadband initiatives are usually able to accomplish more for less cost. Broadband networks don't recognize political boundaries, and there are construction and operational efficiencies to a regional network. A regional development authority with membership representing multiple counties may be formed to begin executing the region's multi-year plan.

### ***INVEST ONLY IN BASIC TELECOM INFRASTRUCTURE – LEAVE INTERNET TO THE PRIVATE SECTOR***

Local and county governments should not engage in retail Internet service delivery. Government investments should be focused on basic infrastructure like wireless towers and dark fiber that can be leased out to the private sector for their use.

### ***MEET WITH LOCAL AND REGIONAL ISPS TO GET FEEDBACK ON TOWER LOCATIONS AND USE***

Once an initial plan is in place to make broadband infrastructure improvements (conduit, handholes, fiber cable wireless towers), Internet Service Providers (ISPs) should be invited to meet to discuss making use of the planned infrastructure.

Any investments in wireless broadband tower infrastructure should be made in consultation with WISPs who are already offering services in the area. Local and regional WISPs may be able to provide insight into where towers are most needed and what they are willing to pay for tower space.

### ***DEVELOP A LONG TERM FUNDING STRATEGY***

Grants may not provide sufficient funds to reach the region's long-term goals. Evaluate longer term funding strategies, like adding a small incremental amount to the 911 fee, using a special assessment, or implementing a very small increase in property taxes. Revenue would be earmarked exclusively for broadband improvements.

### ***IMPROVED AND AFFORDABLE FIBER AND WIRELESS IS NEEDED***

Residents and businesses outside of communities with cable Internet service rely on poor DSL internet access and need an alternative. Making community and/or county-owned towers available to Wireless Internet Service Providers (WISPs) and provisioning new towers in some underserved areas will support improved Internet service. Business parks, industrial parks, and community downtown areas will all benefit from community-owned fiber. Affordable and available fiber in economic growth target areas

can increase property values, make commercial and industrial building spaces more attractive, and help attract and retain jobs and businesses.

### ***FUND FOR SUCCESS***

Successful expansion of broadband in the four counties will be most successful by recognizing that funding will come from a range of funding sources rather than a single source. Grants, public/private partnerships, some local funds, and other sources may all be needed to achieve success.

Grants can be extremely important in the early stages of an effort to support planning activities and/or to fund a first-phase build-out initiative. However, grants rarely allow spending on operational expenses. Grants should be used carefully as one-time cash injections to support very specific goals. Communities that have relied too heavily on “the next grant” as a key source of expansion or operational funding usually experience severe financial problems.

### ***SUPPORT MIDDLE-MILE FIBER EFFORTS***

While improved broadband wireless service is going to be a critical part of any plan, the region needs some middle-mile fiber. While some non-incumbent middle mile fiber exists in all four counties, each county will benefit from having dark fiber available to lease, especially in areas targeted for business attraction and retention (e.g. business and industrial parks). Bandwidth needs for residents and businesses are increasing 30% each year, so some fiber will be needed to keep wireless services able to provide the needed performance. Some fiber is also critical to any economic development efforts to attract jobs and businesses to the region.

### ***PUBLIC SAFETY PARTNERSHIPS***

The availability of public-safety towers and/or new towers can enable new services and applications for police, fire, and rescue in the four counties. Secure WiFi hotspots can be set up around and near the towers, so that reports can be filed from the field using the WiFi Internet connection. Other communities that have done this have found that it saves time and keeps patrol cars out in the field longer.

There are often grants available for public-safety voice and data communications improvements, like new towers and upgrades to existing tower facilities, that could also support the broadband initiative. Any public-safety tower or communications expenditure should be analyzed to determine if the expenditure can also support expanded broadband access in the region.

## 2 BROADBAND SURVEY AND SPEED TEST RESULTS

In the summer of 2019, a residential survey and a business survey in Clinton, Lycoming, Northumberland, and Union counties was conducted. Both surveys were available online. Perhaps the most important statistic residential survey is that 68% of respondents report that they have trouble using common Internet services. A total of 405 responses were collected in the residential survey. Not all responders answered every question.

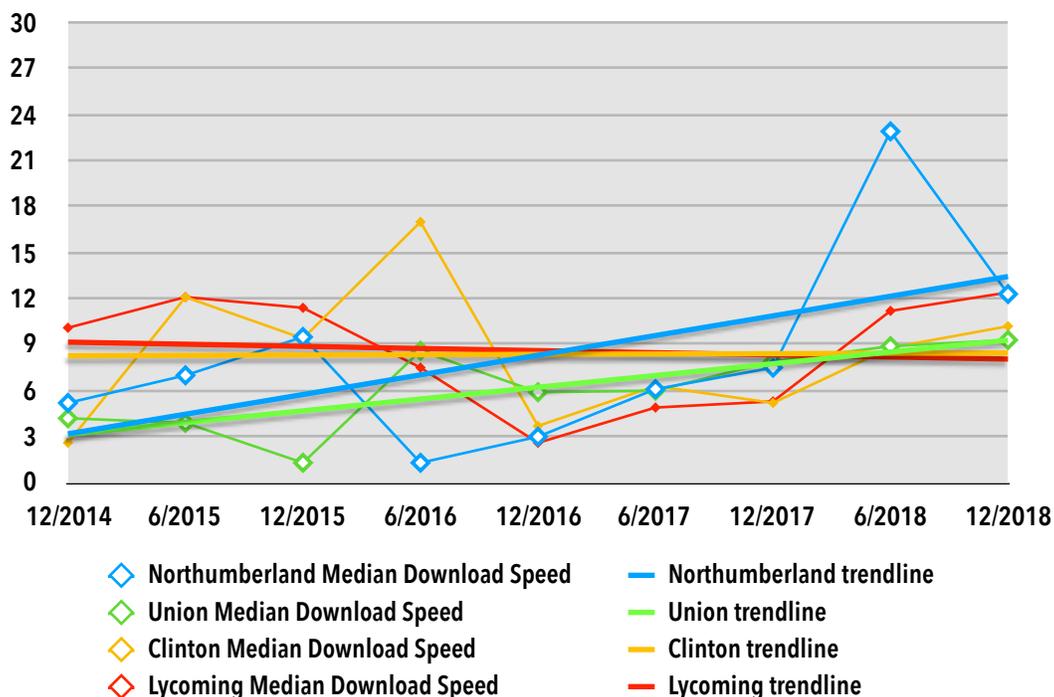
The final question in both the business and residential survey was “Any other comments?” Those responding to the surveys submitted a large number of often passionate comments about the state of their Internet service. Comments from both the residential and business surveys are included in the Appendices.

Penn State has been collecting speed test data from Pennsylvania residents and businesses for several years, and the summary data for all four counties is presented in the next section.

### 2.1 PENN STATE SPEED TEST RESULTS

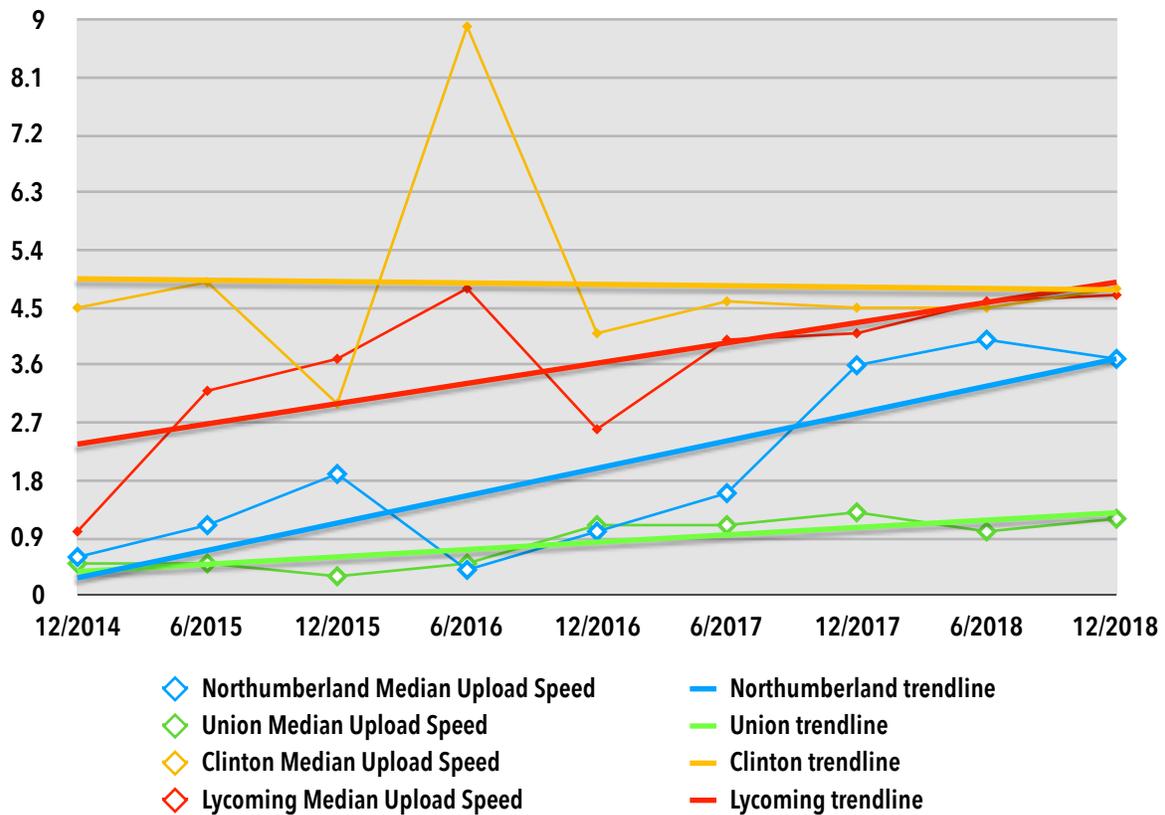
The download speed chart below shows that Lycoming and Clinton download speeds (Megabits/second) are virtually unchanged over the four years of data collection. Union and Northumberland have seen modest improvements, but none of the counties meet the FCC definition of “served” (25 Megabits/second download). The trend line regression analysis shows flat or only slight improvements over the four year period.

**Penn State Download Speed Test Data**



Upload speed test data shows only modest improvements in upload speeds. Union County does not meet the minimum FCC requirement of “underserved” (1 Megabit/second upload). Clinton county upload speeds are essentially unchanged over the four year period, and Lycoming and Northumberland show slow improvements. The trendiness are a regression analysis of the four years of data, showing the general trend of the data.

### Penn State Upload Speed Test Data



## 2.2 REGION-WIDE RESIDENTIAL SURVEY RESULTS

In the summer of 2019, a broadband survey was conducted in the Pennsylvania Counties of Clinton, Lycoming, Union, and Northumberland. The online (Web) version of the survey was publicized on social media and paper surveys were distributed by local libraries. Residents were encouraged to complete the survey online or fill out and return the paper version by surface mail. Businesses were encouraged to complete a separate business-focused survey, and the results of that are included later in this report.

A total of 405 responses were collected in the residential survey. Not all responders answered every question. Note that because of rounding errors, not all percentages sum exactly to 100%.

Some of the key findings from the results are listed below.

88% of respondents are interested in having access to Gigabit fiber

58% of residents are "not satisfied" or "only somewhat satisfied" with current Internet service.

94% of respondents agree that local Government should help facilitate better Internet access

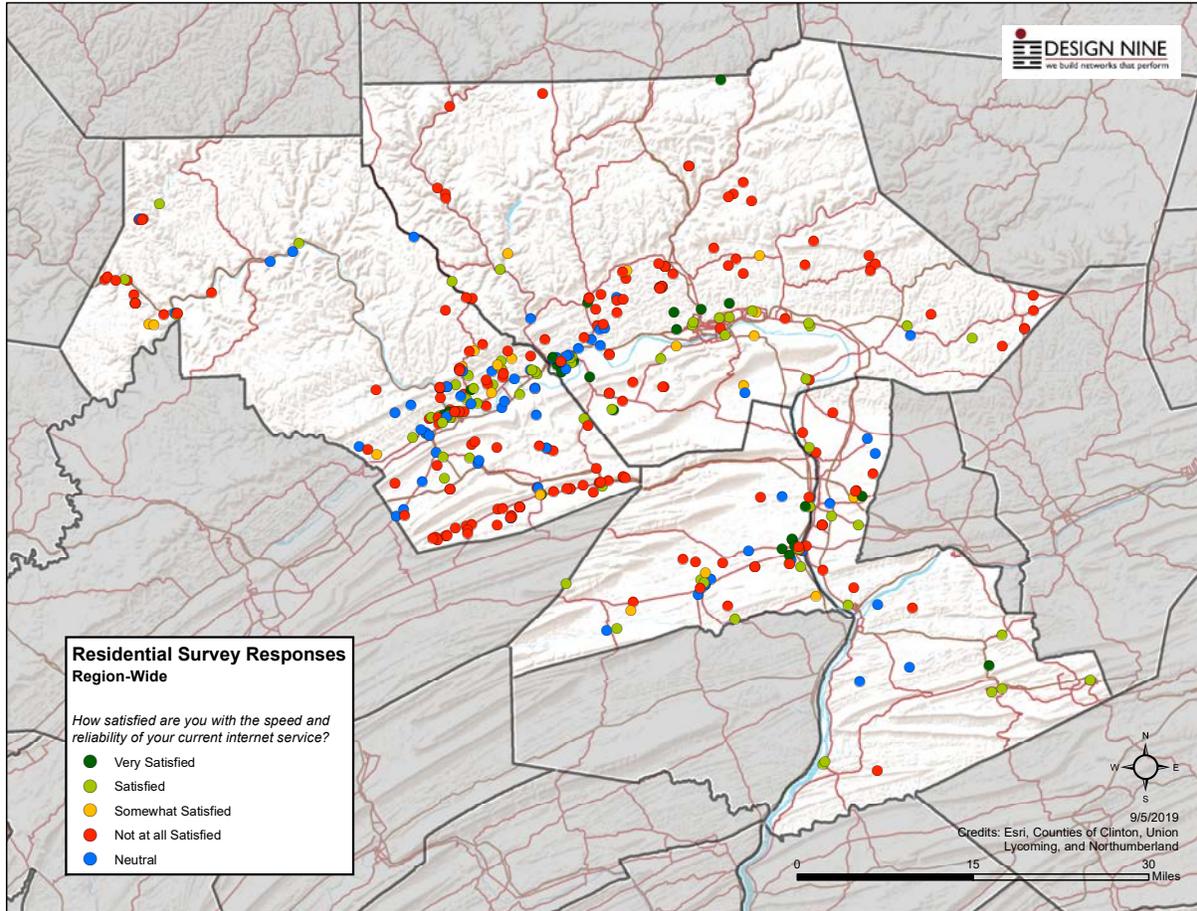
33% of residents have 5 or more Internet-connected devices in their home.

67% of respondents report they have trouble using common Internet services

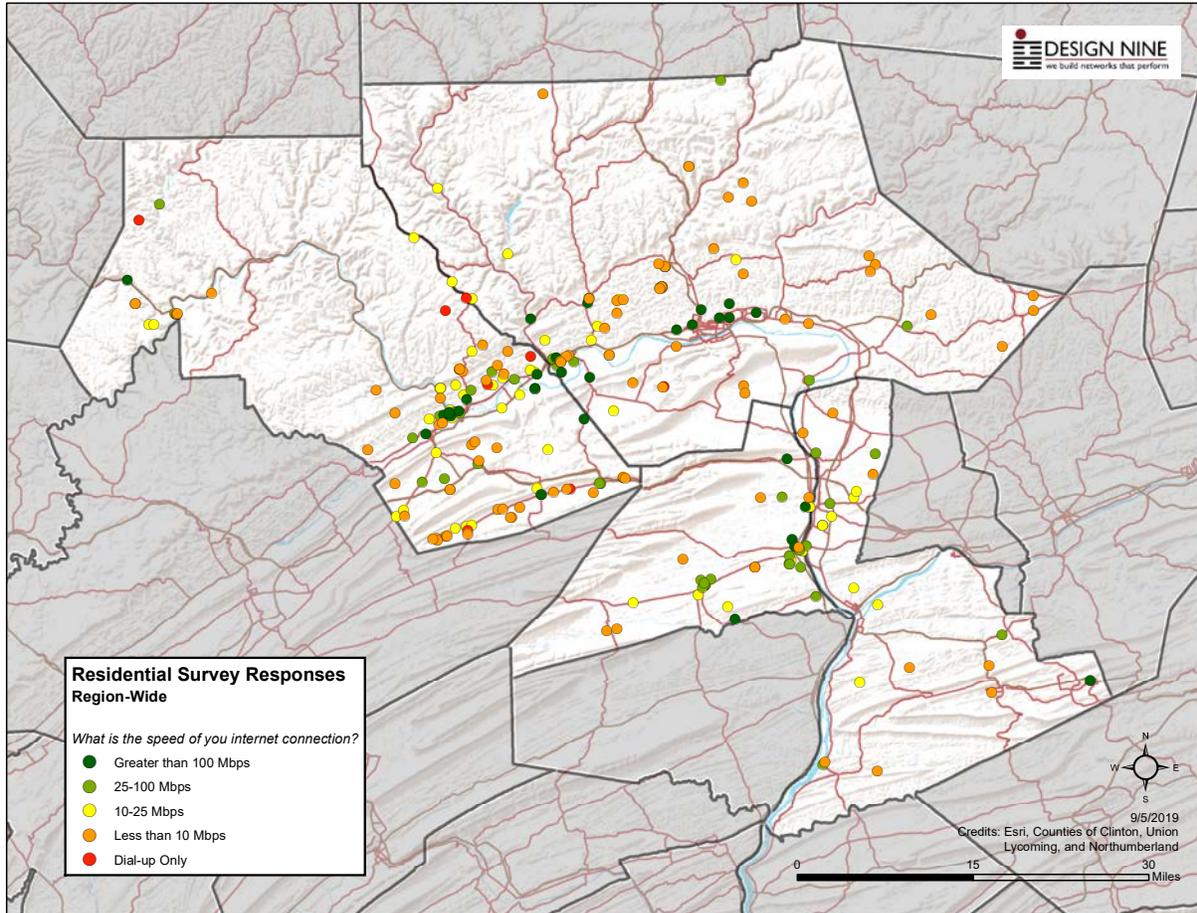
30% indicate that availability of broadband Internet is affecting where they choose to live.

## 2.3 DISTRIBUTION OF RESIDENTIAL SURVEY RESPONSES

The map below shows the geographic distribution of responses to the residential survey, coded according to their satisfaction with their existing Internet service.

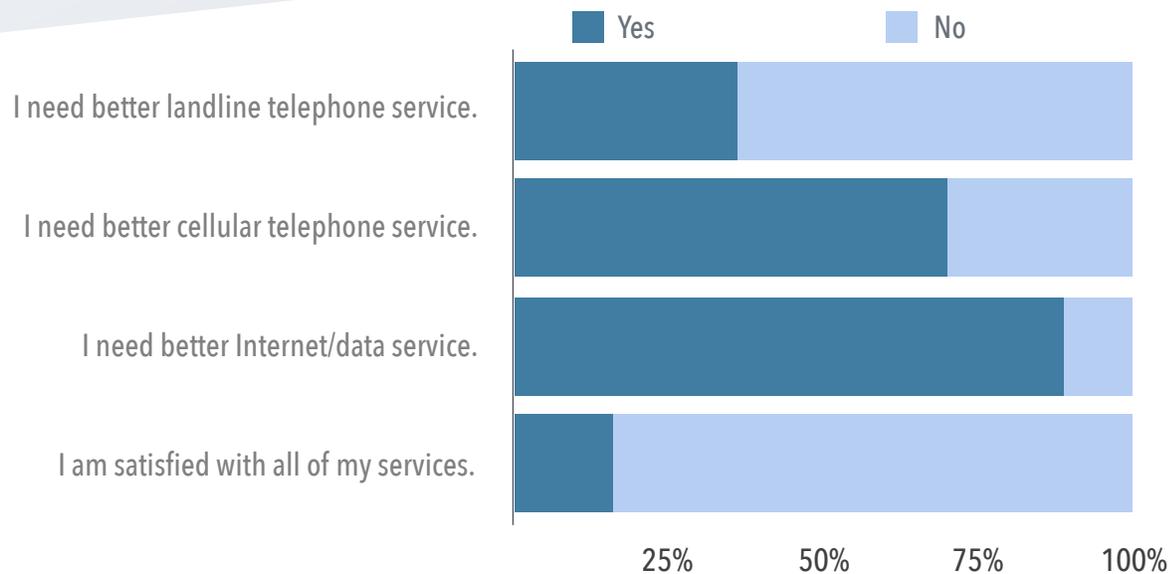


The map below shows the geographic distribution of responses to the residential survey, coded according to the speed of their internet connection.



## 2.4 RESIDENTIAL SURVEY SUMMARY DATA

### 1. Select the items you agree with below



### 2a. Total number of adults in household

1	2	3	4	5	6	+7
42	264	36	36	7	8	3
11%	67%	9%	9%	2%	2%	1%

### 2b. Total number of K-12 Students in the house hold

1	2	3	4	5	6	+7
88	52	17	7	1	2	0
53%	31%	10%	4%	1%	1%	0%

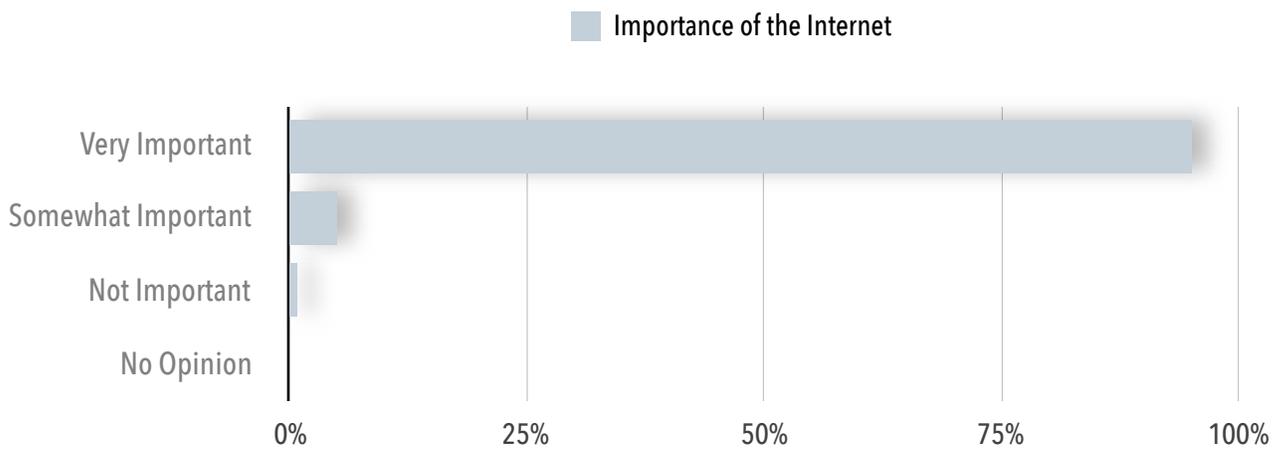
### 2c. Total number of college students in household

1	2	3	4	5	6	7+
60	18	2	0	1	0	0
74%	22%	2%	0%	1%	0%	0%

**2d. How many total Internet users in household**

1	2	3	4	5	6	+7
34	159	72	72	26	15	15
9%	40%	18%	18%	7%	4%	4%

**3. How important is Internet access to you or your household?**



**4. For your household, how much do you spend each month for local and long distance telephone , TV, and/or Internet? Do NOT include cell phones.**

\$50 or less	\$50-75	\$75-100	\$100-150	\$150-200	More than \$200/month
28	32	55	94	88	97
7%	8%	14%	24%	22%	25%

**5. How much do you pay now for at home Internet access each month?**

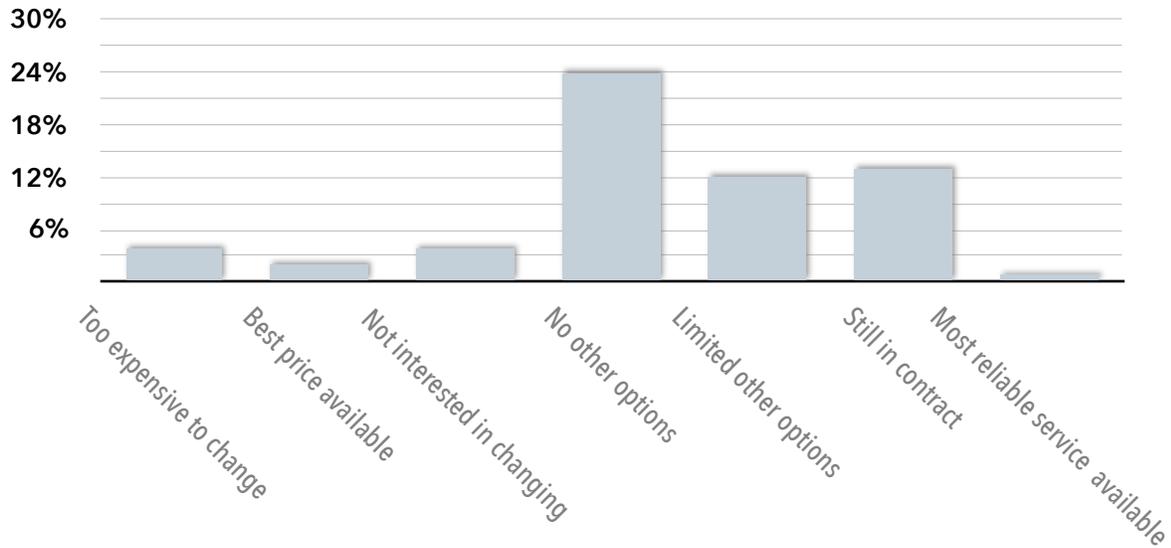
No Internet	I only use free hotspots	\$10 to \$20	\$21 to \$40	\$41 to \$60	\$61 to 80	More than \$80/month	I don't know
29	7	6	30	82	90	127	28
1%	2%	2%	8%	21%	23%	32%	7%

**6. What type of Internet do you have at home?**

Dial-up	3	1%
Cable modem	120	30%
DSL line	134	34%
Fiber	7	2%
Satellite	30	8%
Cellular wireless	29	7%
Wireless WISP	17	4%
I don't know	16	4%
No Internet	25	6%
Other	13	3%

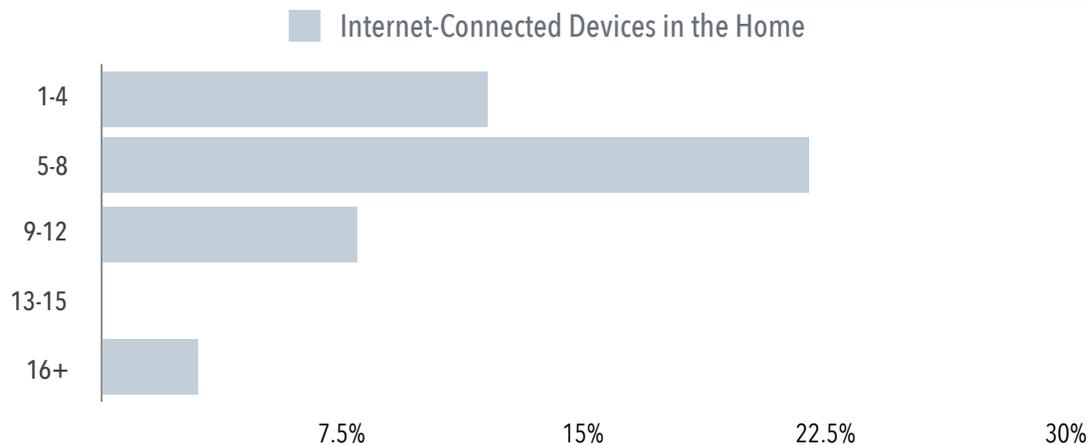
**7. Based on the type of Internet connection you selected above, why do you still have it? (select all that apply)**

24% of respondents indicated they have no alternative to their current Internet provider



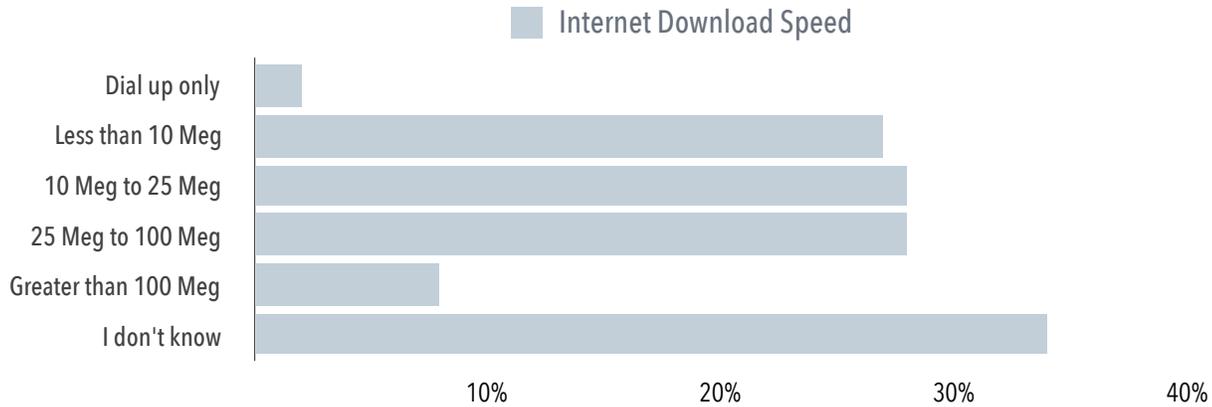
**8. How many devices (for example computers, cellphones, smart TVs) connect to the Internet in your household?**

11% of residents have 9 or more Internet-connected devices



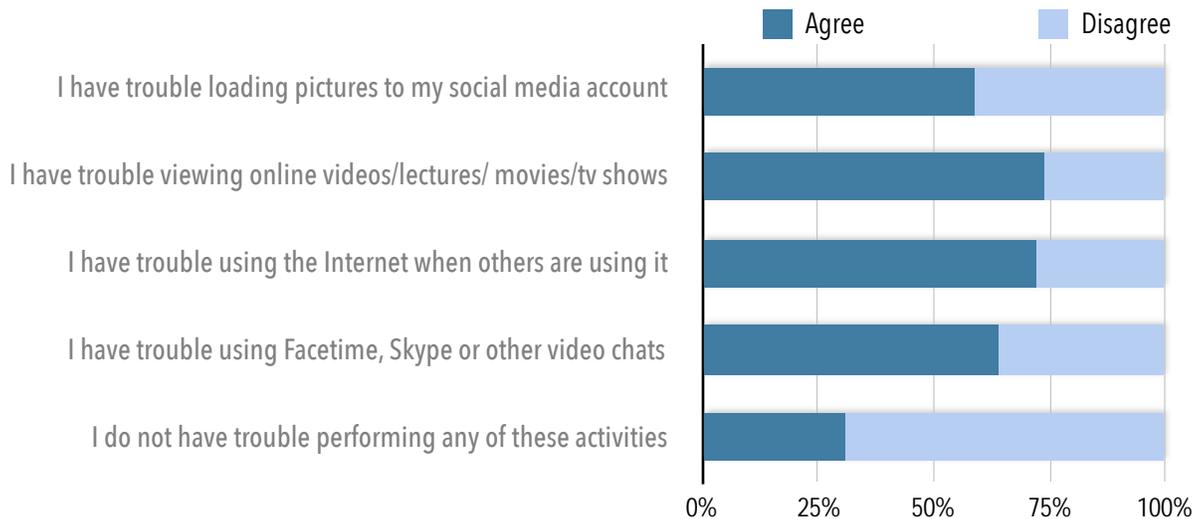
## 9. What is the speed of your Internet Connection?

As few as 36% of residents have Internet service that meets the FCC definition of broadband (25 Meg down, 3 Meg up).



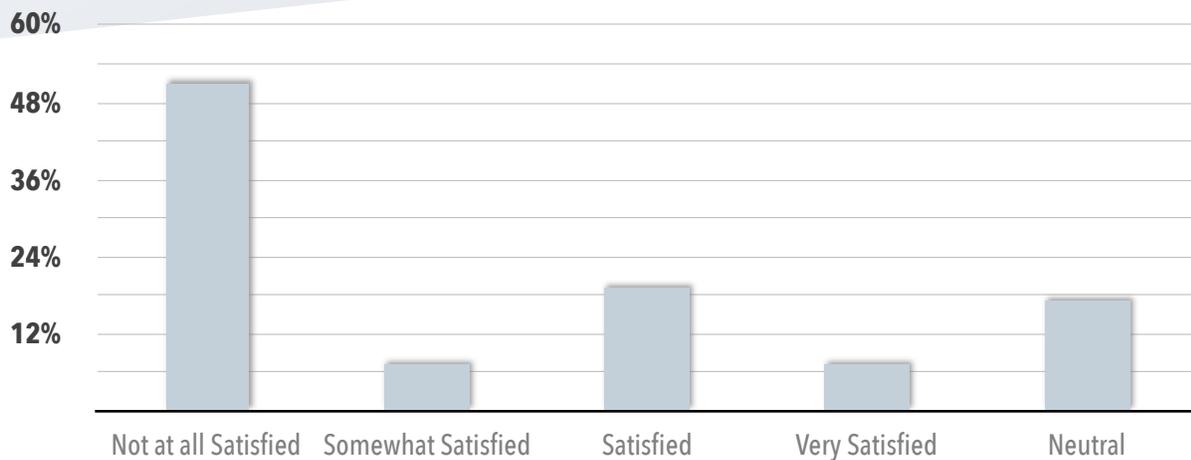
## 10. Select the items you agree with below

67% of respondents report they have trouble using common Internet services



### 11. How satisfied are you with the speed and reliability of your Internet Service?

Only 49% of residents are "satisfied" or "very satisfied" with their current Internet service.



### 12. Select all items you use the Internet for now

Email	387	96%
Access news and current events	357	88%
Homework	192	47%
Use a VPN (Virtual Private Network) for work or	107	26%
Download or listen to music or audio books	277	68%
VoIP (Vonage, Skype, FaceTime)	163	40%
Online Backup (files, photos, music)	246	61%
Telemedicine, tele-health	80	20%
Online gaming	155	38%
Social media and social networking	350	86%
Shopping	359	89%
Online banking	333	82%
Home security	91	22%
Smart speakers	135	33%
Other	28	7%

#### Other uses for the Internet

Online textbooks, online courses, and online exams

My job depends on internet access for managing our company online presence.

Netflix, wifi calling

Downloads for apps and other products that need to require a update.

We both need it to do work for our employer. We teach and cannot both work at the same time - even when not using the VPN.

Streaming Netflix/ movies from tv's

I own a business and would love to work at home sometimes. Ready to sell house because of internet.

I own a business and would love to work at home sometimes. Ready to sell house because of internet.

We have tried many times to get internet services as far as we know it's not available for us

internet TV, Netflix, Amazon music and videos

Fire stick

Work from home Stream sports events Stream movies

Streaming Netflix, Hulu etc.

I teach online classes to students all over the world

Movies

Alexa Fire/Echo Dots/Work Laptop

I would use more but i am limited by my cellular plan for data usage and speed.

Smart TV

<b>Yes</b>	<b>29%</b>
<b>No</b>	<b>42%</b>
<b>I don't know</b>	<b>29%</b>

TV (We use Hulu and Netflix only)

Professional/forms sites

no service available

Run a business from our home can not do credit cards

I use internet at other locations that I own at the 20019 renovo road location I have only land line telephone and sat tv

Broadcasting gaming

Smart switches for all my lighting and also smart thermostats

Smart switches for all my lighting and also smart thermostats

Smart TV and wireless printer

work from home

These are things I would like to use internet for if it worked at my house

I have my own website.

Apple TV Smart TV Apple Watch

A good question to add would be the same question above but "what items would you want to use the internet for but are currently not able to due to speed, cost, data caps, etc?" - because I would check many more boxes above - we keep our use to bare bones and will not use the cloud because we have data cap and it is slow

Landline

We have limited usage for any online software or platforms due to limited hotspot with our cell phones. To get more hotspot data it is too expensive. We tried satellite - Hughes Net - and that was a rip off. We could not even load a website page and the service is not unlimited with Hughes Net...we had 10 gb which is nothing with

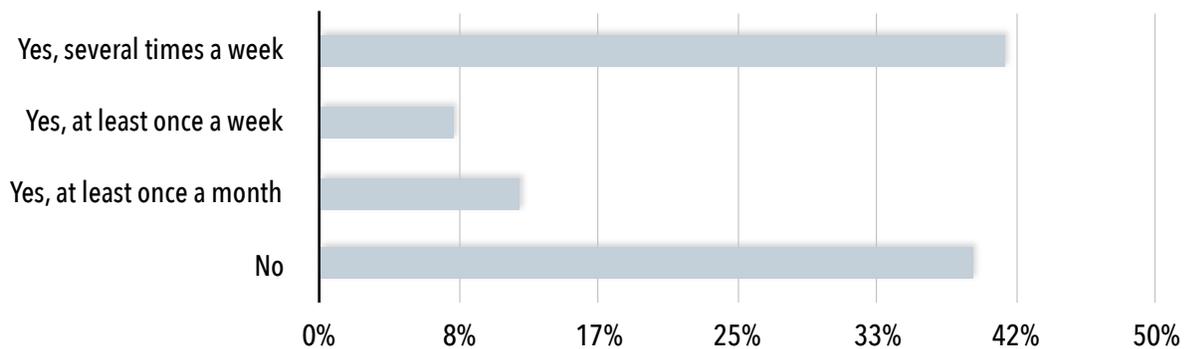
teenagers studying online and streaming. I have to send my granddaughters to Dunkin each day to complete school work f  
 Medical, Prescriptions, Veterinary  
 Scheduling and posting transport requests for animal rescues.  
 watching youtube videos  
 No internet  
 Work from home

### 13. High speed, affordable Internet influences where I choose to live?

Availability of broadband Internet is affecting where people choose to live.



### 14. Does anyone in your household use / need the Internet to complete school assignments or job training course work?



### 15. Who is your Internet Service provider?

Some responses included more than one provider.

<b>Service Electric</b>	6%
<b>Comcast</b>	25%
<b>Other</b>	11%
<b>Atlantic Broadband</b>	3%

<b>Verizon</b>	29%
<b>Windstream</b>	8%
<b>Centurylink</b>	4%
<b>ADS</b>	10%
<b>River Valley Internet</b>	3%
<b>Penn Telephone Company</b>	1%
<b>Frontier</b>	1%

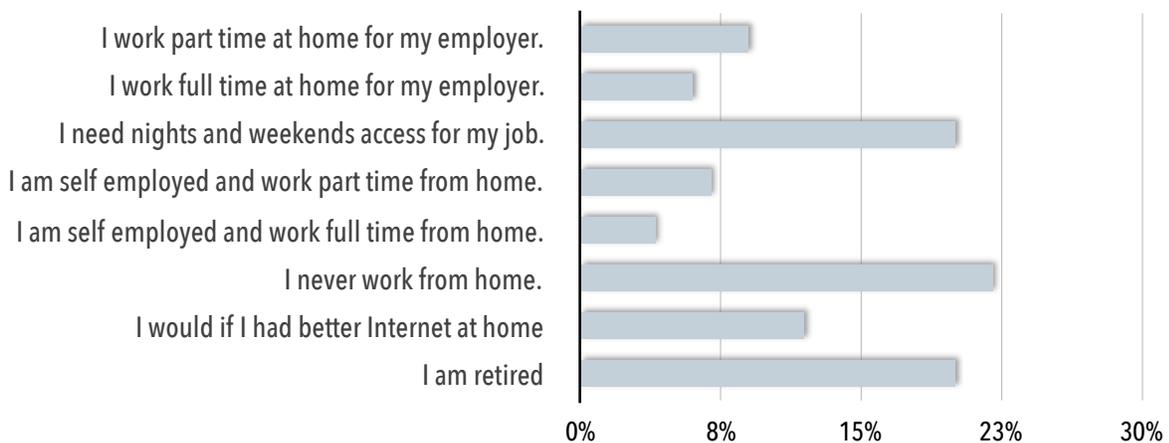
**16. Do you have data caps on your current Internet service?**



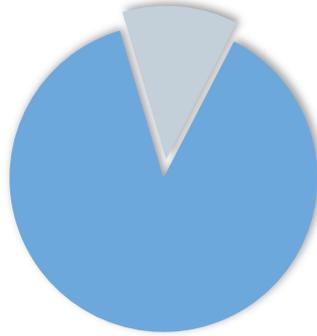
**17. If you have data caps, have you exceeded those caps?**

**18. Do you work from home?**

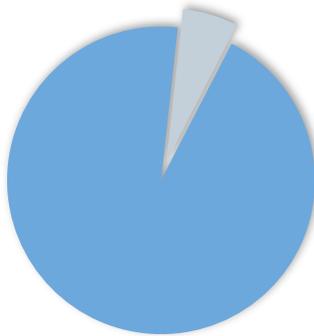
46% report working from home part or full time—the Internet has made residential neighborhoods into business districts. Home-based jobs and businesses reduce traffic congestion and reduce road maintenance.



**19. I am interested in Gigabit fiber Internet Services.**



**20. Should the county government help facilitate better broadband services and more affordable services?**



## 2.5 REGION-WIDE BUSINESS SURVEY RESULTS

---

A total of 95 responses were collected from businesses in the four counties. Not all responders answered every question.

Some key findings from the results are listed below.

71% of business respondents want better Internet access.

83% of business respondents say the local government should help facilitate better and more affordable broadband service

94% indicated that the Internet is important to the success of their business over the next five years.

Only 30% of businesses are "satisfied" or "very satisfied" with their current Internet service.

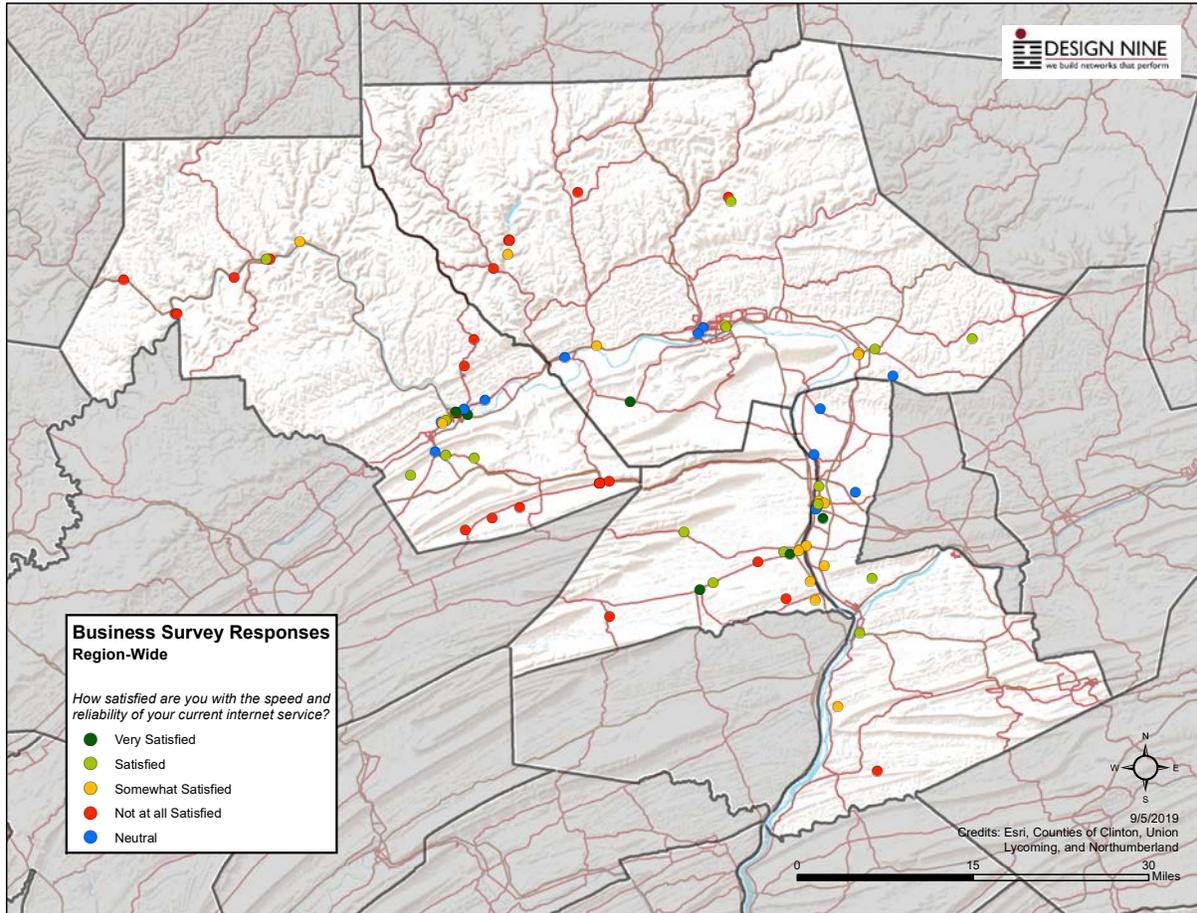
30% of the businesses that responded are home-based.

72% of businesses that responded need employees to be able to work from home.

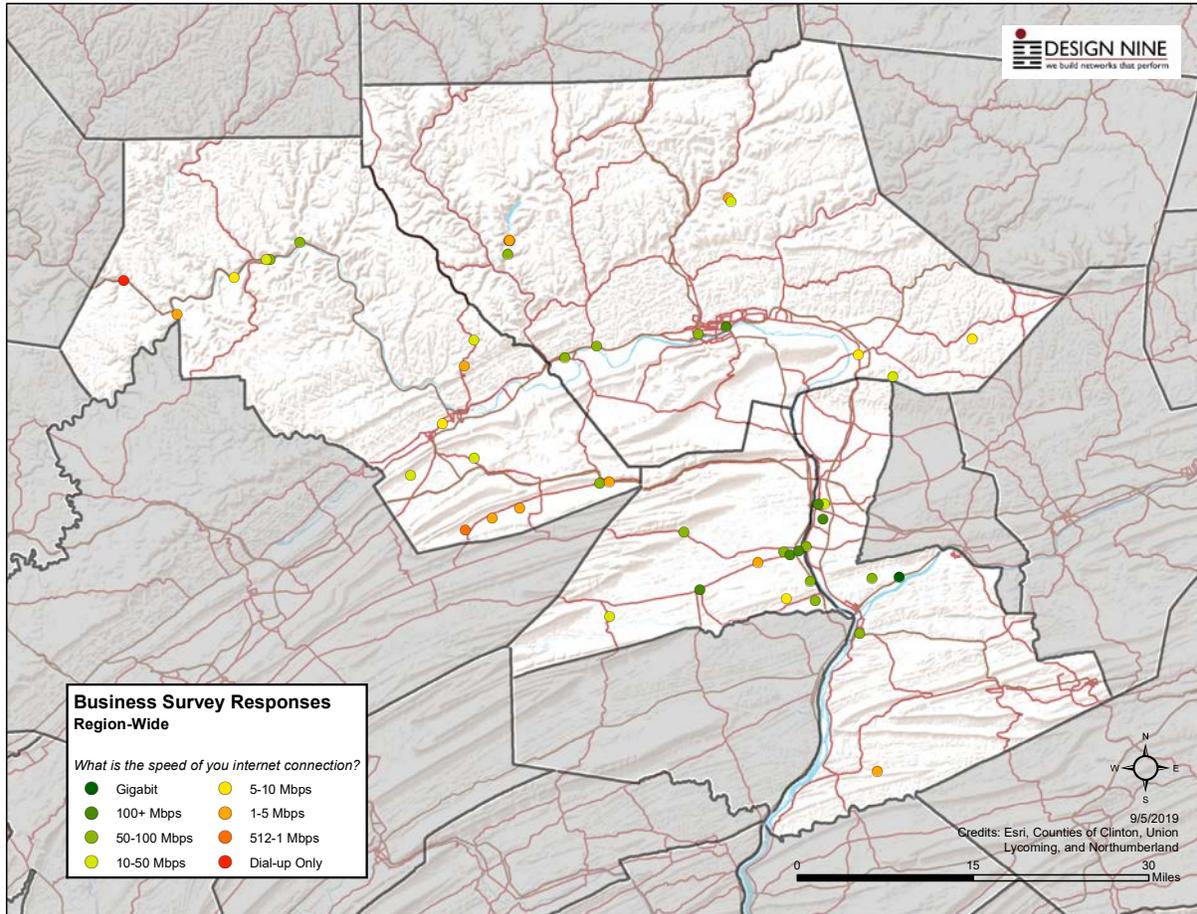
Home-based workers and businesses need affordable Internet access

## 2.6 DISTRIBUTION OF BUSINESS SURVEY RESPONSES

The map below shows the geographic distribution of responses to the business survey, coded according to their satisfaction with their existing Internet service.

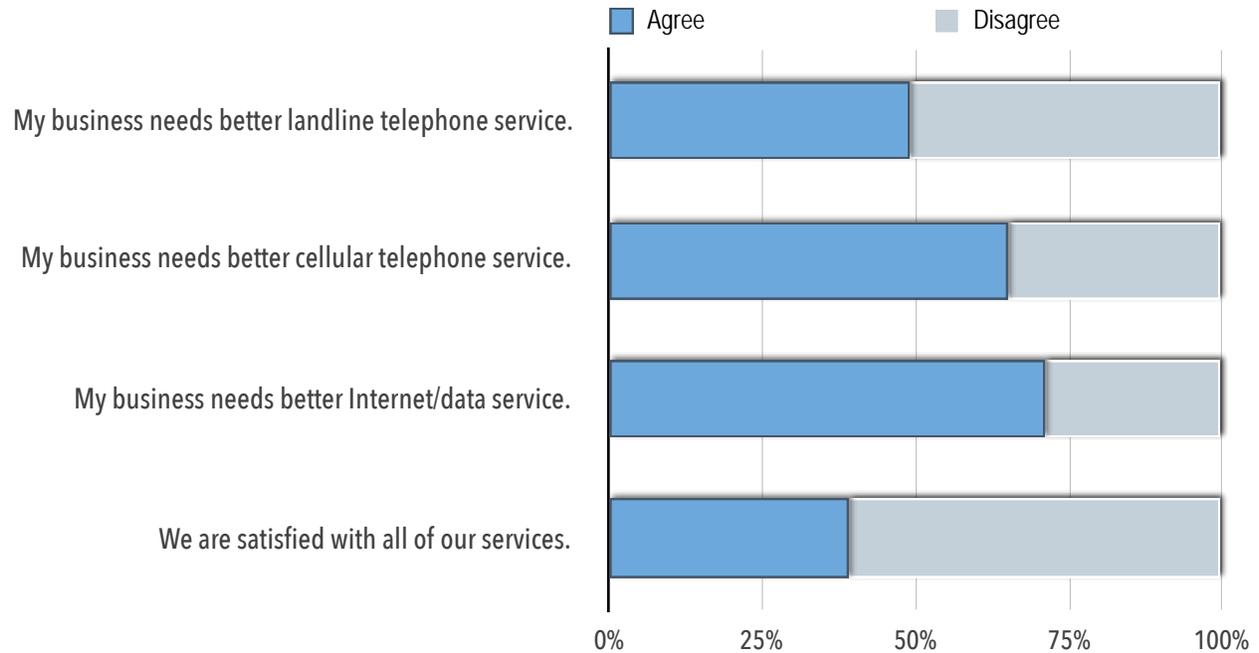


The map below shows the geographic distribution of responses to the business survey, coded according to the speed of their internet connection.

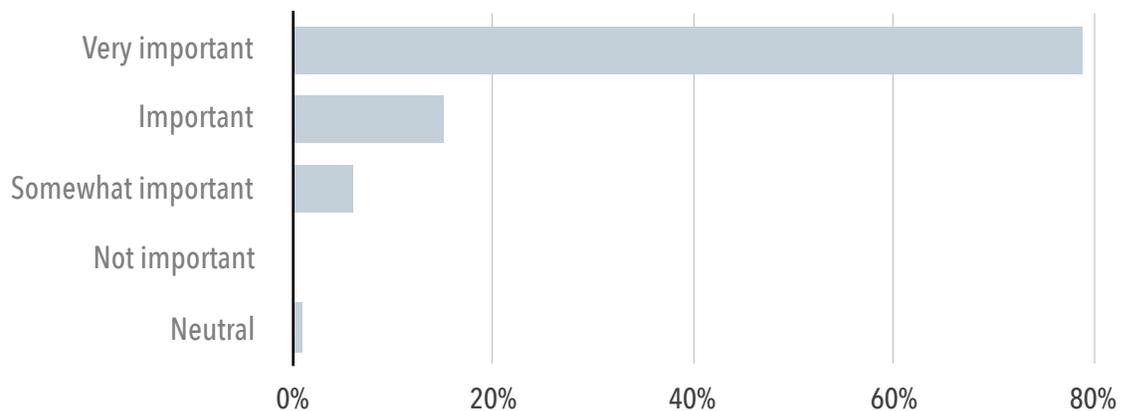


## 2.7 BUSINESS SURVEY SUMMARY DATA

### 1. Select the items you agree with below



### 2. How important do you think Internet technology will be for the success of your business over the next five years?



**3a. Total number of employees**

<b>1 to 10</b>	<b>64%</b>
<b>11 to 40</b>	<b>25%</b>
<b>41 to 80</b>	<b>6%</b>
<b>81 to 150</b>	<b>3%</b>
<b>Over 150</b>	<b>2%</b>

**3b. Total number of Internet users**

<b>1 to 10</b>	<b>67%</b>
<b>11 to 40</b>	<b>14%</b>
<b>41 to 80</b>	<b>4%</b>
<b>81 to 150</b>	<b>2%</b>
<b>Over 150</b>	<b>12%</b>

**4. If you are a business, what type? (select all that apply)**

<b>Retail / Wholesale</b>	<b>12</b>	<b>15%</b>
<b>Professional / Office</b>	<b>10</b>	<b>13%</b>
<b>Government</b>	<b>15</b>	<b>19%</b>
<b>Educational</b>	<b>2</b>	<b>3%</b>
<b>Medical</b>	<b>3</b>	<b>4%</b>
<b>Non-Profit</b>	<b>12</b>	<b>15%</b>
<b>Manufacturing</b>	<b>6</b>	<b>8%</b>
<b>Restaurant/Food Service</b>	<b>4</b>	<b>5%</b>
<b>Communications/Technology</b>	<b>1</b>	<b>1%</b>
<b>Construction / Maintenance/ Repair</b>	<b>5</b>	<b>6%</b>
<b>Agriculture/Forestry</b>	<b>6</b>	<b>8%</b>
<b>Other</b>	<b>4</b>	<b>5%</b>

## Other types of businesses

Event venue

Graphics company

Public Library

Library

Cabin

Junk yard/Garage

Not a business

Self employed photographer for non-profit

Transportation

Publishing a publication in the valley

Architect

Hospitality

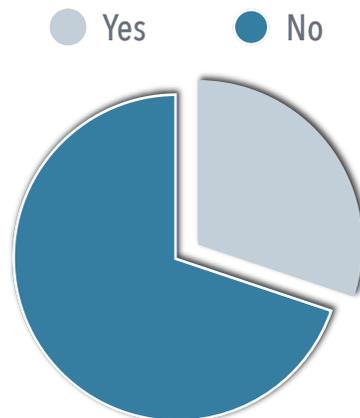
We are a vacation resort and campground that has 58 cabins, rooms and 150 plus campsites. We service thousands of customers a year.

Recreation, Kayak launch site

mechanic

Hunting Club

### 5. Is this a home-based business?

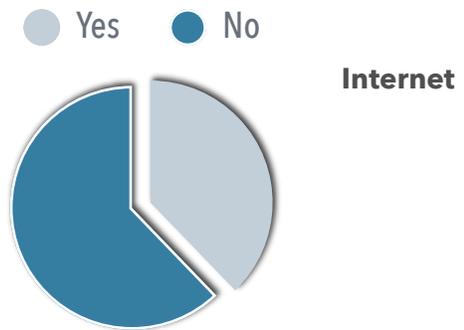


30% of the area  
businesses that responded  
are home-based

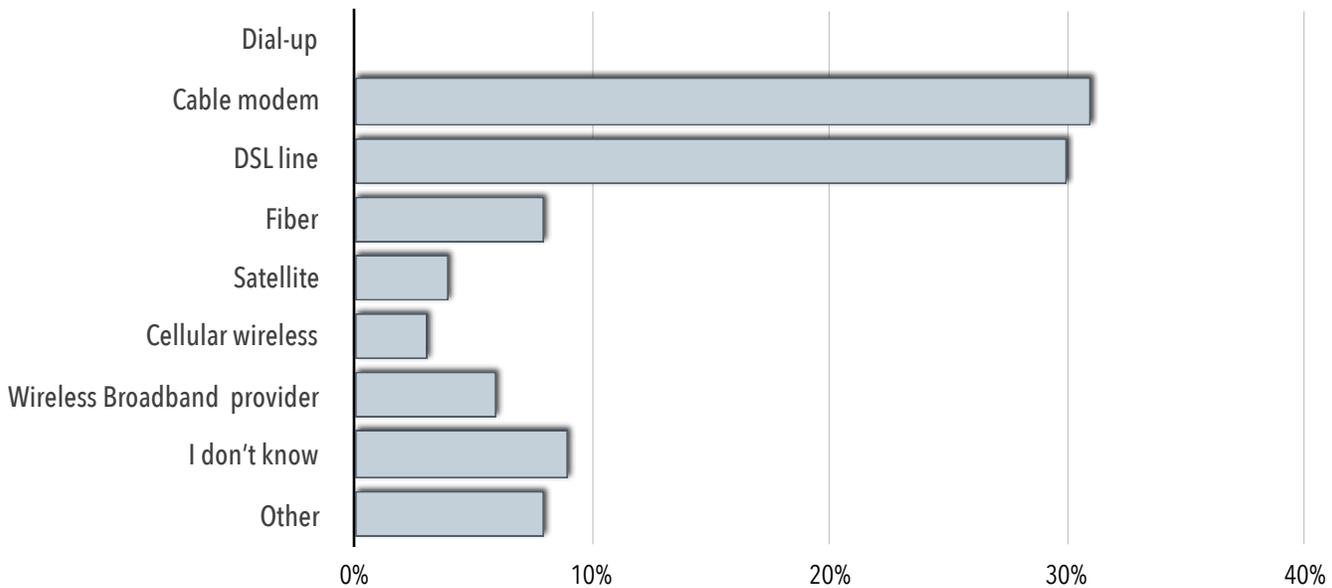
**6. How much do you pay now for Internet access each month?**

No Internet	\$0 to \$50	\$51 to \$100	\$101 to \$150	\$151 to \$300	\$301 to \$500	\$501 to \$1000	\$1001 to \$5000	\$5000+	I don't know
7	15	19	23	9	3	3	4	0	7
8%	17%	21%	26%	10%	3%	3%	4%	0%	8%

**7. Are you satisfied with what you pay for service?**

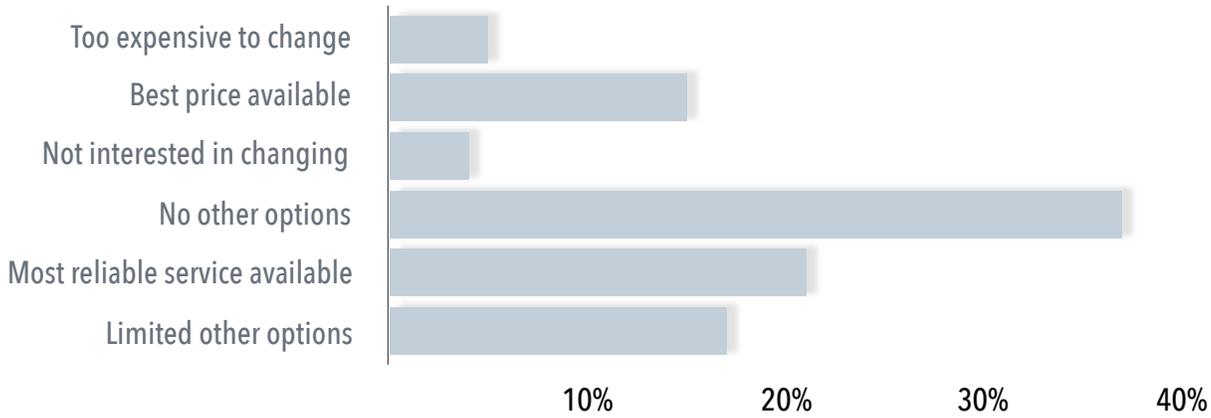


**8. What type of Internet do you have?**



### 9. Based on the type of Internet you selected above, why do you still have it?

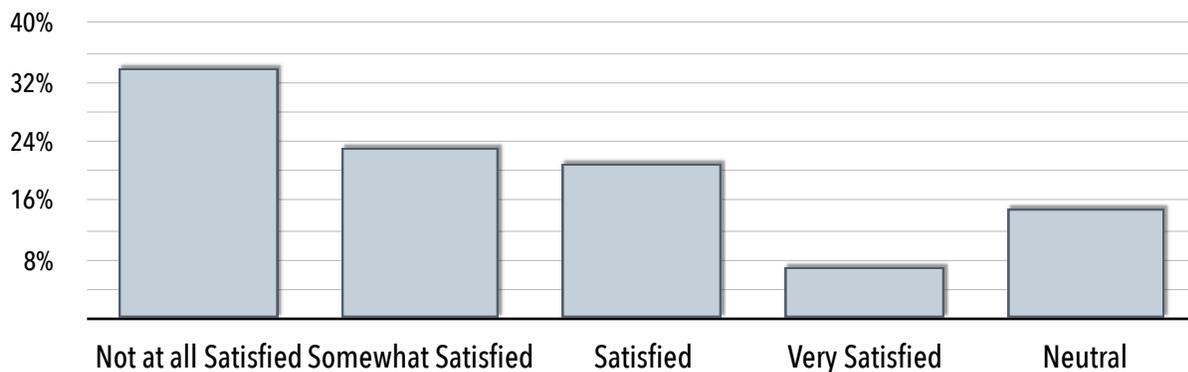
Respondents could choose more than one option.



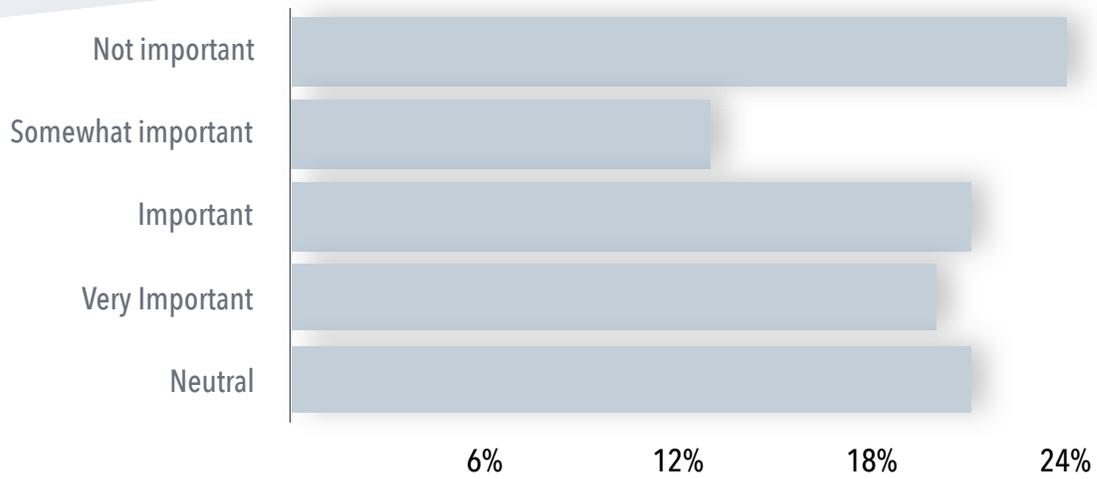
### 10. What is the speed of your Internet connection? (A Gigabit is 1000 Megabits (Mbps))

Dial up only	512 k -1Mbps	1-5 Mbps	5-10 Mbps	10-50M bps	50-100 Mbps	100+M bps	Gigabit	I don't Know
0	0	12	5	8	17	6	1	33
0%	0%	15%	6%	10%	21%	7%	1%	40%

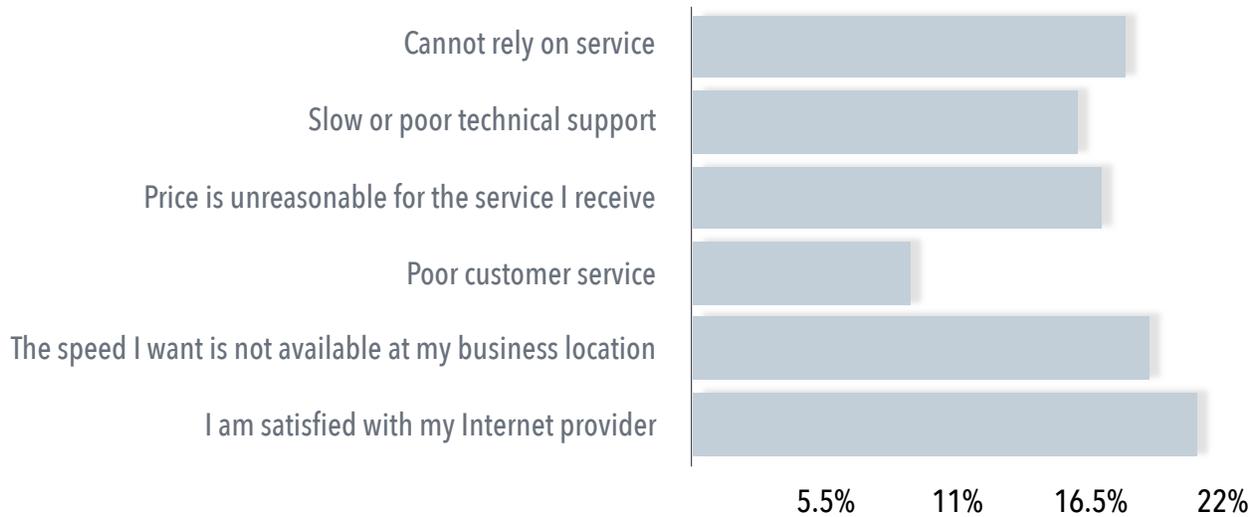
### 11. How Satisfied are you with the speed and reliability of your Internet service?(\*\*get rid of neutral?)



**12. How important is a redundant or second Internet connection to your business?**



**13. Please select all that apply to your current Internet provider**



**14 . Select all the items you use the Internet for now(Select all that apply)**

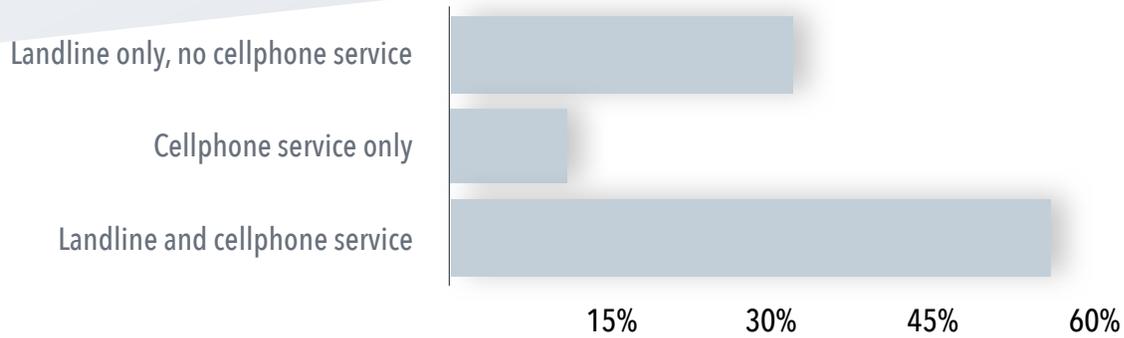
<b>Email</b>	83	87%
<b>Communication between headquarters and remote sites</b>	42	44%
<b>VoIP Internet phone (Vonage, Skype, etc.)</b>	27	28%
<b>Online Backup (files, photos, music)</b>	61	64%
<b>Transfer large files</b>	47	49%
<b>Monitor / control security, alarms, health, processes, etc.</b>	36	38%
<b>Processing credit card / debit card transactions</b>	49	52%
<b>Ordering / managing inventory</b>	55	58%
<b>Maintaining a Web presence, or blog</b>	56	59%
<b>Social media (Facebook, LinkedIn, Google+, Instagram)</b>	71	75%
<b>Receiving and processing online orders</b>	39	41%
<b>Cloud-based business, accounting or other services</b>	32	34%
<b>Smart TV</b>	23	24%
<b>Other</b>	9	9%

**15. Who is your Internet Service provider?**

Some responses included more than one provider.

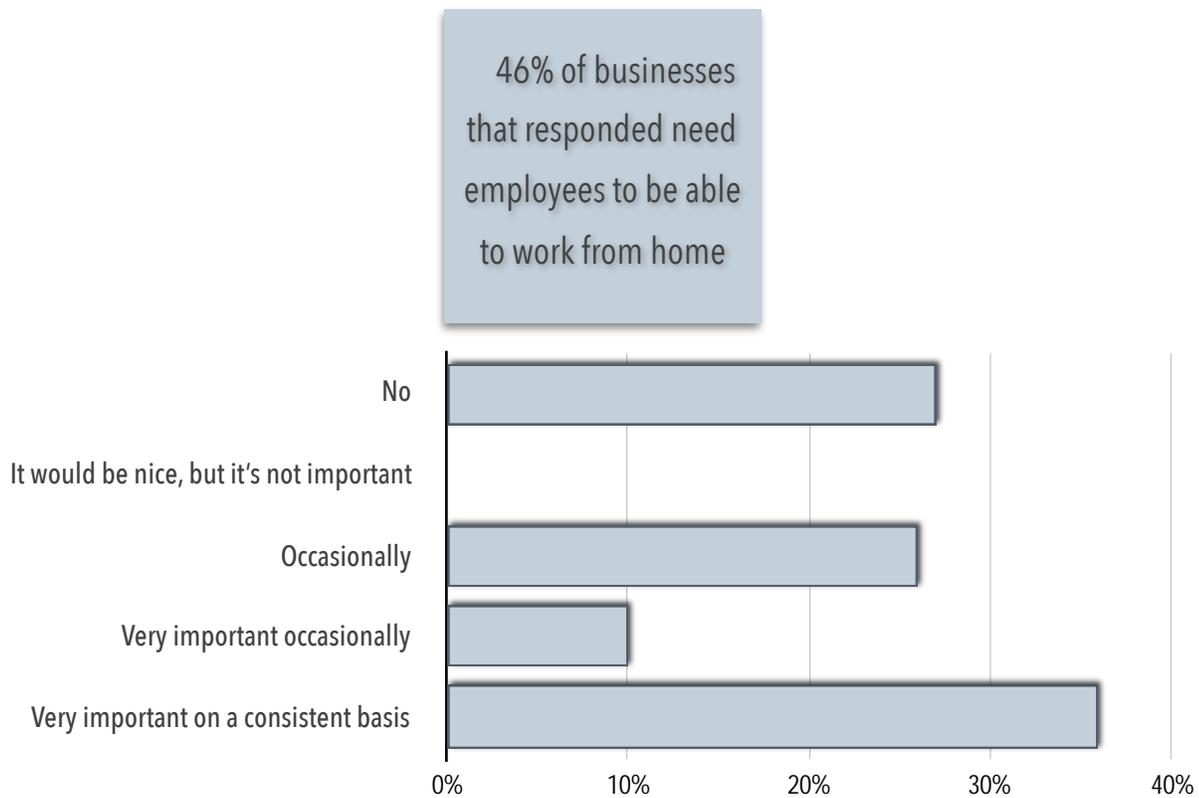
<b>Comcast</b>	22	26%
<b>Century Link</b>	1	1%
<b>Service Electric</b>	8	10%
<b>Verizon</b>	18	21%
<b>Windstream</b>	9	11%
<b>River Valley Internet</b>	2	2%
<b>TDS</b>	8	10%
<b>Penn Tel. Co.</b>	4	5%
<b>Atlantic Broadband</b>	1	1%

**16. What kind of telephone service do you have?**



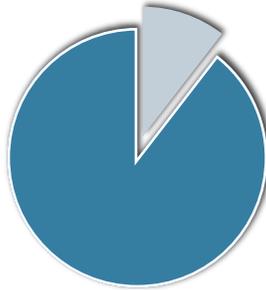
**17. Do you or your employees use a VPN (Virtual Private Network) to obtain remote access for your work or to a company network?**

**18. Do you or your employees need or want to work from home?**



## 19. Does limited Internet access at employees' residences impact your business?

● Yes ● No



## 20. Do the existing internet service options impact your business's decision to relocate or stay in the County?

● Yes ● No

### If yes, briefly state why:

I moved to Easton road because I knew I could get River valley internet. My previous home in upper Fairfield township ONLY had cellular modems/hot spots as an option.

The only reason we say no is because we cannot move our resort - but business would be a thousand times better if we had better internet. If we could relocate our business we would do so as the most important piece we are missing is the lack of high speed internet and cell service. It holds us back from creating more revenue and from bringing more business to the area which in turn helps other local businesses and their revenue.

We have no choice as we cannot move the building! But if we could we would!

Only because we cannot move the building.

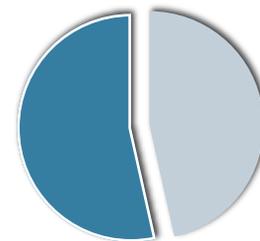
PA I have considered moving out of the area because of the lack of availability of affordable high-speed internet access.

its hurting the connection and some people don't come around because of it.

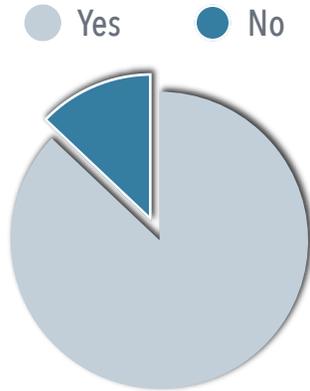
Scaffs Enterprises is actively looking for a place to move that has RELIABLE high speed internet access. Our entire business is run through our web sites. We are a manufacturing company that sells to wholesalers and distributors. WE receive Purchase Orders online and through email, we must acknowledge orders this way, we use online FEDEX and UPS for daily shipping, and company data is stored through cloud services. Our company has been SEVERELY hurt by TDS this year - through multiple outages in both pho

www.DELFIRESTORE.com is an Internet-business. All orders, credit card processing, ship notifications, shipping labels, etc. - everything is done through Internet (and some phone). We got rid of TDS phone land lines due to constant problems with long distance outages and clicking sounds (poor quality) on the phone. TDS has continual slow down every day - and periods of outages. EMAIL is completely messed up and this is the 2nd time! We plan to move as there are no other Internet options in the east end

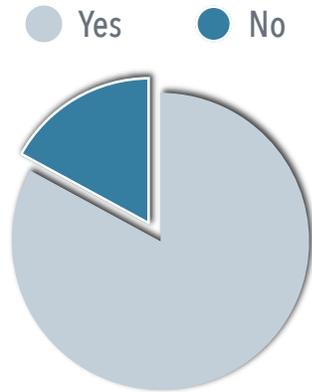
TDS performance is so incredible-incredibly BAD that it has devastated out business, especially this year. We added cell phone service last year given continual phone sound quality issues. Two years ago, TDS email went completely down and when resolved-they no longer support Outlet Express Email Client (which we use) - requiring we upgrade computers to support new Email Clients all due to TDS. This year in 2019, TDS email was hacked so our customers could no longer contact us and send Purchase Orders.



**21. We are interested in fiber delivered Internet Service.**



**22. Should the local government help facilitate better broadband services and more affordable services?**



# 3 BROADBAND INFRASTRUCTURE AS A UTILITY

Affordable high speed Internet is essential to the future growth and prosperity of Clinton, Lycoming, Northumberland, and Union counties. Over the past 20 years, Internet access has evolved from a luxury to a necessity. School students need Internet access to complete homework and to study. Online shopping can save energy and make it easier for the elderly and homebound to obtain daily necessities. Telemedicine and telehealth services and applications are revolutionizing health care, reducing costs, and allowing older citizens to live independently longer. More and more workers and business people are working from home, either on a part-time or a full-time basis. New work-from-home job opportunities are growing rapidly, but most of those jobs require reliable, symmetric Internet service to qualify.

Many business employees are already trying to work from home more often (e.g. one or two days per week) to reduce travel costs. Some major businesses in other parts of the U.S. are actively planning to have 20% of their workforce work full time from home to reduce employee travel costs and office energy costs. Corporate employees working from home require high bandwidth services to be connected to the office network and to use corporate videoconferencing systems. These corporate network services often require 10-50 Megabit-per-second (Mbps) symmetric connections (symmetric Internet service is not widely available in the region).

The ability to obtain full-time employment work from home with good pay can be a game changer for the communities in the four counties – but only if residents and businesses have access to affordable broadband services that support work from home.

This region has many lifestyle amenities that are highly desirable in today's economy: small towns with excellent quality of life, a tremendous variety of recreational opportunities, and a low cost of living. However, the most important data point from the broadband survey is that 68% of respondents indicated that the availability of good broadband was affecting where they choose to live. For remote employees to leverage those the area's amenities, and for the region to reap the community and economic benefits of better employment opportunities, the region must have good broadband.

## **Broadband has become essential community infrastructure.**

Just as communities had to take on the task of building and maintaining roads in the early twentieth century, communities must now provide basic broadband infrastructure as a matter of community and business survival.

Governments build and manage roads, but don't own or manage the businesses that use those roads to deliver goods and services.

The tremendous versatility of the Internet and the underlying technology bases now allows services that used to require their own, separate (analog) road system (voice telephony and TV services) to be delivered alongside other services like Internet access on a single, integrated digital road system.

If we managed overnight package delivery the way we manage telecom, UPS and Fedex would only deliver packages to residences and businesses where each delivery firm had built a private road for their exclusive use. We recognize immediately the limitations of such a business model-few of us

would have overnight package delivery to our homes because the small number of packages delivered would not justify the expense of building a private paved road.



Before the rise of the automobile, most roads were built largely by the private sector. After cars became important to commerce and economic development, communities began building and maintaining roads because it became an economic development imperative to have a modern transportation system in communities.

Before the rise of the Internet, digital networks were built largely by the private sector. As broadband has become critical to commerce and economic development, communities with digital roads are more competitive globally.

The time has come to recognize that it is inefficient and wasteful to build full duplicated digital road systems, which only raise the cost of telecom services to all public and private users. Networks that share capacity among a wide variety of public and private users have a lower cost of construction and a lower cost of operation—benefiting all users.



The table on the next page provides a comparison of the shared telecom model with the long-standing “shared roads” and “shared airport” models. Both roads and airports provide excellent examples of how local and regional infrastructure can be built and used successfully to reduce the cost of delivering private sector goods and services.

## A UTILITY COMPARISON

SHARED ROADS	SHARED AIRPORTS	SHARED TELECOM
Historically, roads have been built and maintained by the community for the use of all, especially private firms that want to use them to deliver goods and services.	Airports are built and maintained by a community or region as an economic and community development asset. Both public and private users benefit from the shared use of a single, well-designed airport	Towers, duct and fiber may be installed and maintained by the community and/or a neutral owner/operator for the use of all, including private firms that want to use them to deliver goods and services.
Access to the community road system is provided by parking lots and driveways, built by property owners, developers and builders.	Airport assets like departure gates, ticket areas, and runways provide access to the airline services.	In the digital road system, access across private property to the community-wide network in the public right of way is provided by towers, duct and fiber built by property owners and/or developers and builders.
The local government uses roads only to deliver government services. Local government does not offer services like overnight package delivery.	While the local government or a consortium of local governments typically own the airport facility, the local governments do not offer flight services.	Local government uses the digital transport system only to deliver government services. Government does not offer services like Internet access or Voice over IP.
Private sector businesses use roads so that their own cars and trucks can deliver goods and services to customers. Because businesses do not have to build and maintain roads, all businesses benefit directly by being able to reach more customers at less expense.	Private sector airlines are able to offer competitively priced airfares because of the shared cost of the airport terminal facilities. Each airline does not build its own airport (which would sharply increase the cost of airfare).	Private sector businesses use the digital transport system to deliver goods and services to customers. Because businesses do not have to build and maintain a digital road system, all service providers benefit directly by being able to reach more customers at less expense.
There are no road connection fees, and anyone may connect to the road system for free. Governments pay for the cost of maintaining roads largely from those that use the roads. Fees are proportional to use, from taxes on tires and gasoline.	Businesses and citizens do not pay a fee to access the airport facility. The cost of maintaining the airport facility is paid by the airlines, which bundle that cost into the price of airfare. Fees are proportional to actual use by flying customers. Airlines benefit because they do not have to build, own, and operate the airport directly. Those costs are shared across all users.	Any qualified service provider may connect to the digital road system for a nominal fee and begin to offer services, without any significant capital expense. Network capital and operating costs are recovered by charging service providers a small fee that is based on a percentage of their income from services offered over the system.

### 3.1 THE SHARED INFRASTRUCTURE BUSINESS MODEL

Traditionally, the telecom services market has been vertically integrated, with telephone and cable companies owning the cable infrastructure (i.e. twisted pair copper cable for telephone, and coaxial copper cable for TV). These companies bundled analog services with their own infrastructure, which made sense when only one service could be delivered over the cable.

American residents and businesses needed two networks: one for voice telephone service, and one for television. The rise of the Internet and associated changes in technology led to digital services (voice, video, Internet) that could be delivered simultaneously over a single cable or wireless connection.

By the early 2000s, it was becoming apparent that it was inefficient and costly to have two competing “retail” cable systems (e.g. telephone, cable) delivering the same content and services—it was only creating higher costs for residents and businesses.

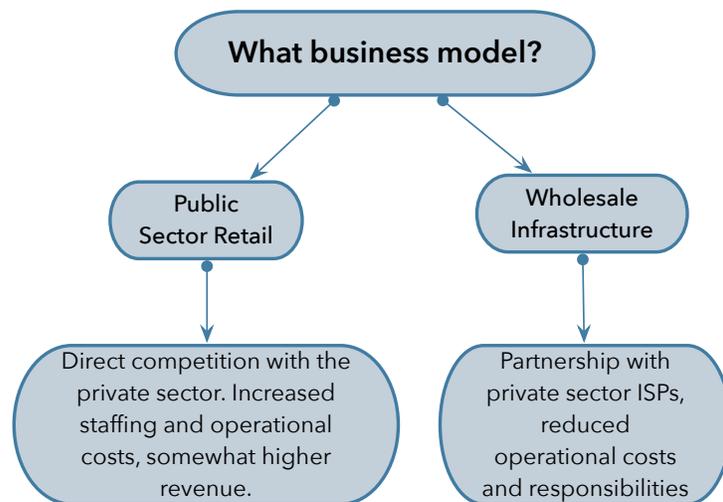
A new business model became possible: wholesale leasing of the cable/wireless infrastructure to private sector service providers, which unbundles the infrastructure from the services. A side effect of this unbundling is that it becomes much easier to determine what a customer is actually paying for a given service: in the vertically integrated 20th century model, with the cost of infrastructure maintenance bundled together with the services, it is much more difficult to determine what a service actually costs.

While a few communities have pursued the retail business model (typically building fiber to the home and business and selling retail Internet and other services directly to customers), most of these retail efforts have been by local governments that are also providing electric service—owning the utility poles is a significant cost advantage not available in most communities.

In the wholesale infrastructure business model, local government investments are limited to passive infrastructure like conduit, dark fiber, and wireless tower space. Services for businesses and residents are offered by private sector providers offering Internet, TV, telephone and other data services. The components of the transport network include conduit, handholes, cabinets and shelters, splice closures, and network equipment.

#### Recommendation

In all four counties, improved wireless broadband is going to be an important part of improving broadband service availability and affordability, and WISP access to existing and/or new towers should continue. Fiber to the business in key areas and fiber to the home in key areas is also critical to support long term community and economic development goals.



Comparison of Muni <b>Retail</b> and Muni <b>Wholesale</b> Business Model		
Features	Municipal Retail	Wholesale Infrastructure
<b>Basic Concept</b>	Generally more difficult to because of possible legal challenges from incumbent providers.	One or more private sector ISPs use the infrastructure to sell their services directly to their own customers. Use of County-owned conduit, fiber, and wireless towers makes it less expensive for ISPs to expand service.
<b>Government Involvement</b>	Local government competes directly with the private sector for Internet service.	County involvement is limited to providing basic infrastructure to ISPs.
<b>Management</b>	Local government is responsible for management and operations. Most functions could be outsourced to a qualified third party entity.	ISPs responsible for virtually all day to day customer services and support. Each County government is only responsible for network and tower maintenance and repairs.
<b>Competition</b>	The incumbent telephone and cable providers would compete vigorously against local government service offerings.	Private sector ISPs would provide competition to the telephone and cable companies.
<b>Service Options</b>	Local government would sell only Internet. Businesses and residents could get TV and voice using their Internet connections.	ISPs would focus on high speed Internet, with some other service offerings like voice and business services.
<b>Risks</b>	The primary risk would be lawsuits from incumbent providers.	Leasing tower space, conduit, or dark fiber is simple to manage, with limited day to day responsibilities. A tower-based radio backhaul network requires some additional management, but most tasks can be outsourced to a qualified private sector firm. It is important to identify service providers early in the process.

## 3.2 WHAT IS GOVERNMENT'S ROLE?

Successful improvements in broadband access, affordability, and reliability for each of the four counties involves several decision points, as outlined in the illustration below. Government has several "first choice" options.

**Do nothing** is to accept that businesses and residents in the four counties will have to continue to use whatever is available, despite the cost and bandwidth limitations that limit what many are able to do online.

Government can **remove barriers** to private sector investment. This can be an effective and low cost strategy. Possibilities include reducing permit fees for fiber

construction and tower installation, incentives to developers to install conduit and meet-me boxes in new residential and commercial construction, simplified permit requirements for rural utility pole installation on private property, and identifying areas of residential and business demand and sharing that information with providers.

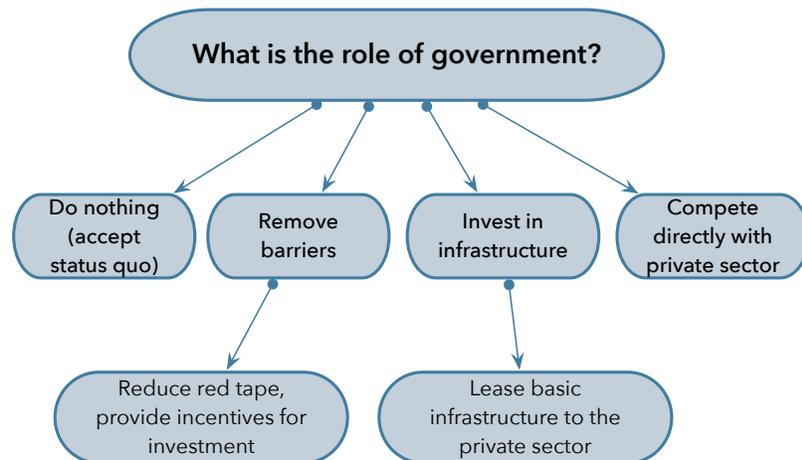
The counties could choose to make **investments in basic infrastructure** and make that infrastructure available to the private sector via revenue-generating lease agreements.

When communities have chosen the option to **compete directly with the private sector** by offering retail Internet, phone, and TV services lawsuits from incumbents often create difficulty moving forward as well as expensive legal fees.

### Recommendation

The four county governments can both **remove barriers** and **make targeted investments** in infrastructure. These two activities can be executed in parallel, with investments taking place as funding sources are identified. There are a variety of low cost and no cost efforts, mostly at the policy level, that each of the counties can do to encourage more private investment—with a primary focus on keeping the cost of permitting and constructing new wireless towers as low as possible.

As one example, investments in improvements to existing county-owned towers and/or adding new county-owned towers could help existing wireless providers bring more services to underserved areas of each county and/or attract much competitive broadband wireless providers into the region.



# 4 FUTURE BROADBAND NEEDS

## 4.1 DEMAND ASSESSMENT

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In most areas of the region, many residents and businesses are limited to the FCC “underserved” bandwidth definition of 10 Mbps down/1 Mbps up. This slow-speed service is impacting economic and community development:

- It limits residents’ ability to work from home.
- It limits the ability of the four counties to retain existing businesses and to attract new businesses and jobs.
- It limits school children’s ability to access the K12 and higher education resources needed to complete homework assignments.
- It limits residents' ability to access cost-saving tele-medicine and tele-health services from home.
- It limits residents' ability shop from home to save money on gas and travel expenses.

In the four counties, the real issue as it relates to broadband speeds is the future of work. In eastern Kentucky’s rural Jackson and Owsley counties, the People’s Rural Telephone Co-op deployed high speed fiber service, and the improved infrastructure brought more than 800 new work-from-home jobs to the two counties. Residents in Clinton, Lycoming, Northumberland, and Union counties will not have the opportunity to pursue the kinds of jobs that are now available without better and more affordable access to broadband.

Current usage patterns are not a good predictor of future broadband needs. Network investments in the region must be designed to scale gracefully to support future uses over the next thirty years. Those uses include K12 education, work from home opportunities, tele-medicine and tele-health services, home security, energy management, and many other emerging services and uses. The local governments should invest in infrastructure that will meet future needs, not current demand. A future-proof community includes:

- Abundant, inexpensive local bandwidth.
- Massive connections to the rest of the world.
- Network redundancy available in some areas of each county and around the region.
- Rich local content from a multitude of sources.

Communities in Clinton, Lycoming, Northumberland, and Union counties can be attractive to an emerging new group of businesspeople and entrepreneurs that typically are well-educated, own their own businesses or work for large global corporations, and are making choices about where they lived based on family needs and interests rather than business interests.

This new breed of entrepreneurs and workers places a high value on the kinds of amenities that contribute to a good quality of life, such as traditional neighborhoods, vibrant downtown areas, a wide range of cultural and recreation opportunities, good schools, and a sense of place. These businesspeople and their families make relocation decisions based on quality of life only where there is abundant and affordable broadband, because broadband enables this new approach to personal and work life.

The FCC has defined the next broadband tier (fully served) to be 25 Mbps down and 3 Mbps up. The problem with the 25/3 definition is that the upload speed (3 Mbps) is not always going to be adequate to support work from home, especially where home-based workers need to connect to a corporate Virtual Private Network (VPN). Work-from-home and business-from-home activities should have at a minimum 10 Mbps down and 10 Mbps up speeds. Higher speed service could include service levels like 25 Mbps down and 10 Mbps up. The critical requirement is an upload speed that supports work from home.

If the goal is to enhance residential and business access to broadband, there can be no upper limit on the definition of broadband. Defining "broadband" as 5 Mbps or 10 Mbps of bandwidth is telling residents and businesses in the region that there will be limits on their work and job opportunities.

Broadband is a community and economic development issue, not a technology issue. The essential question is not, "What system should we buy?" or "Is wireless better or cheaper than fiber?" Instead, the question is:

***"What do businesses and residents of the region need to be able to compete globally over the next thirty years?"***

In short, the four counties in the region today have many areas hampered by low-end broadband in the form of DSL, very limited wireless, expensive satellite Internet, and very limited cable modem service. They also have a very limited high-end broadband in the form of fiber to a few businesses and institutions.

If the region is to make investments in broadband and telecommunications infrastructure, it is absolutely critical that those investments are able to scale gracefully to meet business and economic development needs for decades.

To close that gap between the FCC definitions and what the region needs to support future work opportunities and to support K12 and higher education school work, the region needs the following:

***Broadband Services, Technologies, and Needs***

BROADBAND SERVICE	TARGET DATE	TECHNOLOGY	WHERE NEEDED
25 Mbps download 3 Mbps upload	2021	Wireless	As much of all four counties as possible, given funding constraints
25 Mbps download 10 Mbps upload	2022	Wireless	In many locations in all four counties
1 Gbps download 1 Gbps upload	2021	Fiber	In some key business and commercial areas
50 Mbps download 10 Mbps upload	2022	Wireless & Fiber	In many locations in all four counties
100 Mbps download 100 Mbps upload	2022	Fiber	Available to a minimum of 50% of residents and businesses in all four counties

Two key concepts that should drive community investments in telecom are:

*“Broadband” is not the Internet*

*Bandwidth is not a fixed number*

Broadband and “the Internet” are often used interchangeably, but this has led to much confusion. Broadband refers to a delivery system, while “the Internet” is just one of many services that can be carried on a broadband network. The challenge for the region is to ensure that businesses and homes have a broadband network with sufficient bandwidth to deliver all the services that will be needed and expected within the next three to four years, including but not limited to “the Internet.”

The economic impact on Clinton, Lycoming, Northumberland, and Union counties can include the following effects:

- Difficulty retaining some existing businesses. As business bandwidth needs continue to increase over the next several years, some businesses may need to move out of the area to ensure that they have the right bandwidth to support their business operations.
- Difficulty attracting new businesses. New businesses interested in some of the advantages of the region, like low cost of living, good recreational opportunities, and good workforce ethic, may be deterred by the cost and limited bandwidth available, and therefore choose other areas to locate.
- Difficulty keeping younger workers and families in the region. Younger workers and families tend to be heavy users of Internet services, and real-estate agents are reporting that younger house buyers are reluctant to live in areas with poor Internet service. **Note that a significant percentage of respondents to the residential survey (30%) indicated that Internet availability or lack of it was affecting where they choose to live.**
- Reductions in real estate value. Homes with poor Internet service are more difficult to sell, leading to lower prices, negatively impacting county income from property taxes.

## 4.2 LIMITING FACTORS

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The factors limiting broadband availability and affordability in the four counties include:

- Low population density. The generally low density of homes and businesses in many areas of the four counties make it more difficult for competitive service providers, like WISPs, to justify the expense of building towers and offering Internet service.
- Poor service from Verizon. Like many other areas of Pennsylvania, Verizon has not upgraded infrastructure and Verizon DSL service is slow and unreliable.
- Limited cable Internet service. Related to the low density, cable Internet service is very limited in many areas.
- Lack of a regional entity to manage infrastructure improvements. At the present time, there is no coordinated multi-county effort to plan broadband infrastructure improvements and coordinate funding and grant applications.

- Difficult terrain for fixed point broadband wireless service. The terrain in the region has many low hills, which block wireless broadband signals and require more towers and community poles than some other parts of Pennsylvania.
- Difficulty attracting WISPs. The reasons listed above increase the difficulty of attracting WISPs to the area.

## 4.3 HOW MUCH BANDWIDTH IS ENOUGH?

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Bandwidth needs for the past several years have been growing by an estimated 30% per year and show no sign of slowing.

***This means residential and business bandwidth needs are doubling every three years.***

As computers and associated hardware (e.g. video cameras, audio equipment, and VoIP phones) become more powerful and less expensive, new applications and services are continually emerging that drive demand for more bandwidth.

“Next generation” is the term used to describe future planning for network connectivity and infrastructure. Next-generation broadband reaps substantial benefits. There are several key benefits of Next-generation broadband:

- Dramatically faster file transfer speeds for both uploads and downloads.
- The ability to transmit streaming video, transforming the Internet into a far more visual medium.
- Means to engage in true-real time collaboration.
- The ability to use many applications simultaneously.
- Ability to maintain more flexible work schedules by being able to work from home on a part-time or full-time basis.
- The ability to obtain health-related services for an occasional illness and/or long term medical services for chronic illnesses.

Clearly, consumers have a strong interest in a visual medium from when and wherever they are. YouTube is the second most popular search engine after Google, which demonstrates the need to support the infrastructure to transmit streaming video. In addition to video streaming, true real-time collaboration also provides an effective way for people to interact from wherever they are. People can engage in a two-way real-time collaboration so that fruitful, visual conversations can be held between friends, family, business associates from the state, country, or internationally.

Because of fiber networks, employees have the capability of working from home. Findings suggest that if all Americans had fiber to the home, this would lead to a 5 % reduction in gasoline use, a 4 % reduction in carbon dioxide emissions, \$5 billion in lower road expenditures, and 1.5 billion commute hours recaptured.

In all four counties, most residents and businesses are relying on copper-based services. The bandwidth tables below show what is likely to be needed over the the next several years in terms of bandwidth. The existing copper infrastructure is going to become a limiting factor in economic development.

## 4.4 BUSINESS BANDWIDTH NEEDS

The table below shows bandwidth consumption for several types of businesses and a projection of the bandwidth needed 5 and 10 years out. The cost of fuel is already affecting business travel decisions, and more and more businesses will invest in high definition (HD) quality business videoconference systems to reduce the need for travel. These HD systems require substantial bandwidth; a two-way HD video conference requires 20-25 Mbps during the conference, and a three-way conference requires 30-35 Mbps during the conference. As more workers try to reduce the cost of driving to and from work by working from home, the business location must provide network access (Virtual Private Network (VPN)) to employees working from home. These home-based workers will make extensive use of videoconferencing to attend routine office meetings remotely and to enhance communications with co-workers, including videoconferences with other home-based workers in the company. A VPN network providing remote access to just two or three home-based employees could require 50 Mbps of bandwidth during normal work hours.

*Business Bandwidth Needs*

DESCRIPTION	LARGE BUSINESS		SMALL BUSINESS		HOME BASED WORKER		BUSINESS FROM HOME	
	Concurrent Use	Mbps	Concurrent Use	Mbps	Concurrent Use	Mbps	Concurrent Use	Mbps
	A larger business with about 50 workstations.		A small business with 10 to 15 employees, and 7-10 workstations.		A single employee working at home for his/her company.		A home business with one or two employees working at home.	
Telephone	20	1.28	5	0.32	1	0.064	1	0.064
TV		0		0		0		0
HDTV		0		0		0		0
Credit Card Validation	4	4	1	1		0		0
Security System	1	0.25	1	0.25	1	0.25	1	0.25
Internet	20	30	7	10.5	1	1.5	1	1.5
VPN Connection	5	25		0	1	5		0
Data Backup	5	7.5	1	1.5	1	1.5	1	1.5
Web Hosting	1	2		0		0		0
Workforce Training (online classes)	2	20	1	10	0	0	1	10
HD Video-conferencing	10	100	2	20	1	10	1	10
Telecommuting	5	15	2	6	0	0	0	0
Totals		<b>205.0</b>		<b>49.6</b>		<b>18.3</b>		<b>23.3</b>
<b>5 YEARS FROM NOW (MBPS)</b>	<b>615</b>		<b>149</b>		<b>55</b>		<b>70</b>	
<b>10 YEARS FROM NOW (MBPS)</b>	<b>1845</b>		<b>446</b>		<b>165</b>		<b>210</b>	

## 4.5 RESIDENTIAL BANDWIDTH NEEDS

The table below depicts the bandwidth needed for typical residential services which are available now or will be available in the near future. In a next-generation network all services will be delivered over a single network infrastructure which will require a network that can support providing most services to most consumers simultaneously. Today's shared networks (cable and wireless in particular) rely on the "bursty" nature of traffic to provide services to end users. If all end users were consuming their advertised maximum bandwidth, today's cable and DSL networks would grind to a halt. Existing cable modem network users are overwhelming the digital cable networks that were upgraded as little as three or four years ago, and the firms have had to artificially reduce the bandwidth available for certain kinds of high bandwidth services (e.g. peer to peer file sharing). Some cable providers have even run into capacity issues with the TV portion of their networks, and some consumers have observed that some HD TV channels have been so highly compressed that picture quality has been noticeably degraded.

*Residential Bandwidth Needs*

DESCRIPTION	RESIDENTIAL DAYTIME		EARLY EVENING		EVENING & LATE NIGHT		SNOW DAY	
	Concurrent Use	Mbps	Concurrent Use	Mbps	Concurrent Use	Mbps	Concurrent Use	Mbps
	Intermittent Television and Internet use across a small percentage of households.		Increased Internet use as children arrive home from school and employees from work.		Peak television and Internet use. Multiple TV's are on, phone and computer being used.		On top of typical daytime traffic children are home from school, and many employees are home working.	
<b>Telephone</b>	1	0.064	1	0.064	1	0.064	1	0.064
<b>Standard Definition TV</b>	1	2.5	1	2.5	1	2.5	1	2.5
<b>HD TV</b>	1	4	2	8	2	8	3	12
<b>Security System</b>	1	0.25	1	0.25	1	0.25	1	0.25
<b>Internet</b>	1	1.5	1	1.5	2	3	3	4.5
<b>Online Gaming</b>		0.25		0.5		1		1
<b>VPN Connection</b>	0	0	1	2	1	2	2	4
<b>Data Backup</b>		0	1	5	1	5	1	0
<b>Telehealth (subscriber)</b>	1	4	1	4	1	4	0	0
<b>Distance Learning</b>		0	1	10	1	10	2	20
<b>HD Video-conferencing</b>		0		0		0	1	14
<b>Totals</b>		<b>12.6</b>		<b>33.8</b>		<b>35.8</b>		<b>58.3</b>
<b>Five years from now (MBPS)</b>	<b>38</b>		<b>101</b>		<b>107</b>		<b>175</b>	
<b>Ten years from now (MBPS)</b>	<b>113</b>		<b>304</b>		<b>322</b>		<b>525</b>	

## 4.6 CURRENT AND FUTURE USES AND SERVICES

When analyzing future service needs, it is important to take into account ALL services that may be delivered over a broadband connection. Broadband is not a service – it is a delivery medium. Using roads as an analogy, broadband is the road, not the trucks that use the road. Internet access is a service delivered by a broadband “road,” and that Internet service is just one of many services that are in demand. Today, congestion on broadband networks is not due just to increased use of email and Web surfing, but many other services.

This means that current DSL, wireless, and cable modem services are completely inadequate for future needs. Current DSL offerings are in the range of one Mbps to three Mbps for most residential users, three Mbps to five Mbps for business DSL users, and there are severe distance limitations on DSL. Higher bandwidth is possible, but as the DSL bandwidth goes up, the distance it can be delivered goes down.

Typical wireless broadband (not cellular data service) offerings are in the range of 5 Mbps to 10 Mbps. Some wireless providers are rolling out 10-20 Mbps services. As bandwidth increases, the cost of the equipment also increases, and even a 20 Mbps service is well short of the FCC definition of broadband: 25 Mbps down and 3 Mbps up.

Across the U.S., current average bandwidth for cable modem services is typically 10 to 25 Mbps, with cable companies promising much more using the phrase “up to...” to obscure actual bandwidth being delivered.

The challenge for the area is to ensure that the businesses, residents, and institutions have a telecommunications infrastructure in place that will meet future needs.

Distance learning, entertainment, and video conferencing are three major applications of internet video. Distance learning from home with live video feeds requires high-performance two to five Mbps connections in the near term, the next two to four years. Over the next four to seven years, there will be many distance-learning courses that will incorporate live HD two-way video feeds, enabling students to participate in classroom discussions at a much higher quality level. Distance learning could be an important home-based application for workforce training and retraining.

***U.S. homes now have more than half a billion devices connected to the Internet, according to a study by the NPD Group. Furthermore, the overall number of connected devices per household is 10. This is more than three times the average number of people per household.***

The table below lists these and other services that all represent broadband-enabled applications and services that must be available in at least parts of the region if it is to remain economically viable.

### ***Current and Future Uses and Services***

RESIDENTIAL	Vide Conferencing
	IP TV (Internet Protocol TV)
	HD streaming video
	Ultra hi-def (BluRay) video streaming
	Video on demand (e.g. Netflix)
	Cloud computing services

<b>RESIDENTIAL AND BUSINESS</b>	Online and cloud-based gaming
	Smart homes, buildings, and appliances, including smart electric meters, AMR (automated meter reading), and AMI (advanced metering infrastructure)
	Remote computer aided design (CAD)
	Work from home jobs and business from home opportunities
	3D graphic rendering and CGI server farms
	Remote network management and managed services
	Virtual collaboration spaces (e.g. enhanced GoToMeeting, Webex style services)
<b>PUBLIC SAFETY</b>	Intelligent transportation applications (smart road systems)
	Public safety and first responder networks
	Emergency dispatch and coordination
	Webcast agency meetings (e.g. virtual meetings)
	Online training for first responders, fire, and rescue
<b>SOCIETY</b>	Broadcast of local sports events
	Videoconferencing of community and town hall meetings for wider participation
	Wider availability of nonprofit and community organization services
<b>HEALTH CARE</b>	Telepathology
	Telesurgery
	Remote patient monitoring
	Remote diagnosis
	Remote medical imaging
	Grid computing for medical research
	Distance education
<b>EDUCATION AND RESEARCH</b>	Virtual classrooms
	Remote instrumentation
	Multi-campus collaboration
	Digital content repositories and distribution (digital libraries)
	Data visualization
	Virtual laboratories
	Grid computing for academic research

# 5 BEST TECHNOLOGY ANALYSIS

## 5.1 OVERVIEW OF THE TECHNOLOGY

In large portions of the four counties, broadband wireless will be an important strategy for improved Internet access for businesses and residents. But both fiber and wireless technologies and systems are going to be important to meet the goal of improving access to broadband. The rest of this section provides more detail and some specific build out strategies.

Businesses and residents may obtain Internet service:

- With a small radio directly attached to their home or business that receives a signal directly from a towers owned by a private provider, from a County-owned tower (e.g. shared with public safety use), or from a community-owned tower (e.g. a coop).
- With a small radio attached to a utility pole (60 or 70') to improve line of sight to a tower.
- With a small radio directly attached to their home or business that receives a signal from a "community" utility pole. The "community" pole will receive a signal from a distant tower and redistribute it locally to a cluster of customers (typically within a half mile).
- With a fiber connection to the fiber installed in areas where economic development is important, and in other areas as additional fiber network segments are added.

The table below summarizes how fiber and wireless can work together in a variety of ways.

Distribution Type	Access Type	Capacity
Wireless	Wireless	Typical customer connection starting at 5 to 10 Megabits, can be higher, with 50 Meg connections common. More dependent on the capacity of the wireless Distribution link.
Wireless	Fiber	Users can have fiber Gigabit connections locally, but total throughput dependent upon the capacity of the wireless link, which can be up to a Gigabit, depending on distance and budget.
Fiber	Fiber	Any amount of bandwidth needed, with standard connection typically a Gigabit (1,000 Megabits).
Fiber	Wireless	Typical customer connection starting at 5 to 10 Megabits, can be higher, with 50 Meg connections common.

## 5.2 WIRELESS TECHNOLOGIES

WISPs (Wireless Internet Service Providers) use a wide variety of radio frequencies to deliver fixed point wireless broadband. By "fixed point," this means that these systems are not designed to support roaming in the way that cellular voice/data radios are (that is, mobile phone and data services).

Fixed point broadband is broadcast from a tower to individual homes and businesses (fixed points). Most of the frequencies used require clear line of sight between the tower and the location where

service is desired. In Pennsylvania and many parts of the east, tree cover is often an obstacle to getting good service.

The hilly topography of the area can work for or against good wireless broadband service. Towers located on the tops of hills and mountains can provide service over a larger area than a tower in relatively flat terrain, but hills also block the signal. A residence can be a short distance from a large tower, but heavy tree cover or an intervening hill will block service. The solution to this can be addressed in several ways:

### **More larger towers of 180' to 300'**

The taller the tower, the wider the coverage, but as tower height increases, the cost of the tower also increases. Towers taller than 190' require a light at the top to make them visible to low-flying aircraft, and lighted towers are more expensive to erect, and the bulbs have to be changed periodically at significant expense. Many broadband towers are 180' to avoid the additional cost of lighting.

### **Small cell broadband utility poles**

Small cell broadband utility poles, often called community poles, are shorter towers or utility poles of typically 60' to 80', located in or very near a cluster of homes. The towers can be wooden utility poles or relatively low cost steel monopoles or steel lattice towers. These towers are located to get above local tree cover so that clear line of sight to a distant taller tower is available. Local access point radios provide service to homes and businesses with line of sight to the pole. In many parts of the four counties, these are going to be an important part of a strategy to get better broadband to rural residents and businesses.

### **Variety of radio frequencies**

WISPs are beginning to deploy a wider range of licensed and unlicensed radio frequencies to overcome distance, bandwidth, and line of sight issues. Traditional 2.4 Ghz and 5.7 Ghz WiFi and WiMax frequencies are being supplemented or replaced with LTE broadband radios that provide better bandwidth and will tolerate light tree cover better (2.5 Ghz, 3.5-3.7 Ghz). Some WISPs are also using lower frequencies (e.g. 900 Mhz) that will travel farther and will also provide better penetration in light tree cover.

## **5.3 EMERGING WIRELESS TECHNOLOGIES**

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### **MIMO Wireless**

MIMO (Multiple Input, Multiple Output) describes a variety of technologies that can be summarized as using more than one receive and transmit antenna for wireless data applications. Wireless protocols that are using the MIMO concept include IEEE 802.11n (Wi-Fi), IEEE 802.11ac (Wi-Fi), 4G, LTE (Long Term Evolution), and WiMAX. Each of these protocols use the MIMO technology to increase the amount of available bandwidth in a given section of radio frequency spectrum.

New hardware is required to make effective use of MIMO. While the technology increases wireless bandwidth, the typical amount of bandwidth being used by wireless devices is also increasing rapidly. Some applications where MIMO is likely to provide noticeable improvements are in home wireless routers, where the effective throughput will be able to better handle the demanding bandwidth requirements of HD and 4K video streams. MIMO is slowly being developed for use with cellular smartphones, but both the phones and the cell tower radios have to be upgraded to support MIMO.

## LTE/4G/5G

LTE (Long Term Evolution) is a set of protocols and technologies designed to improve the performance of voice/data smartphones. Like MIMO, both the user phone and the cell tower radios have to be upgraded to support LTE improvements. In 2013, only 19% of U.S. smartphone users were able to take advantage of LTE speeds, although that percentage has been increasing rapidly since then, and more than 85% of the U.S. cellular towers have been upgraded to LTE. As noted previously, the actual bandwidth available to a smartphone user is highly variable and depends on distance from the cell tower, the number of smartphones accessing the same tower simultaneously, and the kinds of services and content being accessed by those users.

The primary purpose of cellular bandwidth caps is to keep cellular users from using too much bandwidth and degrading the overall service. While LTE and MIMO improvements will improve overall cellular service, these technologies are not going to replace fiber to the home and fiber to the business.

In 2017, new fixed broadband wireless systems entered the marketplace using LTE frequencies, and many WISPs have begun to replace existing wireless radio systems with LTE equipment. These LTE systems do not provide any cellular voice services; they are designed specifically to support only broadband/Internet service.

Reports of performance have been mixed. In our conversations with both vendors of these systems and WISPs that have begun testing them, we get two very different stories. The vendors have been conservative in discussing the improvements, while some WISPs have been taking single user test results and suggesting that they will be able to deliver higher speeds at greater distances to all users.

There is little debate that the LTE equipment offers higher bandwidth, at somewhat greater distances, and with somewhat better penetration of light foliage and tree cover. Over the next two to four years, most WISPs will change out most of their existing radio systems for the improved LTE radios. Perhaps the most significant advantage of LTE fixed point broadband is its ability to provide better performance when clear line of sight between the customer and a tower is not available. LTE provides better penetration of light to moderate tree cover and other line of sight obstacles.

The much touted 5G wireless technology, as of 2019, is still largely marketing hype. The official standard for 5G radio technologies is planned for release later in 2019, although some companies, like Verizon, have begun trials of the equipment with a few customers.

5G does bring much higher speeds to wireless broadband (e.g. it might be able to deliver 30 to 50 Meg of bandwidth consistently). But 5G has significant limitations that do not make it a good solution in rural areas of the U.S.

The fact that 5G can deliver much higher bandwidth means that 5G cell sites will require fiber connections. This is going to effectively limit 5G deployments to denser urban environments where both customers and fiber are plentiful.

There is no free lunch in the physics of radio frequencies. The higher bandwidth of 5G means that cell sites need to be closer together because the 5G frequencies do not travel as far as existing 4G/LTE frequencies currently being used by the cellular industry. Most users will have to be within 500 to 1,000 feet to receive 5G service.

To achieve the full benefit of 5G technology, more fiber is needed.

Some experts estimate that more than a million miles of new fiber will have to be deployed just to support the 25 largest metro areas in the U.S. 5G will not appear overnight.

As many as 60 cell sites per square mile may be needed to make 5G widely available in a given area. If, as an example, about 25%, or 222 square miles of Clinton County is underserved, fifteen hundred or more cell sites would be needed to provide ubiquitous coverage.

For rural areas, the cost of 5G service may be one of the most significant obstacles. The cellular carriers see the increased customer bandwidth use possible on 5G networks as a major revenue opportunity. While they will increase the “standard” bandwidth package for monthly service, bandwidth caps and rate limiting is likely to keep 5G cellular customers bills high.

## White space broadband

White space broadband uses some of the frequencies that were formerly used by analog TV channels. These lower frequencies travel farther and provide better penetration of light foliage. Microsoft has been supporting a number of community white space experiments, and has promised much wider support for this technology, but there are few other users, equipment is still relatively expensive, and few WISPs have ventured into this still largely experimental technology. The Microsoft white space project in southern Virginia, although still underway, serves less than three hundred households and is still regarded as experimental. Other white space pilot projects have reported good results. River Valley Internet has indicated that their trials with white space equipment has been able to deliver 50 Meg/50 Meg service.

## 5.4 DARK FIBER AND LIT FIBER

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### About Dark Fiber

Dark fiber is installed in conduit underground and/or hung on utility poles. It is called “dark” because no network electronics are installed to “light” the fiber (using small lasers in a fiber switch). For small municipal/local government fiber installations, dark fiber has a significant advantage in terms of management—very little ongoing operational responsibility is required.

Dark fiber is leased out to service providers, who install their own network electronics in cabinets or shelters attached to the fiber cables. The providers typically lease fiber pairs between the cabinet and their customers, and are responsible for all equipment-related management and maintenance. Dark fiber networks can be used by service providers to provision either Active Ethernet or GPON services to their customers.

Dark fiber networks do not generate large amounts of revenue, but this is offset by very low maintenance costs—primarily an emergency break-fix arrangement with a local or regional firm qualified to splice fiber. Emergency break-fix contracts are usually based on a time and materials basis, so there is little or no expense if there are no fiber breaks.

Other costs include “locates,” which are called in to Pennsylvania Call811 (Miss Utility) and are performed by either the local Public Works department or a private sector contractor. For small fiber networks, locate costs are generally modest.

### About Lit Fiber

A “lit” fiber network includes the network electronics needed to transmit data over the fiber (using the small lasers in a fiber switch, hence there is light traveling over the fiber cable). In a lit network, “lit

circuits” are leased out to service providers rather than fiber pairs. The muni/local government/community network provides the network electronics, which reduces costs for the service provider—meaning they are able to pay higher lease fees for the circuits they use to deliver services (like Internet) to their customers. Lit networks generate more revenue, but also have higher expenses because the network electronics have to be monitored and managed on a 24/7/365 basis (this task can usually be outsourced at reasonable cost). However, very small fiber deployments often do not pass enough homes or businesses to generate sufficient revenue to cover the higher costs.

Like dark fiber, a lit network incurs break-fix and locate costs as well.

## 5.5 THE MEET-ME BOX CONCEPT

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In some of the larger towns, some smaller communities, rural neighborhoods, and subdivisions, “meet me” boxes could be installed. A meet me box is a telecom cabinet with fiber cables installed between the cabinet and nearby homes and/or buildings. Providers only have to reach the meet-me box, lowering their costs. Both wireline and wireless providers can use this infrastructure. This approach can also be used to provide fiber services in business and industrial parks. A small Virginia county installed five miles of fiber in their business park and was able to attract a Tier One provider to provide service to an existing business (a manufacturing plant that was going to leave if the county did not help them get better Internet service).

The dark fiber approach minimizes operational costs. Service providers would install their own equipment in the cabinet and would pay a small monthly lease fee for the fiber strands they use to connect customers to their services.



For a meet-me box installed in a “main street” area (e.g in an alley behind commercial/retail buildings) with relatively inexpensive and short fiber drop cables into nearby buildings, the lower end of an installation might start at \$35,000. For a box installed in a rural sub-division that requires distribution conduit/fiber and drop cables, the cost to connect 25 homes might start at \$175,000 on the low end and increase as the number of homes connected increases. Larger numbers of homes or businesses will each add to the cost, but adding more connected premises also increases the value of the infrastructure and increases the revenue potential.

## 5.6 TERRAIN CHALLENGES

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The propagation study map studies that are included in the county-level reports illustrate the challenge of providing adequate fixed point wireless Internet service in the four counties. The mountainous terrain throughout the region shows that many towers and community poles will be needed to near an adequate solution using fixed point broadband wireless. In some areas, the difficulty of obtaining line of sight for a radio link between two locations may dictate using fiber in place of wireless.

As an example, in Richwood, West Virginia, a group of about seventy-five homes along two and a half miles of road led to a fiber to the home solution that was less expensive than broadband wireless, primarily due to the cost of bringing electric service to many community poles. A combination of

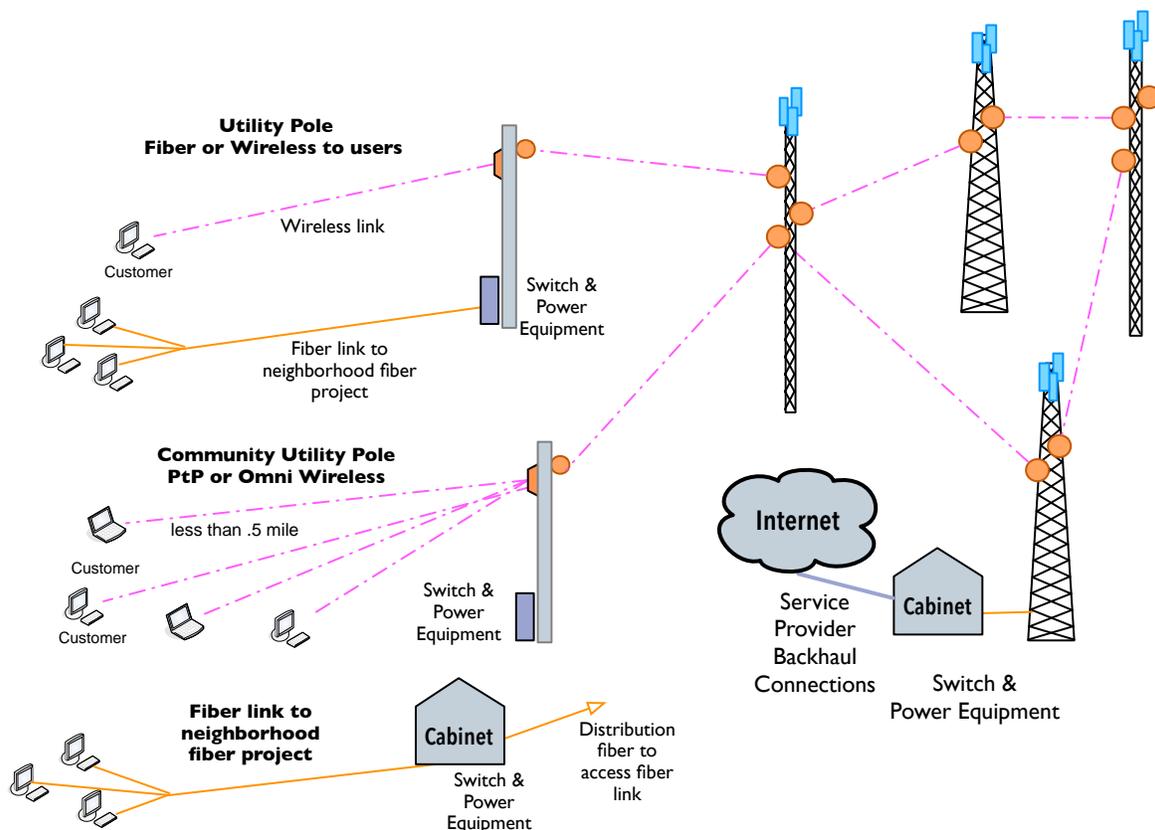
taller towers and shorter community poles may be needed to provide good service to most areas of the four counties.

## 5.7 CONNECTIVITY SOLUTIONS

Both wireless and fiber networks, as well as legacy copper-based networks, all share three primary components. How these are designed and deployed can vary greatly, but all networks have these three parts in some form.

- The **Core Network** provides access to the Internet, a place for service providers (ISPs) to distribute their services locally on the network, and for larger institutional and business customers to meet service providers. The counties have both landline and wireless service providers, but there are still areas that are underserved. Each of these providers has their own Core Network, but wireless broadband could be more widely available if additional county-owned towers were available to the private sector providers.
- The **Distribution** portion of the network connects the Core Network with collections of users. A Distribution network can include both fiber and wireless portions of a network.
- The **Access or Last Mile** portion of the network connects residential users and businesses to the network, and like the Distribution network, that connection will be by fiber or by a wireless link.

The illustration below shows the full range of technology options (fiber and wireless) and how they can be connected together in various ways to meet the diverse needs of the region. More detail is provided on the following pages.



## Last Mile Access

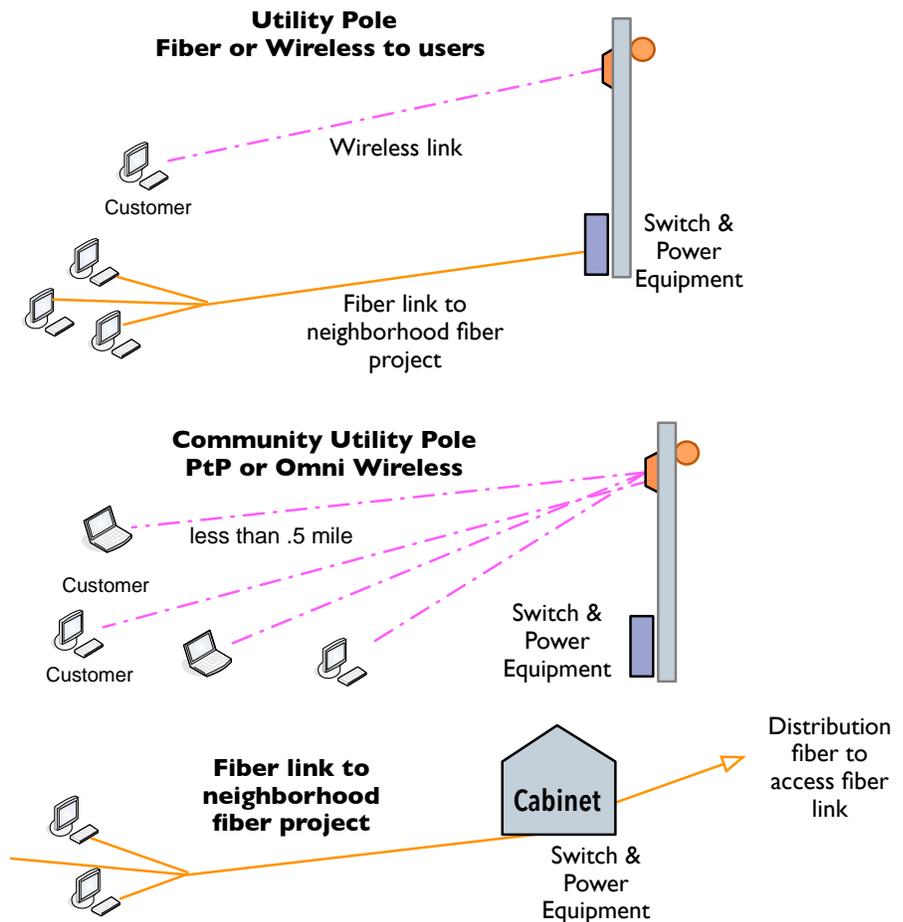
The Last Mile Access is the portion of the network that connects customers to their service provider and the Internet. Both broadband wireless and fiber links can be utilized to provide service. There are several ways that customers can receive service:

- Service providers can install their own local access radios on the Distribution towers, using both point to multi-point and point-to-point radios to deliver service to their customers.
- A single user utility pole (or inexpensive steel lattice tower) can be installed on the property of a single resident or business. A radio at the top of the pole receives service from another tower site (typically one of the Distribution towers).

- A utility pole (or inexpensive steel lattice tower) can be installed near a cluster of homes (e.g. a rural residential sub-division, several homes in close proximity on a rural road). Service providers can install their point to multi-point radios on this pole and provide economical service to several customers from a single pole.

- A utility pole (or inexpensive steel lattice tower) can be installed in a rural subdivision. A service provider installs a point to point radio on the pole, and fiber cable can be run from the pole past several homes to offer fiber service with wireless backhaul.

- Customers near existing fiber can have a fiber drop installed directly to their home or business.



## Distribution Network

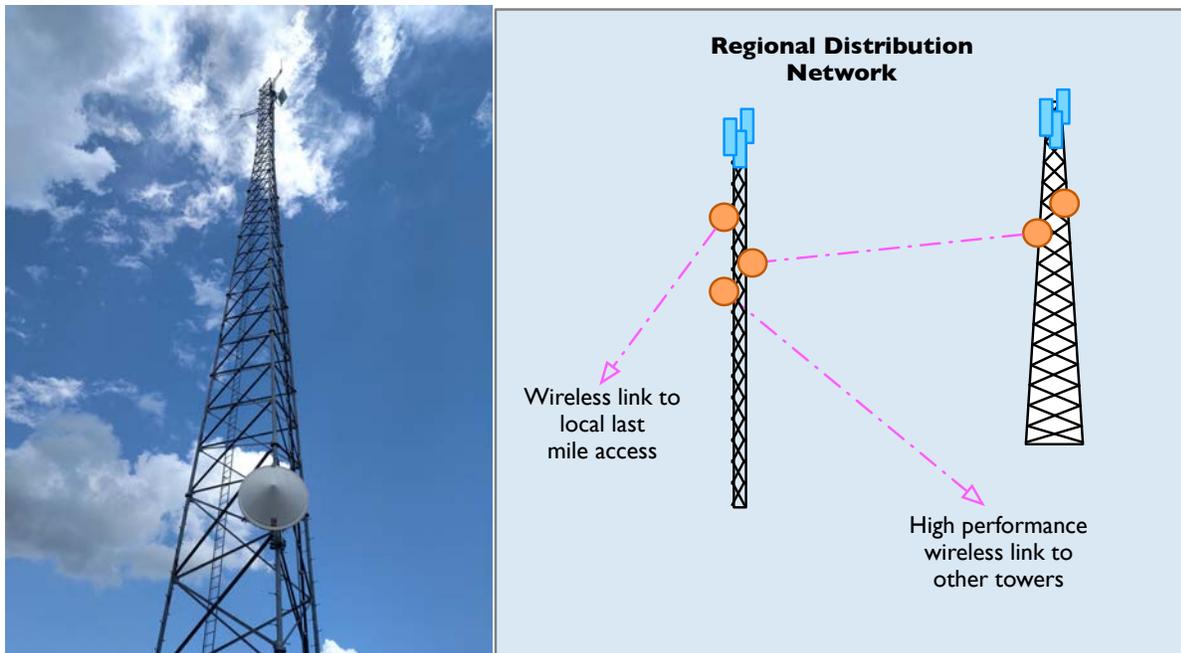
Distribution is the portion of the network between the Distribution sites to the Last Mile Access portion of the network. It is desirable for each distribution site to have a connection back to more than one Distribution site (tower) on a redundant ring. This ring topology protects against hardware failure at the port level and does provide some protection if one of the tower to tower wireless links is disabled by an equipment failure.

These tower sites are typically 120' to 180' tall to provide the height needed to enable Line Of Sight (LOS) between towers, and for local access, to enable service providers to mount point to multi-point radios on the towers.

Towers taller than 199' become subject to FAA regulations because the height can be a potential hazard to airplanes. Towers that exceed 199' usually have to be painted (alternating red/white) and have a blinking light at the top. These requirements increase the long term maintenance costs, but the taller towers can improve line of sight to other towers.

The towers can provide two functions:

- Space for backhaul connections to other towers in the county or the region.
- Space for local access radios to provide Internet access within 2-3 miles of the tower (or farther with good Line Of Sight).



## Core Network and Service Providers

In the past, the telephone company switch office (Central Office, or CO) has provided that function. Today, many communities have either a community-owned data center or a privately owned data center that offers an affordable range of options for customers of broadband services.

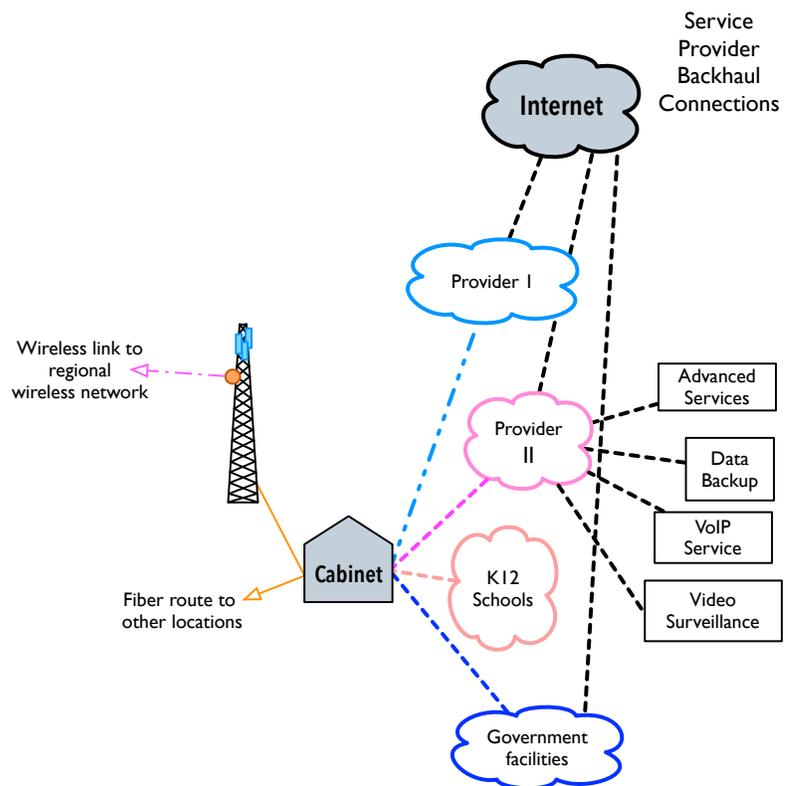
The Co-Location facility provides a meet point for various public and private fiber cables and networks to inter-connect. A local facility with space available for both public and private uses could help attract additional private sector investments (e.g. a long haul fiber provider wants connect to this facility because of increased access to customers).

A colocation facility is a controlled environment (i.e. secure, heated, and air-conditioned) room with Internet access through wired and/or wireless systems. The colocation facility is a place where fiber, wireless, and copper-based network facilities meet. It is equipped to house high-end network equipment, servers, and other electronic gear.

A variety of middle layer network components and services can be located within the co-lo including, for example, directory services, replicated content servers, routing services, and other elements needed to deliver new multimedia services to the home and small office from multiple, competing providers.

Characteristics of the colocation facility are:

- A reliable source of AC electric power is required, with backup UPS (Uninterruptible Power Supply) service, and additional power backup available by an onsite generator is desirable.
- Controlled access to the facility (e.g. by electronic keycard) 24 hours/day, seven days a week. Service providers need to be able to gain access to the equipment room as needed, and work activities performed at night or on weekends is common.
- Racks for locating network equipment and servers, and optionally locked cages for equipment racks.
- Sufficient cooling capacity for the network's current and long-term needs. Equipment rooms require both a cool air input vent and an air return vent.



## 5.8 SMALL CELL BROADBAND POLES

Line of sight issues are a constant problem for rural residents and businesses, as clear line of sight (or near line of sight) is required for fixed wireless Internet services. Even newer technologies like white space and LTE systems work better with clear line of sight to distant towers.

The increased use of wooden utility poles is already common in some other areas of the country, and increased use of this technique to get the customer CPE radio/antenna above tree cover is a relatively simple solution.

### Ownership and Governance

The utility poles would normally be placed on private property, subject to existing or updated ordinances governing the placement of wooden utility poles. The local government would have no responsibility for maintenance and repairs.

### Cost Discussion

The cost of placing an eighty foot pole can range from a low of about \$2,000 to \$7,000 or more, depending on permitting, engineering requirements, and the location of the pole. Some municipalities provide "by right" permitting of these poles if they are placed on private property, which can reduce the cost of installing them.

### Funding Options

Because these are placed on private land, local government would not have to provide any direct funding. However, the localities could encourage wider use of this option with a public awareness campaign developed in partnership with wireless providers. Local banks could be encouraged to provide low cost financing of the poles so that property owners could make a small interest and principal payment monthly over several years to reduce the financial impact.

### Recommendation and Next steps

Given that this strategy requires minimal financial support from the County and that it has the potential of improving broadband access in rural areas of Clinton, Lycoming, Northumberland, and Union quickly, the municipalities should support "by right" permitting of wood utility poles in rural areas, including allowing a minimum of fifteen feet above existing tree cover and subject to a very limited set of restrictions (e.g. a minimum set back from public right of way).



## 5.9 NANO-CELL AND WIFI CALLING SERVICE

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A common complaint in the four counties is the poor cell service in many areas. In some parts of the area, there may be adequate broadband service via DSL or cable modem Internet, but poor cellular phone/data service. There are now two solutions to improving rural cellular service that do not involve the expense or difficulty of attracting and/or building more cellular towers.

**WiFi Calling** – This approach takes advantage of the WiFi Calling feature that is now common in many late model cellphones. Once the phone is connected to a WiFi network (e.g. in the home using the home's broadband Internet service), the phone will automatically route the call over the WiFi network—phone calls and text work normally, as if the phone is connected to a cellular tower.

**Nano-cell Calling** – Poor or no cellular service in rural areas can be addressed by promoting the wider use of “nano-cell” devices. These small pieces of equipment are connected to the DSL or wireless broadband connection and provide improved cell service in the home or business. The working distance of these devices is limited, and service generally drops off once you leave the house itself (it may work for some short distance in the yard). These devices work very well and do not require an upgrade to a newer phone.

The cellular providers do not always promote the use of these devices, so many cellular users who would benefit from their use are not aware that this option is available. The device averages around \$200 retail, but the cellular providers often provide substantial rebates (50% discount or more) and in some cases may provide them at no charge.

The improved wireless broadband service will also support use of WiFi calling and/or nano-cell devices.

***This strategy is important because improved broadband service can also improve cellular service without the need for more cellular towers, especially in parts of the region where cellular providers have not been able to make the business case for more towers.***



# 6 OWNERSHIP OPTIONS AND PUBLIC/ PRIVATE PARTNERSHIPS

## 6.1 PUBLIC/PRIVATE PARTNERSHIPS

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Broadband efforts in Clinton, Lycoming, Northumberland, and Union counties will by necessity have to include both public and private partners. Among some public and private entities, the common synergies are:

- The need for more bandwidth,
- The need for more affordable bandwidth, and
- The need for more affordable bandwidth to be more widely available.

Potential project partners include:

### Local government

The four county governments of Clinton, Lycoming, Northumberland, and Union must play a significant and steady role in this effort because the future economic and community health of the region is at stake. ***The residential survey has indicated that nearly 30% of residents see the availability of good broadband as a factor in where they will live.*** In other parts of the country, some county governments are funding middle mile fiber routes to connect county facilities, (e.g. schools, libraries, pump stations, water tanks, fire and rescue facilities, etc.). This approach often includes significant cost savings by eliminated the expense of leased lines for all connected facilities. The City of Palm Coast, Florida saved \$80,000/year by building its own fiber ring in the City.

### Public Safety

The Sheriffs departments, fire, and rescue departments all need better access to broadband and improved wireless voice/data communications. Throughout the United States, public safety voice and data communications systems are being upgraded, often at staggering cost. Many of the upgrades include new towers to eliminate “holes” in the served area where first responder, fire, and rescue radios do not work. Combining public safety needs with community broadband needs can bring new sources of funding and cut costs, sometimes dramatically. Elected officials may need to take the lead in this area to ensure that public safety officials work collaboratively with the broadband efforts.

As additional towers and community pole sites are deployed in the four counties, first responders will benefit from lower Internet costs. Sharing tower space (WISP access and first responder voice/data) is extremely efficient, and all tower improvement and tower construction activities should be coordinated closely. There are some grants and funding sources available for public safety infrastructure like towers that may be available to help support new tower development.

### K12 Schools

K12 students often lack adequate Internet service at home, and some schools are careful not to assign homework that requires Internet access. Parents consistently report on the burden of having to drive children to a public library or some other WiFi hotspot to get Internet access for school work. Depending on location, some schools in the four counties could consider setting up a WiFi hotspot outside the building and make it available after school hours, when classroom instruction would be not

be impacted. It is possible to make this access controlled, so that students would have to a userid/password to use it. The county governments should work with the schools to apply for education grant funds to achieve this goal, and to keep K12 parents informed about broadband activities.

## ISPs and WISPs

Internet Service Providers (ISPs) and Wireless Internet Service Providers (WISPs) are important partners, as they will be the companies leasing tower space and/or conduit/fiber infrastructure.

Regional telecom investments will be a public/private enterprise, and service providers are the primary customers of the infrastructure. Service providers cannot be taken for granted. Instead, a fair fee structure, high quality infrastructure, excellent maintenance and operations (where needed), and flexibility on business agreements and pricing will be required to recruit and retain service providers.

See the chapter later in this report (*Legal and Regulatory Analysis*) for more information on how to work with providers. For providers that express interest in using community infrastructure, it will be important to meet with them on a regular basis. These companies may also be partners on grant applications, where it may be required to show that the infrastructure being constructed has a service provider already committed to using it.

## Area Businesses

Businesses in the four counties and the local Chamber of Commerce chapters have an important role to play as advocates for the work of this effort. At both the county and state level, businesses that need more affordable and better broadband should ensure that elected officials understand the urgency. As part of a regional marketing program, ensure that local businesses are kept up to date with work activities, grants, and other efforts (e.g. attend CoC meetings at least quarterly to report on the work of the broadband effort).

## Electric Utilities

Electric utilities are natural partners in any municipal broadband venture. Electric utilities own utility poles, bucket trucks, and the equipment needed to install aerial fiber. Chattanooga's fiber to the premises (FTTx) initiative has enabled millions in savings for the city-owned electric service. When power outages occurs from events like ice storms or tree damage, the utility is able to use the fiber network to very accurately pinpoint where the outage occurs, enabling a more rapid repair of the electric network at less cost.

Portions of Clinton and Lycoming counties are served by Tri-County Rural Electric Coop, which has recently announced a major fiber to the home initiative. The coop has committed to a five year build out plan, with the first fiber to be constructed in Potter County. Other service areas will be added year by year based on local demand in those areas.

## Broadband Coop

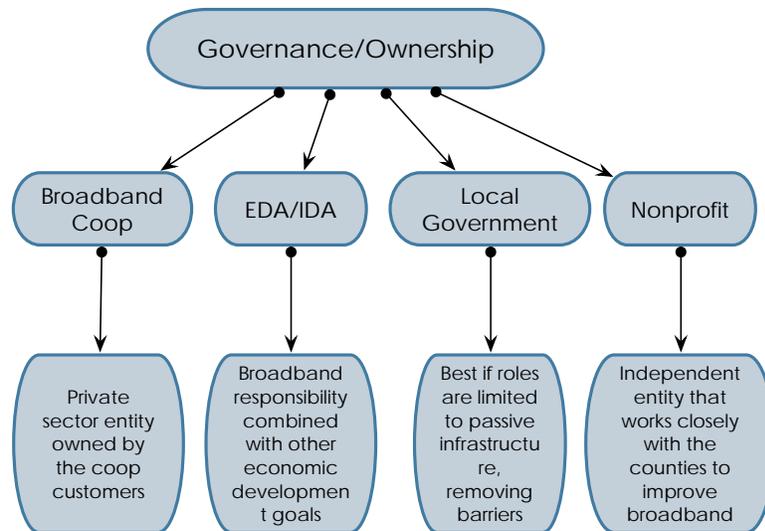
Forming a broadband coop may be one of the most effective ways of creating a multi-county partnership with a diverse and robust set of public and private members (partners) that could include residents, businesses, schools, health care providers, public safety, and local government. More information on the coops and how they are formed is contained in the next chapter (*Governance and Ownership Options*).

## 6.2 GOVERNANCE AND OWNERSHIP OPTIONS

For whatever infrastructure improvements may be made in the four counties, there will be a limited number of essential roles.

Community and county government investments in telecom improvements can be a mix of passive infrastructure like dark fiber, conduit, and wireless towers and well as some network electronics. These assets can be leased out to the private sector.

If the improvements are owned directly by the **county governments**, many of the routine responsibilities could be managed by existing locality staff and departments that might include IT, Public Works, and Planning.



An **EDA or IDA** (Economic Development Agency, Industrial Development Agency) as a nonprofit, could also own and manage telecom assets.

Another option is to form a **nonprofit**, which would not be subject to the state level restrictions on local government. A number of communities have formed a nonprofit (typically a 501(c)(4) to provide the governance and ownership roles for a community broadband effort.

In the region, a **broadband coop** may also be a useful option to consider. Coops are typically formed as a 501(c)(12) and are owned by the members (who are also the customers of the coop). Coops can receive membership fees in advance of providing the service, which can help raise the funds needed for infrastructure. There can also be more than one type of membership (e.g. residential, small business, large business, government, institutional, etc.), and each membership type can have a different membership fee associated with it.

### County Government

Many community-owned networks have achieved success with direct ownership by the local government. Local governments have a range of options when they evaluate ownership of telecommunications infrastructure:

- Space can be made available on existing county and state owned towers. Leasing space on an existing tower help attract a WISP to a new area by lowering the capital costs associated with developing a new market area.
- Where government-owned towers do not exist, county government or a regional entity can build new towers to expand the available service area for a WISP or WISPs that would lease space on the new towers.
- Empty conduit, ideally with several empty tubes, may also be an option, especially in new rural sub-divisions, where the developer may be willing to make the investment if the county government or a regional entity is willing

to take responsibility for it once the construction of the neighborhood is complete. Empty conduit can be leased to private sector providers to generate an ongoing revenue stream. If the conduit is installed concurrently with street repairs, sidewalk upgrades, and/or grinding of streets prior to resurfacing, the construction cost can be lower. The long-term benefits include reduced street maintenance and repairs in the future because providers no longer have to cut streets and sidewalks to install their own conduit. Even in small communities where this is being done, multiple providers show interest in leasing conduit in business areas of the community.

- If a local government installs dark fiber in conduits (while leaving some tubes empty for conduit leasing), the potential revenue is higher than if it only installs conduit. If it installs fiber drops into commercial and retail business buildings, businesses in those building will potentially have more provider options and better (competitive) pricing for internet, voice and other IP-related services.

Managing conduit and dark fiber networks is practical for even very small communities because there are virtually no day-to-day operational responsibilities for the two systems, unlike an end-to-end “lit” networks with fiber switches and customer-premises equipment.

## About Nonprofits

There are various kinds of nonprofit businesses. The most common is the 501(c)(3), which is limited to strictly charitable efforts. A 501(c)(3), according to IRS rules, must have a well-defined charitable purpose targeted toward a specific need and/or a specific target population. In other words, a 501(c)(3) cannot, according to IRS rules, operate as a nonprofit business that provides services to the general public.

Many of the first community networking projects in the early and mid-nineties were formed as 501(c)(3) organizations; it was common for these entities to offer dial-up Internet access to the general public at a time when Internet service providers were still relatively uncommon. But by 2000, most of these organizations had closed their doors and/or discontinued their Internet access services because of IRS challenges.

Today (2019), we have seen new 501(c)(3) and 501(c)(4) organizations being formed, and the Federal government’s 2015 endorsement of both community-owned networks and the open access business model has removed the uncertainty of using a nonprofit for this kind of effort. The IRS defines one role for 501(c)(4) entities as *“Social welfare organizations: Civic leagues or organizations not organized for profit but operated exclusively for the promotion of social welfare.”*

A 501(c)(3) can accept tax deductible donations, but contributions to a 501(c)(4) are not tax deductible. The advantage of a nonprofit is that they are relatively easy to create and legal fees are usually nominal. Nonprofits are often eligible for certain kinds of grants not available to for profit enterprises, and the nonprofit can provide the needed oversight to manage broadband infrastructure investments.

The advice of legal counsel should be solicited before forming a nonprofit.

## About Coops

Cooperative business enterprises as formal entities date from the mid-1800s. The first cooperative was set up in England to serve customers unhappy with local merchants. In the United States, the Grange movement began setting up cooperatives in rural areas to sell needed items to members and to help sell produce and other agricultural products that were produced by members. Today, credit unions are the most common form of coop business in the United States, with more than 65 million people obtaining services from over 12,000 credit unions.

Telephone and electric coops continue to be very common in rural parts of the U.S., and in fact, the majority of telephone companies in the United States are coops, but most have very small numbers of customers--often less than a thousand subscribers. Telephone coops serve more than a million subscribers in thirty-one states. The True Value and Ace Hardware chains are actually buying coops that help keep independent hardware stores competitive with the large chain stores.

The U.S. Department of Agriculture (USDA) provides extensive support for existing coops, and also helps communities start coops. One of their publications lists the principles of the coop:

- User-Benefits Principle -- Some purposes of a coop are to help members get services that might otherwise not be available, to get access to markets, or for other "mutually beneficial" reasons.
- User-Owner Principle -- The users of the cooperative own it.
- User-Control Principle -- The owners of the coop (i.e. members) control the coop through voting (annual meetings, etc), and indirectly by electing a board of directors to manage the enterprise. Large users who make high volume purchases of goods or services may receive additional votes.

Because cooperatives are user-managed, control of the enterprise is vested in the community or county where the users reside. Cooperatives also return excess earnings to its members; these refunds are called patronage refunds, and are typically computed at the end of the fiscal year. The expenses and income of the coop are calculated for the year, and any excess is returned to members, based on the percentage paid in by each member (e.g. a member that paid in 1% of total earnings would get a refund of 1% of any excess earnings).

Most cooperatives do not pay dividends on capital. This helps keep outsiders from taking control of the company, which would result in the community losing control over the quality of services and direction of the enterprise.

Coops are organized in part based on the territory they serve, and there are several classifications that may be relevant for community broadband efforts. A local coop serves a relatively small area that may be a single town or county and/or a radius of ten to thirty miles. A super local coop serves two or more counties. A regional coop may have a service area of several counties up to an entire state (or multiple states). For projects that involve several local government entities that are already trading services like local public safety dispatch, a super local coop may be the most appropriate designation.

Most local and super local coops use the centralized governance structure, which means that individuals and businesses represent the bulk of members.

Cooperatives offer one or more of three kinds of services:

- Marketing coops help sell products or services produced by members.
- Purchasing coops buy products and services on behalf of members.
- Service cooperatives provide services to members, and service coops include the credit unions, the electric coops, and the telephone coops.

Equity is typically raised for coops by direct investment from members. In return for an investment, members receive a membership certificate. The member may also receive shares of stock if the cooperative issues stock (some do, and some do not). Once a member has invested, they gain the right to vote in elections. As an example, if the local governments made a large initial investment in

the cooperative, they could gain substantial influence in the affairs of the organization by gaining multiple shares and increased voting rights. Property owners (residential property owners and business property owners) who paid an initial connection or pass-by fee would also gain shares in the business, so every property owner that pays the connection fee gains ownership in the enterprise--an important selling point when encouraging property owners to, quite literally, invest in the project.

Although cooperatives are typically constrained by both Federal and state laws to do a majority of business with members, in most cases, cooperatives are able to do business with nonmembers up to some percentage of business income that can be as high as 49 percent. Note that this may be affected by the underlying legal incorporation of the cooperative--if incorporated as a 501(c)(12), the IRS requires that 85% of income must come from members for the purpose of meeting ordinary expenses.

In summary:

- Coops are member (subscriber) owned, meaning they are strongly vested in the community. Any effort by the coop board to dispose of assets or to sell the coop would have to be approved by a majority vote of the members.
- Members play an active long term role in governance by nominating and electing board members. So members have a straightforward way of influencing decision-making by the board.
- Coops generally operate on a cost-plus basis. Income that exceeds some preset level is returned to members periodically as a distribution of funds.
- Broadband coop bylaws must be carefully written, especially if there is an interest in several classes of membership. Each class of membership can be charged a different membership fee, and this can be a valuable source of start up funds, but membership categories are difficult to change later.
- Coops are largely immune to challenges by incumbent telecom providers due to the long history of existing coops and because of special legislation passed by Congress.
- Coops can tap USDA funds, but the application process would be time-consuming and expensive for a start up coop.

### **Advantages of a Coop**

The primary advantages of an Coop as opposed to the counties pursuing projects independently include:

- Avoids the strict limitations on local government participation. A coop, as a private sector entity, would have a wider range of infrastructure options, including offering retail wireless and fiber services.
- Coops can raise funds prior to delivering services to its shareholder customers. A broadband coop could solicit memberships from throughout the region (as long as the coop can clearly articulate its mission). Alternately, it could start with smaller "first phase" service areas and only solicit memberships from the initial target areas.
- A coop, with local members as the shareholders and owners, is firmly vested in the community. By comparison, a nonprofit, while easier to set up, does not have the same vesting in the community--the volunteer board of a nonprofit can sell the assets and/or disband it without any input from the community.

A broadband coop would need a carefully selected board of directors with significant business and management experience.

## Governance Quantitative Evaluation

Six factors can be evaluated to provide a quantitative assessment of the governance options. These factors are:

- Transparency - Does the governance structure provide adequate transparency about decision making? Do stakeholders and interested parties have adequate ways to obtain documents, financial reports, and related governance materials?
- Timeliness - How quickly can the governance entity be legally formed? Time may be of the essence.
- Community Oversight - Does the entity have adequate community control and oversight? Do the communities and local governments have adequate representation in the governance structure to ensure that assets are managed properly?
- Legislative Authority to Build/Operate - Does the governance entity have clear legislative approval to build and operate a telecommunications network?
- Financing Options - Are there adequate financing options available to provide the appropriate level of funding over time to meet the long term vision of the county or counties?
- Tax Liability - Does the governance entity incur tax obligations?

## 6.3 RECOMMENDATION

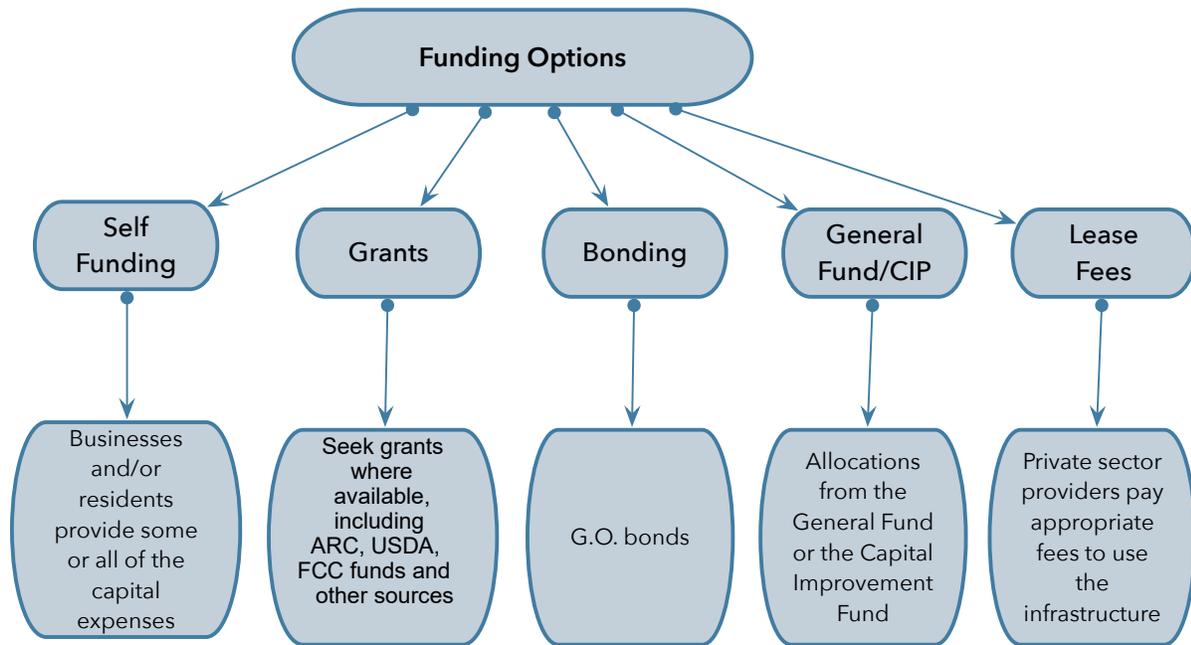
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If local government participation is primarily limited to investments in passive infrastructure, direct county government ownership is the simplest and most direct route. This also aligns ownership most easily with state and Federal grant opportunities. If public safety tower needs can be combined with improved broadband wireless tower needs in underserved areas of the counties, this also supports county government ownership.

A coop, while requiring more time attention during formation, could provide a durable long term solution to improving broadband in one or more of the counties, and a broadband coop could apply for loans and grants, especially from USDA, and that could be used to make improvements in an area that includes more than one county (or even all four).

# 7 FUNDING STRATEGIES

It is important to note that any investment by any of the four counties in broadband infrastructure should be focused on passive infrastructure. These assets will have a conservative life span of thirty years or more (e.g. wireless towers, conduit, fiber cable). These types of infrastructure investments create hard assets that have tangible value and can then be leveraged for additional borrowing. The demand for services and the associated fees paid for those services will provide the revenue that will pay back loans over time. There is ample time to recoup not only the initial capital investment, but also to receive regular income from the infrastructure.



The financing of community-owned telecommunications infrastructure faces several challenges with respect to funding.

- Not all local governments are willing to commit to making loan guarantees from other funding sources like property taxes, because the idea of community-owned telecom infrastructure has a limited track record and therefore a higher perceived risk.
- Similarly, citizens are not always willing to commit to the possibility of higher taxes that may be needed to support a telecom infrastructure initiative, for many of the same reasons that local governments are still reluctant to make such commitments: perceived risk and a lack of history for such projects.
- Finally, banks and investors are also more skeptical of community telecom projects because of the relative newness of the phenomenon. By comparison, there are decades of data on the financial performance of water and sewer systems, so the perceived risk is lower.

Somewhat paradoxically, the cost of such a community digital road system is lower when there is a day one commitment to build to any residence or business that requests service. This maximizes the potential marketplace of buyers and attracts more sellers to offer services because of the larger potential market. This is so because:

- Service providers are reluctant to make a commitment to offer services on a network without knowing the total size of the market. A larger market, even if it takes several years to develop, is more attractive.
- Funding agencies and investors that may provide loans and grants to a community network project want to know how the funds will be repaid and/or that grants will contribute to a financially sustainable project. Knowing that the size of the customer base is the maximum possible for a service area helps reduce the perceived risk for providing loans and grants.

## 7.1 COOP MEMBERSHIP FEES

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Coop members pay a one time membership fee to join the coop. For fiber and wireless improvements, this fee could be set at a level that pays for part or all of the cost of building the fiber to the business or residential premises and/or placing the towers and equipment to deliver wireless service. It may also be possible to work with local banks to provide a financing option (e.g. the membership fee could be paid monthly over a period of several years to reduce the financial burden on a household or business).

The coop membership fee offers the area a way to self-finance a substantial portion of the initial network, as well as providing a long term framework for expansion.

## 7.2 COMMUNITY REINVESTMENT ACT

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The Community Reinvestment Act (CRA) was developed forty years ago to encourage banks and savings institutions to help meet the credit needs of their local communities, with a focus on low and moderate income areas of those communities. The Federal agencies that oversee private banks assign a CRA rating to each institution. Banks are often looking for well-planned community efforts that need loans. Such loans can improve a bank's CRA rating.

The CRA was revised in 2016 to encourage banks to support community broadband efforts. A community broadband project may be able to get some loan financing from a local bank that wants to get credit for their CRA work.

## 7.3 HUD COMMUNITY DEVELOPMENT BLOCK GRANTS

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The U.S. Housing and Urban Development CDBG State Program allows the Pennsylvania state government to award grants to smaller units of general local government (e.g. counties, towns) that develop and preserve decent affordable housing, to provide services to the most vulnerable in our communities, and to create and retain jobs. In recent years, CDBG funds have been successfully used for broadband infrastructure development where the local government applicant can show the improvements meet the general guidelines of the program—so grant funds have to spent in low and moderate income areas.

Over a 1, 2, or 3-year period, as selected by the grantee, not less than 70 percent of CDBG funds must be used for activities that benefit low- and moderate-income persons. In addition, each activity must meet one of the following national objectives for the program: benefit low- and moderate-income persons, prevention or elimination of slums or blight, or address community development needs having a particular urgency because existing conditions pose a serious and immediate threat to the health or welfare of the community for which other funding is not available. More information is available here ([https://www.hud.gov/program\\_offices/comm\\_planning/communitydevelopment/programs](https://www.hud.gov/program_offices/comm_planning/communitydevelopment/programs)).

## 7.4 USDA RECONNECT PROGRAM

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The ReConnect program is a new funding program managed by the USDA Rural Development Office. This program is sometimes called the USDA e-Connectivity pilot program. Grant applications can be a combination of 100% grant, 50% grant/50% loan, or 100% loan. \$600 million has been allocated to the program, and a wide variety of entities can apply, including non-profits, coops, and state and local governments. Successful applications will require a very credible business plan that shows the project can be financially sustainable. Up to \$25 million is available for a 100% grant application. Applications are due in the spring of 2020. More information is available here: ([reconnect.usda.gov](http://reconnect.usda.gov)). A mapping tool is available on the Web site to show areas that are eligible. To qualify as an eligible area, households must have less than a minimum of 10 Megabit down/1 Megabit up broadband service.

## 7.5 911 FEES

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Improved broadband access in the region can improve household access to 911 services by using broadband Internet to carry 911 voice calls, using one or more strategies to include:

**WiFi calling** – now a commonly available feature on new cell phones. WiFi calling switches voice telephone call from the cellular network to a nearby WiFi Internet network seamlessly. This reduces the need for additional large cell towers in low density areas of the counties.

**Nano-cell Devices** – Nano-cells are a small box attached to a home wireless router. The nano-cell, which is typically obtained from the cellular provider, enables a cellphone to operate inside the home or business even if there is no cell tower near by.

A modest increase in the 911 fee to improve 911 access in rural areas of the four counties could generate funds to support additional broadband towers and community poles. See the tables above in the Special Assessment section of this chapter.

## 7.6 OPPORTUNITY ZONES

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An Opportunity Zone is an economically-distressed community where new investments, under certain conditions, may be eligible for preferential tax treatment. Localities qualify as Opportunity Zones if they have been nominated for that designation by the state and that has been approved by the Internal Revenue Service. Opportunity Zones are designed to create tax incentives for private investors to make investments that can encourage economic development and job creation in distressed communities. Opportunity Zones would be of most use for Internet Service Providers who could use the tax benefits to make a business case to improve Internet access in a qualifying area (zone).

Opportunity Zones are defined by census tract, and the Census Bureau's Geocoder online tool can provide census tract ID numbers. A link to the list of currently qualified census tracts can be found on this page (<https://www.cdfifund.gov/Pages/Opportunity-Zones.aspx>). Clinton, Northumberland, and Union counties all have designated Opportunity Zones.

## 7.7 BONDING

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Revenue bonds are repaid based on the expectation of receiving revenue from the network, and do not obligate the local government or taxpayers if financial targets are not met. In that respect, they are different from general obligation bonds. Many kinds of regional projects (water, sewer, solid waste, etc.) are routinely financed with revenue bonds. We believe many community projects will eventually finance a significant portion of the effort with revenue bonds, but at the present time, the limited financing history of most community-owned broadband networks has limited using revenue bonds.

Selling revenue bonds for a start up municipal network can be more challenging because there is no financial or management history for the venture. Bond investors typically prefer to see two or three years of revenue and expenses and a track record of management success. It would be advisable for the counties to have an early conversation with qualified municipal bond counsel to assess the viability of this approach.

Obtaining funding using revenue bonds requires an excellent municipal credit rating and an investment quality financial plan for the operation and management of the network. Revenue bonds must be used carefully, and a well-designed financial model is required to show investors that sufficient cash flow exists to pay back the loans.

General obligation bonds are routinely used by local governments to finance municipal projects of all kinds. G.O. bonds are guaranteed by the good faith and credit of the local government, and are not tied to revenue generated by the project being funded (i.e. revenue bonds). G.O. bonds obligate the issuing government and the taxpayers directly, and in some cases could lead to increased local taxes to cover the interest and principal payments. Some bond underwriters have indicated a willingness to include telecom funds as part of a larger bond initiative for other kinds of government infrastructure (e.g. adding \$1 million in telecom funds to a \$10 million bond initiative for other improvements).

In discussions with bond underwriters, it has been suggested that it would be easier to obtain bond funds for telecom if the telecom bonding amount was rolled into a larger water or sewer bond, or some other type of bond request that are more familiar to the bond market.

## 7.8 CAF 2 FUNDS

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The second round of the FCC Connect America Fund (CAF2) continues to provide funds to incumbent and competitive service providers. The funds must be used in unserved or underserved areas as defined by Federal census blocks. To be eligible, a census block could not have been served with voice and broadband of at least 10/1 Mbps (based on Form 477 data) by an unsubsidized competitor or price cap carrier.

The FCC published the final eligible census blocks for the auction on February 6, 2018. The final areas were based on FCC Form 477 data as of December 31, 2016 (the most recent publicly available FCC Form 477 data at the time). So there is a time lag between the determination of a qualifying census block or blocks and the schedule for submitting a bid to serve those areas.

Because many CAF2 qualifying areas are only served by low performance DSL (e.g. less than 10/1 Mbps service), incumbent carriers use the awards to upgrade DSL switches, which is not a long term solution. More recently, competitive carriers are applying for CAF2 funds to provide higher performance broadband wireless and in some cases fiber to the home. Because the use of CAF2 funds are so restricted, it has not had as much impact as many hoped.

## 7.9 LEASE FEES

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Initiatives like tower access and access to local government-owned conduit and fiber can create long term revenue streams from lease fees paid by service providers using that infrastructure. The City of Danville, Virginia has recovered their entire initial capital investment from lease fees paid by providers on the nDanville fiber network.

## 7.10 CONNECTION FEES

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Tap fees, pass by fees, and connection fees are already commonly used by local governments for utilities like water and sewer. The revenue share model can be strengthened from additional sources of revenue, including one time pass by fees, connection fees and sweat equity contributions. It is important to note that the Coop Membership Fee can be treated as a connection fee in whole or in part.

**Pass By Fees** - Pass by fees could be assessed once the fiber passes by the property, just as some communities assess a pass by fee when municipal water or sewer is placed in the road or street-and the fee is assessed whether or not the premise is connected, on the basis that the value of the property has been increased when municipal water or sewer service passes by. At least one study has indicated that properties with fiber connections have a higher value by \$5,000 to \$7,000 that similar properties without fiber access.

**One Time Connection Fees** - A one time connection fee can be assessed to property owners (e.g. residents and businesses) when the fiber drop from the street to the premise is installed. This is similar to the kinds of connection fees that are typically charged when a property is connected to a municipal water or sewer system. The fee is used to offset the cost of the fiber drop and the Customer Premise Equipment (CPE) needed to provide the operational access to the network. The connection fee can be modest (e.g. \$100) or it can be a larger percentage of the actual cost of the connection. Fiber CPE may range from \$250 to \$350 and a fiber drop may cost from \$200 for a premise very close to the distribution fiber passing along the property to \$1,000 or more if the premise is hundreds of feet from the road. One variant would be to charge a minimum connection fee for up to some distance from the road (e.g. \$100 for up to 75' and \$2 for each additional foot).

There is already some data that indicates that residential property values increase by as much as \$5,000 to \$7,000 if fiber broadband services are available, so pass by fees can be justified on the basis of increased property values accruing to the property owner. Given the novelty of this approach, pass by fees may need more time to become an accepted finance approach, but tap fees (for installing the fiber cable from the street or pedestal to the side of the home or business) may be easier to use, especially for businesses that may need improved broadband access. Tap fees have the potential of reducing the take rate in the early phases of deployment, but as the value of the network becomes established, it is likely that there will be much less resistance to paying a connection fee.

## 7.11 GRANTS

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Grant funding is limited and should be viewed as part of a larger basket of funding. Federal funds from sources like the USDA and the FCC are highly competitive and often come with substantial limitations on who can qualify and how the funds can be used. CDBG funds can support telecom infrastructure construction but must be tied to job creation and/or job retention.

## 7.12 NEW MARKETS TAX CREDIT

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New markets tax credits are a form of private sector financing supported by tax credits supplied by the Federal government. The New Markets Tax Credit (NMTC) Program permits taxpayers to receive a credit against Federal income taxes for making qualified equity investments in designated Community Development Entities (CDEs). The CDEs apply to the Federal government for an allotment of tax credits, which can then be used by private investors who supply funds for qualifying community projects. Substantially all of the qualified equity investment must in turn be used by the CDE to provide investments in low-income communities.

The credit provided to the investor totals 39 percent of the cost of the investment and is claimed over a seven-year credit allowance period. In each of the first three years, the investor receives a credit equal to five percent of the total amount paid for the stock or capital interest at the time of purchase. For the final four years, the value of the credit is six percent annually. Investors may not redeem their investments in CDEs prior to the conclusion of the seven-year period.

Throughout the life of the NMTC Program, the Fund is authorized to allocate to CDEs the authority to issue to their investors up to the aggregate amount of \$19.5 billion in equity as to which NMTCs can be claimed.

These tax credits can be quite useful, and there may be some areas that qualify. However, it can take up to a year or more to apply and then finally receive NMTC-related cash. This can be a useful long term source of funds.

## 7.13 ARC POWER GRANTS

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All four counties all qualify for ARC (Appalachian Regional Commission) grants. POWER (Partnerships for Opportunity and Workforce and Economic Revitalization) is a congressionally funded initiative that targets federal resources to help communities and regions that have been affected by job losses in coal mining, coal power plant operations, and coal-related supply chain industries due to the changing economics of America's energy production.

The Appalachian Regional Commission uses an index-based county economic classification system to identify and monitor the economic status of Appalachian counties. The system compares each county's averages for three economic indicators—three-year average unemployment rate, per capita market income, and poverty rate—with national averages. The resulting values are summed and averaged to create a composite index value for each county. Each county in the nation is then ranked, based on its composite index value. Counties are designated as distressed, at-risk, transitional, competitive, or attainment, based on their ranking in the index. Designations are revised annually using the most current data available. Clinton, Lycoming, Northumberland, and Union all have been ranked as “transitional” for 2020, meaning they have the middle-ranked eligibility ranking for grants and awards.

The four counties should consider applying for this grant opportunity. To get started, the project should contact the state ARC program manager to request a pre-application package. The local development district (SEDA-COG) can also provide guidance on a project's eligibility for funding and assistance in preparing a grant application. More information is available here (<https://www.arc.gov/funding/ARCGrantsandContracts.asp>) and here (<https://www.arc.gov/funding/power.asp>).

## 7.14 SPECIAL ASSESSMENT/SERVICE DISTRICT

Communities like Bozeman, Montana and Leverett, Massachusetts have been funding broadband infrastructure improvements with special assessments (in Leverett, \$600/year for five years), and in Bozeman, TIF (Tax Increment Funding) is being used in some areas to add telecom conduit, handholes, and dark fiber. In some localities, it is possible to levy a special assessment in a service district designated for a particular utility (like broadband) or other kind of public service.

Charlemont, Massachusetts intends to add an \$11/month assessment to every household to build a town-owned Gigabit fiber network that will pass every household in the community. A town-wide vote supported this funding approach. Put in perspective, the average cost of a large, single topping pizza in the U.S. is currently \$9 to \$12.

Two small cities in Utah is currently evaluating the potential of a \$10-12 utility tax levied on every household and business to finance a full fiber to the premises build out, including a modest "free" Internet service that would be adequate for email and light Web use. Most households will probably choose to select a higher performance Internet package from a private provider on the network. A \$10/month special assessment (the cost of one large pizza) on every household in the four counties could raise as much as \$400 Million for broadband—enough to take Gigabit fiber to nearly every home and business.

The tables below shows the kind of funds that could be generated over several time periods. If ten dollars per month were collected from each household for thirty years, it would easily finance the immediate build out of Gigabit fiber that would pass nearly all homes and businesses in each county.

Individual Service District Examples				
Monthly Assessment Amount	Fifty Homes Five Year Assessment	Fifty Homes Ten Year Assessment	100 Homes Five Year Assessment	100 Homes Ten Year Assessment
\$5	\$15,000	\$30,000	\$30,000	\$60,000
\$10	\$30,000	\$60,000	\$60,000	\$120,000
\$25	\$75,000	\$150,000	\$150,000	\$300,000
\$50	\$150,000	\$300,000	\$300,000	\$600,000

A lesser amount (e.g. \$2/month over twenty years) would easily finance the immediate build out of a comprehensive wide area wireless tower network in each, as well as some fiber infrastructure.

<b>Clinton County Special Assessment</b>		
<b>Monthly Assessment Amount</b>	<b>Twenty Year Assessment</b>	<b>Thirty Year Assessment</b>
<b>Number of Households</b>	<b>14,702</b>	
\$1	\$3,528,480	\$5,292,720
\$2	\$7,056,960	\$10,585,440
\$5	\$17,642,400	\$26,463,600
\$10	\$35,284,800	\$52,927,200

<b>Lycoming County Special Assessment</b>		
<b>Monthly Assessment Amount</b>	<b>Twenty Year Assessment</b>	<b>Thirty Year Assessment</b>
<b>Number of Households</b>	<b>39,281</b>	
\$1	\$9,427,440	\$14,141,160
\$2	\$18,854,880	\$28,282,320
\$5	\$47,137,200	\$70,705,800
\$10	\$94,274,400	\$141,411,600

<b>Northumberland County Special Assessment</b>		
<b>Monthly Assessment Amount</b>	<b>Twenty Year Assessment</b>	<b>Thirty Year Assessment</b>
<b>Number of Households</b>	<b>45,991</b>	
\$1	\$11,037,840	\$16,556,760
\$2	\$22,075,680	\$33,113,520
\$5	\$55,189,200	\$82,783,800
\$10	\$110,378,400	\$165,567,600

Union County Special Assessment		
Monthly Assessment Amount	Twenty Year Assessment	Thirty Year Assessment
Number of Households	14,675	
\$1	\$3,522,000	\$5,283,000
\$2	\$7,044,000	\$10,566,000
\$5	\$17,610,000	\$26,415,000
\$10	\$35,220,000	\$52,830,000

### 7.15 PROPERTY TAX INCREASE

While raising taxes can be politically very difficult, a very small incremental increase in property taxes, with the increase clearly earmarked specifically designated for broadband development (.e.g. one-quarter cent) might be possible to sell to citizens and businesses. The table below is adjusted to reflect the cost of borrowing over the listed periods of time.

The table below illustrates a hypothetical example of what funds might be raised for broadband improvements with a sample county-wide assessed property value.

	Sample Assessed property value	Broadband increment	Annual Broadband Fund	Ten Year Aggregate	Twenty Year Aggregate	Thirty Year Aggregate
1/4 of one cent	\$5,000,000,000	\$0.0025	\$112,500	\$1,125,000	\$2,250,00	\$3,375,000
1/2 of one cent	\$5,000,000,000	\$0.0050	\$225,000	\$2,250,000	\$4,500,00	\$6,750,000
1 cent	\$5,000,000,000	\$0.0100	\$450,000	\$4,500,000	\$9,000,00	\$13,500,00

## 7.16 GRANT APPLICATION ACTIVITIES

Activity	Description	Discussion	Tasks
Develop a grant application	The grant application process, from start to award announcement, can be nine to twelve months.	Broadband grant application requirements have become more stringent over time, with more grant agency oversight and review. Careful planning is essential to develop a successful application.	<ul style="list-style-type: none"> <li>• Once a grant opportunity has been identified, review grant requirements to determine if the project can qualify. For example, some grants require two years of financial history.</li> <li>• Identify regional agency that will assist (e.g. SEDA-COG).</li> <li>• Begin contacting potential ISP partners.</li> <li>• If the project qualifies, identify at least two people to take the lead to prepare application.</li> <li>• Prepare a task list of all grant materials requirements and identify data needed.</li> <li>• Develop a timeline for developing sections of the grant.</li> <li>• Identify requirements for letters of support and matching funds and develop timeline to solicit and collect commitments.</li> <li>• Complete all sections of grant application with assistance from public and private partners.</li> <li>• Submit grant application.</li> </ul>

Typical Timeline	Months											
	1	2	3	4	5	6	7	8	9	10	11	12
Tasks												
Determine grant qualifications	█											
Identify regional council partner	█											
Identify ISP or WISP partner if needed		█										
Appoint grant team	█											
Create grant task list		█										
Prepare timeline and assign tasks to partners		█										
Identify matching fund requirements and letters of support to solicit and collect as needed		█	█	█								
Complete all sections of the grant application			█	█	█							
Submit grant					█							
Grant agency review						█	█	█	█			
Awards announcement										█		

# 8 LEGAL AND REGULATORY ANALYSIS

## 8.1 REGULATORY ISSUES

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Community-owned broadband projects are subject to state and Federal regulations of various kinds, but unless a project is offering retail services (e.g. the local government is selling Internet, TV, and/or voice services directly to residents and businesses), there are limited regulatory issues. The City of Eagan's AccessEagan Gigabit fiber network has been in operation for seven years, and has four private sector service providers offering services. There has never been an incumbent legal challenge because incumbent providers like Comcast and CenturyLink have been invited to use the network (both have repeatedly declined).

The key strategy is for community-owned projects to adopt the wholesale model of leasing passive infrastructure like towers and dark fiber and for active networks (with network electronics) to lease circuits to providers on a wholesale basis rather than selling retail services. The Utopia project, which offers services in fourteen communities in the Salt Lake City area, has been targeted in the past as a "failed" effort but has overcome some early financial challenges and today has 23 private sector providers offering a wide range of price points and service packages—delivering true choice and competition to citizens and businesses. The wholesale model is not subject to many of the FCC (Federal Communications Commission) regulatory requirements.

The management of telecom infrastructure is a business enterprise that requires a variety of legal contracts, service agreements, maintenance and work agreements, procurement and performance contracts, and corporate legal documents of various kinds.

- Development of service provider master agreements and service agreement addendums.
- Leases for easements and rights of way.
- Review of work contracts for consultants, contractors, and engineering firms.
- Review of maintenance and operations agreements.

The project will require the services of an attorney with some demonstrable experience with community telecom agreements. Many attorneys are not familiar with community-owned open access networks, and some time and effort should be made to carefully qualify an attorney or firm prior to hiring them.

## 8.2 WORKING WITH INFRASTRUCTURE LEASES

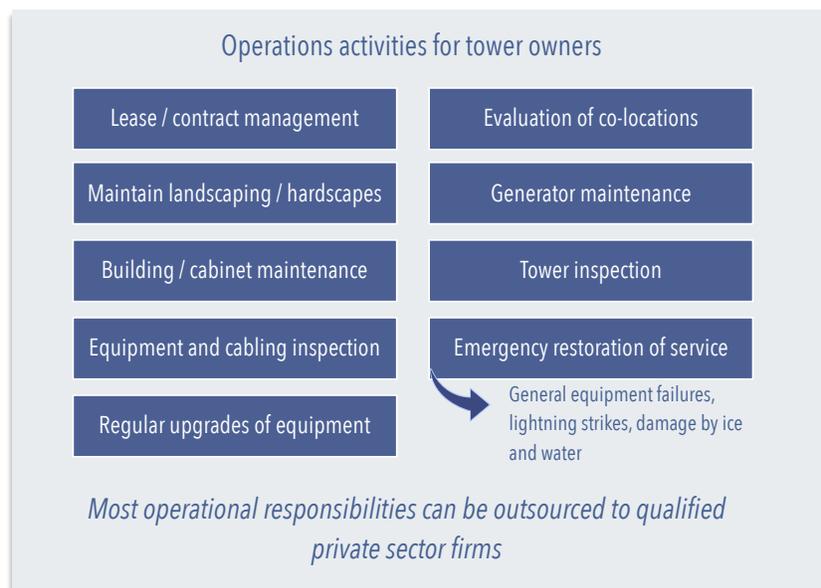
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Once dark fiber cable and/ existing or new towers have space available to lease to WISPs, there are policy and contract decisions that must be evaluated.

### Tower Lease Considerations

- There should be a single public fee schedule for all providers that want to lease space on the tower.
- There should be a single tower space agreement that is used for all providers.

- Tower access should be made available in ten foot vertical segments, as high as possible on the tower without interfering with other uses (e.g. public safety antennas). Note that it is unlikely that any tower will have more than two providers on it.
- Leases should be a minimum of two years and should auto-renew if the ISP is meeting performance requirements.
- It may be more effective to have a single lease agreement with access to all towers, and the contract should require the ISP to put equipment on all towers within a certain period of time (e.g. nine to twelve months). This limits ISPs from “cherry picking” towers with more potential customers and ignoring towers in parts of the region with lower population density.
- Monthly tower lease fees should be on the order of \$200 to \$250 per tower. Higher fees make it difficult for providers to make a business case for the cost of equipment and the extensive marketing required to develop a customer base around a tower.
- For a typical tower, identify two (2) ten foot spaces (where space is available) on existing towers and designate/reserve those for WISP use. The spaces should be as high as possible on each tower without interfering with other local government and public safety use. The lease cost of the lower space should be at least 20% less than the higher space. Tell WISPs exactly what space is available at each tower and at what heights; this makes it easier for WISPs to evaluate the potential market that could be served from each tower.
- An initial grace period of three to six month should be offered on fees, and/or offer a one year sliding scale of fees (e.g. first three months, fee waived; months four to six, 25% of normal fee; months seven to nine, 50% of normal fee; months ten to twelve, 75% of normal fee). There are many ways to structure the initial fee period, but it is important to recognize that the WISPs incur substantial early costs to develop revenue and customers for a new tower.
- All tower leases should expire on the same date even if started at different times. This allows the regional enterprise to potentially make a smoother transition to a new provider if there are performance issues, and will give the regional entity more leverage and control over the WISPs.
- Leases should be a minimum of two years and should auto-renew if the ISP is meeting performance requirements.
- In contracts, fee reductions should be worded as discounts that can be revoked if performance



requirements are not adequately being met.

- There are considerations for ground-space (e.g. WISP cabinets, shelters, H-frames for electric service) that will have to be evaluated at each tower site. If new shelters will be allowed, the regional entity should set minimum standards for new shelters.

## 8.3 DARK FIBER LEASE CONSIDERATIONS

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Passive fiber infrastructure (i.e. no electronics) can include conduit, fiber cable, splice closures, and cabinets. Because all powered network equipment would be provided by the lessee (i.e. the ISP), there is no day to day management responsibilities and only occasional routine maintenance. Emergency break-fix for situations like a cable broken by a construction firm working in the right of way can be outsourced to a qualified private sector provider. Local governments routinely manage much more complex water and sewer systems. Some guidelines for leasing dark fiber include:

- There should be a single public price list for the cost of leasing fiber strands.
- A standard master agreement should be used for leases. This agreement will typically require an SLA (Service Level Agreement) that specifies repair times for emergency break-fix (i.e. the fiber cable has been damaged and a qualified break-fix repair firm must be on call to make repairs).
- It will also be important to have IRU pricing (Indefeasible Right of Use). Fiber strand leases are typically for periods of ten years or less. IRUs are long term leases and are typically twenty to thirty years in length. IRU fees have two parts: a single upfront payment that usually reflects some portion of the construction cost for the fiber route. As an example, if a lease will include twelve strands of fiber on a ten mile route of 144 strand fiber that cost \$100,000 to construct, the one time fee might be  $12/144 * \$100,000 = \$8,333$ . Most IRUs also have a modest annual maintenance fee that reflects the cost of maintenance and repairs; this would also be pro-rated to reflect the number of fibers assigned to the IRU agreement.
- Splice points and who is allowed to open handholes to perform splicing must be identified in the master agreement.

# 9 NEXT STEPS

## 9.1 ESTABLISH GOVERNANCE ENTITY

A decision on ownership and governance entity will have to be established, either on a county by county basis, or on region basis. The entity (or entities) will own the network assets and provide oversight of the assets. This could be as simple as direct County ownership.

Most day to day tasks like network monitoring, routine maintenance, and emergency repairs can be outsourced to a qualified for profit or non profit firm, so the entity may only need a board and support as needed from the County and the Planning Districts for activities like grant application preparation.

Activity	Description	Discussion	Tasks
Establish the ownership entity	There will be substantial management and network efficiencies if the long range plan is to create an entity that can provide improved Internet coverage across more than one county	<p>A county or regional development <b>authority</b> or <b>County</b> ownership are both options. A <b>broadband coop</b> is also an option.</p> <p>A Broadband Development Authority would have board members appointed by the County Commission..</p>	<ul style="list-style-type: none"> <li>• Meet with the County Commissions to present the options and develop a consensus on which option is preferred.</li> <li>• Once a decision has been made, engage legal counsel to develop a corporate charter and bylaws (if needed). A county attorney may be able to do this work.</li> <li>• Identify qualified board or advisory board members for initial terms of service. At least three, and no more than five board members is recommended.</li> <li>• Some of the board members should have a strong background in business management or grant writing.</li> <li>• Hold the first meeting.</li> </ul>

Tasks	Months								
	Month 1	2	3	4	4	6	7	8	9
Present options to County Commission	█								
Determine consensus for preferred option		█							
Engage attorney if needed			█						
Charter and bylaws approved if needed				█					
Identify/appoint board members					█	█	█		
Hold first meeting							█		

## 9.2 GOVERNANCE ACTIVITIES

Activity	Description	Discussion	Tasks
Set project and funding goals	Define project vision and broad goals. Set one, two, and three year funding goals aligned with report recommendations.	Project and funding goals should be reviewed and updated regularly.	<ul style="list-style-type: none"> <li>• Develop one paragraph Vision statement.</li> <li>• Develop one page set of short and long term goals.</li> </ul>
Identify year one grant opportunities	Meet with regional planning officials and state officials to review grant opportunities.	Set priorities for grant opportunities.	<ul style="list-style-type: none"> <li>• Identify one or two year one grant opportunities.</li> <li>• Identify public and private grant partners.</li> <li>• Develop timeline for completing grant application.</li> </ul>
Begin execution of marketing plan	It will be necessary to have a modest but regular marketing and awareness campaign to ensure that local businesses and residents know that the counties are engaged in trying to solve the broadband problem	Political support for this effort will be essential. There should be a regular and consistent awareness effort to keep local, state, and Federal legislators up to date with both the needs of the area and the activities that are underway.	<ul style="list-style-type: none"> <li>• County Web site page has been created for the effort</li> <li>• Mailing list for stakeholders and interested parties has been created.</li> <li>• Facebook page is updated regularly.</li> <li>• Facebook comments are checked regularly and responses are posted.</li> </ul>

Typical Timeline	Months											
	Jan 2020	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Review Vision Statement and Goals												
Develop short and long term goals												
Identify year one grant opportunities												
Identify grant partners												
Develop timeline for grant application												
Set up Web page on County Web sites												
Set up stakeholder mailing list												
Update Facebook page regularly												
Respond regularly to FB inquiries												

## 9.3 SERVICE PROVIDER ATTRACTION

Activity	Description	Tasks
Attract Internet Service Providers (ISPs, WISPs)	One or more service providers will be needed to lease poles, and/or manage the network, and to partner for grant funds.	<ul style="list-style-type: none"> <li>• Once the County Commission have approved the plan, contact local and regional ISPs to assess partnership interest.</li> <li>• Schedule individual meetings with the ISPs to present project goals and objectives.</li> <li>• Assess interest of the companies in public-private partnership.</li> <li>• If interest is positive, reach agreement on which grant opportunities to pursue jointly and in what area.</li> <li>• Develop an MOU (Memo of Understanding) that identifies what tasks the WISP will perform for grant application and what project will perform.</li> </ul>

Typical Timeline	Months											
	Sep '19	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Tasks												
Contact ISPs and WISPs	█											
Schedule individual meetings		█										
Assess interest in partnerships			█	█								
Schedule meetings to discuss grant opportunities					█							
Develop MOUs as needed for grants that will be pursued jointly						█	█	█	█			

# APPENDIX A: GLOSSARY

**Active network:** Typically a fiber network that has electronics (fiber switches and CPE) installed at each end of a fiber cable to provide “lit” service to a customer.

**Asymmetric connection:** The upload and download bandwidth (speed) are not equal. Cable Internet and satellite Internet services are highly asymmetric, with upload speeds typically 1/10 of download speeds. Asymmetric services are problematic for home-based businesses and workers, as it is very difficult to use common business services like two way videoconferencing or to transfer large files to other locations.

**Backhaul:** Typically refers to a high capacity Internet path out of a service area or locality that provides connectivity to the worldwide Internet.

**Colo facility:** Colo is short for Colocation. Usually refers to a prefab concrete shelter or data center where network infrastructure converges. A colo or data center can also refer to a location where several service provider networks meet to exchange data and Internet traffic.

**CPE:** Customer Premises Equipment, or the box usually found in a home or business that provides the Internet connection. DSL modems and cable modems are examples of CPE, and in a fiber network, there is a similarly-sized fiber modem device.

**Dark fiber:** Dark fiber is fiber cable that does not have any electronics at the ends of the fiber cable, so no laser light is being transmitted down the cable.

**Fiber switch:** Network electronic equipment usually found in a cabinet or shelter

**Fiber Optic Splice Closure:** See **FOSC**.

**FOSC:** Fiber Optic Splice Closure. Typically a water and air tight cylindrical container where fiber cable is split open to allow splicing (connecting together) of fiber strands for a drop to a premises.

**FTTH/FTTP/FTTx:** Fiber to the Home (FTTH), Fiber to the Premises (FTTP), and Fiber to the X (FTTx) all refer to Internet and other broadband services delivered over fiber cable to the home or business rather than the copper cables traditionally used by the telephone and cable companies.

**Handhole:** Handholes are open bottom boxes with removable lids that are installed in the ground with the lids at ground level. The handholes provide access to fiber cable and splice closures that are placed in the handhole. Handholes are also called **pull boxes**.

**IP video:** Video in various forms, including traditional packages of TV programming, delivered over the Internet rather than by cable TV or satellite systems.

**Latency:** The time required for information to travel across the network from one point to another. Satellite Internet suffers from very high latency because the signals must travel a round trip to the satellite in stationary orbit (22,500 miles each way). High latency makes it very difficult to use services like videoconferencing.

**Lit network:** A “lit” network (or lit fiber) is the same as an active network. “Lit” refers to the fact that the fiber equipment at each end use small lasers transmitting very high frequency light to send the two way data traffic over the fiber.

**MST:** Multipoint Service Terminals are widely used in fiber to the home deployments to connect individual home drop cables to larger distribution cables on poles or in handholes. Pre-connectorized drop cables snap into the MST ports and do not require any splicing.

**Passive network:** Refers to infrastructure that does not have any powered equipment associated with it. Examples include wireless towers, conduit (plastic duct), handholes, and dark fiber.

**Pull boxes:** Pull boxes (also called handholes) are used to provide access to fiber cable and splice closures. They are called pull boxes because they are also used during the fiber cable construction process to pull the fiber cable through conduit between two pull boxes.

**Splice closures:** Splice closures come in a variety of sizes and shapes and are used to provide access to fiber cable that has been cut open to give installers access to individual fiber strands. Splice closures are designed to be waterproof (to keep moisture out of the fiber cable) and can be mounted on aerial fiber cable or placed underground in handholes. Also called **FOSCs**.

**Splicing:** The process of providing a transparent joint (connection) between two individual fiber strands so that laser light passes through. A common use of splicing is to connect a small “drop” cable of one or two fiber strands to a much larger (e.g. 144 fiber strand) cable to provide fiber services to a single home or business.

**SCADA:** Supervisory Control and Data Acquisition. Used by the electric utility industry and some other utilities (e.g. water/sewer) to manage their systems.

**Symmetric connection:** The upload and download bandwidth (speed) is equal. This is important for businesses and for work from home/job from home opportunities.

**Virtual Private Network:** A VPN creates a private, controlled access link between a user’s computer and a corporate or education network in a different location. VPNs are often encrypted to protect company and personal data. VPNs usually require a symmetric connection (equal upload and download speeds) to work properly.

# APPENDIX B: COMMENTS FROM RESIDENTIAL SURVEY RESULTS

## **Question 22 from Residential Survey: Any Other Comments**

What is gigabit fiber internet service?

Lack of rural cell and internet service will reinforce the brain drain effect and leave our rural areas behind in the modern economy. This is the equivalent of rural electrification 100 years ago. We need local leadership, not benign neglect, on this issue. We would never move outside of the Comcast service high-speed area currently. This limits our mobility if we ever want to buy a larger house/property in the county where we live.

We live between Mifflinburg and New Berlin.. For past two years, Hughes.net satellite gives us 25 MPs until we reach our data limit and then it drops back to 1-2 MPs. We normally exceed our Hughes.net internet data limits by the middle of the month and we have their largest plan , \$99.00 per month.. Then they reduce our downloading speed to very slow for the balance of the month, which is still better than Windstream DSL for our location.

Need more competition in the Lewisburg/Union County area. Right now Service Electric has a monopoly and can charge whatever they want for service.

We really have no options in this area. Honestly 600kbps loads nothing. I have trouble accepting jobs to substitute teach, I cannot open email, when my children are older this will be a huge problem with public school assignments.

No internet available. Just mifi verizon hotspot at 600kbps or satellite with a data cap and speeds 1 to 3 mbps.

High Speed Internet services with long latency times are as useless as dial-up.

Where I live is three miles from the center of Lock Haven but DSL is not available for me due to poor reception. and I'm not even able to update my cell phone with the cable internet through comcast that I currently have

Windstream offers faster speeds, but get kicked off for hours . Would like to have something more reliable.

Forced to pay extremely high Internet access prices for packaging established by cable provider. No other reliable options. Technology drives so much of what we need to do as a family. More service options desperately needed in Union County.

There is a Comcast cable on a pole at the edge of my property, but Comcast/Xfinity will not extend the line to my house or others on my lane.

Comcast bleeds every penny they can get from their consumers, spending millions to lobby to change tax laws to allow them to charge more. It would be nice to have a different option entirely, I do not wish to support them but I do not have any other decent choice.

My comcast bill is about to jump from 39.99 a month to 59.99 a month plus Comcast's technology fees which add 13 dollars a month. I am the only person living in my residence currently and 39.99+13.00 is ridiculously expensive. Once my bill jumps, I'll have no choice but to cancel the service.

Verizon is the only internet and phone provider where we live. (It's also the only cell provider with reliable service, so we can't move to lower-cost cell service.) By Verizon's own admission, its copper lines are ancient and failing. Every 6 months, I have to argue with tech support until Verizon agrees to send a repair person out to address noise on the landline and constant DSL interruptions. The repair person always tells me that the outdated Verizon equipment outside my home are to blame. Add to this the fact that robocall-blocking technology doesn't work with copper lines, and we're deluged by spam calls to our landline. Our DSL is so slow that it sometimes registers 0 MBPS when we test it, and service is intermittent. On a good day, we may reach 3 MBPS. Uploading photos, accessing work documents, etc., is often difficult or impossible, and we cannot stream movies. We pay far too much for absolutely terrible service because we have no other options, and Verizon knows it. Please help to address the need for quality broadband service in our county!

Government should not be involved in broadband Internet delivery.

Comcast is JUNK

Living on the wrong side of the digital divide makes getting a truly wireless home, using cloud services, and texting from our home impossible. When Windows pushes out an upgrade, it stops all internet usage in the house or slows it down so much that none of the online media providers will work. I feel as if we live in the last century. DSL is awesome (3 MB download speed) compared to dialup and satellite (both of which we have had) but it is still a poor second to a fiber connection. I would love to see people in this region get the internet service they need. Then maybe someday we can have driverless cars and other innovations in our community. Thank you for creating this survey. Let's hope you can make something happen. If it hadn't been for SEDA-COG we never would have gotten DSL.

I would love to stop the Monopoly that Comcast has on internet in our area.

I have repeated issues of dropped signal. Several times a day I have to reset my router. I have to select an unsecure options for some devices so that I do not run into "loading" "buffering" or "no internet connection". I had to go purchase a timer so that it would automatically reset my router daily. (The router had already been replaced but the issue continued)

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Is there any hope of faster internet any time in the near future?!?!

We currently do not have an internet provider at our home due to the lack of options. We use the 4G from our smart phones. Please make high speed internet in the Haneyville area.

Loganton area has been struggling with this issue for years, yet community leaders don't seem to have any concern about it.

Verizon continues to run fiber optic cables around this area to run it to other area, i.e. New Jersey, yet never runs any here and does not offer fiber optic service in this area. This needs to change.

Please help us we need better service in our area

TDS is the telephone/ internet provider in this small community of Sugar Valley/ Loganton area. The internet service is so shoddy that most of the time it doesn't even work or very slow hookup. Buffering is very frustrating. I dropped my service and went with a wifi device from my Verizon cellular plan. That limits ya to 15g. on that device. I am currently at 29 g. and have 3 days on my plan till next month. I cannot stream movies, use Netflix or any other tv internet connections. It's like living on Little House on the Prairie and its 2019. There has to be some better way to update this valley. At this time there are no other options as Comcast does not come out the valley to my house. I never checked into satellite because of the cost.

The current FCC broadband availability map is inaccurate! It shows my address as served by Comcast when in fact Comcast's Williamsport/Montgomery/Muncy digital network ends about a mile away, my address is on the analog-only Turbotville system. (And shame on Comcast for still operating an analog system in the 21st Century!)

Furthermore, this inaccurate map is probably why Windstream didn't get Connect America funds to upgrade my area beyond 3 Mbps down, 0.7 Mbps up. (Although, shame on Windstream for not upgrading its infrastructure without government stimulus!)

Existing satellite internet companies are not a financially viable option for me due to data caps.

Existing cellular internet is not a satisfying option due to signal reliability at my location.

Existing wireless ISPs don't reach my location due to terrain and foliage.

Service is terrible

The clarify my answer to #20. In general principle, I do not think it is the role of county government to be involved with private company services. But I think there should be some entity emphasis/coordination/subsidy put on

improving service in the rural valleys with large Amish populations since there is not enough of a customer base to economically incentivize the private companies to establish service.

We had DSL with TDS in our previous home at the same exact location of our newly built home. The service worked well in our old home, but it would not work at all in our new home after paying for all the hookup costs. We then got dish network satellite service and exceeded our limits every month in the first 2 weeks of our billing month in addition to using all of our cell phone data. We currently use verizon hotspots as this is our best option however we are not able to utilize our smart TVs do to lack of service. I have a young child in my home who will be left behind in this ever changing world of technology due to lack of internet service which really concerns me.

To be more open and honest with it consumers If you need to know more I can show a lovely clip how this should be the stander of quality to anyone with internet services then some random joe that doesn't know what the heck he doing. Trust me you should listen to this all the way though to the end because they will not admit to doing this. [https://youtu.be/ywl\\_X1Ary7o?t=1358](https://youtu.be/ywl_X1Ary7o?t=1358)

The service we have often fails and provides even less service than what is typical and have to call to get the issue resolved.

I lived in location that had Comcast. moved here 4 years what a disappointment with TDS. if you call them they tell you to deal with it or find something else. no other options. have called Comcast begged them to run down here with service. no response yet . any help would be great and appreciated

I have Verizon high speed what they call it. But i don't even get 3mbps. And for about 3 days now that i have known about i have no phone dial tone and Verizon wont have someone here till July And my internet is randomly drops off. And there is no other provider that i can get. So i am unable to switch to anyone else. And if you try to call and fix a problem i am on the phone for more then 30mins just to not talk to anyone. Or have anyone fix my problem

The internet at my home is supposed to be 3mbs download speed. But they have added so many people to it and never upgraded things. They need to be held responsible for this. There's no reason the upgrades haven't come. This makes our area look bad and people won't move here. And it's causing people to leave. I hope everyone is truly taking this seriously. Don't want to fall further behind.

Internet needs to be affordable, reliable, and accessible to all if Governor Wolf expects the students to access work at home for snow days versus making up the day where actual teaching and instruction can take place.

ISPs need more competition and regulation to ensure customers can get reliable access for reasonable prices.

The 5G is very bad health wise. Too many microwave causing cancer . Read up on the damaging cancer waves.

It is unfair, in 2019, to not have an option for reliable internet service. It puts working adults and students at a deep disadvantage.

If I were looking to buy a house right now I would not buy my current house due to lack of good internet service. 20 years ago when we bought this house it was not an issue. I have looked and looked and we have no options besides VERIZON. We have had the DSL and the cellular wireless. Neither work well. If we need to do anything online we need to go somewhere like Dunkin to do so.

In my neighborhood we can see houses about 1/8 mile that gets Comcast but they won't run it. Years ago they wanted 6k to do it!

In my neighborhood we can see houses about 1/8 mile that gets Comcast but they won't run it. Years ago they wanted 6k to do it!

We do not have internet available we live close to Loyalsock and Williamsport

We can't even get internet on our road. It's ridiculous

Data flow interruptions are quite frequent spoiling efforts to maintain connections. Also slow data flow make streaming videos hit and miss! Forget about streaming TV or movies or online app that requires lot of data movement !

We bought our house about a year ago, and moved from an area with cell service and lots of high speed internet options to an area with limited to no cell service and poor internet options. We've had to significantly reduce our internet usage and primarily use our cell phones during the day when we're away from home. Using internet speed tests, we usually average less than 0.5mbps, even though our service is rated for 1 to 3 mbps. It's very inconsistent and frustrating. There are services and devices we have had to stop using due to the poor quality of our internet. We've considered trying satellite, but are deterred by its high cost and unreliability.

The alleged rural broadband problem seems another bit of money-driven "fake news" from politicians, as broadband is available to most rural areas via satellite. I would, of course, enjoy competition to my provider, who overcharges for their Internet access. Gigabit fiber availability would be amazing. I j u s t don't think government should be spending tax money on this. There are much bigger problems to resolve.

I would like to be educated on internet options available in my neighborhood. I'm not sure what is available. I think my service should be less expensive than the comcast service I have. I think the county government should FACILITATE better broadband service and maybe cover some cost for studies but not pay for or own the actual infrastructure. Private industry should build and own the infrastructure.

We do not even have an opportunity for cable Internet. Comcast won't come to our area unless we pay for the lines to run to our home.

This is our summer residence and we have no internet service or cell service. We plan on getting internet service possibly next year as we will be building a home on the property. There is no cell service currently available to us but it would be extremely helpful. We can put in a landline phone if need be.

The only service available in this area is Satellite or Dial-up. As far as Cell phone services there is a Verizon tower on the mountain but there are many dead spaces in this area and other carriers cannot access this tower.

We currently have no remotely reasonable options at our location. It makes it impossible for me to justify visiting my parents because I cannot keep up with work.

County and State need to incentivize private sector to install fiber by tax breaks. i.e. No state or local taxes for 3 to 5 years on revenue derived from installing fiber optic to homes. Or since most of the rural areas are already serviced by Rural Electric Cooperatives which already have established infrastructure, poles and right of way it would seem that partnering with the Electric Cooperatives by private internet providers would be the most economical cost effective way to go without creating a layer of bureaucracy such as a permanent SEDA COG to administrator. A good example of this working is the Current Tri-County Electric Cooperative current project in bringing fiber optic broadband to all its members in the next 5 yrs. This is being done with grants and loans and appears to be the way to go for rural areas obtaining fiber optic broadband. This project must be looked at and addressed by your study.

look for creative solutions. Union County Library System is accessing the Kinber fiber optic network (at Bucknell University). Signal is sent to 911 tower then to a satellite on Lewisburg library roof then sent to a satellite on a private farm in Mifflinburg to give the Mifflinburg library access.

We have satellite internet because it is the only reasonable option. We don't even have cell phone service to use our phones to create a hot spot. The internet is terrible. It slows way down during peak hours, which is also when we typically want to use it. We often times can't have more than one device online at any time. Even streaming music is terrible and hard to do sometimes. For the price we pay, we are highly disappointed with the service we receive. But there is nothing that we can do about it because we don't have options. Satellite internet may be considered high speed, but in reality, it is not much better than dial-up. I've talked at length with the phone company about our location. We had to fight tooth and nail to even get a phone line installed. But then come to find out that a very limited, local only phone plan is over \$30/mo. Nation-wide calling is over \$70. So we get our phone through our satellite internet and have to deal with a terrible lag all the time. The phone company didn't even want to talk about or consider providing DSL to us. And we are not that far out!

I do not feel any forms of government should have any control over our internet.

Although I am retired, I am very active in substitute teaching and in our local education foundation. I use the internet for many activities such as writing grants, searching for resources for our teachers and for the foundation.

My internet is a hotspot on my phone as there is no cable or services offered where I live which is 5 miles outside of Montoursville. Others around me have services and I do not understand why this place is a dead zone. No cable tv or internet. It is ridd

If this entails placing cell phone towers in the Pine Creek, Loyalsock Creek Valleys and other relatively pristine woodlands and watershed areas, I would be opposed to it. People go to those places to escape development and the over infrastructure that prevails in so many places. The Lycoming Creek Valley is forever marred by the relocation of US RT 15 and the gas pipe line right-of-way that notched the top of the top of, and was cut to the bottom of, the south face of the mountain at Trout Run. We don't need more unsightly intrusions like this. County government is already spending far too much money to facilitate better broadband services.

Our landline is usage only, so no long distance is offered. We have to use a calling card. Our landline works half the time. It drops phone calls, is very static, and does not work (no dial tone) through Verizon. We can text with our Hughes net service, but cannot make phone calls, can only text certain individuals. If phones do not work, we have to travel 2 1/5 miles for cell phone service.

I hear foreign countries have better connections than us!

Phone lines in Woolrich have to be old or something. Had phones issues a few months ago whenever it would rain. Internet leaves a lot to be desired. Usually need to reboot the modem at least daily and online streaming of shows (especially Amazon) has pauses in them. Very annoying.

You did not include Dish - Hubs internet service

Better pricing!

Our internet is terrible. Only one person can use it at a time, and it's still too slow to effectively download anything. I have had work from home opportunities that I have had to decline because of the poor quality of our internet.

Don't think that my tax dollars will be effectively or efficiently used to provide these services.

We are in desperate need for internet service in our area

We need accountability for services offered and provided. There needs to be regulatory actions to hold all providers accountable and requirements to what they provide and can charge.

At the present time, I have been told that I can not get better service because of where I live. We have the old 3 mg and are paying for the higher service because ours is not even an option anymore.

At the present time, I have been told that I can not get better service because of where I live. We have the old 3 mg and are paying for the higher service because ours is not even an option anymore.

Broadband service for emergencies is the most important service missing in East Keating Township with good internet next. We had landline service which was very expensive and was down more than available.

Extremely dissatisfied with TDS. need other options paying over \$80. A month and can't use internet 75% of the time

keep the government out of the services that should be available to the public, it seems as if it is selective who is serviced and where the area in which I am in is serviced by land line at the present time cell towers are the responsibility of private companies. I have a Verizon cell phone I travel a lot the reception I have is determined on cell tower location and the 2g 3g 4g 5g coverage also when they do away with the g technology the consumer must up date to that newest technology, the coverage should be the responsibility of the provider, Verizon, att, frontier, ect. Ronald g Oswald icc usn ret 570 923 0669 412 709 4025 if you want any additional info please contact me. this is not a computer generated response.

If the County were helping facilitate this broadband service I do not believe it should come at a higher tax rate, however the County should find greater efficiencies in the way they do the broadband business. Be it in the fact that they help fund and then share in the revenue, collect fees on things like registrations and licenses done online, etc.

I would invest in more property in East Keating Township if reliable internet was easily available.

High-speed internet is an issue for the county because more people are working from home and this influences who will move to our area. Local organizations are having difficulty, including hospitals, finding high quality employees and part of that equation is having reliable, high speed internet so that a spouse can be mobile and work from home. This is an integrated issue, not just an issue of people liking to surf the web. My company routinely uses video conferencing and our lack of internet may cause me to have to move out of the area.

In reference to question 20 - County should only help facilitate better broadband services if it can be funded with grant funding for the initial purchase and the model implemented will generate enough return on investment to be self sustaining. I suggest that a minimum 10 year projection plan be developed and initial grant funding be requested to cover costs for the first 5 years of operation.

I live 3.5 miles west of Route 15. The only internet options we have is cellular data or satellite, which have data caps. Also, it is extremely expensive compared to broadband internet options. Yet those who live on Route 15 and east of Route 15 have access to broadband internet. Part of the reason our development where I live hasn't fully developed is because of the lack of broadband options.

Our internet out here works about half the time and is always slow.

Please, please! Offer fiber!! We are building a new home within a year and need a better solution.

Verizon refuses to install fiber optic line along our road beyond the initial 1/2 mile. Our home and several others are 1-1/2 miles beyond this.

Cell service in my area is sketchy at times. We need more than one option for broadband. The current satellite services available are too slow. Thank you for your review.

We are desperate. We were told that a local internet company was expending in our area 3 years ago when we built here. That has not yet happened and we are desperate for high speed internet service especially with unlimited data plan

Windstream has completely handicapped a large portion of Mifflinburg, PA (Union County) and the surrounding areas. The only other non-satellite internet provider option is Atlantic Broadband, which is marginally better, but is expensive.

Providing inexpensive, high-speed internet access is extremely important for communities because it opens so many doors for students, workers and families in general to do work and connect with each other and the world.

I'm tired of Windstream being the only option, DSL has only been of recent years

Everyone should have access to high speed internet at an affordable price.

5G wireless services are going to make Service Electric and Verizon DSL obsolete as they will offer speeds faster than these two internet providers can currently.

Please expedite better service!

There are many more people living in my area (Caldwell/ Gallagher Township) than ever before. We are ALL impatiently waiting for fiber optic lines to FINALLY be installed to establish much desired high speed internet. What ever happened to the Fair Trade Act ????

Where my family and I live we only have Hughesnet as an internet option which was very unreliable due to weather, trees, and a cap on using the service. Our cell service was only 3G with one bar. We spent \$200 for a cell phone booster. We now have LTE with two bars. This is our "internet service". It is not strong enough to create a hotspot for my daughter to get on our laptop and take advantage of KCSD learning websites. We pay \$130 for directv (only option other than dish) and we can only watch tv. We have no internet so we cannot stream anything or watch anything on demand. We also cannot take advantage of any security system because no internet.

No competition in this area. We are paying more than double for same service from the same company who operates in a different area.

Rural communities suffer and need better service and access to wireless and internet. With everything being switch to on-line, i.e. doctors, hospitals, test results, prescriptions, shopping, social security, retirement, banking

and on and on, we need faster, affordable, and reliable services to operate in our everyday lives. It is getting worse everyday with more and more electronic and internet required functions.

I tried satellite internet and it did not work. I also tried a booster for my cell phone. My cell phone drops calls and takes a long time to send pictures if it even sends them.

Internet access should be considered a utility like electric and water. We live in a connected world and those with poor access or no access are at a disadvantage in everything from staying connected with loved ones to bettering themselves with education to applying for jobs online.

Xfinity is so slow and I'm paying for 250 Mbps

River Valley Internet is doing a great job. It is a great, reliable and affordable option. If spending time and resources on looking at how to expand broadband services, I suggest bringing River Valley into the discussion.

Mostly I am concerned about price and the lack of choices. This questionnaire assumes that we have television. I made the decision not to have television to save money. Cellphone reception is not great in my neighborhood, or at least at my house, so I need a landline. These realities mean I really have one option (Windstream) unless I want to pay two companies and pay a lot for services I don't need (TV cable). We recently received notice that Windstream is in Ch 11 reorganization, so I'm just hoping things will work out for them. Each time I pay the \$80+/mo + \$25/mo for the most basic cellphone (non-smart phone), I wonder how in the world how struggling households are managing to provide these necessary services. To make the area appealing to business, we need better internet service; to make the internet accessible to everyone, we need lower prices. I think cellphones and the internet should be regulated as utilities; in the absence of that, we need more competition to bring prices down and give people more choices.

preaching to the choir, but this is ridiculous already in this day and age...had hughesnet, was OK, expensive and had data caps; switched to Viacom and they are unethical crooks that I will never give another dime to and I wouldn't take their service if they paid me. Had DSL, yes I am laughing, too. Now have cellular coming into the home, with a Wilson booster, had to buy a cellular modem to convert the signal into something that could be passed to a wireless router, now run the house off it but it has a 15gb monthly data cap. I have to buy another cellular model just to get a new IMEI and then add a data line to Verizon for another 15gb cap if I want to expand but then I will have to physically swap equipment when the first cap is reached. The tether limit on my phone plan is 22gb and I cannot distribute the tether option to the wireless router. And overall speeds are in the 5-7mb down and 2-3mb up range at best. Thank you for your time and efforts. If I can help I am willing to do what's needed. I have a contact at Comcast who spec'ed out a run from the closest point they have fiber (Lycoming Creek Rd and Beauty's Run Rd) and to bring it down Beauty's Run it would cost about \$125,000.

Internet connection is so sporadic that I actually go to another place to "work from home"!

We have also had issues with our home phone line, as it is the old copper wire. We have cancelled all home line and DSL services because they could not provide the services they advertised.

Bring better more affordable service to the trout run area

We need better service in the country!

We have no access to DSL. I work 20 to 40 hours per week on the Internet from home for an employer based four hours away. We exceed our supposedly unlimited Verizon data plan every month. We pay far too much for the very slow Internet access we have, but we don't have other good options. We gave up on having reliable landline telephone service a couple of years ago because the phone would go out when it rained and we now use only cellular. I checked no on the question about schoolwork above because my son is in Kindergarten, but this will be an issue soon too.

PLEASE HELP LOGANTON ASAP!!!! We have no other options! TDS has Terrible phone and Internet over here!!!

How long until help is available? East End of Loganton has poor Internet and Cell service, HUGHESNet not available. COMcast not available. TDS is awful!!! Awful!! Awful!!!

Where we are located appears to be a "lowly" area for cell service and internet services - Granted I do have Comcast service for television and internet but we have a Comcast technician visit us all too frequently as they all tell us the power in this particular area of Nisbet Heights is very low and causes frequent problems with the smart

tv - in that it will not turn on and must be rebooted - Also, I purchased a mini tower for my cell service as it was virtually impossible to receive good reception otherwise - I have an older brother that lives in the Linden area (Piatt Township) and he has been without internet for two months and has had no assistance from Verizon to re-establish -- Therefore I truly believe the county needs to place pressure on the applicable utilities to deliver a now needed product - internet - to all areas -- Thank you - You may contact me if needed - Jean M.

Rural America is severely hampered by limited broadband. I may have to move so I can work from home. There are many federal dollars out there as well as private philanthropic money to help distressed areas. We need high speed options. I started with TDS which is a joke and now I'm relying on Exceed which is a little better. Help me help rural by making this a priority for Loganton and Clinton county. Thank you.

If you're looking for additional cell towers for internet service there use to be federal funds available for cell companies to put up towers. This is if there is no or poor internet access where there are residences with children of school age.

The county government need to speak to the public and listen to their answers before making an internet decision before they make a decision. Public meeting or discussion.

This is a camp. Maximum number of people using this parcel is usually 4. We presently do not have a land line or internet service at this camp but we would like to have cell phone service.

Even as we connect to the internet more efficiently and effectively, we should also consider having public education options in media literacy tied to the service improvements.

I have Hughes net as a provider and very expensive.

We bought our house last year and we were told that the property had internet. After moving in, we discovered it was only Hughes Net satellite which we couldn't afford and it was running at 3-5 mbps so it was useless. We complained and the company would raise it to 10 mbps for 24 hours. We contacted Comcast, Century Link, and another company but we were told our area is Verizon territory and they can't service us. We then contacted Verizon several times to find out that there are no ports available for our area. Then we learned from River Valley Internet at the town meeting that Verizon will not open any new ports because it is too expensive and they are trying to faze out cable DSL to move everyone to LTL. LTL is sooo expensive compared to a cable based option. We cannot afford it. My husband has cancer and is a Vietnam Vet and he cannot access his medical needs online from home. My daughter is in college online and has to drive into town each day with her daughters to study and pay bills online. My oldest granddaughter needs it for college classes and my other granddaughter needs internet for her high school classes. Our smart tv's are sitting in storage because we can't use them. We really need help. There are 12 homes in our neighborhood that could use it also.

It's time for change, rural areas have been left behind. Should this come to fruition I hope rural areas are the first to be given access

Don't know what Gigabit fiber is. Not sure if government should help.

More choices in rural areas would be nice, without breaking the bank

Help get citizens to form MESH coop.

Total telephone and internet \$114.00 per month

Thanks for the survey!

The only thing that affects us is the cellular telephone service which could be better. This is a camp and we spend many weekends here.

We have very poor if any cell phone service in Torbert Village.

No cell service at our camp at this time.

We have a camp with NO cell service.

Our area needs a cellphone tower

The speed is not sufficient to use laptops for school assignments

N/A

Residence is in the village of Keating. We use Hughes Network.

Live in village of Keating. East Keating township. Have Hughes Net

No internet service.

This is a seasonal camp 6-10 people using

As I am a volunteer for various entities. I work with 9 different online bank accounts. We have 3 smart TV's and have difficulty using any of them. Thanks

Sorry this is late. I hope you can still use the information. Address listed is a seasonal dwelling with no landline, cable or internet. We were told cable is not available. Landline and internet is not affordable for a seasonal dwelling.

Our download speed is less than three and upload is less than .50 making our internet inefficient and unenjoyable. It is so slow and unreliable that I cannot upload documents to other sites. We had a faster service but was told the lines are unstable and when dropping our landline was downgraded to less than 3.

Need better cell service

Internet is fine. I don't like the lack of choice and at mercy of the ISP re: price increases.

# APPENDIX C: COMMENTS FROM BUSINESS SURVEY RESULTS

## Question 23. Any other comments?

A big need in Union County is to improve / start up better broadband in the western parts of Union County.

We are limited to Verizon cell phone service at my business location because no other providers will give reliable service. But even Verizon service is not very reliable.

Verizon internet changes has made our extender non-operational and therefore no cell service at all at our facility.

We would like fiber for higher speeds and more data flow. However, that is not available in our area. With all the students watching online courses - as well as the general public watching videos, as a public library we need more internet access. We do have a library catalog online - but find that most families don't bother because their internet connections at home are too slow.

Broadband service is a definite need in our community. Many of our patrons use the library for this type of service. We would be able to better serve our area with this service.

We are a personal care home and many of our staff, residents and their family members get poor cell phone service here. ATT does not work at all and Verizon is spotty. It makes communication hard.

tax break incentives for providers to team up with the Rural Electric Cooperatives for bringing fiber optic to the rural areas serviced by the Rural Electric Cooperatives. See the Tri-County Rural Electric fiber optic broadband project. Appears to be a successful endeavor without creating a permanent bureaucracy such as SEDA-COG to administer and syphon money from the projects to pay the Bureaucracy .

I have ADSL as a backup since Hughesnet has huge issues with weather (rain/snow fade). Verizon is only able to provide 2M/768k at their highest speed. VPN usage on Hughesnet is not possible. With Verizon ADSL it's possible but subject to constant outages. Hughesnet provides enough bandwidth but latency is above 600ms so many activities are completely impossible.

Comcast stops 1 mile from my house.

We have two connections, the one from Verizon is our primary (and SLOWER) service. We also have a single computer, Comcast Cable internet service for some of our mechanical systems that is about 10X faster than our current single T1 Verizon connection, but it is not secured with government protocols.

We have Service Electric Telephone Service, PTD, and Verizon

I think everyone would love to see consistent, fast internet with a fair price. With my business, we use Vonage for our landline. If our internet is down, so are our phones which is not convenient.

If the price goes down and speed goes up in all for a change

PenTeleData should be added to the list of service providers in question 15. Am not convinced that public funds should be used to build or operate broadband systems as often these systems duplicate systems/services that already exist and have been built with private capital. Such municipal systems have also been shown to not be sustainable without continued public funding. Government involvement may only slow private investment in expanding existing systems. Government/municipalities/public organizations should look to work with existing providers to develop methods of expanding existing systems where it makes economic sense. A mix of technologies (wired (fiber, coax, twisted pair), wireless cell and satellite) will be needed to bring broadband to every home due to expense in building infrastructure to very rural and remote areas.

At this point in 2019, everyone should have acceptable internet service no matter where they live.

the county should be pro-active in either providing or facilitating service to our region, as long as the technology is not outdated before it is fully implemented

The borough is currently receiving free internet service from a Comcast Franchise but have been told that when the Franchise is up for renewal that free internet service will no longer be provided.

We are in the west end of Union county...Windstream says we'll never have fiber and if we did we wouldn't be able to afford it... Hopefully you can help, our service is poor...

In reference to question 22, Lycoming County should not jump into a solution that cannot be made self sustaining. Any solution implemented should generate enough ROI to pay for it's own ongoing costs.

PLEASE HELP US WITH THIS ISSUE!! We are located in a remote area surrounded by large mountains and there is no cell service - the closest is 15 miles from our resort. Due to the nature of the area we will never be able to have cell coverage - except for through the internet. We have talked to numerous companies regarding getting FIOS to our resort they all say the same thing - it is too expensive to bring to us even though we are only 3 miles from the nearest FIOS line (Comcast), which is highly frustrating!! We service thousands of customers a year and are open year round.

The biggest complaint and reason people leave or do not visit our resort again is the lack of high speed internet. As you know with DSL the more people on the system the slower it works. Many times it just goes down causing a hardship for our business as we do internet reservations, payroll etc. Our customers get frustrated and our office suffers. We the owners personally live in Lancaster County and remotely access the resort to track income, expenses etc. from Monday through Thursday. At times it is impossible when the DSL is down. This causes a hardship to the business. We also have a home in Waterville that we live at every weekend Thursday-Monday and remotely access the resort from that location also. We only have DSL at that location also and if high speed internet was brought into the area we would also subscribe to it at our Waterville location so we could keep track of our business from there. From talking to our neighbors we know they would all subscribe to better internet as it is vital these days for safety and communication! In this day and age it is vital for most people to have high speed internet due to work , health issues etc. We have people who work in the area that rent from us but are frustrated with the internet and lack of cell phone coverage, we lose a lot of business due to lack of high speed internet as they need it to survive. We believe our customer base would increase immediately if we had high speed internet! If we had high speed internet our customers would be able to use their internet for their cell phone so they could keep in touch with work, family etc. Please know that we are desperately in need of better internet service for our business and our customers. If we have an emergency and the phone and the DSL doesn't work we cannot get the help we need. Currently we have 14 different routers set up through out the resort to try to give DSL service to our customers - as you can imagine with that amount of customers trying to log on to DSL the service is just not sufficient! The Little Pine Creek State Park is directly across the street from our resort and their visitors and campground customers come over to use our DSL all the time as there is no where else within 12 miles to get service. This adds to our use of the internet, adding thousands more customers using it beside our own guests. If we had high speed internet we would use more services such as internet based security systems and alarms. We submitted a form for our Happy Acres Resort that states our huge need for high speed internet. To remind you, we are located in a remote mountain area that will never have cell service - so the internet is the only way for people to use their cells and contact their businesses, homes etc. This is a form for our Happy Acres Restaurant which is a vital part of the Resort business but in itself brings its own challenges as far as the internet is concerned At this time we have 2 different routers taking care of a 300 seat restaurant. Offering only DSL. We use a POS system that utilizes the DSL and we process our credit cards over the DSL. We also offer our customers the use of the DSL as there is no cell service or access to public internet other than our resort internet, closer than 15 miles away. We also utilize the internet for ordering product and contacting services necessary to the business. As we stated in the resort survey, we are open year round and service thousands of guests. Our restaurant is very large and does not only service our resort guests, but people travel from all around to come eat at our establishment. Also people from the area that do not have access to the internet, come visit us to use ours often along with the guests from the state park next door. You will see them sitting outside or in their vehicles using their devices to contact home, work etc... The huge demand causes a hardship for our business as it affects the speed inside the building where our POS systems are located. As owners we access the POS system remotely to monitor the income and expenses of the restaurant, and also we keep in contact with our management and employees by cell or internet when we can. As I stated in the other survey, with DSL it is not consistent and goes down on us often due to overuse. When that happens our POS system does not work and we cannot process credit cards or get orders back to the kitchen to take care of our customers orders. We simply do

not have enough bandwidth to service all the customers that need to use the internet. If we had high speed internet we would utilize internet security and alarm systems for the restaurant. We also currently use the DSL for our ATM machines, our jukebox and our game machines. As we stated in the resort survey, high speed internet is vital in this day for the safety, security and convenience of our customers and business. The lack of high speed internet in the area affects the customers and the business directly and we are positive the if we had high speed internet our business would increase dramatically and the economy in the area would highly benefit from the service. We hope you consider how many people are affected by lack of high speed in our business and this beautiful area, and bring high speed to our area! Sincerely, Owners Happy Acres Restaurant

Happy Acres Store is a separate part of our Happy Acres Resort. With no cell phone service in the area the only way our guests and employees can keep in touch with work or family is by using our DSL services. We currently use 1 router at the store and service thousands of customers that visit our store and resort. Please see the resort survey information and again the store brings its own challenges to the use of the internet. We use the internet to make orders and contact employees and vendors. We also use it for our separate Game Room that has a juke box along with many video games that utilize the internet. We offer the DSL to our customers and you will find they come and sit outside our establishment to utilize our internet as there is no internet or cell phone for 15 miles. We are happy to provide internet to our visitors but it affects the business use of the internet. If we were to offer high speed we would utilize the internet more then we do now as it goes down on us frequently and we cannot rely on it. We would use a high speed internet for security reasons along with every day business use. We appreciate your concern of this issue and hope that we can get high speed internet in the near future. Thank you, Gene and Irene Feerrar Owners, Happy Acres Store

I have looked into installing fiber. Local companies want approximately \$130,000 to install fiber, an amount I cannot afford.

PLEASE HELP! We are desperate for help to get away from TDS!! Our 50th year in business -we should be celebrating and we are struggling to overcome TDS! TDS=hurts our growth!

PLEASE HURRY! If we knew options were coming, we would not have to move!!!!!!

WILL THIS BE ACCOMPLISHED in 2019? As we have plans to lease a new facility in another county.

No internet

Government business in the village of Keating. Using Hughes Net.

We are not a business. We are a hunting camp. We would love to have the service for emergency purposes.

It would be nice to have internet options and to have cell phone service in our valley.

More options in rural areas would be nice, without breaking the bank

Family Camp. Would like open towers for cell coverage. Towers are located thru valley but only open to them.