MICHIGAN
BROADBAND ROADMAP

AUGUST 2018

21st CENTURY
MICHIGAN INFRASTRUCTURE COMMISSION

Dear Governor Snyder:

Executive Order 2018-2 created the Michigan Consortium of Advanced Networks (MCAN), and tasked it to create a roadmap for high-speed, secure, reliable, and affordable broadband service for the State of Michigan.

The consortium conducted months of research, sought guidance from two subgroups representing 47 diverse public and private entities, and held six listening tours throughout the state to collect input from more than 130 stakeholders. This input yielded the following report, which outlines five primary goals to improve the access and adoption of broadband across the state. We are confident this roadmap will improve the quality of life for all Michiganders.

The goals and recommendations put forth in this roadmap will take years to implement and will require continued involvement from a diverse array of stakeholders at all levels of government, communities, and industry. No one entity can do this alone. As we traveled the state to discuss this issue, we heard broad consensus across the various functional groups that Michigan's residents deserve high-speed, secure, reliable, and affordable broadband. We feel confident that this roadmap will help to coordinate interest groups across the state, and we look forward to implementing the recommendations in this roadmap to move Michigan forward.

Sincerely,

David L. DeVries
Director and State of Michigan CIO &
Chairman - MCAN

Consortium Members

Appointed Members

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Gavin Leach, Vice Chair, Northern Michigan University
Bonnie Alfonso, Alfie Logo Gear
Peter Anastor, Michigan Department of Agriculture and Rural Development
Dawn Brinningstaull, Michigan State Police
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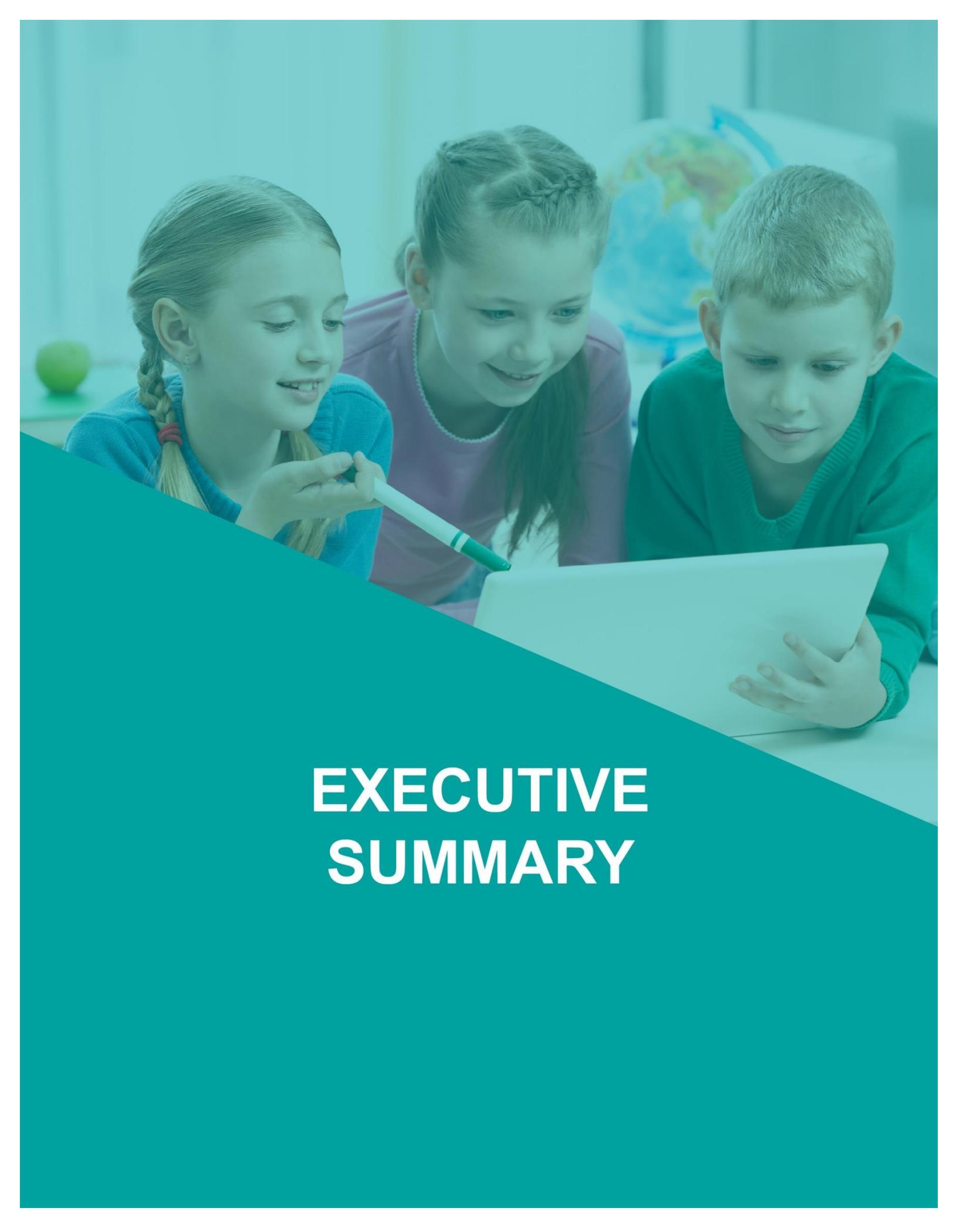
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ACD.net
Alpena Public Schools
AT&T
Casair
CenturyLink
Charter
ChoiceTel
City of Detroit
Comcast
County Road Association of Michigan
Delta County Economic Development Alliance
Eastern Upper Peninsula Intermediate School District
Eastern Upper Peninsula Planning and Development Region
Flint and Genesee Chamber of Commerce
Fraser Trebilcock
Frontier Communications
HARBOR Inc.
Innovate Marquette SmartZone
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Michigan Public Service Commission
Michigan State University Department of Media and Information
Northeast Michigan Council of Governments
Northern Initiatives
Oakland County
Ottawa County Planning Commission
Peninsula Fiber Network
Rocket Fiber
Sault Ste. Marie Tribe of Chippewa Indians Economic Development Corporation
St. Clair County Economic Development
Telecommunications Association of Michigan
Upper Peninsula Marketing Department, Inc.
United States Department of Agriculture
Verizon

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EXECUTIVE SUMMARY

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Executive Summary

Purpose of the Michigan Consortium of Advanced Networks

Universal access to broadband is a clear and urgent priority for every Michigan resident, business, region, and community. Michigan, and its communities and businesses, must ensure that secure, reliable, and affordable broadband services are available across the state. The Michigan Consortium of Advanced Networks (MCAN) was created to develop a broadband roadmap for the state, the purpose of which is to identify gaps in service coverage and capacity, current efforts underway to address connectivity issues, and key strategies and recommendations for the public and private sector to pursue over the coming years to achieve ubiquitous connectivity.

In developing its recommendations, MCAN established the following goals and guiding principles:

Goals:

- Accomplish speeds of 1 Gigabit per second to all residents and businesses by 2026.

- Achieve fixed, or comparable, affordable broadband service to all residents and businesses at a speed of at least 25 Megabits per second download and 3 Megabits per second upload by 2022.

- Priority and state funding will be focused on areas currently unserved by broadband at 10 Megabits per second download and 1 Megabit per second upload.

- Attain fixed, or comparable, household broadband adoption of 95% by 2024.

Guiding Principles:

- Work to remove barriers to residential, business, and institutional broadband adoption in coordination with infrastructure investments.

- Encourage connectivity for Community Anchor Institutions (CAI). CAIs include schools, libraries, hospitals and other medical providers, public safety entities, institutions of higher education, community/region support organizations, and local government.

- Promote coordination, cooperation, and communication between private and public infrastructure owners, communities, schools, libraries, project partners, and local, regional, state, tribal, and federal governments, among others.

- Utilize existing and emerging funding sources and investments more effectively by targeting investments where needed most and leveraging a variety of public and private financing resources.

- Focus on embracing all technologies, visionary planning principles, and innovative approaches to ensure high levels of broadband service for Michigan's residents, businesses, institutions, and communities.
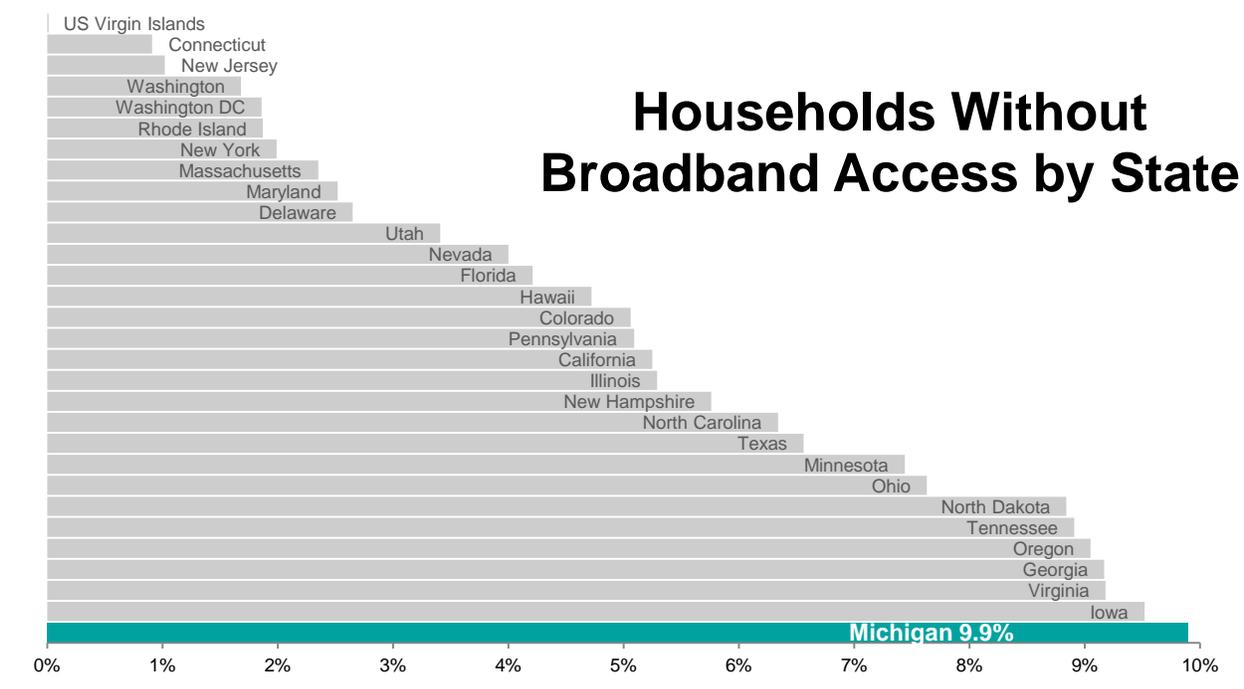
What is Broadband and Why it Matters

Broadband commonly refers to high-speed internet access that is "always on." Broadband includes several high-speed transmission technologies, such as fiber, wireless, satellite, digital subscriber line, and cable. There are two primary types of broadband service: fixed and mobile. Fixed broadband is designed for permanent, stationary use at a home, business, or institution, while mobile broadband is designed for use "on the go." This report focuses on fixed broadband. Broadband is an essential infrastructure that impacts nearly every facet of a region or community.

Broadband in Michigan

The first step in addressing Michigan's broadband needs is to understand where broadband is available and where it is not and the barriers to adopting and leveraging technology. The following is a snapshot of Michigan's broadband landscape:

- Michigan ranks 30th among other states and territories for broadband availability. [1]
- An estimated 368,000 rural Michigan households do not have access to broadband.[1]
- Nearly 2 million Michigan households (48%) have access to only one fixed, terrestrial internet service provider.[2]
- Just over $2.5 billion in potential economic benefit is left unrealized among disconnected households.[3]
- One-third of households that do not subscribe to the internet say the cost of service is too expensive.[4]

Households Without Broadband Access by State

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[1] As defined by the Federal Communications Commission: https://docs.fcc.gov/public/attachments/DOC-348770A2.pdf

[2] Connect Michigan, Broadband Data Collection, September 2017, https://connectednation.org/michigan/planning/

[3] 1,363,000 Michigan households do not subscribe to broadband service. "Connecting the Dots of Ohio's Broadband Policy," estimates that subscribing households experience an annual economic benefit of $1,850. 1,363,000 x $1,850 = $2.521 billion.

[4] http://www.pewinternet.org/2015/12/21/3-barriers-to-broadband-adoption-cost-is-now-a-substantial-challenge-for-many-non-users/

MICHIGAN CONSORTIUM OF ADVANCED NETWORKS

Telemedicine applications are estimated to add $522,000 to rural economies and reduce hospitalizations of nursing home patients and generate savings for Medicare.

Small businesses with websites have higher annual revenues and are more likely to have recently hired than those without websites.

Surveys find that 50% of K-12 students say they can't complete their homework due to the lack of an internet connection at home and 42% received a lower grade because of their disconnectedness.

Communities without access to real-time data experience 25 percent higher rates of injuries and crime.

Farmers with broadband experience a 6% increase in farm revenue on average.

In a study of manufacturers, 40% stated they were able to add new customers and 57% realized cost savings because of their broadband connections.

BROADBAND MATTERS IN MICHIGAN

Businesses with faster connections have a higher share of employees with advanced technology skills than those with slower internet speeds.

More than 28% of adults use a smartphone as part of a job search and 51% make purchases via their device.

Having a home broadband connection gives households an estimated economic benefit of $1,850 per year.

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"Use of Telemedicine Can Reduce Hospitalizations of Nursing Home Residents and Generate Savings for Medicare," *Health Affairs*, 2014
"Why Does Broadband Matter," *NTIA*, 2018.
"Broadband Technology in Manufacturing," *Commonwealth of Pennsylvania and the NTIA*, 2014.
"The Benefits of Expanded Broadband for Missouri Farms and Agribusiness," *University of Missouri*, 2011.
"Ten Facts About Smartphones as the iPhone Turns 10," *Pew Research Center*, 2017
"Going Social on Small Business Saturday," *Connected Nation*, 2016
"Connected the Dots of Ohio's Broadband Policy," *Swank Program in Rural-Urban Policy*, 2017
"The Homework Gap: The 'Cruelest Part of the Digital Divide'," *National Education Association Today*, 2016

Key Recommendations

MCAN received guidance from two subgroups representing 47 diverse public and private entities and held six listening tours throughout the state to collect input from more than 150 stakeholders. To meet the clear and urgent need for broadband in every community, MCAN has identified three primary recommendation areas to improve the access and adoption of broadband:

1. Access to Unserved Areas (Page 25)

Connect unserved communities, leverage partnerships, and improve data.

- Facilitate the creation of successful partnerships for broadband expansion.
- Connect communities and institutions.
- Improve broadband coverage data collection and validation.
- Increase backhaul capacity in rural areas.
- Improve the workforce pool for the telecommunications industry.

2. Increase Broadband Adoption (Page 32)

Improve affordability; increase digital literacy; close the homework gap; and bolster the quality-of-life benefits of technology to create a more digitally equitable state.

- Promote and build awareness for low-cost broadband subscription programs.
- Support residents to become more digitally literate through coordinated training.
- Create partnerships to promote innovative uses of technology.

3. Progress Michigan's Broadband Ecosystem (Page 40)

Coordinate and invest in broadband to improve access and adoption; support and empower communities, regions, and stakeholders; and remove barriers to expedite deployment.

- Invest in broadband and technology to improve community and economic development.
- Create a single point of contact within state government to support communities.
- Provide comprehensive broadband technical assistance, best practices, and guidance to communities and other local stakeholders.
- Encourage "dig once" best practices to reduce construction costs.
- Improve the pole-attachment process for internet service providers.
- Streamline access to the right-of-way (ROW) for all technology types and ROW owners.
- Leverage the robust experience of infrastructure deployment from telecommunications providers, cable networks, electric service providers, and others to shape a better policy and regulatory ecosystem to connect unserved areas.
- Create a permanent long-term broadband commission to advise future governors and the legislature.

The Path Forward

Improving Michigan's access to and adoption of broadband and technology is complex and ever-changing due to the nature of the telecommunications industry and rapid advances in technology. MCAN's goals may take years to implement and will require the participation of a diverse array of stakeholders at all levels of government. No one person, group, or entity can do this alone. Immediately following the release of the roadmap, MCAN and supporting state agencies and staff will:

- Create a Community Broadband Playbook by October 2018 for distribution to communities and regions across the state. The Playbook will provide stakeholders with tools, resources, best practices, and case examples that will help communities begin to implement the roadmap recommendations and actions.
- Develop an accountability and implementation strategy by December 2018 that assigns state agency support and responsibility for roadmap implementation. This strategy will include immediate assignments of short-term action items to kick-start the roadmap implementation, and a thorough plan for the execution of the long-term recommendations.
- Work with the legislature in the fall of 2018 to secure and administer a long-term, permanent broadband commission and secure funding to assist communities with the expansion of broadband access and adoption.

Additionally, MCAN recommends the following short-term actions be taken by 2020 to begin charting a positive course for Michigan's broadband landscape to achieve robust and ubiquitous connectivity and adoption:

- Designate a single point of contact (SPOC) within state government for residents, businesses, institutions, and communities seeking information and assistance on broadband. The SPOC should be a neutral advocate for broadband and technology.
- Develop templates for the creation of partnerships to facilitate the predictable and expeditious implementation of innovative models for broadband expansion.
- Create an inventory of the location and current connectivity of Michigan's Community Anchor Institutions.
- Continue to gather, refine, and validate broadband coverage data.
- Identify and aggregate broadband infrastructure data, building on the work of the Michigan Asset Management Pilot.
- Leverage the resources offered by Governor Snyder's Marshall Plan for Talent to identify opportunities for training residents to meet the workforce needs of internet service providers (ISPs).
- Develop a grassroots outreach and education strategy that targets households experiencing broadband affordability issues to provide information on programs that assist with the cost of broadband service.
- Support libraries, schools, and others with the ability to provide digital literacy and technology training to residents and businesses through the creation of a statewide clearinghouse of such programs.
- Conduct a statewide school technology inventory.
- Develop model dig once policies for ROWs maintained by local units of government with the guidance of the Michigan Infrastructure Council.
- Monitor the impact of Public Act 97 of 2018 on ISPs, road commissions, and other ROW owners to determine the law's effectiveness in streamlining the permitting process and fees for ISPs accessing the ROW.
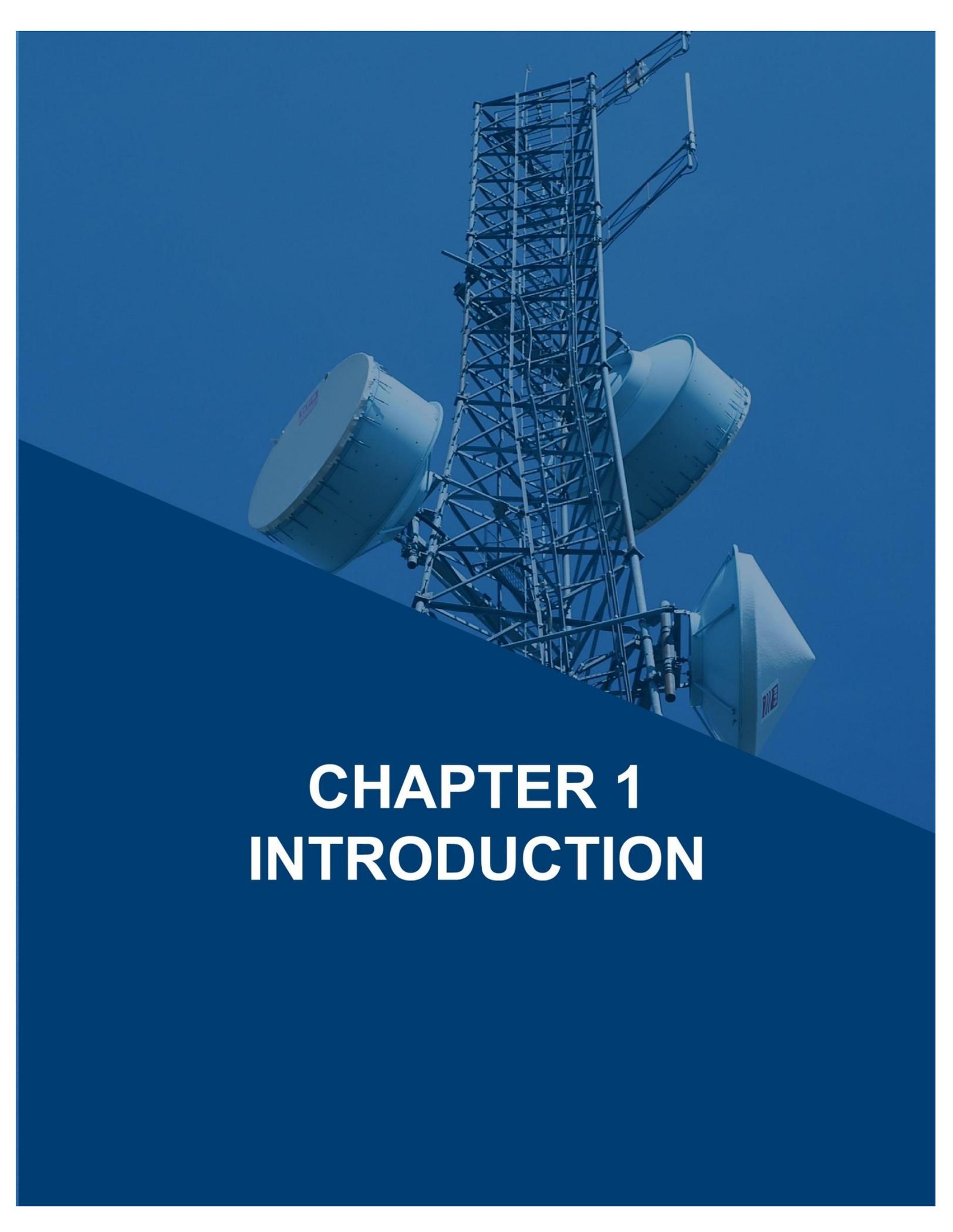
CHAPTER 1
INTRODUCTION

Chapter 1: Introduction

1.1 Background

Today, the success of a state has become dependent on how well it is connected to the global economy and how those connections are leveraged to improve the quality of life for its residents, the sustainability and growth of its businesses, the delivery of services by its institutions, and the overall economic development of its communities. As noted in the National Broadband Plan,[5] broadband internet is "a foundation for economic growth, job creation, global competitiveness, and a better way of life."

In this environment, deploying broadband infrastructure, services, and applications, as well as supporting the universal adoption and meaningful use of broadband, are challenging—but required—to advance twenty-first century technologically empowered communities. From healthcare, agriculture, public safety, and tourism, to government, education, libraries, talent, and economic activity, every sector of a community or region requires the power of broadband and related applications to function at the highest capacity.

One thing is clear, broadband and related technologies have transformed nearly every facet of society. While many of these technology changes can be discussed on a global scale, community or regional technology advancements depend on local leadership and action. A critical first step in advancing technology is identifying and understanding the opportunities and barriers to technology advancement and developing a strategy for removing those obstructions and leveraging opportunities.

1.2 Broadband Defined

The term "broadband" has evolved over time as the need for faster speeds and greater bandwidth continue to expand. Broadband, or high-speed internet, is currently defined by the Federal Communications Commission (FCC) as internet service with speeds of at least 25 Mbps download and 3 Mbps upload (25/3 Mbps).[6] Broadband is delivered by two groups of technologies: fixed and mobile. These speeds may be delivered to the end user in a variety of formats, including fiber optic, Digital Subscriber Lines (DSL), cable modem, fixed wireless, satellite, or mobile service.[7]

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[5] https://transition.fcc.gov/national-broadband-plan/national-broadband-plan.pdf

[6] Broadband speeds are often expressed in a fractional form with the download speed of the connection to the left of the forward slash and the upload speed to the right. Typically, broadband speeds are expressed as megabits per second (Mbps). Other variations include Kilobits per second (Kbps), or 1/1,000 of a Megabit, or Gigabits per second (Gbps), or 1,000 Megabits.

[7] https://www.fcc.gov/general/types-broadband-connections#fiber

WHAT IS BROADBAND?

In its simplest form, the term broadband refers to high-speed internet access that is always on and faster than dial-up. However, as demand for faster and faster internet speeds has increased, so too has the speed definition of broadband. Currently, the Federal Communications Commission defines broadband as an internet connection with a download speed of 25 Megabits per second and an upload speed of 3 Megabits per second. Fixed, terrestrial broadband is high-speed data transmission to homes and businesses that is designed for permanent, stationary use and includes fiber, cable, DSL, and fixed wireless technologies.

Fixed Wireless
Broadband service provided between towers and customers using radio waves. Primarily found in rural areas.

Mobile Broadband
High-speed internet designed for use on-the-go with seamless connectivity from one location to another.

Satellite
Broadband service provided by satellites orbiting the earth. Satellite service can be impacted by line-of-sight and latency.
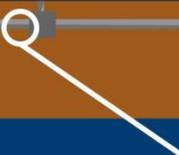
Cable
Internet provided by a cable television company over a mixed coaxial and fiber-optic network.

DSL
Digital-subscriber line (DSL) is broadband delivered over a mixed network of fiber and traditional copper phone lines.

Fiber
Fiber-optic service uses transparent glass fibers to carry data across distances. Some customers can received fiber connections directly to their home, but fiber is also used to transport data from communities to the broader internet.

1.2.3. Unserved and Underserved

For the purposes of this roadmap, areas "unserved" by fixed broadband are those without access to fixed, terrestrial broadband service at a speed of 10/1 Mbps. Additionally, "underserved areas" are those where service is available with speeds between 10/1 Mbps and 25/3 Mbps.

1.2.4. Broadband Adoption

Broadband adoption is different than broadband access and is defined as subscribing to internet service. A household is defined as adopting broadband if its residents have such a connection, while an individual is considered a home broadband adopter if she/he lives in a household that is connected to such a broadband service (even if that individual does not, personally, use that broadband service).

	10 Mbps	25 Mbps	1 Gbps
Estimated time to download 2 GB file:	29 minutes	11 minutes	17 seconds
Devices Supported:	1 or 2	3 to 5	10+
Activities Supported:	Web surfing, e-mail, & moderate HD streaming	Heavy HD streaming, video conferencing, large file transfer	Extreme HD, real-time streaming, frequent & huge file transfers
Primarily used by:	Homes & Some Businesses	Homes & Businesses	Businesses & Some Homes

BROADBAND SPEEDS EXPLAINED

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1.3 Michigan's Broadband History

The State of Michigan has worked to address broadband challenges over the years. The graphic below provides a snapshot of the state's broadband-related milestones. A full description of each milestone is included in Appendix B.

MICHIGAN'S BROADBAND HISTORY
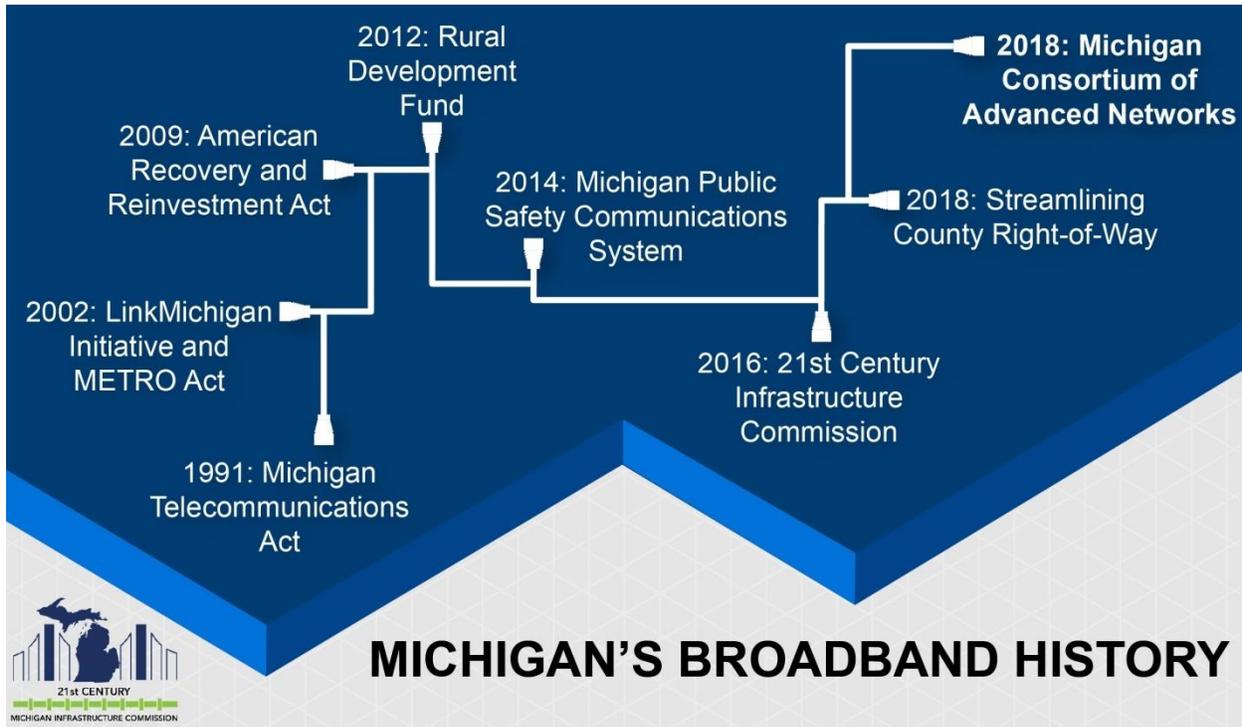
CHAPTER 2
BROADBAND IN
MICHIGAN

Chapter 2: Broadband in Michigan

2.1 Broadband Access and Availability

Broadband access refers to the infrastructure that enables a high-speed internet connection. Broadband is delivered to a user via several technology platforms including cable, digital subscriber line (DSL—through a phone line), fiber optics, fixed wireless, mobile wireless, and satellite. While these are currently the primary methods of delivery, new innovations and technologies are being developed that continue to improve the efficiency and speed of connectivity.

2.1.1. Access by Speed

Over the years, the definition of broadband has changed significantly, as applications require faster speeds and new methods of delivery have been developed. Currently, the Federal Communications Commission (FCC) sets the benchmark for broadband as internet service with advertised speeds of at least 25/3 Mbps. By this definition, approximately 381,000 households in Michigan currently lack access to broadband service. The table provides the estimated number of households unserved by fixed, terrestrial broadband at the three speed tiers that are the focus of the goals of this roadmap. [8]

Estimated Residential Broadband Service Available Via Fixed Terrestrial Platform in Michigan[9]*		
Download/Upload Speed	Unserved Households	Percent Households Unserved
At Least 10 Mbps/1 Mbps	122,000	3.2%
At Least 25 Mbps/3 Mbps	381,000	9.9%
At Least 1 Gbps	3,706,000	95.7%

*Household availability percentages are cumulative of lower speed tiers.

The percentage of households served at 25/3 Mbps varies greatly across the state. For example, an estimated 36.9% of households in Barry County have access to broadband at this speed, while 94% of those in Washtenaw County have access to this speed or faster.[10] Ninety-seven percent, or 368,000 of the 381,000 unserved households, are found in areas defined as rural by the U.S. Census, particularly in Michigan's Upper Peninsula and areas outside of major metropolitan areas and their suburbs.

The map on the following page shows areas of Michigan that have access to broadband service of at least 25/3 Mbps and 10/1 Mbps. Areas shown in white are those unserved by broadband.

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[8] Data displayed in map form and as tabular data is developed from a combination of direct provider outreach and data collection, FCC Form 477 filings, State Broadband Initiative datasets, and independent research conducted by Connect Michigan, a non-profit that has researched broadband in Michigan since 2009 (www.connectmi.org). As such, broadband availability at an exact address location cannot be guaranteed, and the aggregate household availability statistics are estimates made using the most up-to-date and accurate information as is available.

[9] https://michigan.connectednation.org/wp-content/uploads/sites/13/2018/02/mi_sept_2017_table_1.pdf

[10] More county information can be found at: https://michigan.connectednation.org/wp-content/uploads/sites/13/2018/02/mi_sept_2017_table_5.pdf

Fixed, Non-Mobile
Broadband Service Inventory
for the State of Michigan

Advertised Speeds of at Least
10 Mbps Downstream and
1 Mbps Upstream

Published
September 27, 2017

Legend

— Interstate
— US Road
— · — County Boundary

Water

Broadband at Least 25 Mbps
Download/3 Mbps Upload

Broadband at Least 10 Mbps
Download/1 Mbps Upload

Unserved Area

Data displayed on this map is developed from a combination of direct provider outreach and data collection, FCC Form 477 filings, State Broadband Initiative datasets, and independent research conducted by Connect Michigan. As such, broadband availability at an exact address location cannot be guaranteed. Satellite broadband services may also be available.

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N

0   12.5   25   50
Miles

To put Michigan's broadband availability in perspective, the following chart shows the household availability of 10/1 Mbps and 25/3 Mbps broadband across the country.[11] Michigan ranks 30th among other states and territories for broadband availability at 25/3 Mbps.

Households Unserved by Broadband at 10/1 Mbps and 25/3 Mbps by State

■ Unserved at 10/1 Mbps
■ Unserved at 25/3 Mbps

US Virgin Islands
Connecticut
New Jersey
Washington
District of Columbia
Rhode Island
New York
Massachusetts
Maryland
Delaware
Utah
Nevada
Florida
Hawaii
Colorado
Pennsylvania
California
Illinois
New Hampshire
North Carolina
Texas
Minnesota
Ohio
North Dakota
Tennessee
Oregon
Georgia
Virginia
Iowa
3.2%   6.7%   >Michigan<
Maine
Kansas
Puerto Rico
Nebraska
Idaho
South Carolina
South Dakota
Indiana
Wisconsin
Vermont
Kentucky
Arizona
Louisiana
Missouri
Alabama
West Virginia
New Mexico
Alaska
Wyoming
Arkansas
Montana
Oklahoma
Mississippi

0%   5%   10%   15%   20%   25%   30%

_____

[11] Data for American Samoa, Guam, and the Northern Mariana Islands are not shown.

2.1.2. Competition

Broadband service deployment, advancements, and upgrades typically respond to market forces. Internet connectivity can be delivered via several technology platforms, and ISPs offering service via these platforms often compete with each other in areas with high household density. This competition wanes, however, as household density decreases in rural areas due to a smaller, more dispersed market. Increased competition typically equates to more service options and greater affordability for consumers. The table provides the estimated number of households that have access to only one fixed, terrestrial broadband provider at 10/1 Mbps and 25/3 Mbps. As shown, nearly one-half of Michigan's households have access to only one broadband provider offering speeds of at least 25/3 Mbps.

Estimated Households in Michigan with Access to Only One Fixed, Terrestrial Broadband Provider by Speed Tier		
Download/Upload Speed	Households with Only One Provider	Percent of Households with Only One Provider
At Least 10 Mbps/1 Mbps	601,500	15.5%
At Least 25 Mbps/3 Mbps	1,872,400	48.3%

ISPs offering cable internet do not typically compete directly with other cable companies to provide service.[12] Similarly, DSL companies do not typically compete with one another;[13] however, cable and DSL companies do compete for customers. Fiber and fixed wireless companies often compete with each other, as well as with cable and DSL, as they are not typically anchored or enclosed by political or other boundary types.

Cable providers serve the largest proportion of households with 25/3 Mbps service (87.5%). Fixed wireless service, technology found primarily in rural areas, provides an option for broadband service, but speeds are typically less than that of wired broadband types. Fixed wireless service provides 25/3 broadband to approximately 3.2% of households in the state.

2.1.3. Broadband Growth

While broadband availability at 25/3 Mbps rose sharply until 2012, growth in household availability of service at both 10/1 Mbps and 25/3 Mbps has remained relatively flat in the last five years (as shown in the following chart).

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[12] This is typically due to local franchise agreements between municipalities and cable providers: https://www.michigan.gov/mpsc/0,4639,7-159-49641---,00.html

[13] DSL providers are typically traditional phone service providers that have added broadband service to their offerings. These providers typically provide service within the long-established telephone exchange boundaries and their service often do not overlap one another: https://www.michigan.gov/mpsc/0,4639,7-159-16372_17094-392899--,00.html

Household Availability of Broadband Over Time by Speed

Legend: —— 10/1 Mbps —— 25/3 Mbps
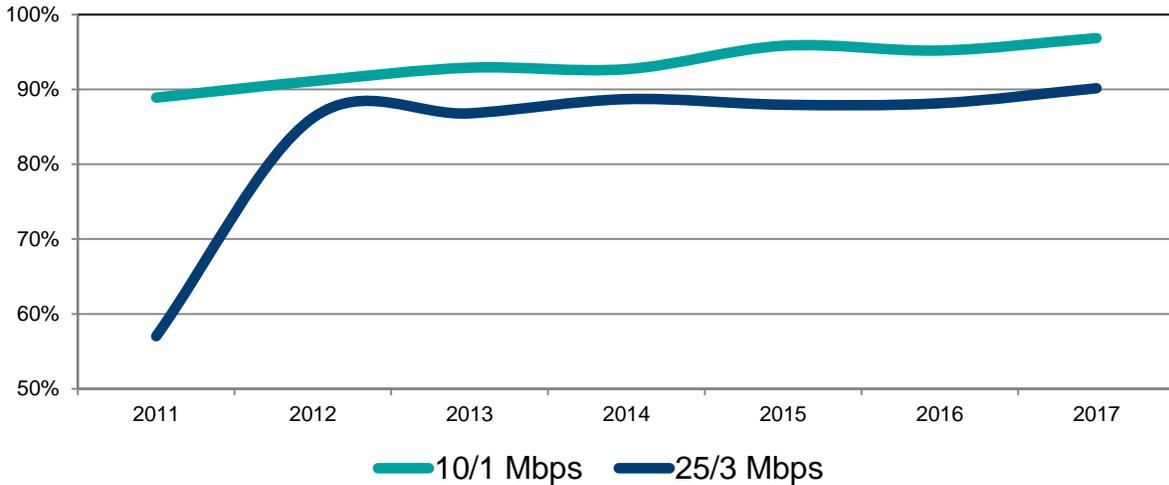
Rural broadband availability has not kept pace with availability in non-rural areas. The following chart compares the non-rural (e.g. Detroit metro area, Lansing, Grand Rapids, etc.) and rural availability of 10/1 Mbps and 25/3 Mbps broadband. Approximately 93.7% of households in non-rural areas have access to broadband with a speed of at least 25/3 Mbps while only 75.3% of rural households have access to similar connections.
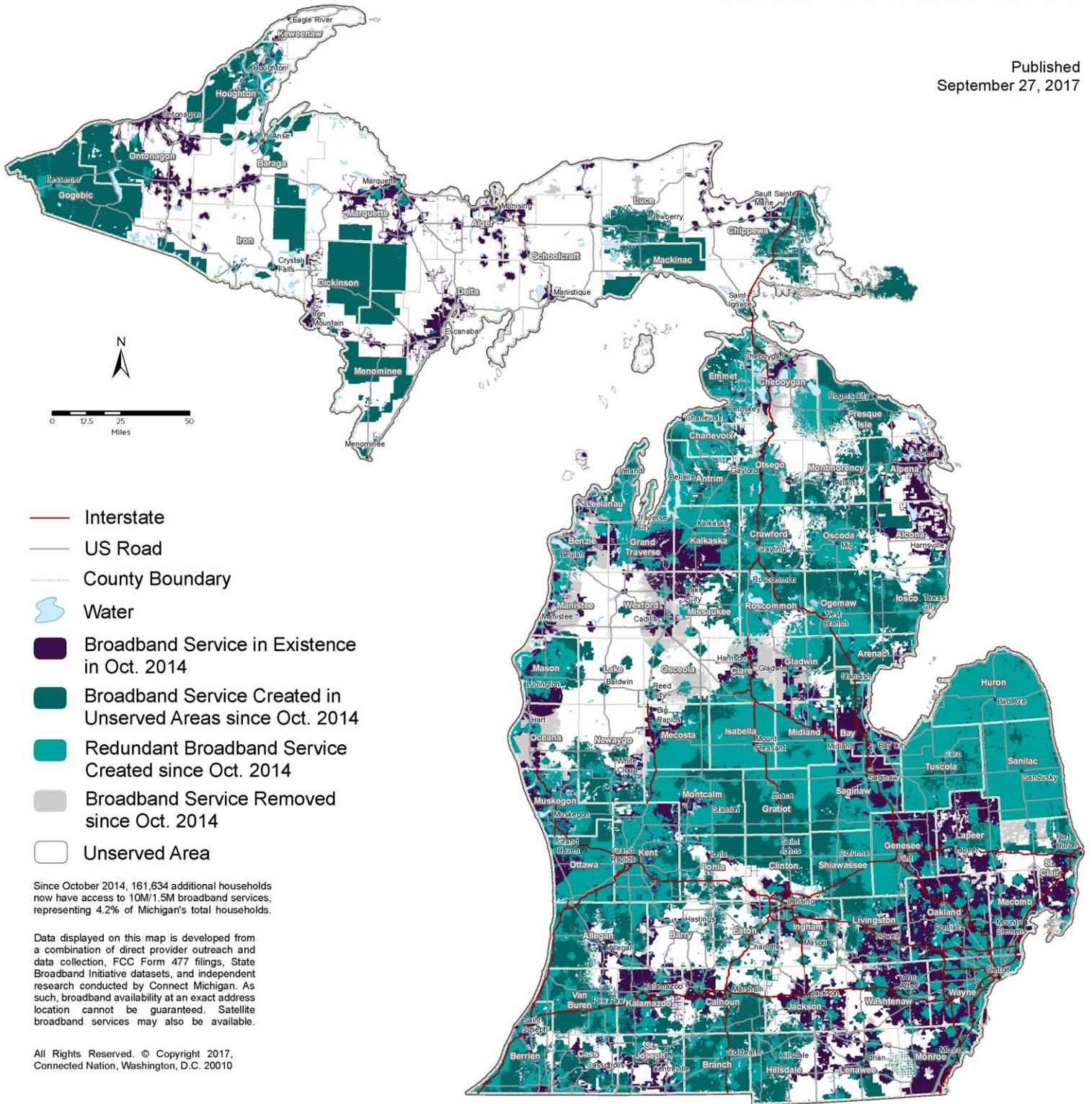
Rural and Non-Rural Household Availability by Speed as of 2017

Legend: ■ Rural ■ Non-Rural
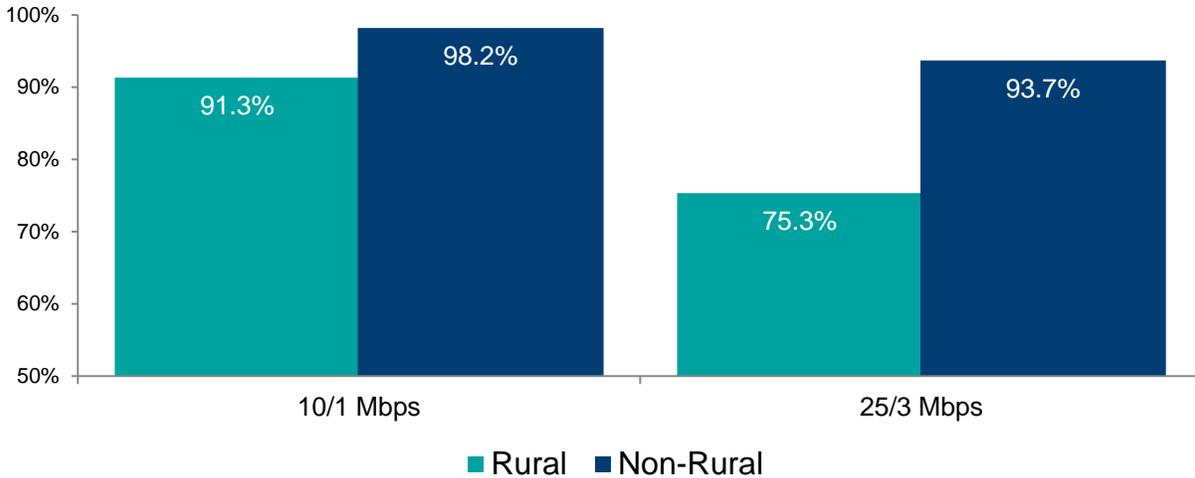
The maps on the following pages show areas of the state that have experienced broadband service expansion at the 10/1.5 Mbps and 25/3 Mbps speed tiers between 2014 and 2017. The maps show areas where the indicated speeds were available in 2014 (and continue to be available); where service was created in previously unserved areas since 2014; where broadband service was created in areas where such service already existed in 2014; and areas where service was removed between 2014 and 2017. White areas on the map represent areas of the state that do not yet have access to broadband service at 10/1 Mbps and 25/3 Mbps, respectively. Areas where service was removed between 2014 and 2017 represent potential areas of opportunity for expansion of service.
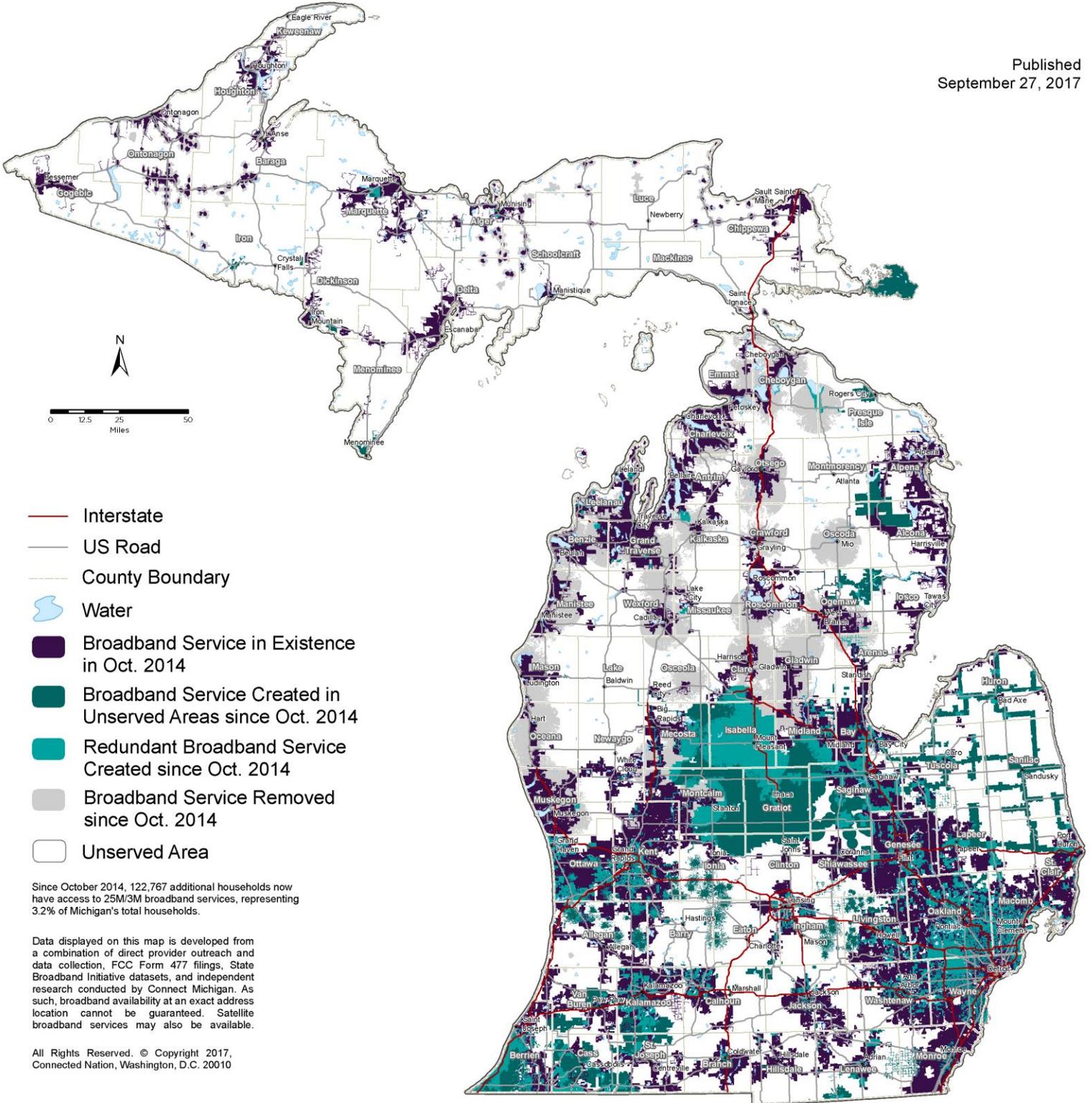
Changes in Fixed, Non-Mobile 10/1.5 Mbps Broadband Service since October 2014

N

0   12.5   25   50
Miles

Legend

— Interstate

— US Road

----- County Boundary

Water

Broadband Service in Existence in Oct. 2014

Broadband Service Created in Unserved Areas since Oct. 2014

Redundant Broadband Service Created since Oct. 2014

Broadband Service Removed since Oct. 2014

Unserved Area

Since October 2014, 161,634 additional households now have access to 10M/1.5M broadband services, representing 4.2% of Michigan's total households.

Data displayed on this map is developed from a combination of direct provider outreach and data collection, FCC Form 477 filings, State Broadband Initiative datasets, and independent research conducted by Connect Michigan. As such, broadband availability at an exact address location cannot be guaranteed. Satellite broadband services may also be available.

Changes in Fixed, Non-Mobile 25/3 Mbps Broadband Service since October 2014

Legend

—— Interstate

—— US Road

·—·— County Boundary

Water

Broadband Service in Existence in Oct. 2014

Broadband Service Created in Unserved Areas since Oct. 2014

Redundant Broadband Service Created since Oct. 2014

Broadband Service Removed since Oct. 2014

Unserved Area

N

0   12.5   25   50
Miles

Since October 2014, 122,767 additional households now have access to 25M/3M broadband services, representing 3.2% of Michigan's total households.

Data displayed on this map is developed from a combination of direct provider outreach and data collection, FCC Form 477 filings, State Broadband Initiative datasets, and independent research conducted by Connect Michigan. As such, broadband availability at an exact address location cannot be guaranteed. Satellite broadband services may also be available.

As shown in the maps, many areas of the state have received new 10/1 broadband connections over the last three years, however, expansion of 25/3 Mbps service is less extensive.

It is important to recognize the investment represented by the growth in broadband service over the last several years. Between 2014 and 2017, approximately 160,710 households received new broadband connections at 10/1 Mbps. During this same period, approximately 56,150 households received new broadband connections at 25/3 Mbps. Together this represents an estimated $623 million of investment in broadband expansion since 2014 from private, federal, and other sources.[14]

2.2 Broadband Adoption

Broadband adoption is a different issue from broadband access. While access refers to one's physical connection to the internet, broadband adoption is the choice made by a resident, business, or institution to embrace and use broadband and its related technologies. Broadband adoption cannot occur without having access to high-speed infrastructure. However, even with access to the internet, broadband adoption may not follow.

Several studies have shown that even with access to broadband, residents, businesses, and institutions may not adopt.[15] Barriers to adoption can often include cost (of either a device used to connect or the cost of the connection itself), lack of relevance to the user, or lack of digital literacy (knowledge and skills associated with the use of digital hardware or software). Lack of broadband infrastructure availability is also cited as a barrier.

The broadband adoption gap (the difference between the number of entities with access to broadband and the number of those same entities that actually subscribe to it) can increase or decrease depending on the demographics of a community or region. For example, low-income populations tend to have lower adoption rates than those with higher incomes. This same disparity can be found between age cohorts, geographies, employment status, educational levels, etc. However, regardless of socioeconomic status, demographic composition, or geographic location, every person should have the opportunity to participate in the digital economy.

According to the 2016 United States American Community Survey from the U.S. Census Bureau, 35.1% of Michigan households do not subscribe to fixed, terrestrial broadband service such as DSL, cable, fixed wireless, or fiber.[16] This rate includes households that may or may not have access to broadband connectivity. This places Michigan 34th in broadband adoption among other states and territories (compared in the following chart).
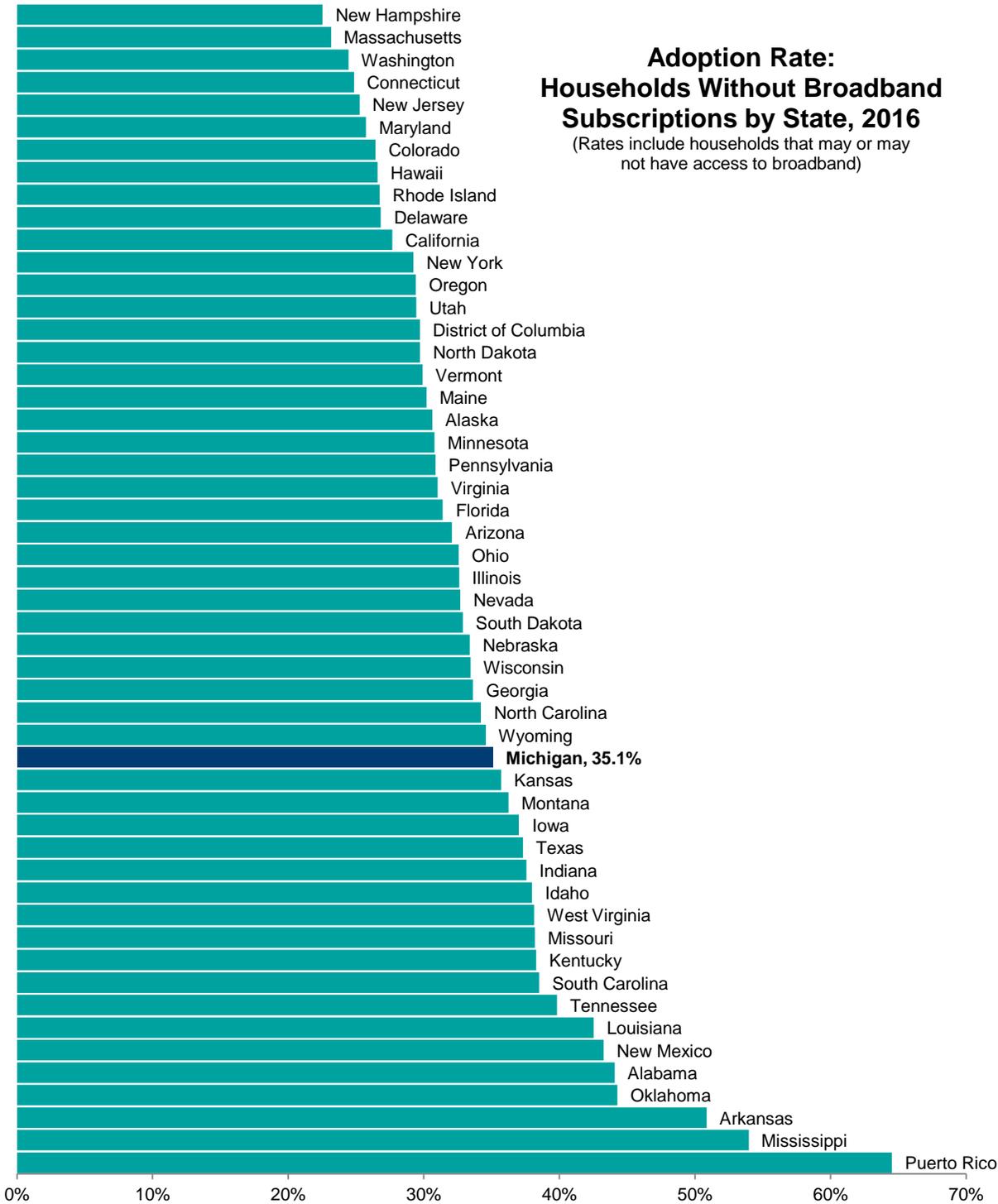
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[14] An estimate of $2,100 per location was used for locations connected at 10/1 Mbps and an estimate of $5,100 per location was used for locations connected at 25/3 Mbps. $2,100 * 160,710 = $337 million and $5,100 * 56,150 = $286 million. Approximately $121 million of this investment is from the FCC's Connect American Fund Phase 2 program. Per location cost estimates were developed using cost models used by the FCC, stated investment over time by individual broadband providers, and broadband grant awards in other states.
[15] "Broadband Infrastructure Alone Does Not Bridge the Digital Divide," *National Digital Inclusion Alliance,* 2017. See also, "Home Broadband 2015," *Pew Research Center,* 2015. Also, Broadband Adoption Rates and Gaps in US Metropolitan Areas," *Brookings Foundation,* 2015.
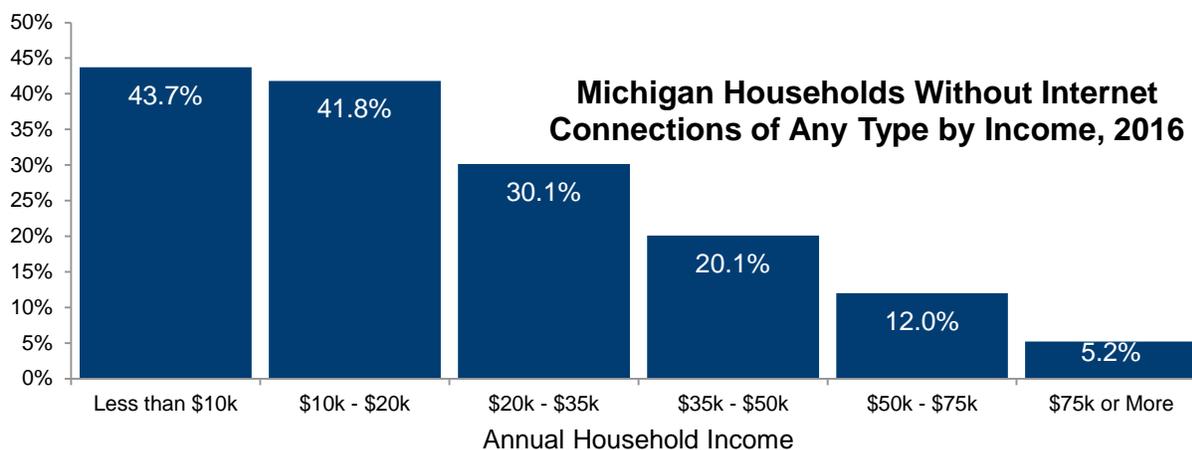[16] https://www.census.gov/

Adoption Rate:
Households Without Broadband
Subscriptions by State, 2016
(Rates include households that may or may
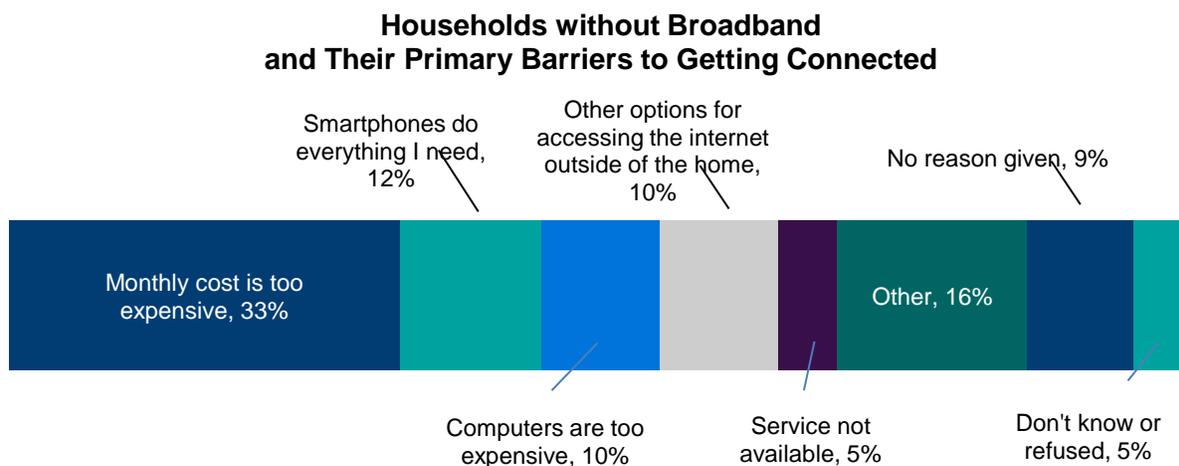not have access to broadband)

New Hampshire
Massachusetts
Washington
Connecticut
New Jersey
Maryland
Colorado
Hawaii
Rhode Island
Delaware
California
New York
Oregon
Utah
District of Columbia
North Dakota
Vermont
Maine
Alaska
Minnesota
Pennsylvania
Virginia
Florida
Arizona
Ohio
Illinois
Nevada
South Dakota
Nebraska
Wisconsin
Georgia
North Carolina
Wyoming
Michigan, 35.1%
Kansas
Montana
Iowa
Texas
Indiana
Idaho
West Virginia
Missouri
Kentucky
South Carolina
Tennessee
Louisiana
New Mexico
Alabama
Oklahoma
Arkansas
Mississippi
Puerto Rico

0%   10%   20%   30%   40%   50%   60%   70%

18

The lack of a home internet connection disproportionately impacts low-income households across the state and country. The following chart shows the percent of households by income without any form of internet access (i.e., fixed, mobile, dial-up, and satellite) in 2016.[17]

Michigan Households Without Internet Connections of Any Type by Income, 2016

Annual Household Income	Percent
Less than $10k	43.7%
$10k - $20k	41.8%
$20k - $35k	30.1%
$35k - $50k	20.1%
$50k - $75k	12.0%
$75k or More	5.2%

As expected, households with lower annual income are those most struggling to connect. In Michigan, 37.3% of households earning less than $35,000 do not have internet access of any kind at home.[18] Michigan ranks 22nd in the nation for broadband adoption among households earning less than $35,000. Adoption rates shown include households that may or may not have access to an internet service provider.

Non-adopting households cite several reasons for their lack of connectivity. The following chart provides information from a Pew Research Center[19] study designed to capture the barriers experienced by households that do not have a broadband connection.

Households without Broadband and Their Primary Barriers to Getting Connected

Barrier	Percent
Monthly cost is too expensive	33%
Smartphones do everything I need	12%
Computers are too expensive	10%
Other options for accessing the internet outside of the home	10%
Service not available	5%
Other	16%
No reason given	9%
Don't know or refused	5%

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[17] US Census Bureau, American Community Survey, 2016
[18] https://www.census.gov/
[19] http://www.pewinternet.org/2015/12/21/3-barriers-to-broadband-adoption-cost-is-now-a-substantial-challenge-for-many-non-users/

The monthly cost of a broadband subscription is the primary barrier to adoption for one-third of currently disconnected households. Other non-adopters say the cost of a computer is prohibitive to obtaining service, while others feel that having a smartphone provides them with all the connectivity they need.
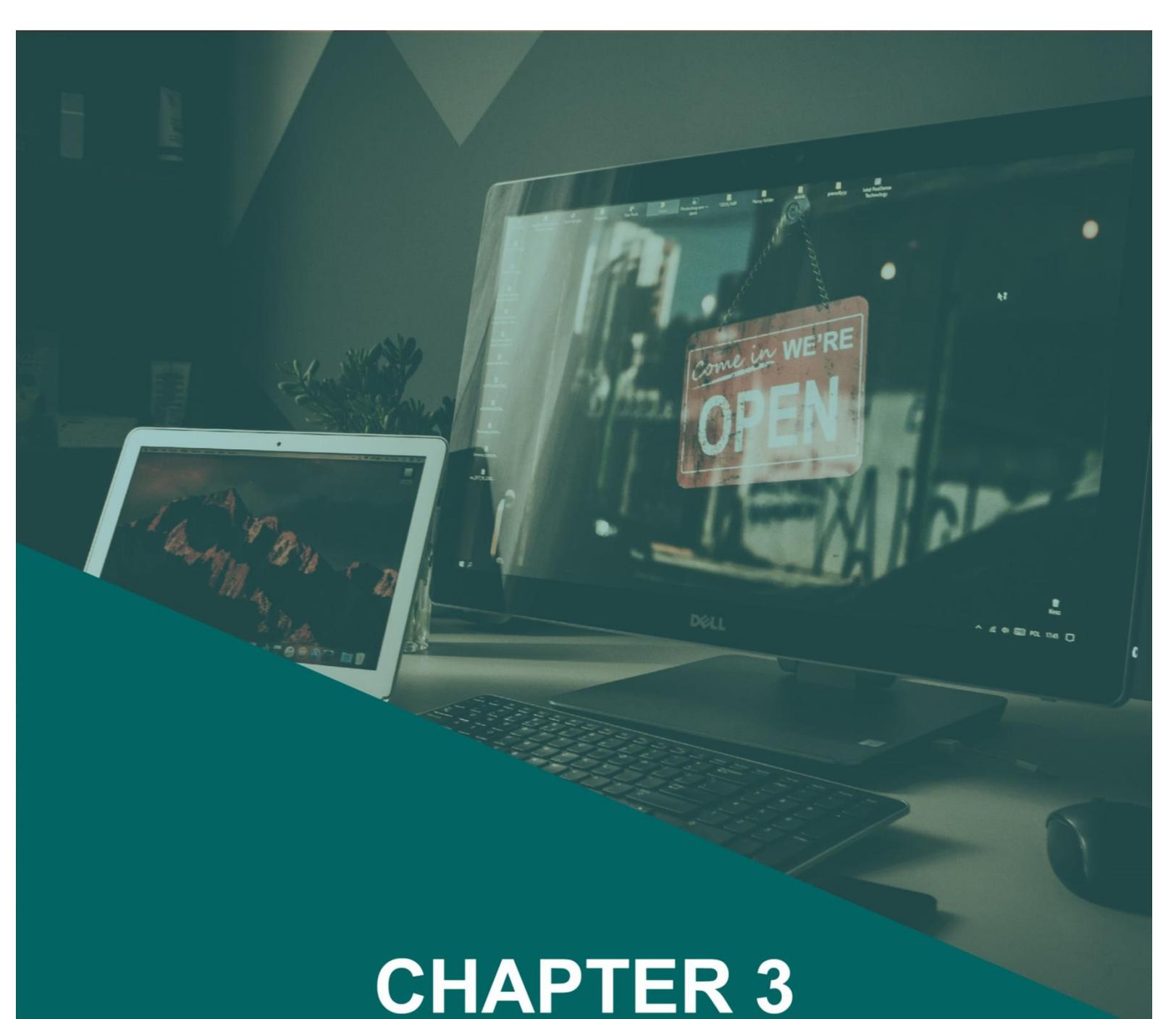
CHAPTER 3
RECOMMENDATIONS

Chapter 3: Recommendations

Improving Michigan's access and adoption of broadband is complex and dynamic due to the nature of the telecommunications industry and rapid advances in technology. Ensuring broadband access for every citizen may take years to implement. Nonetheless, it is important to identify specific actions to facilitate a better-connected Michigan and a "smarter state."[20]

The following are recommended actions to improve broadband access and adoption throughout Michigan. The recommendations provide a comprehensive suite of changes to improve Michigan's broadband landscape and are categorized as either short-term or long-term.

> *Short-Term Actions:* Intended to be completed six- to twelve months after the publication of this report.

> *Long-Term or Ongoing Actions:* Begin soon after the publication of this report, but are likely to take more than twelve months to complete. Additionally, ongoing actions may be those without a definitive end date.

Recommendations Table of Contents

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[20] From the Report of the Michigan 21st Century Infrastructure Commission: "A smarter state improves the quality of a citizen's life by constructing an infrastructure that optimizes IoT technologies to enable potentially radical new work processes, services, and products. This construction relies on evaluating residents' experiences related to, for example, safety, security, health, energy, transportation, and communication. In general terms, the smarter state creates contextualized or demographically aligned service offerings that match the aspirations of the residents, community and society. With the increasing volume of data and insights, the orchestration of context based on data and insights becomes a critical focus of improved governance methodologies."

3.1. Access to Unserved Areas

While Michigan households in rural areas need broadband just as much as their urban neighbors, expanding broadband to areas with fewer households per square mile is more expensive for internet service providers (ISPs). Low population density means that ISPs must use more infrastructure over longer distances, only to connect a smaller number of households. ISPs must either charge more per connection or risk losing on their investment.

The result is that fewer rural residents subscribe to and use home broadband service. According to the Pew Research Center, nearly one in four rural American adults (22%) do not use the internet in 2018, compared to only 8% of urban adults.[21] Similarly, rural adults nationally are less likely than urban and suburban adults to own a computer or smart device, or subscribe to home broadband service.[22] This means that hundreds of thousands of Michigan residents are not connecting to broadband from home.

Access to high-speed infrastructure is necessary for residents, businesses, institutions, and communities to experience the benefits of broadband connectivity. This section provides detailed recommendations and specific action items to extend broadband infrastructure into unserved areas. While these recommendations specifically target the expansion of broadband into currently unserved areas, they are expected to have residual impacts on areas that are already connected. "Unserved areas" are defined as areas of the state lacking broadband service at a speed of 10/1 Mbps.

3.1.1. Support Partnerships for Infrastructure Deployment

Expanding broadband into sparsely populated areas often produces low or zero return on investment for the private sector due to significantly higher deployment costs, lengthier middle-mile networks, or challenging terrain. Partnerships can bridge this gap by bringing multiple assets together to successfully expand broadband access and adoption. A partnership between entities of all types, public, private, and non-profit, can address economic challenges by sharing capital costs and enhancing revenue potential (e.g., finding anchor tenants, aggregating community and regional demand, and removing regulatory barriers to expedite deployment).

MCAN makes the following recommendations to facilitate the creation of successful partnerships for broadband expansion:

Short-Term Actions

3.1.1.S1: The State of Michigan will provide tools to communities to help aggregate demand for broadband service among residents, businesses, and community anchor institutions. Tools could include, but are not limited to, model survey instruments, educational materials, etc. Demand aggregation can help build a business case for expansion and improve return on investment. Tools and best practices should also be developed for communities that help support local broadband adoption efforts and partnerships.

3.1.1.S2: Develop templates and model language for partnerships to facilitate the repeatable, predictable, and expeditious implementation of innovative partnership models for broadband expansion. The model partnership language will establish consistency and best practices for communities and ISPs exploring partnership options and provide guidance to public entities entering into the partnership to be in compliance with state laws and regulations.

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[21] http://www.pewresearch.org/fact-tank/2018/03/05/some-americans-dont-use-the-internet-who-are-they/
[22] http://www.pewresearch.org/fact-tank/2017/05/19/digital-gap-between-rural-and-nonrural-america-persists/ft_17-05-18_ruraltechuse_broadband2/

3.1.1.S3: The State of Michigan will provide tools and models to communities to conduct inventories that aim to identify both public and private assets that could be leveraged to decrease capital costs for deployment as part of a partnership or municipal network deployment. Community or regional assets could include, but are not limited to, vertical assets, conduit, dark fiber, etc. See "Vertical Asset Inventory in Ogemaw County" sidebar.

Long-Term or Ongoing Actions

3.1.1.L1: Develop recommendations to mitigate tax policies that may discourage broadband partnerships (e.g. personal property taxes, etc.).

VERTICAL ASSET INVENTORY IN OGEMAW COUNTY

Ogemaw County has made it easier for ISPs to extend broadband coverage in the area by going upward. A newly completed vertical assets inventory includes barns, poles, towers, water towers, silos, and other tall structures across 14 townships in Ogemaw County. With this information, ISPs can create partnerships to install broadband infrastructure on tall structures in the area and significantly reduce the investment required.

The Ogemaw County Economic Development Corporation (EDC) partnered with Michigan Works! Region 7B Consortium, the Ogemaw County Technology Planning Team, and the Northeast Michigan Council of Governments (NEMCOG) to complete the vertical assets inventory and area map.

The work began in October 2014. The inventory included a survey mailing campaign to call on individual residents and assess the heights of various structures across the area. A grant provided by NEMCOG gave the Ogemaw County EDC access to the technology needed to map the assets once the survey was complete.

"When we have tried to recruit a new ISP or get existing companies to expand, we usually get asked about existing structures that are available to install equipment on, because it will significantly reduce expenses and improve their return on investment," said Mandi Chasey, Director of Business and Economic Services for Ogemaw County. "This will be a huge step in the right direction and something that will benefit everyone in the county."

3.1.2. Connect Community Anchor Institutions

Community anchor institutions (CAIs) include entities such as government offices, schools, libraries, healthcare facilities, higher education institutions, public safety agencies, and others. Robust use of connectivity is critical for CAIs to provide support services to communities. Given this, partnerships with CAIs are an excellent opportunity for ISPs to bring high-capacity networks into a community or region, thereby increasing infrastructure and connectivity to homes and businesses nearby.

MCAN makes the following recommendations to spur additional investment in communities and ensure CAIs have the connectivity they need:

Short-Term Actions

3.1.2.S1: Create an inventory of the location and current connectivity of Michigan's CAIs. Connectivity information should be made public to communities and interest groups where available and appropriate. ISPs could then identify additional connectivity needs and how best to serve the state's critical institutions. Data collection efforts should be undertaken in conjunction with state agencies, local communities, and industry associations affiliated with the type of CAI from which data is being requested. Data should be collected in ways that minimize the impact of the collection to the operations of the CAI and provide proper data security where necessary. The intent of such a database is to facilitate improved communication and coordination between CAIs and ISPs to find connectivity solutions and opportunities that may not have been known before. Additionally, CAI infrastructure could be leveraged to improve connectivity in the surrounding community.

3.1.2.S2: Conduct a statewide school technology inventory in partnership with educators, administrators, policymakers, the Michigan Department of Education, non-profit education technology experts, and others. The inventory should provide data on current connectivity and technology tools available and currently being used by schools. The inventory would identify gaps and technology capacity issues of schools where resources and assistance can be directed. The inventory should build on the successes of the Michigan Technology Readiness Assessment Tool (MTRAX)[23] and identify key takeaways and next steps for closing the Homework Gap.[24]

3.1.2.S3: Assess and monitor the status of the Educational Broadband Spectrum (EBS) in Michigan communities, as well as any state or federal policies that could affect access to this bandwidth. Though most of this bandwidth is currently in use by private entities, changes in technology and policy decisions may make this wireless broadband spectrum more accessible to Michigan schools and communities in the future. It is important to continue to monitor the status of changes in both technology and policy that could affect the ability of Michigan schools to better utilize this bandwidth. To help ensure that Michigan schools can access all available options to incorporate the fastest, most affordable broadband service into their curricula, MCAN supports efforts to expand the effective use of EBS across the state and the nation.

Long-Term or Ongoing Actions

3.1.2.L1: Develop and provide educational materials to rural, unserved, and underserved CAIs with information on the importance of connectivity for their sector and how broadband service can enhance and improve the efficiency of the services they provide to their patrons, constituents, and the public. Materials should also include information on how CAIs can help identify and coordinate sustainable community or regional partnerships.

3.1.3. Improve Broadband Data Collection and Utilization

Many argue that current broadband mapping is insufficient to pinpoint the actual gaps in home broadband availability. Better understanding the gaps in broadband service, speed, and competition is critical to making informed and targeted decisions for any initiative aimed at improving connectivity for Michigan's residents, businesses, institutions, and communities.[25] Accurate data helps communities and ISPs better understand gaps so that appropriate plans for connectivity can be made.

MCAN makes the following recommendations to improve the accuracy and usefulness of broadband service information:

Short-Term Actions

3.1.3.S1: Continue to gather, refine, and validate broadband coverage data available from the FCC to produce a more accurate and granular map of broadband service in Michigan. ISPs can refine and improve the data by cooperating with the state or organizations working on behalf of the state to share broadband availability data at sub-census block granularity while not revealing information that the providers consider to be competitively sensitive.

3.1.3.S2: Develop a set of on-the-ground validation techniques to corroborate and refine broadband coverage information based on testing and observation in locations across the state

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[23] http://22itrig.org/activities/mtrax/

[24] The "homework gap," refers to the difficulty students experience completing homework when they lack internet access at home, compared to those who do.

[25] See Appendix E for more discussion on this topic.

where broadband coverage is likely to be over or understated.[26] These techniques can then be shared with localities, CAIs, colleges, and universities that can partner with state-authorized experts to carry out the broadband data validation plans.

3.1.3.S3: Design a competition that would offer community colleges, universities, and other interested parties the opportunity to design tools by which residents, businesses, and institutions can test their fixed and mobile connection speeds. Data would be submitted to a central repository that would then be used to validate coverage information submitted to the FCC by ISPs through the Form 477 data collection process and better inform the state's broadband coverage mapping efforts.

> **STATE OF MICHIGAN DATA LEADERSHIP**
>
> The State of Michigan is well positioned and willing to be the central data owner and custodian for all critical shared data for Michigan asset management:
>
> Data security - All State of Michigan cybersecurity programs are established and operational for perimeter security, monitoring, intelligence exchange, and infrastructure hardening. Additionally, the State of Michigan has a comprehensive secure data storage, replication, backup, and disaster recovery program. Finally, all state systems have an enhanced attention to and investment on all levels of federal data security compliance.
>
> Data governance - Governor Snyder established an Enterprise Information Management (EIM) program to provide a common legal framework for data sharing. EIM protects the privacy and security of information while maximizing the shared value of data integration. The EIM also provides a network of chief data stewards for each asset management business theme to ensure data quality and consistency.
>
> Shared services - The state has common data sharing and information management tools that provide consistency across the enterprise at a sustainable cost. For asset management, the SOM has an enterprise Master Data Management stewardship tool called the Michigan Geographic Framework. With this tool, all participating data providers maintain local control of the data while an integrated asset management GIS map is created for shared use.

Long-Term or Ongoing Actions

3.1.3.L1: Monitor changes to the data collection methods and standards administered by the FCC and ensure the state is adapting its data validation and analysis methods accordingly. The State of Michigan will continue to advocate at the federal level for more granular and timely data as the FCC and National Telecommunications and Information Administration (NTIA) continues to modify the current data collection and publication methodologies.

3.1.4. Increase Backhaul Capacity

Backhaul capacity, sometimes referred to as "middle-mile" internet access, is a system of infrastructure that carries telecommunications traffic to and from centralized servers around the world and connects it to individual households and businesses. To borrow a comparison from the water utilities industry, a home has a pipe providing water ("last-mile" service) connected to a larger water main ("backhaul" or "middle-mile"), which then connects to the water source (the internet). To ensure all Michigan residents have access to high-speed internet, the state must examine and improve the availability of backhaul infrastructure.[27] Backhaul infrastructure can take several forms, including fiber-optic cables and point-to-point wireless connections. The private sector has invested heavily in backhaul connectivity in Michigan, but ISPs in some rural areas struggle to access the necessary middle-mile bandwidth.

MCAN makes the following recommendations to improve backhaul capacity in Michigan:

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[26] White papers on Connected Nation field validation methodologies available here: http://connectmycommunity.org/wp-content/uploads/2018/07/20112206_Field_Validation_Brief_FINAL.pdf and http://connectmycommunity.org/wp-content/uploads/2018/07/Michigan.pdf

[27] See Appendix D for more discussion on this topic.

Short-Term Actions

3.1.4.S1: Identify and coalesce telecommunications infrastructure data to a single point, building on the work of the Michigan Infrastructure Asset Management Pilot Project.[28] Telecom infrastructure data, including fiber backhaul, conduit, and others, currently resides in several forms across several state agencies including DTMB, Michigan Department of Transportation (MDOT), Michigan Ecomomic Development Corporation (MEDC), MPSC, and the Michigan Utility Notification Center (MISSDIG)[29], among others. Similar data also exists with school districts, municipalities, etc. The state should designate a common repository for this data and work with agencies to coordinate a single access point (see State of Michigan Data Leadership sidebar). Infrastructure data is different than broadband coverage data addressed previously in Section 3.1.3. Coverage data refers to consumer availability information while infrastructure data refers to actual route information for right-of-way planning and construction.

3.1.4.S2: Conduct an analysis of the public and private backhaul accessibility and capacity in the state. Such an assessment should include an examination of both "lit" backhaul (accessible to last-mile ISPs) and "dark" infrastructure (that which is currently in place but does not provide connectivity to any last-mile ISPs), as well as the locations of the nodes where last-mile providers can connect to that backhaul. Considerations of proprietary or sensitive information sharing would need to be included to protect private data. Such an assessment would complement the existing data identified in 3.1.4.S1.

Long-Term or Ongoing Actions

3.1.4.L1: Create incentives for backhaul providers to install dark fiber and maximize the number of strands deployed during construction projects to increase capacity. These could include tax incentives on fiber infrastructure and improving right-of-way access along state highways and other major transportation routes to streamline and encourage backhaul fiber construction in those rights-of-way. Backhaul providers should submit planned ROW projects to the Michigan Infrastructure Council to facilitate coordinated planning in the ROW.

3.1.4.L2: Explore opportunities to better leverage existing publicly funded fiber networks (e.g., Merit Network, municipal and other public networks, etc.) and new models of fiber deployment in rural areas (e.g., electric utilities and cooperatives, etc.) to expand backhaul capacity. This could also include staying abreast of future best practices and engineering breakthroughs to ensure the best backhaul options are being used; convening regular discussions with telecommunications representatives and engineers to discuss new backhaul options; and designating engineering researchers from Michigan state colleges and universities to determine the best options for increasing backhaul accessibility, particularly to rural and remote portions of the state. Additionally, existing publicly funded infrastructure should be considered when communities, ISPs, and institutions are developing partnerships for infrastructure deployment.

3.1.5. Improve the Workforce Pool for the Telecommunications Industry

Broadband access can only be improved if ISPs have enough employees with the right mix of technical and professional skills. ISPs need engineers, surveyors, line technicians, and skilled workers to use heavy equipment to dig trenches, install aerial telecommunications lines, and maintain those lines once they have been installed. Many ISPs offer their own internal training

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[28] https://www.michigan.gov/documents/snyder/asset_management_report_621264_7.pdf

[29] http://www.missdig.org/

opportunities to attract and educate their workforce.[30] Nonetheless, skilled workers are in short supply or are choosing to work in other parts of the country.

To increase and maintain broadband access, Michigan must take steps to increase the number of eligible skilled workers in the telecommunications industry. To that end, MCAN makes the following recommendation:

Short-Term Actions

3.1.5.S1: Leverage Michigan's Marshall Plan for Talent[31] and Project Rising Tide[32] programs to identify opportunities to train residents to meet the workforce needs of ISPs. The Marshall Plan for Talent will invest approximately $100 million for new programs to change the way Michigan invests, develops, and attracts talented workers, including those in the information technology and construction sectors. The Marshall Plan will create certification programs based on competencies that businesses need; provide professional development grants for current employees; encourage competency-based education to partner schools with employers; strengthen partnerships with colleges and universities; hire more career navigators to direct students toward rewarding careers in fields that interest them; and offer scholarships and stipends for students training to work in high-demand fields. Telecommunications is the epitome of a high-demand field of work, making ISPs ideal candidates for this plan. The Marshall Plan could be leveraged to improve the ISP workforce by:

- Developing training programs for the skills needed by job-seekers that are often required or highly sought out for telecommunications technicians, such as Class A Commercial Driver's Licenses, construction management, line technicians, equipment installation and repair, heavy equipment operators, etc. Doing so will reduce the amount of time and resources that ISPs must spend preparing their new hires, allowing them to get to work faster.
- Improving the communication between ISPs looking for talent and Michigan's universities, colleges, and technical training centers. ISPs need a talented workforce from which to hire, and training facilities need to know where to send graduates and which skills they will need on the job. By improving communication and coordination between trainers and employers, Michigan-grown talent can obtain the skills they need to get a job in the telecommunications industry.
- Developing—in partnership with ISPs and state colleges, universities, or other training institutions—tools such as online education programs or certifications by which potential Michigan employees can be trained in the technical skills they need to work for ISPs and be prepared for a job in the telecommunications industry.

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[30] https://www.hrexchangenetwork.com/hr-talent-management/articles/comcast-university-using-training-to-become-a-top

[31] https://www.michigan.gov/ted/0,5863,7-336-85008---,00.html
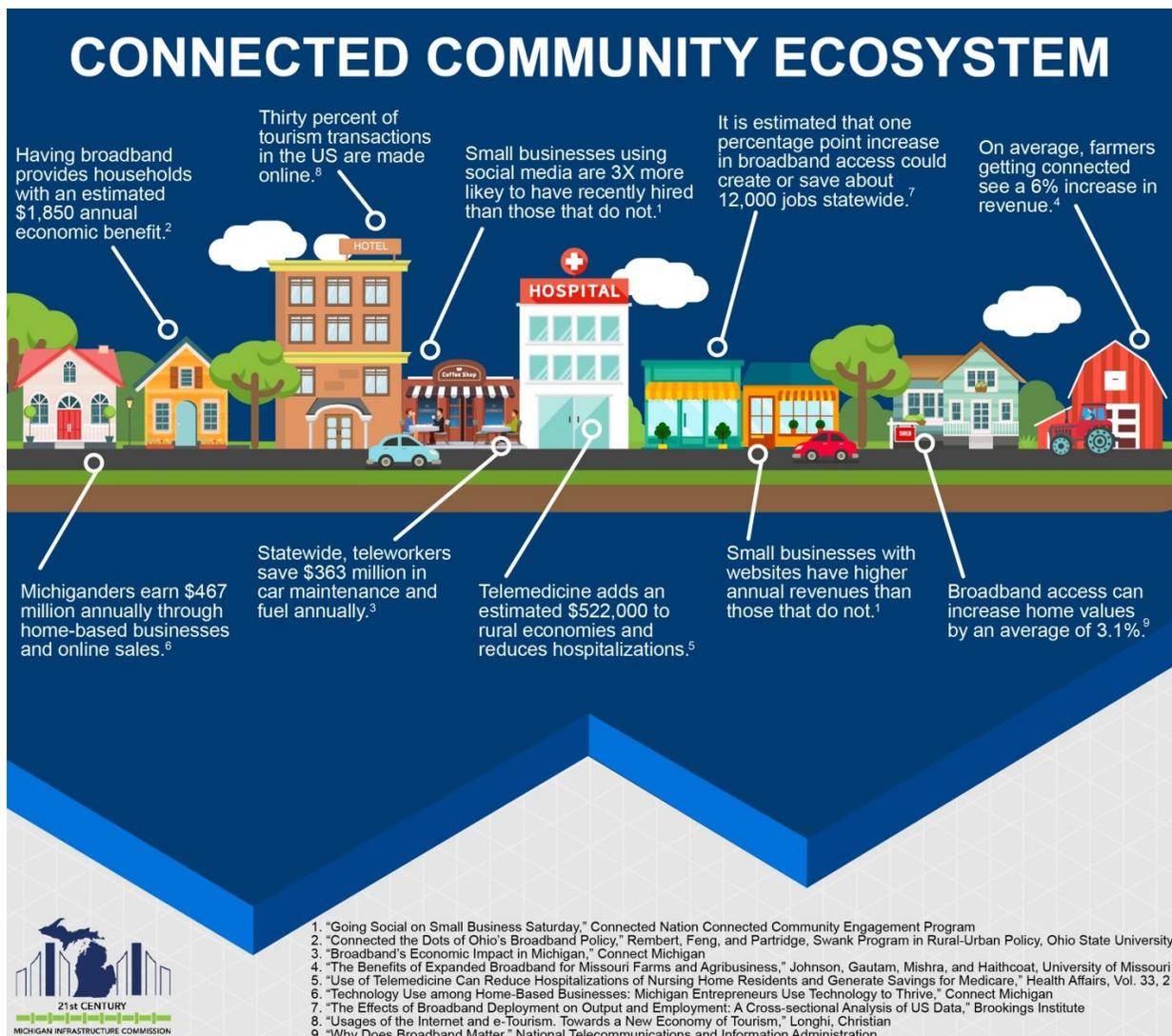
[32] http://mirisingtide.org/

3.2. Increase Broadband Adoption

In addition to growing infrastructure and connectivity, it is also imperative that residents, businesses, and institutions can afford broadband access, are aware of the benefits of connectivity, and are digitally literate and able to use technology to improve their quality of life.

Broadband adoption has significant economic impacts. Households with a broadband connection are shown to experience an estimated annual economic benefit of $1,850[33]. If the estimated 1,363,000 households that do not currently subscribe to broadband in Michigan were connected, the state could experience a potential $2.5 billion economic benefit. Broadband adoption also impacts the business community.

CONNECTED COMMUNITY ECOSYSTEM

Thirty percent of tourism transactions in the US are made online.[8]

Having broadband provides households with an estimated $1,850 annual economic benefit.[2]

Small businesses using social media are 3X more likey to have recently hired than those that do not.[1]

It is estimated that one percentage point increase in broadband access could create or save about 12,000 jobs statewide.[7]

On average, farmers getting connected see a 6% increase in revenue.[4]

Michiganders earn $467 million annually through home-based businesses and online sales.[6]

Statewide, teleworkers save $363 million in car maintenance and fuel annually.[3]

Telemedicine adds an estimated $522,000 to rural economies and reduces hospitalizations.[5]

Small businesses with websites have higher annual revenues than those that do not.[1]

Broadband access can increase home values by an average of 3.1%.[9]

1. "Going Social on Small Business Saturday," Connected Nation Connected Community Engagement Program
2. "Connected the Dots of Ohio's Broadband Policy," Rembert, Feng, and Partridge, Swank Program in Rural-Urban Policy, Ohio State University
3. "Broadband's Economic Impact in Michigan," Connect Michigan
4. "The Benefits of Expanded Broadband for Missouri Farms and Agribusiness," Johnson, Gautam, Mishra, and Haithcoat, University of Missouri
5. "Use of Telemedicine Can Reduce Hospitalizations of Nursing Home Residents and Generate Savings for Medicare," Health Affairs, Vol. 33, 2
6. "Technology Use among Home-Based Businesses: Michigan Entrepreneurs Use Technology to Thrive," Connect Michigan
7. "The Effects of Broadband Deployment on Output and Employment: A Cross-sectional Analysis of US Data," Brookings Institute
8. "Usages of the Internet and e-Tourism. Towards a New Economy of Tourism," Longhi, Christian
9. "Why Does Broadband Matter," National Telecommunications and Information Administration

The following are detailed recommendations and specific action items for improving broadband adoption throughout the state.

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[33] "Connected the Dots of Ohio's Broadband Policy," Rembert, Feng, and Partridge, *Swank Program in Rural-Urban Policy,* The Ohio State University, April 2017

3.2.1. Eliminate Cost Barriers to Broadband Adoption

The monthly cost of internet service can be a significant barrier to home broadband adoption. According to the NTIA,[34] "[l]ow-cost broadband service is more readily available in some geographic areas than others. In areas where service costs are high, broadband adoption programs may be able to negotiate discounts for program participants with local service providers, or may pay the provider to cover all or a portion of program participants' subscriptions." Improving the affordability of broadband can lead to a significant improvement in broadband adoption, which increases economic activity in communities across the state.

Additionally, a series of federal and private programs offering low-cost broadband services to qualifying customers is already available nationwide. Such programs include the FCC's Lifeline Program,[35] which provides a $9.25 per month subsidy for the purchase of voice telephone service, including mobile, and broadband (as of December 2, 2016) by low-income households. To receive the benefit of Lifeline, consumers must receive service from a participating provider that is an Eligible Telecommunications Carrier (ETC). Unfortunately, many low-income consumers are unaware that these services may be available. Additionally, some ISPs offer subscription programs that offer low-cost broadband service for qualifying low-income households. In Michigan, these programs include:

> Lifeline
>
> Comcast Internet Essentials
>
> Access from AT&T
>
> Spectrum Internet Assist (Charter)

The Universal Service Administrative Company (USAC) estimates that the Lifeline program had 411,000 subscribers in Michigan in 2017 out of an estimated 1.24 million eligible households in the state[36]. Additionally, Comcast's Internet Essentials program has 50,000 households subscribed.

The monthly cost of home broadband service is not the only financial barrier to home broadband adoption. Without a device through which a person can access the internet, such a service is meaningless. The type of device can also have a major impact on the individual's ability to use the internet in a meaningful way; while a smartphone is useful for communication or social media, it is not ideal for filling out a job application, doing homework, or working from home. For these tasks, an individual often needs a computer, which can be costly.

MCAN makes the following recommendations to reduce the affordability barrier to home broadband adoption:

Short-Term Actions

3.2.1.S1: Develop a grassroots outreach and education strategy targeting households experiencing broadband affordability issues to provide information on programs able to assist with the cost of broadband service. Outreach efforts should coordinate with the state 2-1-1 information system and other organizations that serve vulnerable populations (e.g., community-action agencies, Michigan Works!, Department of Health and Human Services, etc.) to provide users with information on low-cost broadband subscription programs. The outreach and education strategy should be created and managed by a state broadband single point of contact

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[34] https://www2.ntia.doc.gov/files/NTIA_2013_BroadbandUSA_Adoption_Toolkit.pdf
[35] https://www.fcc.gov/consumers/guides/lifeline-support-affordable-communications
[36] https://www.usac.org/li/about/process-overview/stats/participation.aspx

(SPOC). Additionally, the SPOC should create a clearinghouse for Low Income Adoption (LIA) programs, whereby the SPOC would work directly with community organizations in non-LIA service areas to determine a low-cost solution through a local ISP. This solution could result in the creation of a fund or endowment to help subsidize connections for low-income households and manage the LIA project.

3.2.1.S2: Encourage and support Michigan libraries to seek funding for and implementation of hotspot or device-lending programs. Such efforts allow patrons to check out a 4G or 5G mobile wireless or Wi-Fi enabled device for a specified period of time. This can provide low-income patrons with home connectivity where a device or broadband service is not available or affordable. See "Lending Connectivity in Chelsea" sidebar.

Long-Term or Ongoing Actions

3.2.1.L1: Review the Michigan Telecommunications Act with the goal of including a separate section for Lifeline broadband service that follows federal eligibility criteria. An additional state credit could be included, with the amount to be determined by the legislature.

3.2.1.L2: Simplify and centralize the application process for households looking to participate in low-cost broadband programs, with assistance from ISPs that offer such programs. Cumbersome application processes can deter households from participating. Central points of contact could include the Secretary of State, Supplemental Nutrition Assistance Program (SNAP) application, and enrollment in the National School Lunch Program, among others.

3.2.1.L3: Explore surplus equipment policies to ensure discarded devices (i.e. desktops, laptops, and tablets) can be donated to non-profits that refurbish and provide computers to low-income families and families with K-12 students in the home. Encourage public institutions, including counties, local government, community colleges, and others, to consider computer donations to similar non-profit organizations to maximize available devices for vulnerable populations.

3.2.1.L4: Encourage schools and communities to invest in mobile service solutions and devices for students that can be used at home and provide connectivity. Devices as part of a school one-to-one initiative[37] enabled with Wi-Fi and mobile broadband (3G, 4G, or 5G technology) can provide connectivity on and off campus.

3.2.2. Increase Digital Literacy and Technology Training Programs

Digital literacy is the ability to use information and communication technologies to find, evaluate, create, and communicate information, requiring both cognitive and technical skills.[38] Digital literacy programs can help consumers overcome the technical barriers to broadband adoption via education and awareness building. Digital literacy impacts not only a user's ability to navigate the internet safely and in a meaningful way, but also impacts that user's ability to utilize technology in the workplace, access government services delivered electronically, participate in telemedicine applications, or access online educational opportunities. A focus on digital literacy helps to further bridge the digital divide by bringing together partners for the teaching and learning of digital skills.[39]

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[37] Programs that provide all students in a school, district, or state with their own laptop, netbook, tablet computer, or other mobile-computing device. One-to-one refers to one computer for every student.
[38] American Library Association http://connect.ala.org/node/181197
[39] See Appendix E for more discussion on this topic.

MCAN makes the following recommendations to improve the digital literacy of Michiganders and lessen the literacy barrier to broadband adoption:

Short-Term Actions

3.2.2.S1: Support libraries, schools, community colleges, non-profits, community or regional service organizations, and others in providing digital literacy and technology training to residents and businesses through the creation of a statewide clearinghouse of existing digital literacy and technology training programs and curriculum. The clearinghouse should be accessed via the web and administered locally (see "Digital Literacy in Harbor Springs" sidebar). Training should include relevant curriculum for both residents and businesses (see "Technology Literacy for Businesses in Roscommon County" sidebar). The clearinghouse should be curated and managed by a single point of contact at the state. Additionally, the clearinghouse should host information on digital literacy and technology training grant programs available from both public and private sources.

3.2.2.S2: Leverage the International Society for Technology in Education (ISTE) Student Standards that have been adopted by the Michigan Department of Education (MDE) as a standard set of skills and capabilities needed to be successful in a digital world. Labeled as the Michigan Integrated Technology Competencies for Students

DIGITAL LITERACY IN HARBOR SPRINGS

With a population of just under 1,200, digital learning resources are hard for many residents of Harbor Springs, Michigan, to find. Harbor Area Regional Board of Resources, Inc. (HARBOR Inc.) and community partners are changing that with HarborActive, an interactive digital literacy training initiative.

HarborActive provides hands-on training across a variety of programs and applications, with classes designed for both businesses and casual users. HARBOR Inc. began working with Connect Michigan in 2011, designing a Community Technology Action Plan to advance broadband adoption and use in the area. HarborActive addresses the need for digital literacy at the root of broadband growth.

HarborActive was founded by Rachel Smolinski, Executive Director of HARBOR, Inc. and Marcie Wolf, partner at Abuzz Creative, a web design, social media marketing and video production company. HarborActive brings many of Harbor Spring's richest community resources together, including the Harbor Springs Chamber of Commerce, the Harbor Springs library, and Community Connections of Greater Harbor Springs, an organization focused on aging in place and quality of life for seniors.

"Forming these partnerships within the community is what HARBOR Inc. focuses on," Smolinski explained. "HarborActive gives residents, businesses, and community leaders an opportunity to come together and share their knowledge in a casual and interactive environment. "We've had a lot of fun with it already and there are a lot of opportunities still available."

TECHNOLOGY LITERACY FOR BUSINESSES IN ROSCOMMON COUNTY

Marketing businesses and economic development agencies are teaming up in Roscommon County, Michigan, to help small businesses strengthen their online marketing skills. The Boost Your Business seminars provide free, hands-on instruction using Facebook and website marketing, giving small and home-based businesses and non-profits the opportunity to hone social media skills and use the latest online marketing tools to get real results.

"With a number of Roscommon County residents who make crafts, sell goods, or offer services from their home, many are still unaware of how to take advantage of the internet to market their product or services," said Adele Woskobojnik, owner of Marketing Sense Consulting and one of the key collaborators behind the class. "The seminars help these entrepreneurs decide if social media is enough for them to reach their goals, or if should they have more of a web presence."

The class shows entrepreneurs, businesses, and non-profits in Roscommon County how to set up a business Facebook page to market or sell a product or service. Attendees also receive instruction from local IT hardware and software service experts, on website best practices. Whether making a website for the first time, resurrecting a long-dormant page, or learning how to use an active page to make more impressions, participants at any stage of online marketing can benefit from the class.

(MITECS), the program offers openly licensed educational resources for use by organizations that provide technology and digital skills training.[40]

Long-Term or Ongoing Actions

3.2.2.L1: Establish partnerships with colleges, universities, and libraries to develop mentoring programs to train local residents in digital skills, particularly those skills needed by employers. Partnerships should promote the importance of being digitally literate to stay safe online, improve job skills, and access electronic services, among others.

3.2.2.L2: Support, through schools, the use of technology both in the classroom and at home to foster increased technology competencies in

> **SCHOOL AND LIBRARY PARTNERSHIPS IN MASON COUNTY**
> A Pew Research Center study examining the future of libraries showed that 85% of Americans strongly believe that schools and libraries should work more closely together and many libraries are rising to the need. As schools implement one-to-one computing programs, the devices require content such as e-books, audiobooks, and video footage to be effective. Most libraries already have this content available and some are tailoring their online environments to assist schools.
>
> The school district in Ludington, Michigan, provides iPads for all students, from kindergarten through 12th grade. While the school supplies textbooks, lectures, and classwork on the iPad, local library programs are helping students get the most out of their device.
>
> The Mason County District Library (MCDL), serving Ludington and the county, uses the applications Overdrive and Tumblebooks to supply e-books and other digital content to their users. MCDL staff members have helped students add and learn to use these apps on their iPads, while using the library's existing subscription. Together, these applications offer over a million e-books and even more extra digital content, giving Ludington students access to a wealth of knowledge, without demanding a larger budget.
>
> "It makes financial sense because it prevents the schools from having to set up parallel services," said Eric Smith, Director of MCDL. "It's significant cost savings for the local community and taxpayers."

support of learning and preparation for career and college. Technology skills gained by students often extend to parents and others in the home. Additionally, schools and libraries should collaborate to provide comprehensive technology and access to information (see "School and Library Partnership in Mason County" sidebar). Michigan's Integrated Technology Competencies[41] should be leveraged to further this recommendation.

3.2.3. Create Partnerships to Build Awareness

There are many ways in which broadband and related technologies can improve the quality of life of Michigan residents, businesses, institutions, and communities. Many community anchor institutions (CAIs), such as government offices, healthcare providers, libraries, and schools, as well as private businesses, offer online tools and services for their constituents. Still, many times potential users and beneficiaries do not access these online tools/services, and this may happen for a variety of reasons. Some may not have access to broadband at the speeds required; others may have the access but lack the digital literacy skills or may feel uncomfortable using online tools for such sensitive topics (like healthcare or banking information). Still others may have both the access and the skills but are unaware that such tools exist.[42] Telemedicine, online education, and e-government applications cannot improve quality of life if they are unused, unknown, or unrecognized. To overcome this challenge, MCAN makes the following recommendations:

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[40] http://www.techplan.org/mitecs/
[41] http://techplan.org/MITECS/
[42] See Appendix E for more discussion on this topic.

Short-Term Actions

3.2.3.S1: Develop a best-practice guide to assist institutions, organizations, and businesses in the creation of effective partnerships for the purpose of promoting e-services to the public. Best practice methods could include shared news media, flyers and promotions, social media advertisements, public service announcements, etc. (see "Community/Business Partnership to Improve Tourism in Keweenaw Peninsula" sidebar). Promoting the use of broadband for improved quality of life helps to increase the demand for service, thereby also increasing broadband access.

3.2.3.S2: Conduct a study to determine the extent of the home connectivity gap among households with K-12 students by working with schools to collect information from students and their families about their current state of home broadband access and adoption.

3.2.3.S3: Develop a consistent and coordinated messaging and marketing campaign to continually reinforce the benefits and importance of broadband, its many applications, its availability in the state, and related resources available from the state and others.

COMMUNITY/BUSINESS PARTNERSHIP TO IMPROVE TOURISM IN THE KEWEENAW PENINSULA

The Keweenaw Convention and Visitor's Bureau (KCVB) in Keweenaw, Michigan, is making vacationing easier than ever. In a popular, rural vacation destination of Michigan with large parts untouched by broadband, information about camping, lodging, restaurants, and events has formerly been scattered. In response, KCVB implemented an application that puts all of Keweenaw's resources in one place online—and you don't even need an internet connection to use it.

The Keweenaw attracts sportsmen, skiers, hikers, families, campers, and outdoor adventurers of all types. This rural expanse is a large part of the attraction, yet it also fragments broadband access in the area. Visitors come to unplug and get away from their devices; however, inaccessibility makes planning a vacation itinerary more difficult. KCVB solved this problem by implementing a mobile app which, once downloaded, can be accessed even without an online connection.

The app went live in 2015 with approximately 2,500 downloads projected for the year. In only four months, it surpassed 3,000, including tourists and residents alike.

The app offers information on lodging, campsites, restaurants, nature trails, historic sites, events, shops, and more. When the user is not connected to the internet, they can still use the app for turn-by-turn directions and to contact businesses. "They can literally touch the phone and the number comes up, so they don't have to write numbers down," said Amanda Oppe, Social Media and Marketing Manager for KCVB.

KCVB's app was designed with visitors, residents, businesses, and Keweenaw's natural charms in mind. Push notifications go through the app to the user to inform them of special deals that businesses are hosting or to warn them of oncoming snowstorms. With the app now in place, KCVB plans to implement more features to make vacationing, buying, selling, and generally visiting this area easier.

Long-Term or Ongoing Actions

3.2.3.L1: Encourage anchor institutions, non-profit organizations, agencies that provide services to the public, private businesses, and local, regional, and state government to create partnerships to build awareness for and use of new and existing internet-enabled applications including, but not limited to, telemedicine, e-government tools, online educational content, e-banking, and public safety tools, among others.

CLOSING MICHIGAN'S HOMEWORK GAP

For students to have equitable access to a world-class education, they must have access to the internet. Students without broadband service at home are at a distinct disadvantage as they must seek out other means of access that may be located at places not conducive to learning, not conveninently available, or only allow computer use for a short period of time.
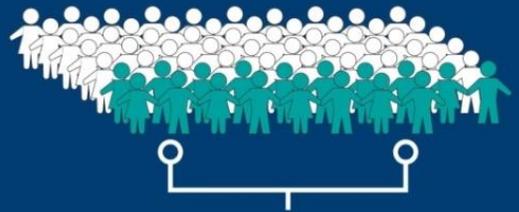
An estimated 462,000 of Michigan's 1,712,086 K-12 students do not have internet access at home.[1]

One study found that 50% of K-12 students surveyed said they couldn't complete their homework due to the lack of an internet connection, and 42% received a lower grade because of their disconnectedness.[3]

"My ability to interact with my students is diminished due to the lack of available internet."
- K-12 Educator, Gogebic County

The homework gap refers to the difficulty students experience completing homework when they lack internet access at home, compared to those who do.[2]

SCHOOL

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1. 2016 American Community Survey's 5-year estimate, 1,712,086 students are currently enrolled in schools in Michigan. Connect Michigan's 2014 Residential Technology Assessment: 73% of households with school age children subscribe to broadband. Leaving 462,000, without broadband at home.
2. http://neatoday.org/2016/04/20/the-homework-gap/
3. "The Homework Gap: The 'Cruelest Part of the Digital Divide'," National Education Association Today, April 2016

3.3. Progress Michigan's Broadband Ecosystem

Sections 3.1 and 3.2, address, specifically, the issues of infrastructure access and broadband adoption in Michigan, however, broader and more comprehensive changes are needed to facilitate this expansion. The following provides specific recommendations and detailed actions to address the need for greater broadband-related state leadership and funding, technical assistance, capacity building, and changes to the state's policy/regulatory framework that impact Michigan's broadband ecosystem.

3.3.1. State of Michigan Permanent Broadband Leadership

The issue of broadband is one that impacts nearly every aspect of the state and its communities, residents, businesses, and institutions. Since the early 2000s, the number of entities working to expand broadband access and adoption has varied and includes ISPs, local governments, state agencies, the federal government, non-profit organizations, and many others. State agencies and affiliated bodies have traditionally responded to the broadband and technology needs of those they serve within silos without clear state leadership or organization. The many issues and opportunities to improve broadband access and adoption and leverage that technology to improve quality of life and community and economic development are intertwined and often impact multiple sectors.

To increase economic opportunity for communities and students, MCAN has a goal of connecting every household and business in the state to 25/3 Mbps broadband by 2022. This goal must be supported in part by targeted state funding, but also through the development of this shared statewide roadmap to encourage private and public collaboration and investment.

MCAN recommends the creation of a long-term, permanent commission focused on broadband access and adoption to implement the recommendations of this roadmap and to disperse state grants:

- The long-term commission should be created within MDARD by statute with representation for internet service providers, local governments, communities, and the State of Michigan and be known as the Michigan Partnership for Broadband Advancement (MPBA). Creating the commission within statute follows the best practices of Minnesota, California, Illinois, and others, to minimize issues with administration changes.
- The commission will be tasked with the implementation of the roadmap created by MCAN and the administration of state broadband grants.
- Additionally, the commission would be tasked with monitoring federal broadband-related activities at the FCC, United States Department of Agriculture (USDA), NTIA, and Congress, among others, for policies that will impact broadband in Michigan and actively provide comment, context, and perspective to agencies and initiatives on the positive and negative impacts of federal actions on broadband in Michigan.

3.3.2. State Investment

MCAN recognizes the significant investments made by ISPs to connect Michigan's communities to high-speed service. This investment, discussed previously in section 2.1.3, signifies a commitment by the state's ISPs to the continued and robust development of broadband access and adoption. Additionally, MCAN recognizes that public investment catalyzes community development and economic activity through the expansion of broadband access and adoption. One of the Commission's tasks will be to oversee a $20M grant that will support broadband access and adoption focused on community investment and economic development efforts. The grant program will be called the Connecting Michigan Communities (CMIC) Grant.

Through MCAN's involvement of subgroups, listening tours, and best practice research, public-private partnerships were demonstrated to be a cost effective manner for spurring investment in broadband access and adoption. The CMIC Grant would fund targeted investments that promote improving broadband

access to homes and businesses, increasing adoption, and maximizing community impact by supporting local collaborative efforts that are already underway. This state grant will demonstrate the value of connecting every business and household in the state to 25/3 Mbps broadband by 2022 by supporting local efforts to use broadband in innovative ways to increase economic activity. It is estimated that the CMIC Grant could support 50 to 100 projects annually, and is intended for rural, unserved and growing communities to leverage broadband for community and economic development, (e.g. rural development, tourism, business attraction or expansion, new investment, etc.).

CMIC grant funds will be used to expand broadband service to homes and businesses to unserved areas through community planning, adoption programming, and infrastructure investment. Eligible entities will be limited to public and not-for-profit local and county governments and regional agencies, and private businesses that have established partnerships with one or more public or non-profit organizations in the grant impacted community. Priority will be given to proposals that demonstrate a commitment to collaboration through partnerships with and among local and regional municipalities, broadband providers, community anchor institutions, non-profit organizations, philanthropic organizations, and similar entities. For the purposes of this grant, a "community" may include, but is not limited to, a single municipality, a partnership of municipalities, a county, a region of counties, a neighborhood or similar subset of a single municipality, and other similar delineations.

Priority will be given to grant applicants who demonstrate that improving broadband service and adoption for homes and businesses is part of a comprehensive economic development strategy. This will be accomplished by:

- Applicants proving that the goal of improving broadband access has been incorporated into a long-term local or regional economic development plan, technology action plan, or similar;
- Analyses of the potential economic benefit of connecting businesses and/or households in the region;
- The existence of efforts already underway in the community to measure broadband access and/or determine ways to improve broadband adoption in the area;
- Support from local businesses demonstrating that they have a strategy for how they would use and benefit from faster broadband service;
- Private, federal, local, or philanthropic matching funds invested in the project to increase the impact of state investment; and
- Other rationale for improving broadband access that would be both demonstrable and measurable.

3.3.3. Other Potential Funding

In addition to state grants and federal subsidies available for broadband funding, MCAN believes that every possible funding source should be explored in an effort to bring ubiquitous broadband to Michigan and support local community efforts. MCAN makes the following recommendations to further leverage existing and new sources of funding to expand broadband access and adoption:

Short-Term Actions

3.3.3.S1: Research alternative funding sources for the expansion of broadband access and adoption. This research could include, but is not limited to, networking with broadband leaders in other states, finding best-practice and case study examples of community or regional broadband funding strategies (see "Local Broadband Funding in Washtenaw County" sidebar), etc.

3.3.3.S2: Enable municipalities to create special assessment districts for the purpose of investing in broadband infrastructure in unserved areas and partnering

LOCAL BROADBAND FUNDING IN WASHTENAW COUNTY

Though residents in a sparsely populated area may express interest in faster speeds or more affordable access, hundreds of homes spread over thousands of miles in rural areas present a problem for ISPs—too much space between too few people. ISPs cannot justify the investment with such a limited return. A non-profit group driven by citizens of rural Washtenaw County and Jackson County in Michigan are working to change this model and bring the power of broadband infrastructure back to the citizens.

The Michigan Broadband Cooperative (MBC) is a grassroots, non-profit organization working to expand broadband access and options in Washtenaw and Jackson counties by focusing the needs and voices of residents. With the ultimate goal of installing a fiber network in the area, the current objectives are garnering residents' support, expanding coverage and gathering data, and making a plan for the further development of the network.

"We conducted surveys with Connect Michigan and the net result was that 92% of households in our area want more choices for our Internet service providers," said Ben Fineman, President of MBC. Though many residents in metropolitan areas like the cities of Jackson and Ann Arbor have multiple options, coverage drops off significantly in less densely populated areas.

"We came to the conclusion that commercial carriers and the incumbent ISPs were not going to solve our problem. If we, the residents, wanted to have broadband, we needed to take matters in to our own hands," said Fineman.

With assistance from MBC, in 2017, Lyndon Township residents in Washtenaw County passed a $7 million bond proposal to fund construction of a community-owned fiber optic network serving every home in the township.

MBC will not act as an ISP. With a fiber network installed in the area, the people would control access. "We would open up the fiber network using an open access network model to any ISP," Fineman explained. "It is not the case where we're looking to compete with or edge out existing carriers. We're looking to make the investment and provide fundamental infrastructure to create a level playing for all the ISPs."

with ISPs. Some Michigan municipalities have sought local tax revenue for use in building telecommunications and broadband infrastructure. This has been accomplished through a millage to pay for municipal bonds[43] and through partnerships with municipal electric utilities.[44] However, one tool that is missing is the ability for townships to create special assessment districts to fund broadband access projects. Special assessment districts would allow townships to gather funds to construct infrastructure and partner with ISPs to provide service in unserved areas.

3.3.3.S3: Create an annual $500,000 fund to provide matching dollars to schools applying for E-Rate funding from the Universal Service Fund. These funds, if not entirely expended during the annual grant period, should roll over to the next grant year as E-Rate cycles do not align with

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[43] Lyndon Twp., in Washtenaw County, passed a bond millage in August 2017 to raise funds to build a fiber network connecting every home in the township to fiber and enter a partnership with a private ISP to provide service over the network: http://www.lyndonbroadband.org/
[44] https://www.hollandfiber.org/

state fiscal and grant years. These matching funds are intended to more fully leverage federal E-Rate funds for Michigan schools. In 2017, Michigan received $48.6 million in E-Rate commitments, 2.2% of the national total committed. However, Michigan enrolls 3.1% of public school students nationally.

3.3.3.S4: Consult and partner with financial institutions, utility companies, and other private entities to explore the use of Community Reinvestment Act funds[45] and similar efforts to support programs and projects for expanding broadband access and adoption at the local level.

3.3.3.S5: Convene a workgroup of outside experts in the fields of community development, philanthropy, non-profit management, and others with the purpose of developing guidelines and best practices for the creation of a "Kalamazoo Promise"[46] –style funding program for broadband.

Long-Term or Ongoing Actions

3.3.3.L1: Actively advocate at the federal level for E-Rate

> **COMMUNITY PLANNING AND TECHNICAL ASSISTANCE IN OSCEOLA COUNTY**
>
> Recognizing that their county was being left behind in regard to internet access and digital literacy, officials in Osceola County, Michigan, knew they needed to spark a change. In 2012, Osceola County began a long journey of ongoing development and cooperation to make a positive change to Internet access, adoption, and use leading to the creation of a community technology action plan in 2016.
>
> "We knew we had a problem," said Dan Massy, Osceola County Community Development Coordinator. "We just didn't know how to start or where to go." Massy and Osceola Township Supervisor Paul Brown discussed the unavailability of reliable broadband on a number of occasions. Brown discovered that a neighboring county was working with Connect Michigan to solve similar problems with broadband development. "We both went to their meeting," said Massy. "We were impressed."
>
> One of the key obstacles to greater access was simply a lack of infrastructure, a problem that could only be solved by ISPs. A county-wide broadband survey, which showed where internet was available and where it was unavailable but desired, made a considerable impact. With this information measured and published, one ISP saw a business opportunity and approached the county about laying more infrastructure.
>
> "For me, it's a quality of life issue. [Broadband] touches everything, from business to education to healthcare," said Massy. "Our association with Connect Michigan has given us the resources we didn't have anywhere else, so we can move forward."
>
> Improvements began slowly, with townships across the county participating and organizations across the state helping. Courtland Consulting conducted seminars to improve digital literacy for residents and businesses, Chemical Bank led classes on cybersecurity, and libraries and chambers of commerce throughout the county introduced online classes for businesses and residents. At the county level, a website redesign provided more functionality and better organization.
>
> Working through the program one step at a time, Osceola County demonstrated both the determination and spirit of solidarity needed to make positive community-wide change.

reforms that allow funds to be used for broader connectivity in the community or region, not just for on-campus connectivity for schools.[47]

3.3.3.L2: Work with the state's rural electric cooperatives to gather information on their barriers and needs related to their ability to provide broadband to their customers. Research and develop best practices and recommendations for changes to funding or policy to facilitate greater involvement in broadband service by electric co-ops.

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[45] https://www.dallasfed.org/assets/documents/cd/pubs/digitaldivide.pdf

[46] The Kalamazoo Promise is a 501(c)3 organization funded entirely by anonymous donors that funds college education for students graduating from the Kalamazoo school district: https://www.kalamazoopromise.com/

[47] In May of 2018, a bipartisan Senate Bill 2958[47] was introduced by Senator Tom Udall (D-NM) and co-sponsored by Senator Cory Gardner (R-CO) to require the Federal Communications Commission (FCC) to make the provision of Wi-Fi access on school buses eligible for E-rate support.

3.3.4. Technical Assistance and Community or Regional Engagement

For many localities, there is a lack of capacity for the many technical nuances and facets regarding broadband and the build-out of internet service. Definitions vary between groups, information about the newest technology is lacking, federal initiatives are not tracked, and policymakers often do not have the time or resources to stay in touch with CAIs, residents, and businesses to ensure that service meets their current needs, let alone plan for future requirements. These issues are most likely to occur in rural regions of the state or on tribal lands where subject-matter experts familiar with the intricacies of improving broadband availability may not be available. As such, even those who want to improve broadband access and usage within their localities may lack the information needed to make those improvements.[48]

> **CONNECTING BUSINESSES WITH TECHNOLOGY IN ALCONA COUNTY**
>
> Alcona County, Michigan, with a population of about 11,000, is bringing their community and their technology assets together to expand education, healthcare, business, banking, entertainment, and more through broadband in the same ways many urban areas do.
>
> The Leadership Alcona Technology Expo began as a part of the Technology Action Plan the county developed with Connect Michigan. The need for better broadband brought Connect Michigan to the county's attention and put the Expo on the schedule. Leadership Alcona, a volunteer group specializing in community stewardship and local business advancement, took on the project.
>
> The Leadership Alcona Technology Expo brings community leaders from law enforcement, banking, education, healthcare, and small business together to show residents, students, seniors, and business owners the opportunities technology provides and how to access those opportunities safely.
>
> The goal of the Expo is to not only bring community members and resources together, but also garner more interest in improving broadband. "We're really pushing to show that there is a need," said Marlena Mac Neill, spokesperson for Leadership Alcona. "Whether there's sparse population or not, we still want to be connected. We want to connect with the rest of the world just like anybody else."

MCAN makes the following recommendations to assist communities, residents, businesses, institutions, and policymakers with broadband and technology challenges:[49]

Short-Term Actions

3.3.4.S1: Create a broadband single point of contact (SPOC) within state government for residents, businesses, institutions, and communities seeking information on broadband and technology access, adoption, and use. The SPOC should be a neutral and unbiased advocate for broadband that can assist with bridging the information and knowledge gap between public and private-sector entities. The SPOC would be responsible for the coordination and implementation of the other action items related to this recommendation.

3.3.4.S2: Develop and implement a framework for engagement that communities can use to create local broadband/technology action plans that incorporate the needs of CAIs, residents, businesses, schools, libraries, and public safety agencies, among others. These planning activities should help communities establish a broadband planning team, assess the local access and adoption of broadband, and create and implement a plan of action for addressing local challenges and leveraging opportunities. The framework would allow communities to gain expert advice on available technology, sustainable financial models, grant writing, and project planning. Finally, resources should be scalable for communities of all sizes and needs (see "Community Planning and Technical Assistance in Osceola County" sidebar).

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[48] See Appendix E for more discussion on this topic.

[49] See additional community broadband resources in Appendix J.

3.3.4.S3: Plan and convene an annual statewide broadband/technology conference designed to bring together a diverse array of stakeholders to share and learn best practices for leveraging broadband for improving quality of life and community and economic development. The state broadband SPOC (as outlined previously) should also participate in national and regional broadband conferences to identify best practices and resources that could benefit Michigan. Funds could also be made available for local and regional stakeholders to attend national conferences and events to spur more involvement and knowledge acquisition. Finally, the state SPOC should partner with various state associations (e.g., Michigan Municipal League, Michigan Townships Association, Michigan Farm Bureau, etc.) and provide information to their constituents on broadband at their regular gatherings.

> **REMOVING RED TAPE FOR TOWER CONSTRUCTION IN EMMET COUNTY**
>
> Radio towers allow ISPs to transfer wireless Internet signals across wide distances, providing broadband service to both smartphones and homes. Emmet County, Michigan, is making it easier to put up more towers and use existing buildings to transmit wireless broadband signals, reaching more residents by revising zoning laws.
>
> While zoning ordinances preserve the natural beauty of the landscape, they also make it difficult for ISPs to install new towers and new technology. The Emmet County Planning and Zoning Commission recently revised their zoning regulations to maintain the natural landscape while still enhancing broadband access.
>
> Revising the zoning ordinance was first suggested by representatives from a group of townships in the county, and also by an interested ISP. Originally, the townships and ISP recommended reducing red tape for even taller towers, up to 100 feet. To protect the beautiful rural landscape throughout Emmet County and accommodate all 12 townships, administrators met in the middle with easier access for shorter towers. Finding a successful middle ground, the new zoning ordinances also make co-location easier, by allowing placement of transmission hardware on top of existing towers and other buildings. With the ability to approve towers under 60 feet through administrative approval, ISPs can build new towers without going through months of red tape.
>
> "It brought to the planning commission's attention that there is a need for broadband in our rural areas," said Tammy Doernenburg, Emmet County Planning and Zoning Director. "It also brought all of our townships together so everyone would be aware of this need."

3.3.4.S4: Partner with colleges, universities, libraries, and other CAIs to develop an annual competition to design solutions to improve broadband access, adoption, and use in unserved and underserved communities.

3.3.4.S5: Collaborate with CAIs, ISPs, and communities to develop a common set of definitions or terminology to facilitate information sharing and educational opportunities.

3.3.4.S6: Track and report on local and regional broadband and technology developments to establish best practices and case studies for communities seeking to conduct similar activities (see "Connecting Businesses with Technology in Alcona County" sidebar).

Long-Term or Ongoing Actions

3.3.4.L1: Create and maintain a central clearinghouse for broadband and technology information that can assist communities, residents, businesses, institutions, and ISPs. Community anchor institutions, ISPs, local and county governments, and non-profit organizations should track and report to this clearinghouse on federal broadband/technology initiatives applicable to their sectors and areas of expertise to ensure Michigan fully leverages outside opportunities. The clearinghouse would likely take the form of a regularly updated website, maintained by the SPOC, with the purpose of housing various resources and information relevant to broadband that a wide variety of stakeholders would find useful.

3.3.4.L2: Support local businesses, communities, and ISPs to develop partnerships and submit grant/program applications for broadband-related programs sponsored by federal agencies or

other sources (e.g., Connect America Fund, USDA Community Connect, E-Rate, foundations, etc.).

3.3.4.L3: Identify and analyze local policies and ordinances (e.g., zoning, tower colocation, etc.) that may be hindering broadband expansion and provide recommendations for modification (see "Removing Red Tape for Tower Construction in Emmet County" sidebar).

3.3.4.L4: Develop "Broadband Ready" guidelines, model language, and best practices for communities in cooperation with ISPs, state agencies, and local government associations.

3.3.4.L5: Host regular broadband/technology information and training sessions featuring topical experts to ensure policymakers and other stakeholders are up to date with recent broadband developments, technology advancements, federal action, etc.

3.3.5. Dig Once

The Federal Highway Administration has indicated that "ninety percent of the cost of deploying broadband is when the work requires significant excavation of the roadway."[50] A "dig once" policy focuses on increasing coordination between government agencies and utility companies to minimize the frequency of roadway excavation and disturbance. These policies aim to facilitate joint trenching cost savings and ensure that broadband infrastructure improvements are considered alongside other infrastructure and public works projects. To this end, these policies encourage or require that every infrastructure project include notification and facilitation of opportunities to lower the costs of broadband infrastructure investment by coordinating project planning when a right-of-way (ROW disturbance is to occur. It is difficult to legislate communication and cooperation, but policies and programs that provide information to parties controlling and located within the ROW can support and encourage these activities.[51] The timely placement of empty broadband conduit, or, where appropriate, wireless facilities for broadband service,[52] can dramatically reduce costs and expedite network upgrades. The Federal Highway Administration provides guidance and federal policies in relation to dig once.[53] Additionally, the National Broadband Plan noted that "the cost of running a strand of fiber through an existing conduit is 3-4 times cheaper than constructing a new aerial build."[54]

MCAN makes the following recommendations to encourage the implementation of dig once:

Short-Term Actions

3.3.5.S1: Develop model dig once policies for ROW maintained by local units of government with the guidance of the Michigan Infrastructure Council (MIC) and municipal associations. Model policies should be based on research of other states' experiences, challenges, and benefits from pursuing similar policies.

Long-Term or Ongoing Actions

3.3.5.L1: Continue the work of the Asset Management Pilot Project that has established a process for coordinating ROW construction planning and communication between ROW owners and those with infrastructure within the ROW.

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[50] https://www.fhwa.dot.gov/policy/otps/workplan.cfm#dig
[51] See Appendix E for more discussion on this topic.
[52] http://www.gpo.gov/fdsys/pkg/BILLS-112hr1695ih/pdf/BILLS-112hr1695ih.pdf
[53] https://www.fhwa.dot.gov/policy/otps/workplan.cfm#dig
[54] Federal Communications Commission, National Broadband Plan, 2010, http://www.fcc.gov/national-broadband-plan

3.3.5.L2: Create a centralized database of planned ROW projects to facilitate coordinated planning through the Michigan Infrastructure Council. All ROW owners and entities with infrastructure in the ROW would be encouraged to participate in the database and provide information on their planned maintenance and projects in the ROW. This information could be used to allow utility and ROW owners to take advantage of planned disturbances in the ROW to more efficiently maintain existing or install new infrastructure.

3.3.5.L3: Provide guidance, education, and model design standards to all ROW owners on the installation of empty fiber conduit into the ROW during all road construction or reconstruction projects. Funding for the conduit itself could encourage local units to implement recommended conduit installation policies. Conduit installation can encourage and expedite the installation of future telecommunications infrastructure without the need to trench, bore, or otherwise disturb the ROW (see "Conduit Installation in Mesa, Arizona" sidebar).

> **CONDUIT INSTALLATION IN MESA, ARIZONA**
>
> In Mesa, Arizona, the city took steps to ensure that conduit was installed whenever streets were excavated for other purposes. The large-sized city with a growing population focused on prioritizing broadband seeing it as a key to attracting new investment in the community. Through Mesa's E-Street Program, conduit was installed whenever streets were excavated and water and other infrastructure was installed. Through its efforts, Mesa has 150 miles of fiber running through the community. Additionally, the government worked to identify abandoned utility infrastructure in the city and then presented that information to broadband vendors. As a result, the government is now returning some revenue back to the city. Having regular meetings with providers and offering full transparency with construction projects, existing assets, and areas of economic development, Mesa gives broadband carriers the chance to be ahead of economic development activities while ensuring the city remains well-connected. Thanks to many of these efforts, Apple is making a $3 million investment in a Global Command Center that will be located in Mesa.[1]

3.3.6. One-Touch Make-Ready

For some ISPs, the make-ready process for pole owners to prepare their poles takes too long and is considered a significant barrier to faster broadband deployment. Across Michigan, various entities, ranging from private entities and utility companies to local municipalities, own utility poles. Before a new ISP can add a new attachment to a pole, existing attachments belonging to other entities may need to be moved so the pole can be made ready for the new attachments. This can involve adjustments made by multiple other parties, often with varying obligations and sometimes competing interests, and can result in multiple trips before a new attachment can be placed. As such, an ISP may be ready to expand its coverage into an area but be unable to do so while waiting for the existing attachments to be properly moved.

Some ISPs have one-touch make-ready (OTMR) or joint-use pole agreements with contractors, pole owners, and/or other pole attachers. Additionally, the FCC and the FCC's Broadband Deployment Advisory Council (BDAC) are currently examining a federal role or advisement for improving the speedier and more efficient competitive access to utility poles while ensuring safety and the integrity of existing attachments.

MCAN makes the following recommendations in light of this ongoing work and the arrangements currently in place by ISPs to address pole attachment issues:

Short-Term Actions

3.3.6.S1: ISPs who have implemented their own OTMR contracts or joint-use pole agreements should share best practices from these agreements and work with the state to create model language and templates for other ISPs that may not yet have such contracts in place.

3.3.6.L1: Continue to monitor actions by the FCC and others in regard to utility pole make-ready and attachments and determine next steps for Michigan should changes and recommendations be made at the federal level.

3.3.7. Residential/Commercial Development Standards

It is necessary to equip new residential and business construction with the capability to connect to high-speed broadband. Often, the conduit or other means of egress needed to connect a residential or commercial development to broadband infrastructure is not planned for and included in the new construction.

By revising building codes, localities can add connectivity standards, ensuring that new construction is equipped with egress opportunities for ISPs to more expeditiously connect tenants to broadband access. By ensuring that broadband is appropriately planned from the ground up, rather than an afterthought, developers and ISPs can save future time and money while helping to expand broadband in a community.

MCAN makes the following recommendations:

Short-Term Actions

3.3.7.S1: ISPs should develop a "wish list" of broadband-related development standards for new construction. Once this list has been fine-tuned, develop an educational how-to guide for developers to use during construction.

3.3.7.S2: Develop model language and policies based on the ISP "wish list" recommending the inclusion of ISP egress options for new residential and commercial development for possible adoption and implementation by local units of government within their construction ordinances. Egress should be designed to be accessible to multiple providers and appropriate for the context of the development (e.g., conduit, poles for aerial deployment, etc.). Additionally, model language should consider both horizontal egress (i.e., connections from the right-of-way to the building), as well as vertical egress within multi-dwelling units (MDUs) to ensure all units within a development have access.

Long-Term or Ongoing Actions

3.3.7.L1: Regional and local economic development organizations should conduct surveys and interviews with local developers and communicate the provider-developed "wish list" to determine how policies can be helpful for broadband expansion, without being overly burdensome on developers.

3.3.8. Rights-of-Way Access and Permitting

In 2002, the State of Michigan enacted the Metropolitan Extension Telecommunication Rights-of-Way Oversight (METRO) Act[55] to streamline access to the ROW for telecommunications providers. This legislation created the METRO authority, though the authority is no longer responsible for the policies of the METRO Act, as responsibility was transferred to the Local Community Stabilization Authority (LCSA). The METRO Act is intended to help telecommunications providers obtain permits faster and more easily, improve competition for telecommunications services, encourage the development of new technologies, provide for a

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[55] http://www.legislature.mi.gov/documents/mcl/pdf/mcl-Act-48-of-2002.pdf

standardized ROW permitting process, and ensure reasonable management for public ROW by municipalities within the state.

As written, the METRO Act currently only applies to ROW in cities, townships and villages. County road commissions are not subject to the METRO Act. As such, providers seeking access to county ROW do not have access to the same streamlined processes, adding a level of uncertainty and ambiguity to infrastructure build-outs in rural areas.[56]

Recently, Governor Snyder signed into law Public Act 97 of 2018,[57] which limited bonding requirements that could be imposed on providers and capped ROW permit fees charged by a county road commission to $300 each, or $1,000 in total for multiple permits per project. In large counties (those with populations greater than 250,000), these caps are doubled.

These streamlined permit fees will improve consistency for accessing the county ROW by ISPs, particularly in rural areas where fee structures previously varied from one county to the next. In addition to establishing a fee schedule, the METRO Act provides a single point of application, standardized timeline and approval process, and process for dispute resolution between ROW owners and ISPs, which are not addressed in Public Act 97.

MCAN makes the following recommendations to continue the momentum of streamlining access to the ROW for information service and telecommunications providers:

Short-Term Actions

3.3.8.S1: Investigate further the equal applicability of the METRO Act to all public ROW owners, including townships, cities, villages, counties, and state lands.

3.3.8.S2: Support collaborations between communities, telecommunications providers, ISPs, and road commissions to gather and share experiences, best practices (both intended and unintended), and data related to working with the METRO Act and Public Act 97 of 2018 to help inform future legislative changes to ensure equitable access to the ROW and the protection of the public health, safety, and welfare.

Long-Term or Ongoing Actions

3.3.8.L1: Update the definitions of "telecommunications facilities" and "telecommunication providers" in the Michigan Telecommunications Act to adapt to new methods of video and information delivery and include new and forthcoming wired and wireless technologies. Senate Bill 637 of 2017 could address this issue, and its status and potential impacts should be monitored.[58]

3.3.8.L2: Monitor the impact of Public Act 97 of 2018 on both ISPs, road commissions, and other ROW owners to determine the law's effectiveness in streamlining the permitting process and fees for ISPs accessing the ROW.

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[56] See Appendix E for more discussion on this topic.
[57] http://www.legislature.mi.gov/documents/2017-2018/publicact/pdf/2018-PA-0097.pdf
[58] http://legislature.mi.gov/doc.aspx?2017-SB-0637

3.4. Summary and Next Steps

Broadband is critical to Michigan's future. Improving the access and adoption of broadband increases economic activity, advances access to healthcare, provides far-reaching educational opportunities, and allows for the more efficient delivery of services. The goals set forth in this roadmap are ambitious but necessary to ensure robust and affordable connectivity for Michigan's residents, businesses, institutions, and communities.

Improving Michigan's access to and adoption of broadband and technology is complex and ever-changing due to the nature of the telecommunications industry and rapid advances in technology. MCAN's goals may take years to implement and will require the participation of a diverse array of stakeholders at all levels of government. No one person, group, or entity can do this alone. Immediately following the release of the roadmap, MCAN and supporting state agencies and staff will:

- Create a Community Broadband Playbook by October 2018 for distribution to communities and regions across the state. The Playbook will provide stakeholders with tools, resources, best practices, and case examples that will help communities begin to implement the roadmap recommendations and actions.
- Develop an accountability and implementation strategy by December 2018 that assigns state agency support and responsibility for roadmap implementation. This strategy will include immediate assignments of short-term action items to kick-start the roadmap implementation, and a thorough plan for the execution of the long-term recommendations.
- Work with the legislature in the fall of 2018 to secure and administer a long-term, permanent broadband commission and secure funding to assist communities with the expansion of broadband access and adoption.

APPENDICES

Appendix A: Listening Tour Summary

The Consortium recognized the extent to which broadband connectivity affects the lives of the people of Michigan. To ensure that the final recommendations produced by the Consortium fully take into account the needs of Michigan residents, the Consortium committed to several public engagements with the following goals:

- Gather feedback from the public in person
- Allow for public engagement in the MCAN process
- Increase exposure to the importance of achieving reliable and affordable broadband connectivity via the listening tour stops

The members of the Consortium engaged in six listening tour events in six different locations across Michigan throughout the process of creating their report. The goal was to gather information from a diverse array of stakeholders in the state during a two week period in May. The Consortium strove to meet with any interested citizens to understand the impact and need for broadband in their area. The listening tour events that were held include:

- Port Huron – Monday, May 14, 2018
- Grand Rapids – Tuesday, May 15, 2018
- Scottville – Tuesday, May 22, 2018
- Traverse City – Wednesday, May 23, 2018
- Marquette – Thursday, May 24, 2018
- Hillman – Friday, May 25, 2018

Feedback from Public Engagement

At each listening tour event, comments and concerns were compiled in order for the Consortium to accurately reflect the needs and desires of the people of Michigan. The Consortium was presented with a wide and diverse range of feedback from across the State. A general overview of the feedback received follows:

- Coordination must be improved to increase connectivity.
- The Consortium should look at all funding source avenues.
- Digital Literacy is increasingly important to understand the benefits of broadband.
- Michigan must work to close the "Homework Gap."
- The state should pursue increased partnerships between private and public entities.
- The Consortium should emphasize "Last Mile" connections.
- There needs to be increased and more accurate mapping, better organization, and increased asset management to better invest in broadband.
- Residential and commercial standards should be created that include broadband conduit in homes to begin with to decrease future connectivity costs.
- 10 Mbps Down, 1 Mbps Up is not an ambitious enough goal. State should aim for 25 Mbps Down, 3 Mbps Up following the FCC's definition of broadband service.
- The Consortium should be careful that any new building standards should not increase the cost of housing for low- and middle-income families.
- The Consortium should look into the role of fiber connectivity as part of their mission.
- The state should explore considering broadband as a public utility.
- The Consortium should look at opportunities to create programs to organize and encourage philanthropic assistance in improving broadband access and adoption.

Appendix B: Michigan's Broadband History

Michigan Telecommunications Act: 1991

The Michigan Telecommunications Act (MTA)[59] was established to "regulate and insure the availability of certain telecommunication services." The act has been amended several times since its original passing. While the MTA is a comprehensive document with many facets impacting phone, broadband, and telecommunications services in the state, there are two sections that are important when considering broadband expansion. The MTA outlines several unregulated services and specifically states that the Michigan Public Service Commission does not have authority over a number of services, including retail broadband.

Additionally, the MTA provides guidance to public entities seeking to provide telecommunications services. The MTA does not ban public entities from providing telecommunications services; instead, the Act states that a public entity may provide telecommunication services within its boundaries if they have complied with the requirements of section 14 of the METRO Act, and if all the following apply:

- The public entity has issued a request for competitive sealed bids to provide telecommunication services.
- The public entity has received less than three qualified bids from private providers.
- It is more than 60 days from the date the request for bids was issued.
- The public entity is providing the telecommunication services under the same terms and conditions as required under the request for bids issued pursuant to subdivision (a).

While these requirements apply to regulated telecommunication services, it is unclear as to their application for municipalities seeking to provide retail broadband and internet service. Retail internet is specifically mentioned in the MTA as an unregulated service in the State of Michigan. The application of these requirements for this purpose has not yet been clarified by a court ruling, nor have the Michigan Public Service Commission or Attorney General's office made a clarifying statement on the matter.

LinkMichigan Initiative: 2001-2002

Developed by the Michigan Economic Development Corporation (MEDC), the LinkMichigan Initiative was a policy analysis and recommendations report regarding information and communications technology in Michigan. The opening paragraph of the report indicates that "improving access to high-speed telecommunications services is the most important state economic infrastructure issue for the new century." The overarching goal of the initiative is to "facilitate the development of the most advanced and robust telecommunications infrastructure in the country."

The LinkMichigan Initiative, after analyzing several issues pertaining to information and communications technologies (including available and affordable bandwidth, education, and e-government), developed four recommendations for the state:

- **Statewide Public User Aggregation.** To provide public-service institutions (e.g., universities, public schools, government, etc.) affordable broadband connections, the state should aggregate these users into a larger collective to leverage for lower-priced access.

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[59] https://www.legislature.mi.gov/(S(ljdg2mhq4wz2lrrcf544nj3h))/documents/mcl/pdf/mcl-act-179-of-1991.pdf

- **Tax and Permitting Fairness.** Telecommunications companies must abide by local permitting and fee systems to deploy broadband infrastructure. The LinkMichigan Initiative recommends restructuring the permitting system to create a level playing field across the state for the deployment of broadband infrastructure.

- **Access to Information.** The LinkMichigan Initiative recommends that all telecommunications and information carriers be required to provide the state with detailed information regarding the location and capability of current telecommunications infrastructure.

- **Community Assistance.** The final recommendation of the LinkMichigan Initiative is to provide communities with financial assistance for the purpose of telecommunications planning.

To implement the LinkMichigan Initiative, a package of related legislation was enacted in 2002. The legislation package consisted of three bills that closely match the recommendations of the initiative:

- **P.A. 48 of 2002 (or the Metropolitan Extension Telecommunications Rights-of-Way Oversight (METRO) Act)**[60] was passed based on the second recommendation from the initiative pertaining to a statewide permit and fee system for the deployment of broadband infrastructure. The bill set common fees and a maximum permit delay time period for communities across the state. It also created the METRO authority to implement and monitor the system. Permitting for access to local municipal rights-of-way is covered by the METRO Act process; however, permitting for access to county rights-of-way is not. Additionally, coordination of the METRO Act falls under the Local Community Stabilization Authority;

- **P.A. 49 of 2002 created the Michigan Broadband Development Authority**[61] to administer and monitor a fund created to facilitate the low-cost financing of broadband deployment. The MBDA was moved to the Michigan State Housing Development Authority and was dissolved in July of 2007; and

- **P.A. 50 of 2002**[62] created a property tax credit as an incentive for increased broadband service deployment.

American Recovery and Reinvestment Act: 2009-2015

During implementation of the American Recovery and Reinvestment Act (ARRA), four programs administered by the National Telecommunications and Information Administration (NTIA) and the United States Department of Agriculture (USDA) provided funding for various broadband and technology efforts.[63] The programs include the Broadband Technology Opportunity Program (BTOP), Broadband Initiatives Program (BIP), State Broadband Data Development (SBDD), and the State Broadband Initiative (the combination of SBDD Rounds one and two). Approximately $134 million in broadband related funding was expended in Michigan between the BTOP, SBI, and BIP programs.

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[60] https://www.legislature.mi.gov/(S(ljdg2mhq4wz2lrrcf544nj3h))/documents/mcl/pdf/mcl-act-48-of-2002.pdf
[61] http://legislature.mi.gov/documents/mcl/pdf/mcl-act-49-of-2002.pdf
[62] https://www.legislature.mi.gov/(S(ljdg2mhq4wz2lrrcf544nj3h))/documents/mcl/pdf/mcl-207-13b.pdf
[63] https://www2.ntia.doc.gov/michigan

Rural Development Fund: 2012

Public Act 411 of 2012[64] created the Michigan Rural Development Fund "to establish certain programs that promote the sustainability of land-based industries and support infrastructure that benefits rural communities; to establish a fund and provide for its use; and to prescribe the powers and duties of certain state agencies and officials."

Broadband infrastructure projects are eligible for the fund provided that infrastructure is built in areas that do not have access to broadband service of at least 3 Mbps downstream and 768 Kbps upstream is available.

Michigan Public Safety Communications System: 2014

Public Act 564 of 2014[65] amended Public Act 152 of 1929 to allow for private and public-sector entities to co-locate[66] wireless broadband equipment on towers that are part of the Michigan Public Safety Communications System. If using the towers to provide commercial broadband service, service can only be provided in an area determined to be unserved by advertised speeds of at least 3 megabits per second downstream and 768 kilobits per second upstream as of October 1, 2014.

21st Century Infrastructure Commission: 2016

To address the state's infrastructure needs, Governor Rick Snyder created the 21st Century Infrastructure Commission[67], an advisory body of 27 members that has developed a long-term vision and associated recommendations to drive the improvement of Michigan's infrastructure systems. As Executive Order No. 2016-5 states, "sound and modern infrastructure is vital to the health and well-being of the people of Michigan, as well as Michigan's economy and vibrant communities." The Commission's vision states: "Michigan will lead the nation in creating 21st century infrastructure systems that will include, at a minimum, innovative technology, sustainable funding solutions, sound economic principles, and a collaborative and integrated asset management and investment approach that will enhance Michiganders' quality of life and build strong communities for the future."

The report created by the Infrastructure Commission includes several recommendations for making Michigan a "smarter" state, improving broadband access and adoption, and securing Michigan's digital infrastructure. The commission adopted bold goals for addressing the state's broadband challenges.[68]

Broadband Access
- All residents and businesses have access to a fixed broadband connection with a download speed of at least 25 Mbps and an upload speed of 3 Mbps by 2020 and a download speed of at least 100 Mbps by 2024.
- All community anchor institutions have access to a fixed broadband connection with download and upload speeds that meet the minimum recommended speeds for their sector by 2024.
- All areas of the state (geographic) have access to a mobile broadband connection with a download speed of at least 10 Mbps by 2020 and at least 25 Mbps by 2024.

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[64] https://www.legislature.mi.gov/(S(ljdg2mhq4wz2lrrcf544nj3h))/documents/mcl/pdf/mcl-act-411-of-2012.pdf
[65] https://www.legislature.mi.gov/documents/2013-2014/publicact/pdf/2014-PA-0564.pdf
[66] To locate together; to place (two or more units) close together so as to share common facilities.
[67] https://www.michigan.gov/snyder/0,4668,7-277-61409_78737---,00.html
[68] https://www.michigan.gov/documents/snyder/21st_Century_Infrastructure_Commission_Final_Report_1_544276_7.pdf

- 95% of residents have adopted a fixed and mobile broadband connection at home by 2024.
- 95% of Michigan businesses have a web presence (defined as a location on the world wide web where a business is represented) by 2020.
- All community anchor institutions have adopted a fixed broadband connection by 2024.

Additionally, the report called for the creation of MCAN to address the state's connectivity issues and achieve these goals.

Streamlining County Right-of-Way: 2018

In 2018, Public Act 97[69] amended the Michigan Public Highways and Private Roads Act by revising right-of-way requirements. This legislation set fee limits for projects within the right-of-way of a county road, required either a security or right-of-way bond to secure the performance allowed in a permit authorizing the project in the right-of-way, and required that a provider maintain general liability insurance.

The language also included several regulations for county road commissions. These included caps on provider fees ($300 per permit, or $1,000 total for all permits per project in rural counties; these fee caps are doubled for urban counties). No more than one permit more than once a year for a provider performing routine maintenance or repair work in a right-of-way. A county road commission would also be prohibited from requiring a provider to perform surveys or analyses such as topographic, environmental, etc. as a condition to issuing a permit.

Public Act 97 also eases regulations in respect to bonds. A county road commission cannot require a provider to have more than one security or right-of-way bond from a state or federal entity, for example.

The primary purpose of this act is to standardize the fees broadband providers pay to county road commissions to access the right-of-way since counties do not currently fall under the standard fee structure of the Michigan METRO Act.

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[69] http://www.legislature.mi.gov/documents/2017-2018/billanalysis/House/pdf/2017-HLA-5097-01460396.pdf

Appendix C: Emerging Technology

The technology capable of delivering broadband to residents, businesses, institutions, and communities is rapidly changing. From faster capabilities of existing technology and new means of delivery to explosive advancement in wireless abilities, new business models of service distribution, and transformative technologies, the only constant in the broadband industry is that it is continually evolving. The following provides summaries of new emerging technologies that could positively impact broadband in Michigan.

Edge of Network Data Centers and Computing

Edge of network data centers and computing refers to the idea that as networks become faster, more prevalent, and less latent, there are advantages to keeping resources, computing, and data closer to the end-user or end-user devices. With advances in networks, new applications and services are being developed that can take advantage of the faster, less latent networks. This means the necessary resources must be closer to the end-user or application, putting them at the edge of the network. This is in many ways a reversal of the past decade, where more and more resources were placed "in the cloud" or a central data storage and server facility. Data centers located at the edge of a network and closer to the end-users of that network ensures nearly instantaneous access to data and computing resources, particularly in applications where milliseconds can and will be the deciding factor in how well new technologies can impact our lives.

Low Earth Orbit Satellite

Low Earth Orbit (LEO) Satellites are being discussed as a way to provide broadband service on a global scale. Multiple companies, including OneWeb, Telesat and SpaceX, are all working to develop the technology. LEO refers to satellites that are in an orbit low enough that latency (or the time it takes for data to travel to and from one place to the other) could be greatly reduced. Testing of SpaceX's current satellites reports latency as low as 25 milliseconds. By comparison, the latency of traditional satellite broadband is approximately 550 milliseconds (or ½ of a second).

AT&T AirGig

In 2016, AT&T Labs announced Project AirGig[70] with a tagline of "Where There Are Power Lines, There Can Be Broadband" and calling it a transformative technology. The general concept of the technology is that it takes advantage of certain properties of the electromagnetic field of medium-voltage powerlines to guide millimeter wave wireless signals along the path of the powerline. The equipment does not physically touch the powerline to make end-to-end communications. AT&T has reportedly developed low-cost plastic antennas that sit atop power poles.

Cooperative Broadband Deployment

As outlined by the National Rural Electric Cooperative Association (NRECA[71]), "as times and technology change, broadband has become an indispensable part of electric utility operations-extending beyond the electric meter and into household energy management. These state-of-the-art energy efficiency services increasingly require access to highspeed internet." NRECA

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[70] http://about.att.com/story/project_airgig_trials_georgia.html

[71] https://www.electric.coop/

notes that nearly 100 electric co-ops are engaged in bringing high-speed internet to their members.

As power companies of all types look to modernize their distribution networks and services, they are being faced with the need to modernize and undergo a transformation that requires digital communications. Many cooperatives see that it's important to both ensure that they are capable of operating their networks to the best of their ability, and most also believe that it's their duty to provide the greatest service to their members, utilizing the infrastructure and resources they have.

There are several Michigan-based electric cooperatives that already provide broadband service or are working to develop services in their area, including Midwest Energy Cooperative, HomeWorks Tri-County Electric Cooperative, Great Lakes Energy, and Presque Isle Electric and Gas Co-Op. Cooperatives, however, are not limited to those already providing other services. The Michigan Broadband Cooperative[72] is working in Washtenaw and Jackson counties to bring broadband service to unserved and underserved residents.

Television White Space

Television White Space (TVWS) technology seeks to utilize the unused wireless spectrum in the broadcast television frequency bands and put them to use through wireless delivery of broadband. TVWS does not require line-of-site between an end-user and tower site and offers hope that it could deliver broadband service in geographies that have traditionally been difficult to service with other wireless broadband technologies. TVWS utilizes the unused channels (space) between the channels used for broadcast television. The FCC first made TVWS spectrum available for use in 2010, and while there have been some successful deployments, the technology has not been widely adopted.

Current applications of TVWS face three primary barriers to more robust expansion. The first barrier is a lack of contiguous wireless channels for transmission. Broadcast spectrum is often reused from one region to another, leaving only a small number of channels available for broadband. Secondly, TVWS spectrum has the ability to penetrate dense vegetation, but equipment still needs to be located on towers or other vertical assets for proper application. TVWS equipment is currently limited to 100 feet above ground or less. Lastly, the FCC currently limits the amount of power with which TVWS equipment can broadcast. This limitation reduces the radius a viable signal can travel from the broadcasting tower.

Microsoft has been engaged in development work related to TVWS for many years, but in 2017 they announced the Microsoft Airband[73] initiative that seeks to build out twelve pilot programs in twelve states, including Michigan. Microsoft is working with Allband Communications, Gigabit Library, and Merit on a pilot project in the northeast Lower Peninsula. In May 2018, the group announced a pilot project that will utilize TVWS to provide Wi-Fi connectivity on school busses. Additionally, Microsoft is working with Packerland Broadband and CCI Systems in the western Upper Peninsula.

Automated, Driverless, and Connected Vehicle Technology

The autonomous vehicle (AV) promises to transform transportation, technology, and the economy of states prepared for its introduction. AVs are equipped with an array of sensors (visual and otherwise), computers, radar, and other instruments necessary for the AV to function

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[72] http://www.mbcoop.org/

[73] https://www.microsoft.com/en-us/affordable-access-initiative/default.aspx

as expected. All these devices rely heavily on robust, low-latency, and high-speed network connectivity. Not only is it critical for AVs to have access to advanced connectivity, but entire networks of non-vehicle-based sensors and devices within communities will also need robust connectivity to properly interact with AVs.

Currently, self-driving vehicles being tested by Google produce nearly one gigabyte of data per second (or 60 GB per minute).[74] These data provide a range of services for drivers, from identifying unusual events to proactively taking actions on potential performance issues. These sensors can inform a vehicle owner that a mechanical problem is imminent and even schedule an appointment for maintenance. These data enable the vehicle to travel on its own, letting it recognize where to drive, how fast to drive, and what potential dangers are ahead.

Some of these data will only be used and processed internally by the vehicles, but to fully benefit from a "smart road" system that uses these data to make road travel safer and more efficient, much of this information will need to be accessible to external devices. Wireless monitors will be required on roadsides or built into the roads themselves to collect and track information from these smart vehicles. Beacons and sensors will be inserted into traffic cones and other road equipment that will alert self-driving vehicles to potential roadway obstructions.[75]

On average, Americans spend 17,600 minutes driving per year, with rural drivers traveling 23% more miles each year than urban drivers.[76] This means that one autonomous vehicle would generate more than 1 million GB (Petabyte) of data in an average year.[77]

If, as predicted, there are 8 million AVs on U.S. roadways by 2025[78], that would equal 8.45 trillion GB, or 8.45 Zettabytes of data per year.[79] To put this into perspective, Cisco's Visual Networking Index initiative estimated that global internet traffic across all platforms equaled about 1.1 Zettabytes by the end of 2016[80], meaning that the networks required to design a functional "smart road" system would transfer nearly eight times the amount of information that the entire internet transferred in a single year.

While there are many issues surrounding the full implementation of AVs (many of which are being addressed by the Michigan Council on Future Mobility[81]), robust broadband connectivity is absolutely necessary to realize the benefits to come from the connected vehicle economy. Urban areas and, most essentially, rural areas of Michigan will need to expand broadband access considerably to support Michigan's AV industry.

5G Wireless Technology

In simple terms 5G, short for 5th generation, is the next step in mobile wireless technology standards and deployment. The new technology has three important characteristics: high speed, low latency[82], and big capacity. Depending on the company, there are various speeds discussed, but multi-gigabit per second speeds are certainly possible on 5G, and much of this will be determined by the frequencies and deployment strategies used by carriers. Latency is often forgotten by most consumers; however, it is extremely important to providing reliable, real-time services, and 5G promises to bring very low and sub-millisecond latency to consumers. As

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[74] https://dataflog.com/read/self-driving-cars-create-2-petabytes-data-annually/172
[75] https://www.trafficsafetystore.com/blog/data-systems-support-self-driving-cars/
[76] https://newsroom.aaa.com/2016/09/americans-spend-average-17600-minutes-driving-year/
[77] 60GB *17,600 = 1,056,000 GB per year
[78] https://www.thestreet.com/technology/this-many-autonomous-cars-will-be-on-the-road-in-2025-14564388
[79] 1,056,000*8,000,000 = 8,448,000,000,000
[80] https://www.livescience.com/54094-how-big-is-the-internet.html
[81] https://www.michigan.gov/snyder/0,4668,7-277-57738_57679_57726-405828--,00.html
[82] Latency is the time it takes for data to travel to and from one place to the other

more people have devices and more products become connected, networks need the capacity to handle an influx of data transfers to a plethora of new devices. 5G promises greater capacity to make more connections, opening wireless networks up to a greater number of connections than those on the current generation mobile wireless networks.

One major factor in how the technology will be deployed is based directly on the frequencies that will be used by the provider. While lower frequencies such as those in the 600Mhz spectrum allow for deployments at greater distances, there is less capacity, so the technology can be deployed with fewer transmitters (towers) but at a lower speed, although likely still faster than current 4G technologies. Where the technology is deployed at millimeter wave frequencies, there will be a need for far greater density of transmitters, but it will be able to offer much higher speeds due to the amount of capacity that wireless spectrum offers. All the U.S.'s major mobile wireless carriers are working on plans for 5G deployments, and the reality of the technology should begin to be made clear as real-world performance is seen for the first time through 2018 and 2019.

5G technology is also designed to cooperate with other wireless technologies in use today, which will be instrumental to the way the new technology is rolled out. Providers will look to make connections on existing networks and technologies, and then move to 5G where it's available. Many of the major mobile wireless providers look to begin commercial deployments of 5G in 2018, and all are taking different approaches. Some look to provide a truly mobile experience, although phones to support the technology will not be ready until 2019, while others are looking to deploy to homes.

5G wireless technology holds significant potential for Michigan and abroad. It is the technology that will likely make autonomous cars a much greater reality, improve the efficiency and practicality of the Internet of Things (IoT)[83], potentially lower the cost of deployment of home broadband, and make more extensive use of augmented and virtual reality for real world solutions. This will not, however, come without obstacles, such as deploying the backbone and middle-mile networks necessary to support the wireless services offered, and it's certainly not clear how the technology will impact broadband service in rural areas.

In 2017, a bill was introduced in the Michigan Senate that was designed to streamline and clarify access to the ROW for wireless infrastructure and service providers. The bill, known as the "Small Wireless Communications Facilities Deployment Act,[84]" sets limits and standards on the location of wireless equipment in the ROW. This act would support the deployment of 5G technology as 5G networks require many more access points and backhaul connectivity to support the increased speed, capacity, and number of devices on the network.

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[83] Internet of things (IoT) is the interconnection via the Internet of computing devices embedded in everyday objects, enabling them to send and receive data.
[84] http://legislature.mi.gov/doc.aspx?2017-SB-0637

Appendix D: Federal Investment

Several federal programs have invested in broadband access and adoption in Michigan over the last several years and are expected to continue funding efforts aimed at improving Michigan's broadband landscape. The section is intended to provide perspective on the myriad of federal activities currently focused on the expansion of broadband and how those activities are impacting the state.

Federal Communications Commission (FCC)

The Federal Communications Commission's (FCC) Universal Service Fund (USF)[85] works to implement the principle that all Americans should have access to communications services, or "universal service." The FCC established four programs within the USF including: Connect America Fund, Lifeline, Schools and Libraries (E-Rate), and Rural Health Care.
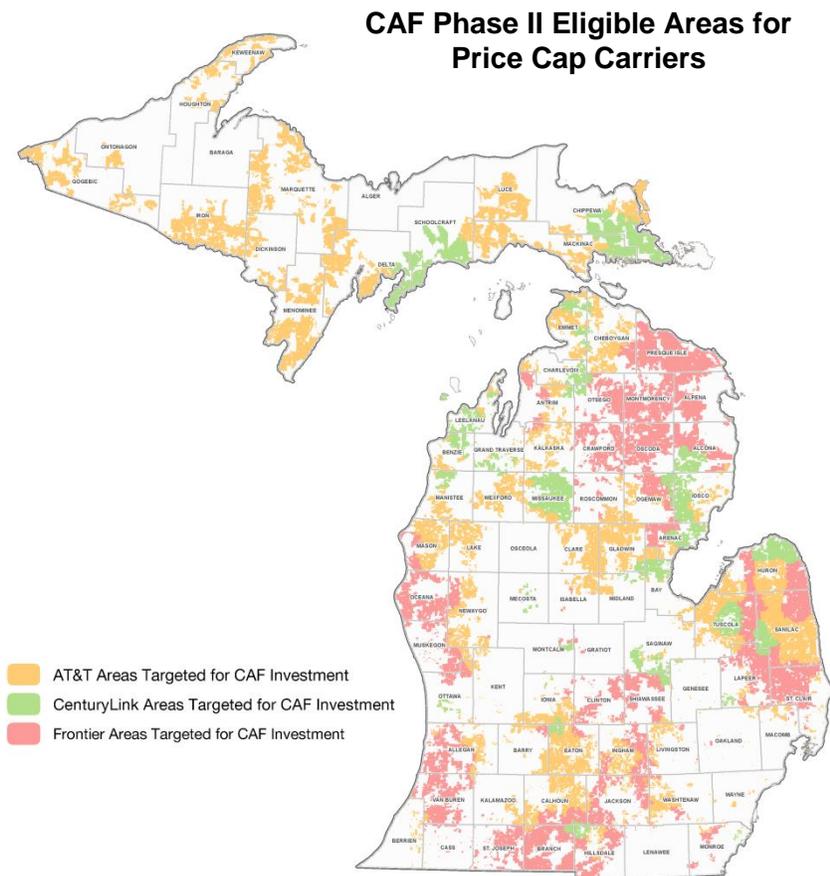
Connect America Fund (CAF)

CAF[86] is comprised of several programs including Phase II, Mobility Fund, and Rural Broadband Experiments. The most recent Phase II of the CAF offers subsidies to three Michigan broadband providers. Collectively, these carriers will build broadband at 10 Mbps/1 Mbps to 180,377 households and businesses over the next six years in Michigan. The total federal investment to connect these entities is $363,075,402.

The map shows the areas of the state eligible for Connect America Fund Phase 2 subsidy for AT&T, CenturyLink, and Frontier (the state's price cap carriers). Price cap carriers accepting build-out subsidies must have completed network deployment to 40% of impacted homes and businesses by the end of 2017, with future benchmarks of 60% by the end of 2019, and 100% by the end of 2020.

Additionally, six of

CAF Phase II Eligible Areas for Price Cap Carriers

AT&T Areas Targeted for CAF Investment
CenturyLink Areas Targeted for CAF Investment
Frontier Areas Targeted for CAF Investment

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[85] https://www.fcc.gov/general/universal-service
[86] https://www.fcc.gov/general/connect-america-fund-caf

Michigan's rate-of-return carriers have been offered $18.8 million to connect an additional 26,855 households (not shown on map).

In early 2018, the FCC announced the final census blocks and block groups eligible for the CAF Phase 2 auction.[87] The blocks represent approximately 39,000 households and businesses that are located in areas considered extremely rural with a high cost of service. The FCC is planning to supply $1.98 billion to support build-out ($198 million over ten years). Subsidies will be allocated to winning bidders based on four tiers of connectivity:

CAF Phase II Auction Eligible Blocks and Block Groups

- Minimum (at least 10/1 Mbps);
- Baseline (greater than 25/3 Mbps);
- Above Baseline (greater than 100/20 Mbps); and
- Gigabit (greater than 1 Gbps/500 Mbps).
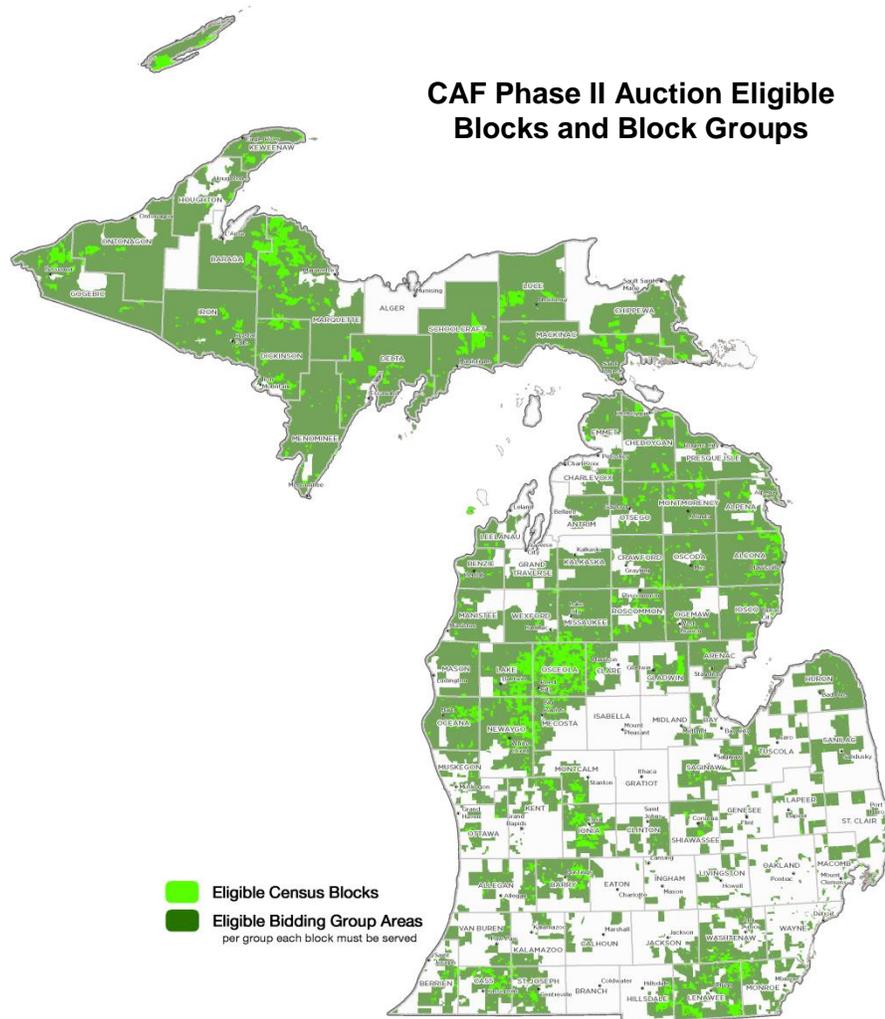
The map shows the location of Census Blocks and Block Groups eligible for the auction. Provider applications were due to the FCC by March 30, 2018, and auction bidding will begin July 24, 2018.

The CAF Rural Broadband Experiments[88] program (RBE) was designed as a targeted experiment to learn more about the impact of technology transitions in rural America. Only one RBE project was awarded in Michigan. Midwest Energy Cooperative was awarded $211,532 to connect 421 locations to fiber broadband service.

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[87] https://www.fcc.gov/auction/903
[88] https://www.fcc.gov/general/rural-broadband-experiments

E-Rate Program

The E-Rate program[89] helps schools and libraries obtain affordable broadband. According to the FCC, eligible schools, school districts and libraries may apply individually or as part of a consortium. Funding may be requested under two categories of service: category one services to a school or library (telecommunications, telecommunications services and internet access), and category two services that deliver internet access within schools and libraries (internal connections, basic maintenance of internal connections, and managed internal broadband services). Discounts for support depend on the level of poverty of the community and whether the school or library is located in an urban or rural area. E-Rate is a discount program, and discounts range from 20% to 90% of the costs of eligible services.

The E-Rate program has an annual cap of $3.9 billion but is based on demand. In funding year 2017, Michigan had received E-Rate funding commitments valued at $48.6 million, representing 2.2% of the national total committed. By comparison, as of 2014, Michigan K-12 public schools enrolled 3.1% of the public-school students in the nation.[90] Overall, since the inception of the E-Rate program in 1998, Michigan schools and libraries have received discounts totaling over $1 billion. The Michigan Department of Education employs an E-Rate specialist[91] to assist schools and libraries with E-Rate applications and other matters.

Currently, E-Rate funds can only be used to provide connectivity to and within schools. In May of 2018, bipartisan Senate Bill 2958[92] was introduced by Senator Tom Udall (D-NM) and co-sponsored by Senator Cory Gardner (R-CO) to require the Federal Communications Commission (FCC) to make the provision of Wi-Fi access on school buses eligible for E-Rate support. The bill aims to address the Homework Gap by helping students without broadband access at home connect to the internet to study and do homework. The legislation would require the FCC's E-Rate program to reimburse schools that place Wi-Fi technology on school buses carrying students to school or to school-related activities. According to Senator Udall[93], the legislation was inspired by a New Mexico student-athlete who, during a roundtable on the Homework Gap, told Senator Udall and FCC Commissioner Jessica Rosenworcel about his struggles to find a Wi-Fi signal when school let out. The student shared that, after traveling hours on the bus to football games, he would sit in the school parking lot late at night to complete homework assignments because that was the only place he could access wireless internet. The legislation has been introduced and referred to the U.S. Senate Committee on Commerce, Science, and Transportation.

Other reforms to the E-Rate program could allow E-Rate funded infrastructure to be used to provide greater capacity for connections to homes in a community and thus help provide connectivity beyond the classroom.

Rural Health Care

The Rural Health Care Program[94] provides funding to eligible health care providers (HCPs) for telecommunications and broadband services necessary for the provision of health care. The program aims to "improve the quality of health care available to patients in rural communities by

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[89] https://www.fcc.gov/general/e-rate-schools-libraries-usf-program

[90] https://nces.ed.gov/

[91] https://www.michigan.gov/mde/0,4615,7-140-5236_21417---,00.html

[92] https://www.congress.gov/bill/115th-congress/senate-bill/2958?q=%7B%22search%22%3A%5B%22s.+2958%22%5D%7D&r=1

[93] https://www.tomudall.senate.gov/news/press-releases/udall-gardner-introduce-bill-to-put-wi-fi-on-school-buses

[94] https://www.fcc.gov/general/rural-health-care-program

ensuring that eligible HCPs have access to telecommunications and broadband services." In 2015, Michigan providers received an estimated $3,609,000 for rural health care support.

The Rural Health Care Program has an annual cap of $400 million and is made up of three programs: the Healthcare Connect Fund, the Telecommunications Program, and the Rural Health Care Pilot Program.

Lifeline

The federal Lifeline program provides a $9.25 monthly discount on voice or broadband service to eligible low-income households. To participate in the program at a federal level, subscribers must either have an income that is at or below 135% of the federal poverty guideline for their household size or participate in certain assistance programs (Medicaid, Supplemental Nutrition Assistance Program, Supplemental Security Income, or Federal Public Housing Assistance).

Michigan has an additional Lifeline program that supplements the federal initiative. Michigan's program covers only voice service. The discount is $11.25 for low-income households and $12.35 for low-income seniors. Providers obtain the $9.25 reimbursement from the federal Universal Service fund, and the rest is made up through a surcharge from most of the landline providers in Michigan. To qualify for this additional Lifeline discount in Michigan, household income must be at or below 150% of the poverty guideline for the household size, or applicants must participate in certain assistance programs (Medicaid, Supplemental Nutrition Assistance Program, Supplemental Security Income, Federal Public Housing Assistance, Low-Income Home Energy Assistance Program, Temporary Assistance to Needy Families, National School Lunch Program, or Veterans and Survivors Pension Benefits).

United States Department of Agriculture (USDA)

USDA provides several loan and grant programs to help support rural areas, including those lacking high-speed internet access. The Telecommunications Infrastructure Program[95] has made $12 million in loans in Michigan since 2014. Additionally, the Distance Learning and Telemedicine program[96] has made grants to eligible healthcare and educational providers of $3.3 million since 2011. The USDA Community Connect program[97], an effort aimed at providing grants to areas unserved by broadband at 10/1 Mbps, has not awarded funds to any entity in Michigan in the last eight years. Previously, a community had to lack broadband at speeds of 4/1 Mbps. The change in eligibility criteria to 10/1 Mbps was made in early 2018. This change may spark new applications and grant awards in Michigan for this program.

Additionally, the omnibus spending bill passed by Congress and signed by President Trump in March of 2018 included a $600 million allocation to the USDA for a broadband grant and loan pilot program with 10/1 Mbps being the qualifying level of service delivery.[98] This funding is in addition to the other broadband-related programs already in place at USDA as described previously. The guidelines and program stipulations for this funding have not yet been defined by the USDA but are expected to be published in the third quarter of 2018.

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[95] https://www.rd.usda.gov/programs-services/telecommunications-infrastructure-loans-loan-guarantees
[96] https://www.rd.usda.gov/programs-services/distance-learning-telemedicine-grants
[97] https://www.rd.usda.gov/programs-services/community-connect-grants
[98] https://www.agweb.com/article/omnibus-spending-bill-gives-usda-600-million-for-rural-broadband/

White House Infrastructure Plan

In February 2018, the White House released the much-anticipated $1.5 trillion Infrastructure Plan,[99] which includes $200 billion in federal funding over 10 years. The release of the plan ended months of speculation on what would be included, what funding levels the administration would call for, and what percentage of that funding would be federal. The 55-page document outlined a "roadmap for the Congress to draft and pass the most comprehensive infrastructure bill in our Nation's history," according to the White House release, and includes a series of grants and loans to improve America's aging infrastructure.

Of the many proposed programs in the plan, only the Rural Infrastructure Program (RIP) would support broadband. The RIP would be allotted $50 billion in federal dollars, 80% of which would go to governors' offices and 20% would be reserved for rural performance block grants. RIP-eligible projects include transportation, broadband, water, power, and other similar infrastructures. The plan does not include a specific carve-out for dedicated broadband funding.

FirstNet

The Middle Class Tax Relief and Job Creation Act of 2012 created the First Responder Network Authority, or FirstNet, which is tasked with ensuring the establishment of a nationwide interoperable public safety broadband network. According to the FCC, "the governor of each state may choose to have FirstNet build, operate, maintain, and improve the network within the state (opt-in) or it may choose to build, operate, maintain, and improve its own radio access network (RAN) within the state (opt-out), so long as the network is interoperable with FirstNet's nationwide network and meets the criteria prescribed in the Act."

AT&T won the 25-year nationwide contract to build and run FirstNet, and in February 2018, AT&T prioritized rural America, stating that rural areas are a key priority during every stage of the build-out and beyond. The build-out will take five years, and there are rural coverage requirements throughout the process.

In Michigan, FirstNet efforts are being managed by the Michigan Public Safety Communications System[100], and Michigan has opted-in to the FirstNet build-out plan for the state system, along with all other states and territories.

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[99] https://www.whitehouse.gov/wp-content/uploads/2018/02/INFRASTRUCTURE-211.pdf
[100] https://www.michigan.gov/mpscs/0,4640,7-184-65453---,00.html

Appendix E: Recommendations Background and Discussion

The following provides expanded context and discussion of some of the recommendations included in this report.

Broadband Data and Reporting

Broadband providers are required to file with the FCC a list of census blocks covered by their services twice annually. Under this current census block methodology, if even one household in a given block is served, the entire block is marked as having service. In rural areas, these blocks can be extremely large, increasing the likelihood of overstatement of service in the very areas that need help the most. Secondly, broadband providers that do not have geographic information system (GIS) capabilities are not able to visualize the spreadsheet-based file of census block IDs being filed through the FCC's Form 477 process to ensure accuracy, resulting in overstated and/or understated coverage reporting. Thirdly, some providers are simply missing from the Form 477 dataset entirely. Lastly, fixed wireless coverage is also reported as full census blocks, instead of service areas developed from propagation modeling, as was produced during NTIA's State Broadband Initiative program (2010-2014). The FCC continues the problematic use of census blocks as the unit of measure for reporting, and thus accepts the well-established and inherent overstatement and understatement that such reporting yields.

Some argue that census blocks can be too large to accurately gauge how much of an area is truly served, particularly in rural or tribal areas. While census blocks in urban areas can be the size of a city block, those in rural areas can cover multiple miles (the largest is located in Ontonagon County, measuring 63.8 square miles). In these cases, the ability to show that one household is served is much less likely to correlate with all households in the block also being served by the same provider at a given speed tier. Without knowing how many households are served in any given census block, it is impossible to determine how many are truly not being served statewide.

For many providers, presenting data at a level more granular than the census block would simply be onerous. Doing so would require the providers to collect and maintain multiple datasets to be sent to multiple audiences, resulting in higher costs of business for them. The level of maintaining such a database at a higher level of granularity would become increasingly difficult and complicated as the level of disaggregation increases, with potentially decreasing marginal benefit for state or local policymakers.

Gathering data from ISPs that presents granularity at the sub-census block level is a challenge given the current structure of data collection implemented by the FCC[101]. Michigan should continue to monitor proposed changes to the federal broadband coverage reporting requirements and continue to advocate for more granular data when the opportunity arises.

The collection of broadband data from users in a "crowdsource" fashion does have its drawbacks. Consumer-reported data could be seen as unreliable since it would depend on the consumer at each household to provide accurate information about their service, platform, provider, and broadband speeds. Some of this information can be gathered from a speed test application itself without input from consumers. Additionally, a significant number of data points would need to be gathered from consumers to accurately validate service coverage reported at the census block level. This would require the state to provide education, outreach, and awareness activities to promote the use of the application to gather the required data. This could be accomplished by engaging and empowering communities to work with their residents,

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[101] https://www.fcc.gov/general/form-477-resources-filers

businesses, and institutions to assist in data gathering. Examples include California's CALSpeed tool[102] and the FCC's Measuring Broadband America program.[103]

Increase Backhaul Capacity

To provide high-speed internet connectivity to Michigan households, those last-mile connections will need to have access to a backhaul network that can scale with growing long-term consumer demand. While wireless backhaul, including point-to-point and point-to-multipoint wireless service, may be a cost-effective option in the most remote portions of the state, fiber backhaul connectivity will oftentimes provide the fastest service and should be expanded where possible. Additionally, those backhaul connections must be accessible to last-mile providers with connections strategically sited with the necessary infrastructure, allowing ISPs to access that backhaul and then provide last-mile service to Michigan homes and businesses. Providing this backhaul connectivity will not be easy or inexpensive, particularly to reach remote portions of rural Michigan.

Digital Literacy

Digital literacy training options are varied and come in a number of different forms. Some offer free training tools that provide training options for individuals at a variety of skill levels. One such example is the Drive[104] digital learning hub. Other offerings include individual trainers teaching specific job skills requested by employers and providing employment opportunities post-training, such as the Digital Works[105] program. Massive online open courses, such as Coursera[106] and edX[107], offer university-styled classes online free of charge, while other training websites like Lynda[108] offer online training for a fee. Additionally, the Michigan eLibrary[109] offers a wide array of digital content, training, and information for Michigan residents.

The clearinghouse available to the public could also be used as a tool to highlight successes, opportunities, and challenges regarding technology training. As programs are implemented by communities, those successes (or critiques) can be shared with other potential users. This will help promote an ongoing dialogue around improving broadband access, adoption, and use.

Community/Business Partnerships to Improve Awareness

The lack of awareness for online digital tools creates a challenge for community anchor institutions: If only a small share of their constituents demand access via online tools, then they will use their oftentimes limited budgets toward other goals. For the consumer, if their institutions only offer minimal online tools, then there is less incentive to learn how to use the internet, and the value proposition of subscribing to home broadband service diminishes for them. As such, there are requirements for both sides of the "equation": Anchor institutions must see that there are benefits and build user-friendly tools that benefit their constituents, and those constituents must then overcome the aforementioned barriers and begin using those tools so the institutions can see how strong the demand is for such online tools.

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[102] http://cpuc.ca.gov/General.aspx?id=1778
[103] https://www.fcc.gov/general/measuring-broadband-america-measuring-fixed-broadband
[104] http://www.driveyourlearning.org/
[105] http://digitalworksjobs.com/
[106] https://www.coursera.org/
[107] https://www.edx.org/
[108] https://www.lynda.com/
[109] http://www.mel.org/index.php?P=Home

If no one uses a school's online calendar tool, for example, there will be no incentive to improve it. If, on the other hand, a larger share of parents begin using that tool and demanding greater capability from the tools, then that school will have a tool that is more beneficial to its constituent families and will have a greater impact for the school, students, and families.

Several studies have shown that when CAIs promote broadband usage and include online tools, they benefit both themselves as well as their communities.[110] For communities where CAIs are still struggling to get connected, the Schools, Health, and Libraries Broadband (SHLB) coalition has created a guide to help with developing online tools, building partnerships, and connecting to high-speed internet service.[111]

Technical Assistance and Community or regional Engagement

Some community leaders may experience the opposite of a lack of information and are instead overwhelmed by a wealth of information about the latest technologies, best practices, model policies, or information about how to best go about promoting the growth of broadband infrastructure and usage. It can be difficult for policymakers and stakeholders at all levels to be able to sift through the available information to find what is best for their constituents and what will result in the expansion of broadband access, adoption, and use. Misinformation, in some cases, may result in enacted conditions, requests, or requirements that are deemed unfair, inappropriate, unreasonable, or overly burdensome for providers, making build-out challenging or impossible, or may result in decisions that negatively impact residents, businesses, and institutions.

As communities struggle with the myriad of issues of maintaining and improving the quality of life for its constituents (e.g., maintaining roads, creating economic opportunity, providing education, protecting the public safety, etc.), it has been found that communities often lack the capacity to effectively address the challenges of broadband access, adoption, and use.

However, residents, businesses, and institutions are looking more and more to their community or regional leaders and policymakers to help address broadband and technology challenges.

Implementation of these solutions will require input by state, regional, and national experts in the fields of broadband access, adoption, and usage, as well as community or regional involvement, input from ISPs, and community anchor institutions to identify needs, share best practices, and implement initiatives that will benefit the largest number of Michigan households. This will be an ongoing process that will need to be maintained for a number of years while best practices are collected, guidance is developed on how best to design platform-neutral ordinances, and communities are given the opportunity to learn from these resources. Additionally, given the rapid pace of development and innovation in the broadband and technology ecosystem, the technical assistance and community or regional engagement program would need to continually evolve to provide the timeliest information to communities and providers.

Dig Once

The maintenance of broadband infrastructure in the ROW is also a consideration in the establishment of dig once policies. ROW planning and dig once policies should minimize the

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[110] https://ir.lawnet.fordham.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=2551&context=ulj, http://m.benton.org/blog/community-anchor-institutions-and-residential-broadband-adoption, and https://www.internet2.edu/media/medialibrary/2016/06/22/CAI-Influence-in-Broadband-White-Paper.pdf
[111] http://www.shlb.org/action-plan

disturbance of utility infrastructure already installed in the ROW during road construction or maintenance, or maintenance activities performed by another utility owner. For example, moving telecommunications infrastructure because of road construction or maintenance can be a burden on ISPs. Long-term conflict avoidance between ROW owners and the utilities in the ROW should be considered during ROW planning to ensure that costs are not unduly incurred by utility owners because of the actions of ROW or other utility owners.

According to the FCC's Broadband Deployment Advisory Council (BDAC) Working Group on Streamlining Federal Siting, "[i]n 2015, members of Congress introduced dig once legislation, but they have not been enacted. Dig once is included in the MOBILE NOW Act, which passed the Senate by unanimous consent on Aug. 3, 2017, but has not been enacted. Despite movement on the issue, dig once policies have not been widely adopted. The BDAC Working Group has encouraged the Department of Transportation and other relevant agencies to continue their work to adopt dig once policies and to provide guidance to states and encourage their implementation of a dig once policy."[112] Additional work on dig once policies from BDAC can be found in the groups recommended Model Code for States.[113]

Rights-of-Way/METRO Act

METRO Act

The METRO Act assesses an annual maintenance fee of 5 cents per linear foot of public ROW. These fees are collected by the LCSA and disbursed annually to municipalities as prescribed by the METRO Act. Those municipalities may then use the money garnered from those fees for ROW-related purposes only. Additionally, telecommunications providers receive a property tax credit for the METRO fees they pay each year.

In addition, different platforms pay different rates. While cable operators are assessed only 1 cent per foot under the METRO Act, this can be waived by the cable operators certifying that the provider's aggregate investment in the state for internet transport access service exceeds the aggregate amount of maintenance fees. As such, cable operators do not qualify for the same property tax credit as telecommunication providers, and cable is locally assessed and not centrally assessed by the state.

Telecommunication providers obtain a property tax credit for the entire amount of METRO Act fees paid annually. Thus, providers are held harmless and the amount of the centrally assessed property taxes collected by the state is reduced by the amount of METRO Act fees paid to the authority.

Conversely, cable operators do not pay METRO fees and pay up to a 5% local franchise fee on cable services; telecommunication providers do not pay a similar local franchise fee on any telecommunication services.

Bridge Crossings

The issue of crossing MDOT ROWs was raised during MCAN subgroup meetings and listening tour events. Requesting a new utility facility bridge attachment may initially appear to be the most practical, quickest and economical installation option. However, at some point in time, construction will occur on the bridge, and the attached facility is identified as a project conflict.

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[112] https://www.fcc.gov/sites/default/files/bdac-federalsiting-report-012018.pdf

[113] FCC's Broadband Deployment Advisory Committee's (BDAC) Model Code for States.

To alleviate this conflict, the bridge owner and utility are faced with limited mitigation alternatives, and the facility almost always needs to be relocated off the bridge.

Utility bridge attachments, needing relocation, have proven to be a challenging and time-consuming undertaking, costing the utility significant money and resources. Many times, the utility relocation timeframe exceeds the project's schedule and becomes a major impact to the proposed highway improvement project, thus causing the utility to apply significant resources to meet the project's schedule. In addition, to assure the highway improvement project proceeds as planned and the facility does not become a project liability, the bridge owner can spend countless utility coordination hours with the utility.

Knowing bridge attachments eventually become project conflicts, necessitating relocation, utilities are strongly encouraged to seek alternate installation locations. This long-range outlook ultimately saves the ratepayers and taxpayers significant time and money.

Alternatively, transverse utility crossings are an allowable and permitted use of state highway ROW by all utility classifications: municipal, public, and private.[114] Facilities permitted on state highway ROW will be placed in a manner which will not impair the highway or adversely affect traffic safety.

Permit applications for a transverse crossing occupancy of state highway ROW will be reviewed by MDOT for impacts to the following:[115]

- Structural integrity of the highway
- Reasonably safe operation, maintenance, and future use of the highway
- Highway aesthetic quality and reasonable protection of roadside vegetation
- Environmental impacts
- Costs and/or difficulty of highway construction and maintenance

As an example, when MDOT reconstructed the I-94 Business Loop bridge over I-94 in Albion, Michigan in the early 2000s, MDOT made a commitment to the Federal Highway Administration to provide for additional underclearance by lowering the grade of I-94 with a future road project. This required relocating a telecommunication line off the structure, not only for the bridge reconstruction, but for the future project as well. MDOT worked with the telecommunication provider to relocate their facility approximately 500 feet west of and 15 feet below the existing grade of I-94. This saved the telecommunications company and taxpayers time and money by not having to relocate the facility a second time with the future construction.

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[114] https://www.michigan.gov/mdot/0,4616,7-151-9623_26662_26679_27267_48606-273646--,00.html
[115] https://www.michigan.gov/documents/mdot/mdot_utility_accommodation_policy_355826_7.pdf

Appendix F: Recommendations Discussed by Consortium Members

The following are recommendations discussed and contemplated by MCAN but were not included as part of the final recommendations.

Broadband Opportunity Zones

MCAN explored the opportunity to identify areas of the state unserved by broadband and define those areas as Broadband Opportunity Zones (BOZ). The BOZ would provide temporary relief from the PPT on newly installed equipment for six months for information service and telecommunications providers that deploy infrastructure to those areas and provide last-mile connectivity to residents, businesses, and institutions.

Tax Credit for Low-Income Households

MCAN examined the opportunity to allow qualifying low-income households the opportunity to receive an income tax credit on the annual cost of their home broadband subscription as well as for the cost of an internet-enabled device to connect to the internet. Low-income households would need to verify their income status.

Wireless "Bleed"

During MCAN's listening tour event in Port Huron, Michigan, on May 14, 2018, several participants discussed the issue of wireless signal "bleed" and interference in the area due to the region's proximity to the Canadian border. Wireless bleed occurs when wireless communications signals originating from and designed to serve customers in Canada cross the international boundary and interfere with wireless signals originating in the United States. MCAN discussed ways in which the wireless bleed issue could be addressed, however, those options are limited given the international regulatory nature of the wireless bleed issue.

Appendix G: Action Summaries

Improving broadband access and adoption in Michigan is a joint effort. The following pages provide summaries of actions federal, state, and local partners can take to implement the recommendations found in this roadmap.

A CALL TO ACTION FOR FEDERAL PARTNERS

Michigan's Broadband Vision

To support Michigan's broadband vision, federal partners can:

Improve broadband availability data reporting and publication, and provide more granular data for improved state, regional, and local decision making.

Continue streamlining the approval process and timeline for broadband infrastructure traversing federal land.

Expand eligibility requirements and funding for the Lifeline program, and streamline the application process.

Continue funding broadband infrastructure deployment through the USDA, Connect America Fund, and other sources.

Modify E-Rate rules to allow funds to be used beyond the school campus and close the homework gap in communities.

Continue providing guidance to state and local government through the Broadband Deployment Advisory Council on issues of dig-once, pole attachments, rights of way, and other topics.

Remove barriers to the deployment of TV White Space, and other technologies, as a rural broadband solution.

One Gbps to all residents and businesses by 2026.

Connect anchor institutions and communities.

Remove barriers to broadband adoption.

Promote coordination, cooperation, and communication.

Embrace all technologies, visionary planning, and innovative approaches.

Fully leverage existing and emerging funds

21st CENTURY
MICHIGAN INFRASTRUCTURE COMMISSION

The Michigan Consortium of Advanced Networks was created to develop a broadband roadmap for the state to identify gaps in service coverage and capacity, current efforts underway to address connectivity issues, and key strategies and recommendations for the public and private sector to pursue over the coming years to achieve ubiquitous connectivity.

A CALL TO ACTION FOR STATE PARTNERS

Michigan's Broadband Vision

To support Michigan's broadband vision, state partners can:

Establish the Michigan Partnership for Broadband Advancement to implement the broadband roadmap.

Create an annual broadband grant program to fund broadband access and adoption projects and programs.

Empower municipalities to create special assessment districts for broadband infrastructure improvements.

Continue to gather and validate broadband coverage data to produce accurate maps of broadband service.

Develop as outreach strategy targeting households experiencing broadband affordability issues to provide information on programs able to assist with the cost of service.

Review the Michigan Telecommunications Act to include a separate section for Lifeline broadband service.

Create a centralized database of planned right of way projects with guidance from the Michigan Infrastructure Council to coordinate planning.

Investigate further the equal applicability of the METRO Act to all right of way owners.

One Gbps to all residents and businesses by 2026.

Connect anchor institutions and communities.

Remove barriers to broadband adoption.

Promote coordination, cooperation, and communication.

Embrace all technologies, visionary planning, and innovative approaches.

Fully leverage existing and emerging funds

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A CALL TO ACTION FOR LOCAL PARTNERS

Michigan's Broadband Vision

To support Michigan's broadband vision, local partners can:

Explore partnerships with providers, institutions, and other communities for broadband expansion.

Work with organizations serving vulnerable populations to distribute information on low cost broadband services.

Adopt and promote e-services to improve the use of technology in communities.

Create local broadband planning teams to assess local broadband challenges and create a plan for improvement.

Identify and analyze local policies and ordinances that may be hindering broadband expansion and provide recommendations for modification.

Research broadband-related best practices and explore similar opportunities locally.

Establish local dig once and conduit installation policies to improve access to the right of way.

Adopt standards that account for broadband egress in new developments.

One Gbps to all residents and businesses by 2026.

Connect anchor institutions and communities.

Remove barriers to broadband adoption.

Promote coordination, cooperation, and communication.

Embrace all technologies, visionary planning, and innovative approaches.

Fully leverage existing and emerging funds

21st CENTURY
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Appendix H: Recommendation and Action Summary Table

	Recommendation	Short-Term Actions (6-12 Months)	Long-Term or Ongoing Actions (12 Months+ or Ongoing)	Lead State Agency(ies)	Supporting Partners
Access to Unserved Areas	Support Partnerships for Infrastructure Deployment	Develop tools for community demand aggregation and adoption planning Develop model partnership language and best practices Support community asset inventories	Study the tax implications for public assets used for broadband expansion	DTMB, MDARD, and (MPBA)	Municipalities, businesses, ISPs, CAIs, and non-profit organizations.
	Connect Community Anchor Institutions	Inventory CAI connectivity Conduct a state school technology assessment	Build awareness for broadband with CAIs	MDE & DTMB	ISPs, CAIs, CAI-supporting associations, and other state agencies
	Improve Data Collection and Utilization	Continue refining and validating coverage data Establish field validation methods Establish a university competition for data gathering applications	Advocate for changes to federal data collection methodologies	MPSC, DTMB, & (MPBA)	ISPs, non-profit organizations, municipalities, higher education, and the public
	Increase Backhaul Capacity	Coalesce infrastructure data to a single point Analyze backhaul capacity and accessibility	Incent ISPs to maximize backhaul construction Leverage publicly funded backhaul networks	DTMB & MDOT	MI Infrastructure Council, MEDC, MPSC, MI Utility Notification Center, and municipalities
	Improve Workforce Pool for ISPs	Leverage Marshall Plan resources for telecom related workforce development: 1) Develop or enhance relevant training programs, 2) Improve communication between ISPs and training programs, and 3) Develop online training programs for necessary skills		TED & MEDC	Higher education institutions, ISPs, libraries, and MDE

	Recommendation	Short-Term Actions (6-12 Months)	Long-Term or Ongoing Actions (12 Months+ or Ongoing)	Lead State Agency(ies)	Supporting Partners
Increase Broadband Adoption	Eliminate Cost Barriers to Broadband Adoption	Increase outreach and education for low-cost broadband programs including a clearinghouse of programs for vulnerable populations	Review the Michigan Telecommunications Act for possible Lifeline enhancements	MDHHS	MDE, organizations supporting vulnerable populations, municipalities, MSHDA, ISPs, schools, and libraries
		Encourage libraries to implement device lending programs	Centralize the qualification of households for low-cost programs		
			Explore surplus equipment as a means to provide low-cost devices		
			Support schools in their investment in mobile service solutions for students		
	Increase Digital Literacy and Technology Training Programs	Create a statewide digital literacy clearinghouse	Establish partnerships between schools and communities for mentoring and training	TED & MDE	Organizations providing digital literacy training, MDE, schools, libraries, ISPs, and businesses
		Leverage the Michigan Integrated Technology Competencies for Students as a benchmark for digital literacy	Support schools to provide technology training in classrooms and at home		
	Create Partnerships to Build Awareness	Develop best practice guide for creating partnerships that build awareness for broadband's use	Encourage CAIs to expand their use of technology	MDE & MEDC	DTMB, CAIs, businesses, and CAI-supporting organizations
		Study Michigan's homework gap in detail			
		Develop a coordinate messaging campaign to reinforce the benefits of broadband			

	Recommendation	Short-Term Actions (6-12 Months)	Long-Term or Ongoing Actions (12 Months+ or Ongoing)	Lead State Agency(ies)	Supporting Partners
Progress Michigan's Broadband Ecosystem	Leadership	Create a long-term commission to implement the roadmap and disperse state investment, (Michigan Partnership for Broadband Advancement, MPBA)		DTMB & MDARD	ISPs, MI Legislature, municipalities, non-profit organizations, and other state agencies
		Monitor federal broadband activities and advocate positions that benefit Michigan			
	State Investment	Invest $20,000,000 in broadband in fiscal year 2019.		MI Legislature, DTMB, & (MPBA)	Municipalities, non-profit organizations, and ISPs
		Support broadband projects that improve community and economic development			
	Other Potential Funding	Research alternative funding sources for broadband	Support rural electric cooperatives and their expansion of broadband	DTMB, MDARD, & (MPBA)	MDE, DTMB, MDARD, banking industry, philanthropic community, and municipalities
		Enable municipalities to create special assessment districts for broadband	Advocate for federal reforms to the E-Rate program		
		Create a $500,000 fund to support school E-Rate applications			
		Explore Community Reinvestment Act funds for broadband			
		Study the possibility of a "Kalamazoo Promise" -style fund for broadband			
	Technical Assistance and Community/ Regional Engagement	Create a state single point of contact for broadband	Create a clearinghouse for community broadband best practices	DTMB, MDARD, & (MPBA)	CAIs, non-profit organizations, ISPs, and municipalities
		Develop a broadband community engagement framework	Support community/ISP/CAI broadband grant/project applications		
		Convene an annual state broadband conference	Identify local policies that create barriers to broadband deployment		
		Create an annual university competition for broadband solutions development	Develop "Broadband Ready" guidelines		
		Develop a common set of definitions to facilitate information sharing	Host regular broadband training sessions for policymakers		
		Curate community broadband best practices			

	Recommendation	Short-Term Actions (6-12 Months)	Long-Term or Ongoing Actions (12 Months+ or Ongoing)	Lead State Agency(ies)	Supporting Partners
Progress Michigan's Broadband Ecosystem (continued)	Dig Once	Develop model dig once policies for ROW owners	Continue the work of the Asset Management Pilot Project	MDOT & Michigan Infrastructure Council	Road commissions, utilities and other pole owners, municipalities, and ISPs
			Create a central database of planned ROW projects		
			Develop model design standards for conduit installation		
	One-Touch Make-Ready	Work with ISPs to establish best practices for improving the pole attachment process	Monitor federal pole attachment policies and updates	MPSC	Utilities and other pole owners, ISPs, and utility associations
	Residential/Commercial Development Standards	Work with ISPs to develop a "wish list" of development standards	Support partnerships between ISPs and the development community	MEDC	MDOT, municipalities, developers and related associations, and road commissions
		Develop model language for including broadband egress in building codes			
	Rights of Way Permitting	Investigate the equal applicability of the METRO Act	Update the definition of telecommunication facilities in the MTA	MDOT & MPSC	MI legislature, Local Community Stabilization Authority, ISPs, utilities and other pole owners, and road commissions
		Gather and share best practices between ISPs, road commissions, and other ROW owners	Monitor the impact of PA 97 of 2018		

Appendix I: Glossary and Table of Units

Reproduced, edited, and amended from a resource provided by the National Telecommunications and Information Administration

Numbers

3G: The term for the 3rd generation wireless telecommunications standards usually with network speeds of less than 1 Mbps.

4G: The term for 4th generation wireless telecommunications standards usually with network speeds greater than 1 Mbps.

5G: The term for emerging 5th generation wireless telecommunications standards usually associated with network speeds of up to 1 Gbps or more.

A

Asymmetrical Bandwidth: A connection in which the maximum transfer rate is different for download and upload speeds.

B

Backbone: A major high-speed transmission line that strategically links smaller high-speed internet networks across the globe.

Backhaul: The portion of a broadband network in which the local access or end user point is linked to the main internet network. Also referred to as "middle mile."

Bandwidth: The capability of telecommunications and internet networks to transmit data and signals.

Bit: The base unit of information in computing. For our purposes, also the base unit of measuring network speeds. A single piece of information is equal to 1 bit. Network speeds tend to be measured by bits per second—using kilo (1,000), mega (1,000,000), and giga (1,000,000,000). A bit is a part of byte; they are not synonyms. Bit is generally abbreviated with a lowercase b.

Broadband: The term broadband commonly refers to high-speed internet access that is always on and faster than traditional dial-up access. Broadband includes several high-speed transmission technologies, such as fiber, wireless, satellite, digital subscriber line, and cable. For the Federal Communications Commission (FCC), broadband capability requires consumers to have access to actual download speeds of at least 25 Mbps and actual upload speeds of at least 3 Mbps.

Broadband Adoption: The use of broadband in places where it is available, measured as the percentage of households that use broadband in such areas.

C

Cable Modem System: Cable television companies have offered internet access via their cable system for more than a decade. The network architecture uses a loop that connects each subscriber in a given neighborhood, meaning they all share one big connection to the internet.

Central Office: A telecommunication company's building where consumers' phone lines are attached to equipment that connects a consumer to other consumers in that central office or other central offices across the globe.

Community Anchor Institutions: Schools, libraries, medical and health care providers, public safety entities, institutes of higher education and other community support organizations that provide outreach, access, equipment, and support services to facilitate greater use of broadband service by the entire population and local governments.

Conduit: A reinforced tube through which cabling runs. Conduit is useful both to protect fiber-optic cables in the ground and because one can place the conduit underground when convenient and later "pull" the fiber cabling through the conduit.

D

Dark Fiber: Fiber that is in place but not being used for broadband services. ("non-lit" fiber, also see "Lit Fiber").

Digital Divide: The gap between those of a populace that have access to the internet and other communications technologies and those that have limited or no access.

Digital Equity: Recognizes that digital access and skills are now required for full participation in many aspects of society and the economy. Digital Equity links Digital Inclusion to social justice and highlights that a lack of access and/or skills can further isolate individuals and communities from a broad range of opportunities.

Digital Inclusion: Implies that individuals and communities have access to robust broadband connections; internet-enabled devices that meet their needs; and the skills to explore, create, and collaborate in the digital world.

Digital Literacy: The ability to leverage current technologies, such as smartphones and laptops, and internet access to perform research, create content, and interact with the world.

DSL (Digital Subscriber Line): A form of technology that utilizes a two-wire copper telephone line to allow users to simultaneously connect to and operate the internet and the telephone network without disrupting either connection.

E

E-Government Services: The government's use of web-based and information technology resources to connect with citizens and provide online services and resources.

F

Fiber (Also referred to as Fiber Strand): A flexible hair-thin glass or plastic strand that is capable of transmitting large amounts of data at high transfer rates as pulses or waves of light.

FTTH or FTTP (Fiber to the Home or Fiber to the Premise): The delivery and connection of fiber optics directly to a home or building.

Fixed Broadband: High-speed data transmission to homes and businesses using technologies such as T1, cable, DSL, fiber, and fixed wireless. Excludes mobile broadband and non-terrestrial services.

Fixed Wireless Broadband Access: The use of wireless devices/systems in connecting two fixed locations, such as offices or homes. The connections occur through the air, rather than through fiber, resulting in a less expensive alternative to a fiber connection.

I

Internet Service Provider (ISP): A company that provides users (individuals or businesses) with access (a connection) to the internet and related services.

Interconnection: The linking of numerous telecommunications networks to exchange user traffic.

L

Last Mile: The technology and process of connecting the end customer's home or business to the local network provider.

Lit Fiber: An active fiber optic cable capable of transmitting data.

Local Area Network (LAN): A group of connected network devices that are on a high-speed connection and typically within the same building or location.

LTE (Long Term Evolution): A 4G wireless broadband technology that provides speeds up to 100 Mbps download and 30 Mbps upload.

M

Middle Mile: The connection between a local network, also called a "last mile" connection, and the backbone internet network. Also referred to as "backhaul."

Mobile broadband: A type of internet connection designed for use "on-the-go" with seamless connectivity from one geographic location to the next.

N

Network Infrastructure: The hardware and software components of a network that provide network connectivity and allow the network to function.

O

Open Access Network: Networks that offer wholesale access to network infrastructure or services provided on fair and reasonable terms with some degree of transparency and nondiscrimination.

P

Point of Presence: The particular place or facility where local internet service providers connect to other networks. Distance from the Point of Presence can affect service availability and pricing.

Public Computer Center (PCC): A facility that is open to the public and provides broadband access, education, support, and training relevant to community needs. PCC locations include, but are not limited to, community colleges, libraries, schools, youth centers, employment service centers, and centers in public housing developments, among many others, that provide broadband access to the general public or specific vulnerable populations, such as low-income, unemployed, older adults, children, minorities and people with disabilities.

R

Rights-of-Way (ROW): ROW are legal rights to pass through property owned by another. ROW are frequently used to secure access to land for digging trenches, deploying fiber, constructing towers and deploying equipment on existing towers and utility poles.

S

Service Area: The entire area within which a service provider either offers or intends to offer broadband service.

Spectrum: A conceptual tool used to organize and map the physical phenomena of electromagnetic waves. These waves propagate through space at different radio frequencies, and the set of all possible frequencies is called the electromagnetic spectrum.

T

Telecommunication Services or Services: Includes regulated and unregulated services offered to customers for the transmission of 2-way interactive communication and associated usage. A telecommunication service is not a public utility service (from the Michigan Telecommunications Act).

Telemedicine: The use of high-speed, high-capacity internet to support long-distance health care services, patient and provider education, and enhanced health care administration.

V

VoIP (Voice over Internet Protocol): A technology that allows users to send and receive voice calls using an internet connection instead of a phone line.

W

Wi-Fi (Wireless Fidelity): A technology that uses radio transmissions to enable electronic devices to connect to a wireless local area network (LAN).

WiMAX: A wireless technology through which wireless internet access is provided with a significantly larger range than regular Wi-Fi. WiMAX can provide broadband service up to 30 miles.

WISP: An ISP that provides service through a wireless network.

Appendix J: Community Broadband Resources

Many of the recommendations in this roadmap benefit Michigan's communities, or communities are heavily involved in their implementation. From local municipalities and county government to regional planning and economic development agencies, a joint effort is needed in order to improve broadband access and adoption across the state.

The following table provides a collection of resources for communities seeking additional information on the various recommendations and action items included in this roadmap.

Topic	Resources
Partnership Development	National Telecommunications and Information Administrations Guide to Effective Public-Private Partnerships: https://broadbandusa.ntia.doc.gov/sites/default/files/resource-files/ntia_ppp_052417.pdf
	Connected Nation sample residential survey: http://connectmycommunity.org/wp-content/uploads/2018/07/Sample-residential-survey_071318.pdf
	Guide to demand aggregation and sample survey: https://www.ncbroadband.gov/playbook/broadband-planning-committees/demand-aggregation/
	Michigan ISPs by County: https://connectednation.org/wp-content/uploads/sites/13/2018/07/MI_BB-Providers-by-County.pdf
Infrastructure, Asset Management, and Inventories	Final report of the Michigan Infrastructure Asset Management Pilot: https://www.michigan.gov/documents/snyder/asset_management_report_621264_7.pdf
	Ogemaw County vertical asset inventory project: https://www.telecompetitor.com/michigan-county-inventories-structures-for-rural-wireless-antennas/
	Example of community-based inventory platform, Motor City Mapping: https://motorcitymapping.org/
	Report of the 21st Century Infrastructure Commission: https://www.michigan.gov/documents/snyder/21st_Century_Infrastructure_Commission_Report_555079_7.pdf
Funding	National Telecommunications and Information Administration Guide to Federal Broadband Funding: https://www2.ntia.doc.gov/files/ntia_guidetofedfunding_062317.pdf
	Michigan State University Libraries Guide to Grant Funding for Non-Profits: http://staff.lib.msu.edu/harris23/grants/2sgalpha.htm

Topic	Resources
Broadband Adoption	National Telecommunications and Information Administration's Broadband Adoption Toolkit: https://www2.ntia.doc.gov/files/NTIA_2013_BroadbandUSA_Adoption_Toolkit.pdf
	National Digital Inclusion Alliance Guidebook: https://guidebook.digitalinclusion.org/index.html
	Why Broadband Matters: http://connectmycommunity.org/wp-content/uploads/2018/07/Why-Broadband-Matters.pdf and http://connectmycommunity.org/wp-content/uploads/2018/07/Speed-Matters.pdf
Devices	Mobile Beacon (providing low-cost wireless hotspots and devices for schools and libraries): https://www.mobilebeacon.org/
	Charitable Computer Reuse and Recycling: https://interconnection.org/
Digital Literacy, Talent, and Workforce	Michigan Marshall Plan for Talent: https://www.michigan.gov/ted/0,5863,7-336-85008---,00.html
	Michigan Integrated Technology Competencies for Students: http://www.techplan.org/mitecs/
	Connected Nation's DRIVE: http://driveyourlearning.org
	National Telecommunications and Information Administration's digital literacy resources: https://digitalliteracy.gov/
	KhanAcademy: https://www.khanacademy.org/
	Microsoft digital literacy: https://www.microsoft.com/en-us/digitalliteracy
Community Broadband Planning & Local Policies	Connected Nation Connected Community Engagement Program: http://connectmycommunity.org
	Guide to Local Policies and Best Practices for Expanding Broadband: http://connectmycommunity.org/wp-content/uploads/2016/09/Local-Policy-Guide.pdf
Affordability	Michigan Lifeline Eligibility Database: https://www.michigan.gov/mpsc/0,4639,7-159-16372_17095-343826--,00.html
	Access from AT&T: https://www.att.com/shop/internet/access/#!/
	Spectrum Internet Assist: https://www.spectrum.com/browse/content/spectrum-internet-assist.html
	Comcast Internet Essentials: https://www.internetessentials.com/

Appendix K: Special Thanks

MCAN would like to thank the following individuals for supporting the development of the roadmap through their subgroup participation.

Jason Allen
USDA

David Allen
MidWest Energy

Robin Ancona
Michigan Public Service Commission

Mike Ashton
Fraser Trebilcock

Phil Bertolini
Oakland County

Roger Blake
AT&T

Craig Borr
Michigan Electric Cooperative Association

Dan Casey
St. Clair County Economic Development

Jason Church
USDA

Emily Dabish
Rocket Fiber

Ben Fineman
Michigan Broadband Cooperative

Paul Griffith
MichiganWorks! West Central

Matt Groen
Michigan Cable Telecommunications Association

Chris Horak
Comcast

Marc Hudson
Rocket Fiber

Marc Keezer
Lyndon Township, Washtenaw County

Sean Kelly
Michigan Public Service Commission

Neil Krevda
Verizon

Jason Kronemeyer
Eastern Upper Peninsula ISD

John LaMacchia
Michigan Municipal League

John Liskey
Michigan Internet and Telecommunications Alliance

Ann-Marie Mapes
Michigan Department of Education

David McCartney
Peninsula Fiber Network

Steve Meinhardt
Casair

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Al Meshkin
Laketown Township, Allegan County

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County Road Association of Michigan

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Library of Michigan

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Andrew Solon
AT&T

Bob Stewart
Frontier Communications

John VanWagoner
Alpena Public Schools

Dennis West
Northern Initiatives

Wayne Workman
Michigan Economic Development Corporation