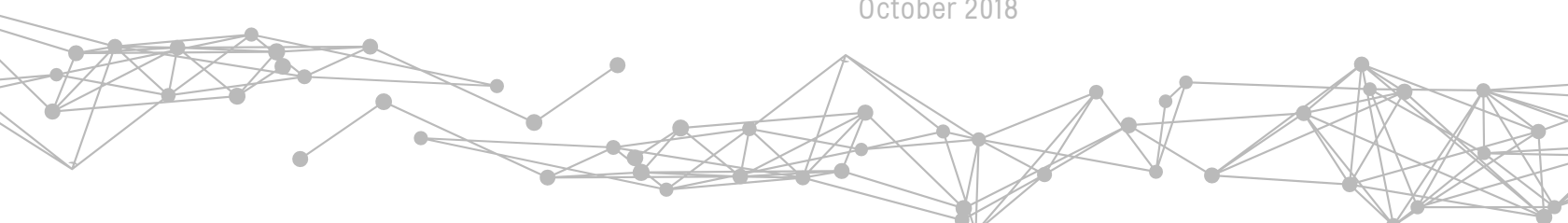




WABASH HEARTLAND INNOVATION NETWORK **State of Broadband**

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Introduction

The main objective of this report is to increase awareness of the state of broadband infrastructure in the ten counties that are part of the Wabash Heartland Innovation Network (WHIN) region. This increased awareness should lead to meaningful discussions regarding broadband in the region and ways to address identified gaps.

This report consists of multiple sections. The first section provides an overview of the most popular broadband technologies. While not meant to be technical, this overview should provide readers a basic understanding of the different broadband technologies available. The following section discusses, in very general terms, broadband deployment or upgrading models the WHIN region could pursue. These models were differentiated for purposes of discussion but, in reality, they overlap significantly.

Publicly available data were utilized to analyze the state of broadband in the region in the next section. Data for this report was obtained from the Federal Communications Commission (FCC) Form 477 as of June 2017 v1 as well as from the 2012-2016 American Community Survey. While the dataset includes all fixed broadband providers (excluding satellite¹) and/or reported advertised speeds, the analysis included only those providers that met the minimum 25/3 FCC threshold. Lastly, a concluding section wraps-up this report where potential next steps and policy recommendations are discussed.

¹Satellite is not included since it has latency, weather, and data plan related issues although it is considered a fixed broadband technology.

Executive Summary

The main objective of this report is to increase awareness of the state of broadband availability in the ten-counties that are part of the Wabash Heartland Innovation Network (WHIN) region and its implications. A summary of the most popular broadband technologies is discussed as well as broadband deployment and/or upgrading models that could be considered.

Data for this report were obtained from the Federal Communications Commission (FCC) Form 477 as of June 2017 v1 as well as from the 2012-2016 American Community Survey. The FCC dataset includes only fixed broadband technology (excluding satellite²) and those records that met the minimum 25 Megabits per second (Mbps) download and 3 Mbps upload broadband threshold established by the FCC, or 25/3 for short.³ It is important to note that the cost of broadband service is not available, a key factor that can contribute to, or impede, broadband adoption.

The main findings of the study are outlined to the right. Potential next steps and policy recommendations are discussed in the concluding section of page 18:

- There were 15 residential (See Table 1) and 19 business (See Tables 7 & 8) broadband providers offering at least 25/3 Mbps in the WHIN region as of June 2017 (excluding satellite).
- About 25.9 percent, or almost 97,500, of the region's population lacked access to residential 25/3. The WHIN region is served by fiber, cable, DSL, and fixed wireless (See Figure 2).
- Benton County had the highest share of population lacking 25/3 in the region with 80.1 percent while Tippecanoe County had the lowest with 9.8 percent (see Table 2). About 34.3 percent of WHIN residents had access to one to two residential broadband providers (see Table 3).
- Low adoption is an issue that needs to be addressed. About a third of WHIN residents live in neighborhoods with low subscription rates and less than 10 percent live in neighborhoods with high subscription rates (see Figure 2 & Table 4).
- While lack of density is an issue when building broadband, there are high density areas not served by residential 25/3 (see Figure 3). It is clear other factors are at play, such as right of way fees or topological barriers limiting access to 25/3.
- About 27.2 percent of households with children (a strong predictor of broadband adoption) or about 11,870 households in the WHIN region had no access or access to only one 25/3 residential provider (see Figure 4 and Table 5) implying a homework gap exists in the region.
- Households in the WHIN region could save \$30.1 million dollars annually if all currently unserved households had access and subscribed to 25/3 service (see Table 6).
- Businesses in the WHIN region were serviced primarily by fixed wireless (see Figure 5). A little less than 17 percent of businesses in the region were outside the business broadband footprint (see Figure 6 and Table 9).
- The region as a whole gained a little more than four percent of digital economy jobs between 2010 and 2016, a lower increase compared to the state and the nation (see Table 10).

² Satellite has latency, weather, and data plan related issues that undermine its broadband potential.

³ https://transition.fcc.gov/Daily_Releases/Daily_Business/2018/db0202/FCC-18-10A1.pdf (speed benchmark is discussed on page 6)

Broadband Technology

Broadband is defined by the Federal Communications Commission (FCC) as Internet access that is always on and faster than dial-up. Since different broadband connections offer different speeds, the current definition on what constitutes broadband is set by a speed benchmark of 25/3.

Broadband connections differ by technology,⁴ of which the most popular are discussed below:

Broadband over Power line (BPL): transmits data over low- and medium-voltage electric power resulting in connections through existing electrical connections and outlets. This is an emerging technology available in limited areas. Speeds are comparable to DSL and cable.

Digital Subscriber Line (DSL): allows the transmission of data over traditional copper telephone lines. DSL consists of asymmetrical and symmetrical. Asymmetrical typically provides faster download speeds while providing slower upload speeds. Symmetrical provides the same speed, both for download and upload, and are usually available only for businesses.

Cable Modem: allows the transmission of data over the coaxial cables used to deliver cable TV. The telecommunication standard used by this technology is called data over cable service interface specification or DOCSIS. Currently DOCSIS 3.0 provides the fastest speeds.

Fiber-optic: transmits data by converting electrical signals to light and sending it through transparent glass fibers offering speeds significantly faster compared to all other broadband technologies. Fiber to the home or business indicates fiber ends in the end users' facility while fiber to the node or cabinet indicates fiber ends at the node or cabinet. The end user is then connected via metallic wires to the node or cabinet.

Fixed Wireless: transmits data using radio links between the end user and the service provider. This does not include mobile wireless. Service is offered from a fixed point requiring an external antenna and a direct line-of-sight. Speeds are comparable to DSL or cable.

Satellite: transmits data by linking with a satellite in orbit. Satellite packages typically include data limits and depend on the end users' line of sight to the orbiting satellite and weather. Speeds are typically slower than those offered by DSL or cable.



Broadband Deployment Models

While there is no one-size-fits-all model when deploying or upgrading broadband infrastructure, this section discusses the most common models. These models are discussed in general terms since the legal, financial, and political complexities of any model are beyond the scope of this report. As the WHIN region considers these models, it is important to balance risk, benefit, and control of assets, as well as financial capabilities. These models should not be treated as either/or and although they have been differentiated for discussion purposes, overlaps exist.

⁴<https://www.fcc.gov/general/types-broadband-connections>

Co-operative model:

This model calls for local government, businesses, or residents to reach out to electric or telephone co-operatives to encourage them to invest and provide broadband. Since co-ops do not seek profit, the lack of customer density is not necessarily an issue. This model proved highly successful when “electrifying” rural communities in the early to mid-20th century. The downside is that co-ops may not feel comfortable investing and managing a service they are not familiar with and resistance from existing private broadband providers.

Municipally owned model:

This model calls for the municipality and/or county to build and operate the network. Unlike the P3 model, municipalities offer a full retail broadband service, just like any other utility (water, sewer, etc.) While research on the success of this model is not definitive, case studies include successes and failures. The key lessons learned from this model is that the municipality or county need to take baby steps, or what is called an “I-Net ‘n’ More” approach, where the municipality or county begins by connecting community anchor institutions and then expands incrementally. A challenge is that political support must be in place for residents to support local government incurring in debt or loans to build the infrastructure. In addition, municipalities may not have the expertise in building and managing broadband networks and may face resistance from private incumbent carriers. In fact, the Institute for Local Self-Reliance has identified several states that have prohibited or made it extremely difficult for municipalities to run their own broadband.

Private sector:

This model calls for communities and residents in the region to reach out to private broadband providers, including wireless Internet service providers (WISPs), to upgrade or expand their footprint. The region can work with federal and/or state agencies to design innovative public policies to help address the challenges of the providers. Examples of these public policies include utilizing public facilities to place broadband infrastructure, streamlining or eliminating right-of-way fees, and/or designing and implementing “dig once” policies. Current costs of right-of-way leases per year per mile add quickly to an already expensive investment due to lack of customer density. Local or state agencies can also provide grants to providers to build out broadband infrastructure in unserved or underserved areas. The downside of this model is that if the math simply does not work out for private providers, the region may remain unserved or underserved.

Public-private partnerships (P3):

P3 calls for innovative ways in which funding, operation, and control of broadband infrastructure is shared among partners. For example, local government entities can bear the capital cost of building the infrastructure through loans, grants, or bonds while providers agree to lease the infrastructure, operate and maintain it. A P3 can also work to providing access to existing fiber-optic infrastructure (also known as “dark fiber”) to private and other broadband providers. These two examples are also called open access models. Depending on the partnership, local government may end up owning the broadband infrastructure or, like in the private sector model, provide grants for providers to upgrade or deploy broadband infrastructure. The downside of this approach is the complexity of P3. Any P3 involves many moving pieces that requires legal and financial expertise.

Any of these models or combination thereof should be considered when deploying or upgrading broadband infrastructure. Important to not overlook is that any effort designed to expand broadband access should be coupled with an initiative to strengthen digital literacy and broadband adoption efforts. Some providers argue that even when broadband is available, customers do not subscribe as expected. Exposing customers to broadband’s benefits and increasing their digital knowledge is critical. This can be done by collaborating with Cooperative Extension, churches, libraries, non-profits, and other groups with a strong network of people and “on the ground” capacity.

State of Broadband in the WHIN region

Data for this analysis were obtained from the FCC Form 477. Internet providers are required to file their advertised speeds (download and upload) as well as the technologies available twice per year at the census block level. The dataset used in this analysis was the June 2017 v1 and includes fixed broadband only.⁵ A couple of disclaimers regarding this dataset is worth discussing.

First, the data is almost two years old. Additional broadband investments may have occurred over the past two years in the region. For this reason, the maps and figures/tables presented here may be inaccurate regarding up to date broadband availability.

Second and more importantly, is that the findings of this analysis may overestimate actual broadband availability for three reasons. First, the data were self-reported from carriers and their accuracy was not validated by customers or by third-party entities. Second, geographic granularity is limited to the census block level and if a household or business has access to broadband within that block, the entire block is considered served. Lastly, speeds are maximum advertised speeds. However, especially with DSL, the actual speeds rarely achieve the maximum advertised speeds consistently, influenced by the time of day, the customer’s distance from the broadband infrastructure, and the customer’s device used to connect to the internet.

Table 1 lists the residential fixed broadband providers identified from Form 477 June 2017 v1 dataset that met the 25/3 threshold. As seen in Table 1, 15 providers in the WHIN region met the 25/3 advertised fixed broadband (excluding satellite).

Table 1. List of residential fixed broadband providers in the WHIN region as of June 2017

Residential 25/3 Provider Name	25/3 Advertised
AgPro Wireless, LLC	Fountain; Warren
AT&T Inc.	Clinton; Fountain; Montgomery
CenturyLink, Inc.	Benton; Carroll; Cass; Clinton; Pulaski; White
Comcast Corporation	All counties in WHIN region
Cyber Broadcasting, LLC	Benton; Warren
Geetingsville Telephone Company Inc.	Clinton
Mediacom Communications Corp.	Pulaski; Tippecanoe
Metronet Holdings, LLC	Cass; Montgomery; Tippecanoe
Monon Telephone Company Inc.	Pulaski; White
Pulaski White Rural Telephone Co-op., Inc.	Pulaski; White
Rochester Telephone Co., Inc.	Cass
Smithville Holding Company, Inc.	Tippecanoe
Swayzee Telephone Company	Clinton
Telephone and Data Systems, Inc.	Carroll; Cass; Clinton; Fountain; Montgomery; Tippecanoe
Wintek Corporation	Clinton; Montgomery; Tippecanoe

⁵Fixed broadband does not include mobile wireless; includes DSL, Cable, Fiber, Fixed Wireless, and others

The 25/3 broadband residential footprint in the WHIN region is shown on Figure 1. The WHIN region is served by fiber (red), cable (yellow), fixed wireless (green), and DSL (light purple). Fiber is concentrated in the center of Cass, Montgomery, and Tippecanoe counties as well as the northwestern corner of White County. Cable has a larger footprint and extends beyond the center of counties. Fixed wireless is available in the southwest corner of Fountain and Warren counties. Note, however, that there are unserved areas in the WHIN region, specifically in Benton, Carroll Pulaski, and Warren counties.

Figure 1. 25/3 residential broadband footprint in the WHIN region

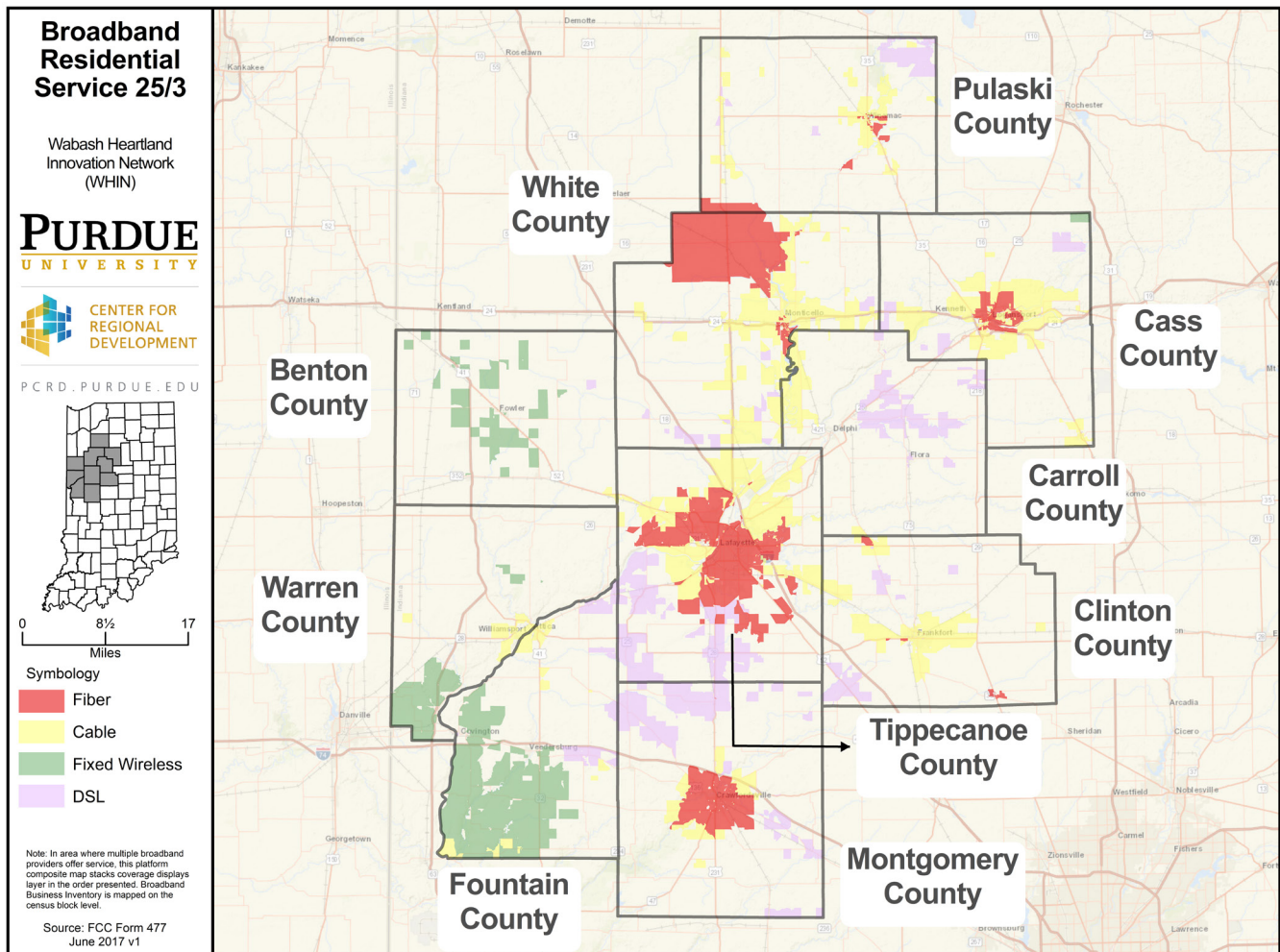


Table 2 shows that a quarter (25.9 percent) or close to 97,500 residents of the WHIN 2010 population⁶ did not have access to 25/3. Note how 80 percent of Benton County's population did not have access to 25/3 followed by Carroll and Warren counties with 70 and 65 percent respectively.

Table 2. 2010 Population with access to 25/3 by WHIN counties

County	Population	Population w/no access to 25/3	Percent population w/no access to 25/3
Benton	8,854	7,088	80.1
Carroll	20,155	14,235	70.6
Cass	38,966	10,706	27.5
Clinton	33,224	9,810	29.5
Fountain	17,240	9,023	52.3
Montgomery	38,124	13,776	36.1
Pulaski	13,402	6,418	47.9
Tippecanoe	172,780	16,944	9.8
Warren	8,508	5,591	65.7
White	24,643	3,907	15.9
WHIN	375,896	97,498	25.9

Regarding providers, Table 3 shows, again, that a little more than one quarter of WHIN residents had no access to 25/3 providers while an additional 23.8 percent had access to only one. In other words, almost half or 49.7 percent of the WHIN's region residents had access to none or one 25/3 provider. On the other hand, almost 40 percent had access to three or more providers. Customers typically benefit from lower prices and better service when multiple providers are competing.

Since the digital divide not only consists of infrastructure, but also adoption, it is important to look at household subscription levels. The FCC provides this data based on the number of residential connections to 10/1 Mbps as of December 2016.⁷ Changes in adoption may be due to cost (cannot afford), lack of relevance (do not think it is worth the cost), and/or lack of digital skills (uncomfortable using the technology). Therefore, this dataset serves as a good proxy for adoption demonstrating other factors are at play aside from broadband access and availability, considering that the entire state of Indiana had access to advertised 10/1 as of December 2016.

Table 3. 25/3 residential providers footprint & population

Number of Providers	2010 Population	2010 Percent Population Served
0 (No access)	97,498	25.94
1	89,574	23.83
2	39,606	10.54
3	113,163	30.10
4	35,466	9.44
5	98	0.03
6	491	0.13
Total	375,896	100.0

⁶Population at the census block level is only available from the decennial census. Although the population is 2010, the actual broadband footprint is from June 2017.

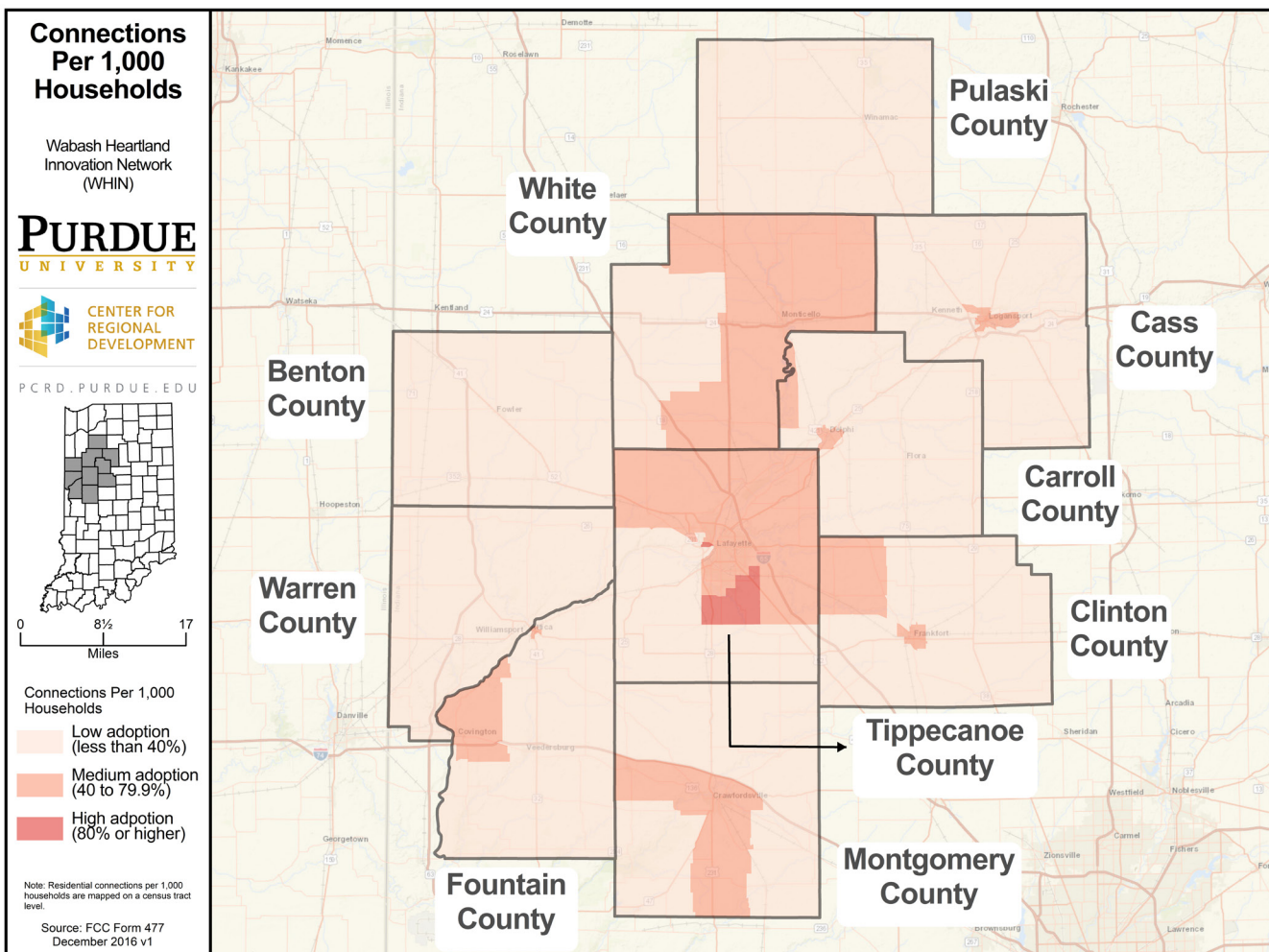
⁷Note this is lower than the 25/3 threshold used but it is due to data availability from the FCC; also note this data is from December 2016, not June 2017, also due to data availability.

The Brookings Institution⁸ categorized census tracts as low or high broadband adoption based on subscription levels. Low adoption refers to neighborhoods where less than 40 percent of households subscribed to available 10/1 service. High adoption neighborhoods are those with 80 percent or more of households with a 10/1 connection. Therefore, medium adoption neighborhoods have between 40 and less than 80 percent households with 10/1 connections.

Figure 2 shows the neighborhoods in the WHIN region based on subscription levels. Notice how the majority of the region had subscription levels of less than 40 percent (light orange). Tippecanoe and White counties have a larger share of neighborhoods with medium and high subscription levels (darker orange). Again, further research needs to be conducted to unravel these adoption differences given that the entire region had access to advertised 10/1 as of 2016.

“Inadequate levels of broadband adoption need to be addressed to ensure the technology is fully leveraged for community economic development purposes.”

Figure 3. Low/High Broadband Adoption Neighborhoods in the WHIN region



⁸<https://www.brookings.edu/research/signs-of-digital-distress-mapping-broadband-availability/>

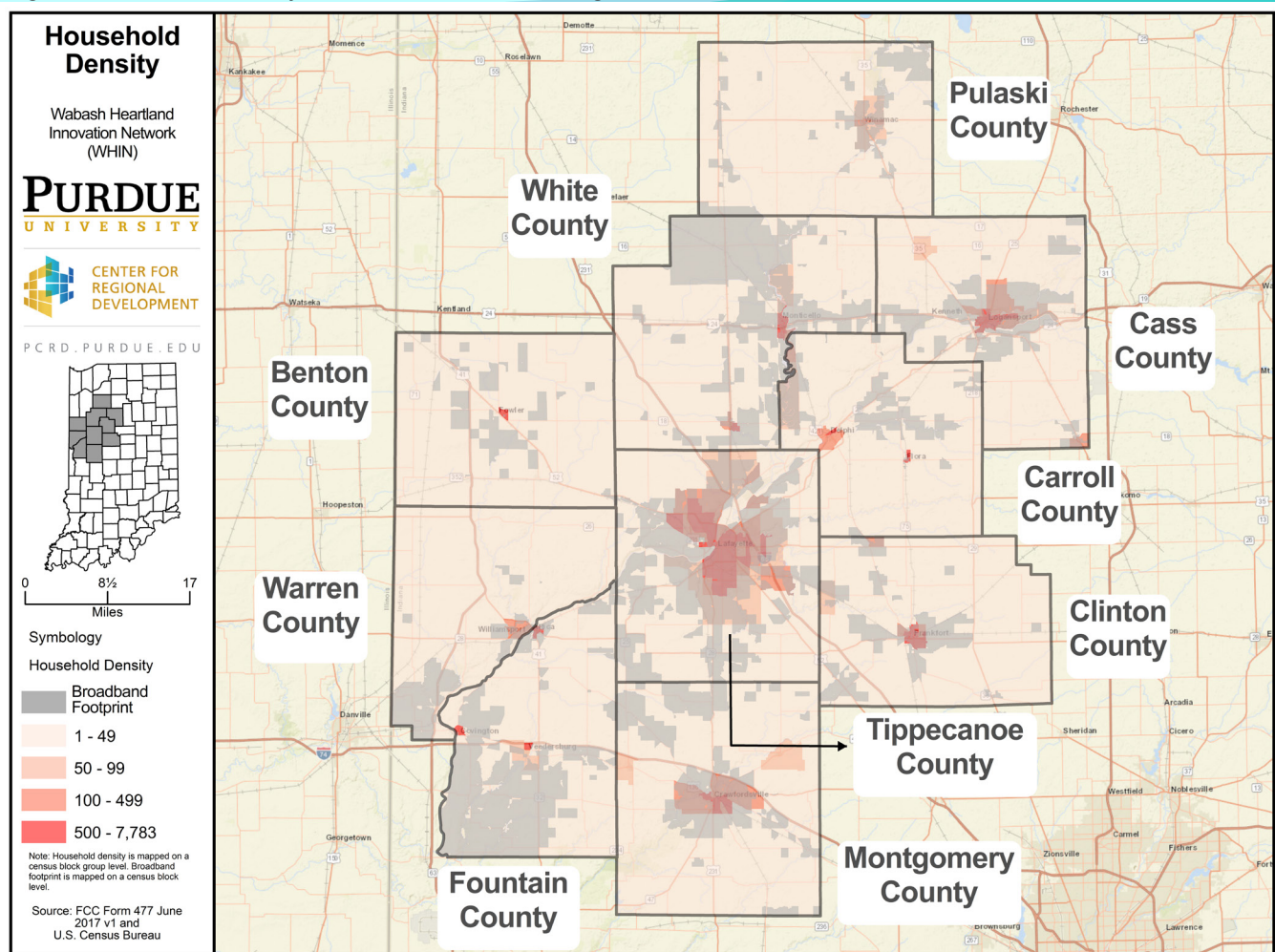
Further dissecting the adoption indicator, Table 4 shows the percent of 2016 population living in low/high adoption neighborhoods by county in the WHIN region. Only Tippecanoe County had some share of its population that lived in high adoption neighborhoods. Benton and Pulaski counties had 100 percent of their population that lived in low adoption neighborhoods. In other words, there was not a neighborhood in those counties where at least 40 percent or more of households subscribed to 10/1 service. Inadequate levels of broadband adoption need to be addressed to ensure the technology is fully leveraged for community economic development purposes, resulting in quality-of-life improvements.

Figure 3 shows the residential 25/3 footprint meshed with household density per square mile. Some areas with a high household density (dark orange) did not have access to residential 25/3 (gray). In addition to the issue of lack of density, right-of-way fees or topological barriers may affect this as well.

Table 4. 2016 Population living in low/high adoption neighborhoods

County	Pop. in Low	Pop. in High	Percent in Low	Percent in High
Benton	8,709	0	100.0	0.0
Carroll	14,120	0	70.6	0.0
Cass	20,649	0	53.9	0.0
Clinton	12,197	0	37.3	0.0
Fountain	10,633	0	63.5	0.0
Montgomery	14,180	0	37.2	0.0
Pulaski	12,910	0	100.0	0.0
Tippecanoe	21,742	9,736	11.9	5.3
Warren	8,309	0	100.0	0.0
White	2,345	0	9.7	0.0
WHIN	125,794	9,736	32.8	2.5

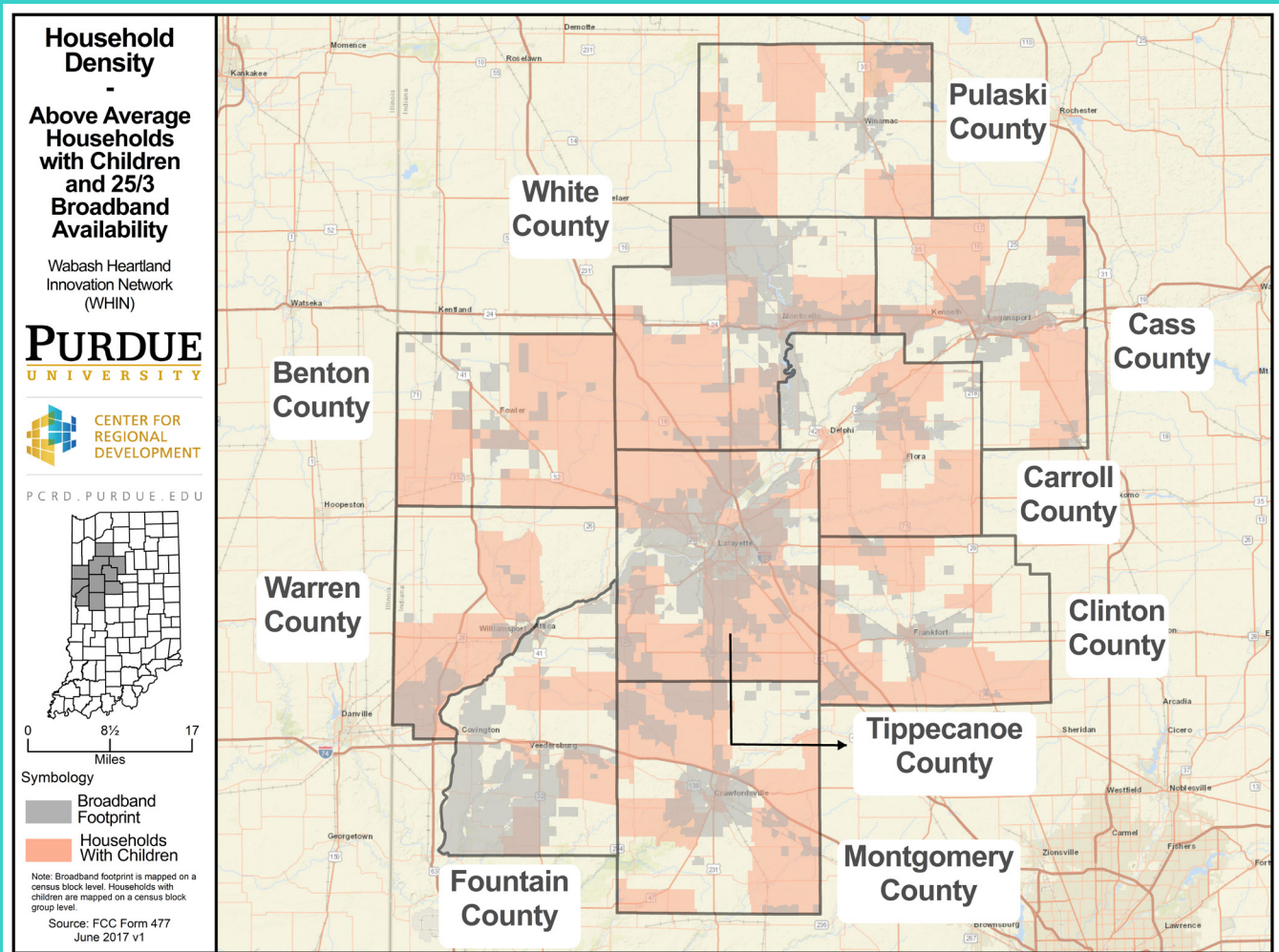
Figure 3. Household density and 25/3 residential coverage



Next, it is worth discussing the “homework gap.” The homework gap refers to children not having access to adequate Internet and/or digital devices to complete online homework assignments/activities at home. Figure 4 identifies block groups in the region with an above average percent of households with children (orange) and the 25/3 residential broadband footprint (gray). According to the 2012-2016 American Community Survey, there were about 145,621 occupied households in the WHIN region of which 43,599, or 29.9 percent, had children.

There are multiple block groups with above average percentage of households with children (orange) not in the residential footprint (gray). Note that the majority of Benton County’s geography had block groups with above average percent of households with children. Other areas such as the southern part of Carrol and Clinton counties and the western part of White County were in a similar situation.

Figure 4. Residential 25/3 footprint and percent of households with children



As shown in Table 5, less than seven percent of households in the region with children or close to 2,900 households had no access to 25/3 providers.⁹ An additional 20.7 percent of households with children in the region or about 9,000 had access to one 25/3 provider. In the end, about 27 percent or 11,870 households with children in the WHIN region had either no access or access to one 25/3 provider.

Aside from the homework gap, households can save around \$750 per year in insurance, energy, shopping, and online services according to a Price Waterhouse Study in the United Kingdom.¹⁰ Since data regarding access to residential 25/3 is available only for population, population without access to fixed 25/3 was divided by the 2016 average household size to estimate the number of households without access to 25/3. As shown in Table 6, households in the WHIN region would save about \$30.1 million dollars over 20 years if **all** current unserved households had access and subscribed to the service.

Table 5. 25/3 residential footprint & households with children

Number of 25/3 Residential Providers	2016 Households with Children	2016 Percent of Households with Children
0 (No access)	2,856	6.6
1	9,014	20.7
2	14,106	32.4
3	15,610	35.8
4	2,013	4.6
Total Households	43,599	100.0

Table 6. Potential Economic Benefit of Currently Unserved Households Subscribing to Broadband

County	Population w/o access to 25/3	Average Household Size	Estimated households w/o access to 25/3	Potential 1-Year Savings ¹¹
Benton	7,927	2.57	3,084	\$2.1 million
Carroll	7,857	2.57	3,051	\$4.3 million
Cass	10,759	2.64	4,081	\$3.2 million
Clinton	10,327	2.78	3,718	\$2.8 million
Fountain	4,158	2.40	1,729	\$3.0 million
Montgomery	14,216	2.57	5,540	\$4.2 million
Pulaski	6,217	2.50	2,492	\$2.0 million
Tippecanoe	17,090	2.69	6,353	\$5.0 million
Warren	5,607	2.50	2,245	\$1.7 million
White	3,984	2.51	1,588	\$1.2 million
WHIN	88,142	2.57	33,881	\$30.1 million

⁹Note that the number of providers is lower than those listed on Table 3. Data on Table 5 was aggregated to the census block group level and a provider serving multiple blocks within the block group is listed only once. The aggregation was necessary because household data is only available at the block group level.

Without question, efforts to expand the residential 25/3 footprint are warranted. Low hanging fruit efforts can focus on those areas where an above average share of households with children exist that lack access to 25/3. Households with children tend to adopt the technology at higher rates. In addition, areas outside the broadband footprint with higher household densities should also be targeted when planning expanding or upgrading the residential footprint.

Shifting gears, we now focus on businesses. Table 7 lists the names of the 19 business providers in the region that met the 25/3 criteria (excluding satellite) as well as which counties they serve. Although Comcast is not listed, it does serve businesses located in their residential footprint according to conversations with the provider.

Table 7. List of business fixed broadband providers in the WHIN region as of December 2016

Business 25/3 Provider Name	Counties Served
Cyber Broadcasting, LLC	Benton; Warren
Fourway Computer Products, Inc.	Cass; Pulaski
Geetingsville Telephone Company Inc.	Clinton
Indiana Fiber Network, LLC	Carroll; Fountain; Tippecanoe
JAB Wireless, Inc.	Warren
Level 3 Financing, Inc.	Benton; Carroll; Clinton; Montgomery; Tippecanoe; Warren; White
LTS Group Holdings LLC	Tippecanoe
Metronet Holdings, LLC	Cass; Montgomery; Tippecanoe
Monon Telephone Company Inc.	Pulaski; White
PCC Holdings, Inc.	All counties in WHIN region
Pulaski White Rural Telephone Coop., Inc	Pulaski; White
Rochester Telephone Co., Inc.	Cass; Pulaski
Smithville Holding Company, Inc.	Tippecanoe
Spectrotel, Inc.	Fountain; Tippecanoe
Swayzee Telephone Company	Clinton
Telephone and Data Systems, Inc.	Carroll; Cass; Clinton; Fountain; Montgomery; Tippecanoe
US Signal Company, L.L.C.	Benton; Clinton; Tippecanoe; White
Wintek Corporation	Clinton; Montgomery; Tippecanoe
Zayo Group, LLC	White

¹⁰ <https://www.gov.uk/government/publications/government-digital-inclusion-strategy/government-digital-inclusion-strategy#contents>

Figure 5 shows the business 25/3 footprint in the WHIN region. Most of Benton, Carroll, Clinton, and White counties have coverage for businesses. On the other hand, Fountain, Montgomery, and Warren counties lack business coverage in the majority of their geographies. Regarding broadband technology available for businesses within the 25/3 footprint, Figure 5 shows that the 25/3 coverage relies mostly on fixed wireless, while some pockets of fiber optic are visible. Fiber optics for businesses is primarily available in Tippecanoe County and the northwestern part of White County. There is also some cable broadband available for businesses in Pulaski County.

Table 8. 25/3 business footprint & establishments at the county level.

County	25/3 Unique Business Broadband Providers
Benton	4
Carroll	4
Cass	5
Clinton	7
Fountain	4
Montgomery	5
Pulaski	5
Tippecanoe	10
Warren	4
White	6
WHIN	19

Figure 5. Business 25/3 footprint

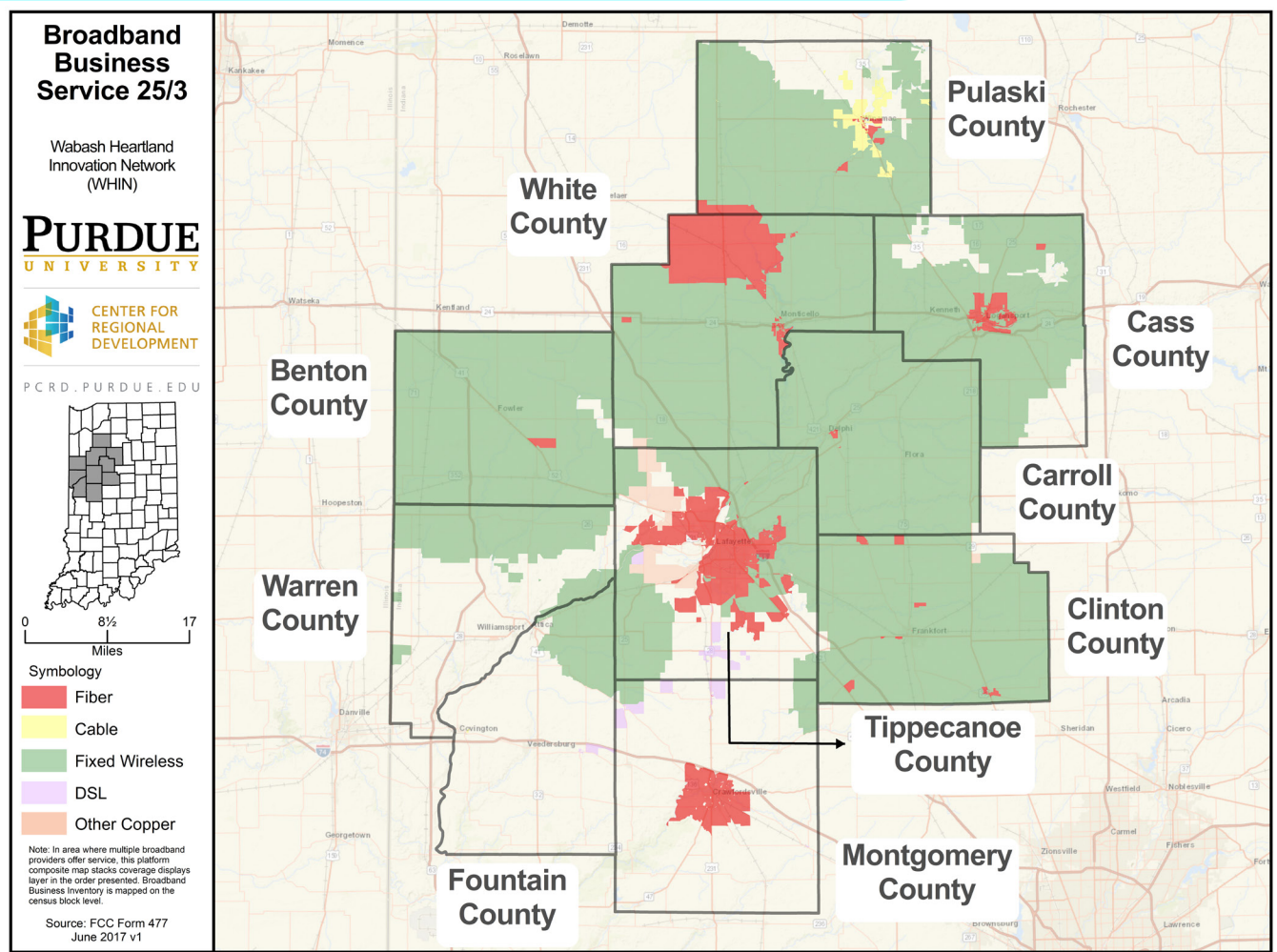
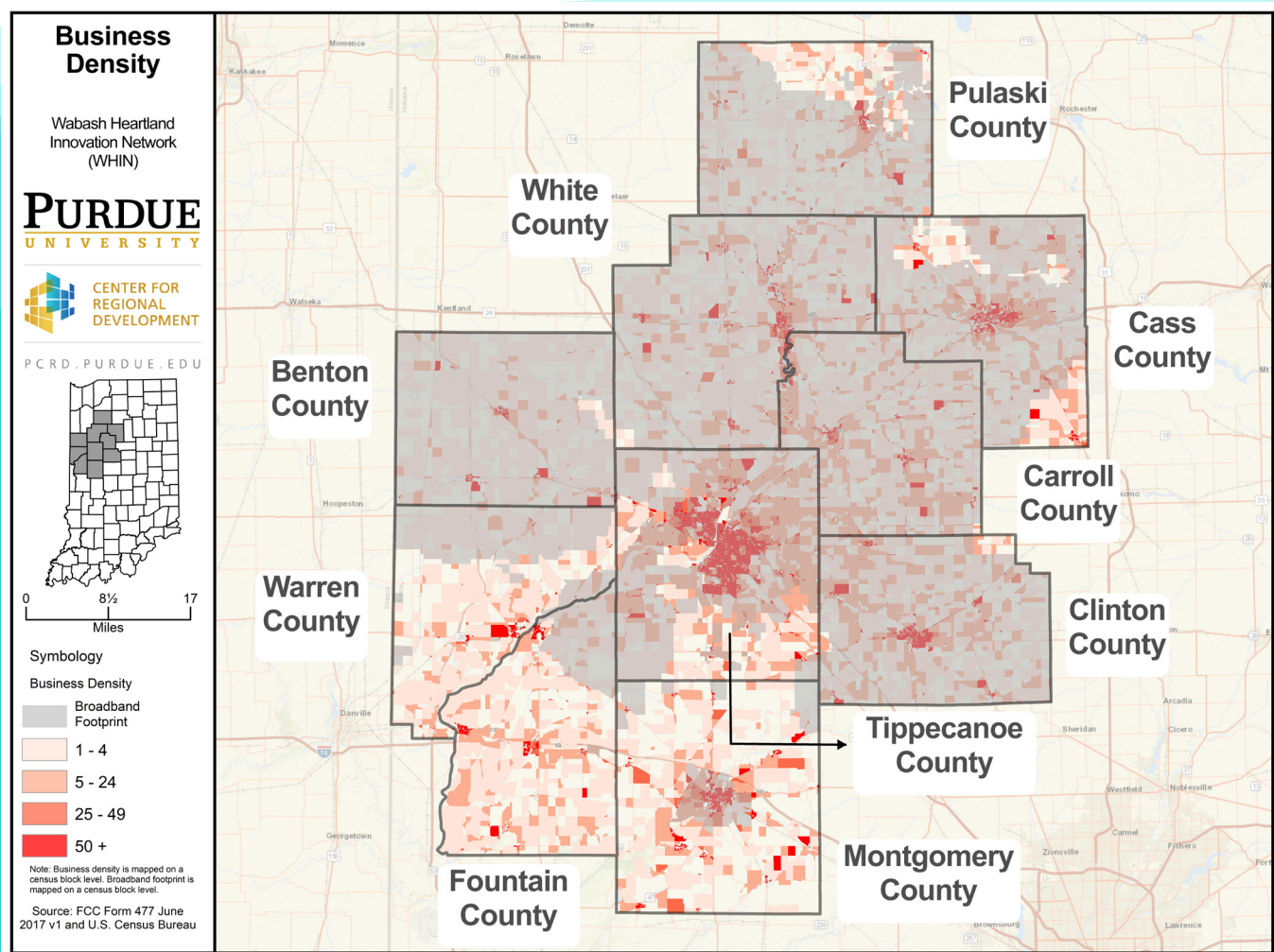


Table 8 shows the number of business 25/3 providers in the region. Tippecanoe County had the highest number with 10, followed by Clinton County with seven. In the region overall, 19 business providers operated as of June 2017.

Utilizing 2012 (latest available) data from multiple sources¹¹, a business density per square mile (orange) was calculated and meshed with the business 25/3 footprint (gray). As shown in Figure 6, areas with the highest business density (dark orange) are mostly covered by the 25/3 business broadband footprint. However, there are areas of high business density that are not in the 25/3 footprint, more noticeable in Fountain and Montgomery counties.

Figure 6. Business Density per Square Mile and Broadband Footprint

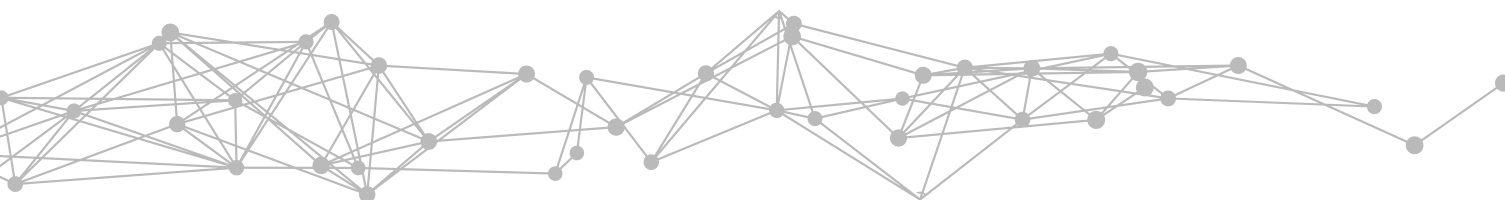


¹¹ Multiple establishment level data sources were evaluated, such as Hoovers (Avention), ReferenceUSA, and National Establishment Time Series (NETS). The challenge was that each source had slightly different counts of establishments. A combination of these sources was utilized to geocode the establishment records, which were aggregated at the census block level.

Of the approximately 49,000 businesses mapped in the region, little less than one-quarter were not in the business broadband footprint (see Table 9). About 98 percent of businesses in Montgomery County were outside the business footprint followed by 94 percent in Fountain County. In contrast, almost 100 percent of businesses in Carroll and White counties were inside the business broadband footprint.

Table 9. 25/3 business footprint & establishments at the county level

County	No. Businesses	In 25/3 footprint	Out of 25/3 footprint	Percent In 25/3 footprint	Percent Out of 25/3 footprint
Benton	1,652	1,641	11	99.3	0.7
Carroll	3,216	3,213	3	99.9	0.1
Cass	4,893	4,248	645	86.8	13.2
Clinton	4,212	4,176	36	99.1	0.9
Fountain	2,731	157	2,574	5.7	94.3
Montgomery	5,603	111	5,492	2.0	98.0
Pulaski	2,315	1,962	353	84.7	15.2
Tippecanoe	18,766	17,266	1,500	92.0	8.0
Warren	1,336	369	967	27.6	72.4
White	4,278	4,276	2	99.9	0.1
WHIN	49,002	37,419	11,583	76.3	23.6



“Adequate broadband is increasingly necessary to not only create and retain digital economy jobs but also allow residents to learn digital skills.”

With regard to broadband’s impact on businesses, it is worth analyzing jobs related to the digital economy,¹² which are growing faster than jobs overall¹³ and pay twice the median national income.¹⁴ Table 10 shows the change in digital economy jobs between 2010 and 2016 for selected geographies.

As shown in Table 10, the region as a whole gained 164 digital economy jobs between 2010 and 2016 as did the state and nation, albeit at a much lower rate. Carroll, Cass, Montgomery, and White counties gained digital economy jobs while Benton, Clinton, Fountain, Pulaski, and Tippecanoe lost these type of jobs during this period. Adequate broadband is increasingly necessary to not only create and retain digital economy jobs but also allow residents to learn digital skills.

Table 10. Digital Economy Jobs

County	2010 Digital Economy Jobs	2016 Digital Economy Jobs	No. Change	Percent Change
Benton	58	18	-41	-69.9
Carroll	45	64	18	40.4
Cass	300	422	123	41.0
Clinton	345	173	-172	-49.9
Fountain	363	332	-31	-8.5
Montgomery	497	912	415	83.6
Pulaski	62	23	-40	-63.5
Tippecanoe	1,725	1,577	-148	-8.6
Warren	5	5	0	0.0
White	301	340	39	13.0
WHIN	3,701	3,865	164	4.4
Indiana	98,509	122,689	24,181	24.5
U.S.	6,190,730	7,311,954	1,121,224	18.1

Source: EMSI 2017 Q4

¹²This paper utilized 52 industries listed as related to the digital economy from four different sources: Bureau of Economic Analysis, Brookings Institution, Progressive Policy Institute and the Internet Association.

¹³<https://www.brookings.edu/research/americas-advanced-industries-new-trends/>

¹⁴<https://blog.bea.gov/2018/03/15/initial-estimates-show-digital-economy-accounted-for-6-5-percent-of-gdp-in-2016/>

Conclusions

Broadband infrastructure, without a doubt, is the equivalent of a railroad line or a four-lane interstate highway in this century. Not having adequate broadband infrastructure and an effective digital inclusion strategy will further disadvantage communities in this 21st century global economy.

This report examined broadband infrastructure as reported by carriers and the FCC as of June 2017 in the counties that make up the Wabash Heartland Innovation Network (WHIN) region. While the region does indeed have 25/3 coverage, gaps exist that need to be addressed. Some opportunities to address these gaps include targeting block groups with a higher percent of households with children as well as high household density block groups near the current 25/3 footprint. On the business side, it is important to increase the 25/3 footprint. Otherwise, entrepreneurs and small businesses located in the region are unable to leverage an online presence and Internet of Things (IoT) systems to increase sales, expand markets and become more competitive.

The most important challenge for providers to expand coverage is lack of population density as is topological barriers and right-of-way. Fewer and spread out customers require a more expensive investment. What could help is having right-of-way fees reduced or eliminated. Otherwise, these fees result in greater costs to the providers, expenses that may be simply too great in light of the higher cost associated with the delivery of broadband to low density areas.

Regardless of the broadband deployment model the region decides to pursue to expand and upgrade the current 25/3 footprint for residences and businesses, it is important to consider the following:

- Focus on low hanging fruit to expand the 25/3 or higher footprint. Proceed incrementally afterwards to avoid potential financial and subscription pitfalls.
- Learn more about the broadband bill that was recently passed by the Indiana legislature since it may provide funding for unserved rural areas.
- Keep in mind however that some state and/or federal programs deem areas with speeds higher than 10/1 ineligible for funding. While this is a serious inconsistency, given that the FCC's broadband definition is 25/3, hopefully it will be resolved soon. In the meantime, keep this in mind when applying for broadband infrastructure funding.
- While a "dig once" policy is about to become federal law and applicable to many federally funded road projects, the region should make efforts to further strengthen this policy and implement a similar policy applicable to county and city roads.
- President Trump recently signed an executive order to streamline and expedite requests to locate broadband facilities in rural areas. This executive order may make it easier to leverage federal facilities to place broadband infrastructure in an effort to increase access. In addition, it is worthwhile to map assets in the region (water towers, utility poles, etc.) that could be used by providers to lower the cost and make it easier to expand their footprint.

- Microsoft announced a project to utilize TV white space (analog TV frequencies) to expand broadband in rural areas. Efforts should be made to promote the region for this project.
- The WHIN region should make efforts to get every community in the region “Broadband Ready” certified. This certification may also provide access to additional funding.
- Be attentive to details concerning the \$100 million investment in rural broadband by Governor Holcomb as well as the \$600 million e-connectivity USDA program. Also, reach out to newly appointed Indiana Director of Broadband Opportunities Scott Rudd.
- Lastly, the region should design and implement a digital inclusion strategy. At a minimum, this strategy should make efforts to continue to increase awareness of why broadband is important and collaborate with community anchor institutions, educational institutions and nonprofits to provide digital literacy trainings throughout the region, to both residents and businesses. Promoting adoption is both a complementary and necessary component to make any broadband investment sustainable.



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