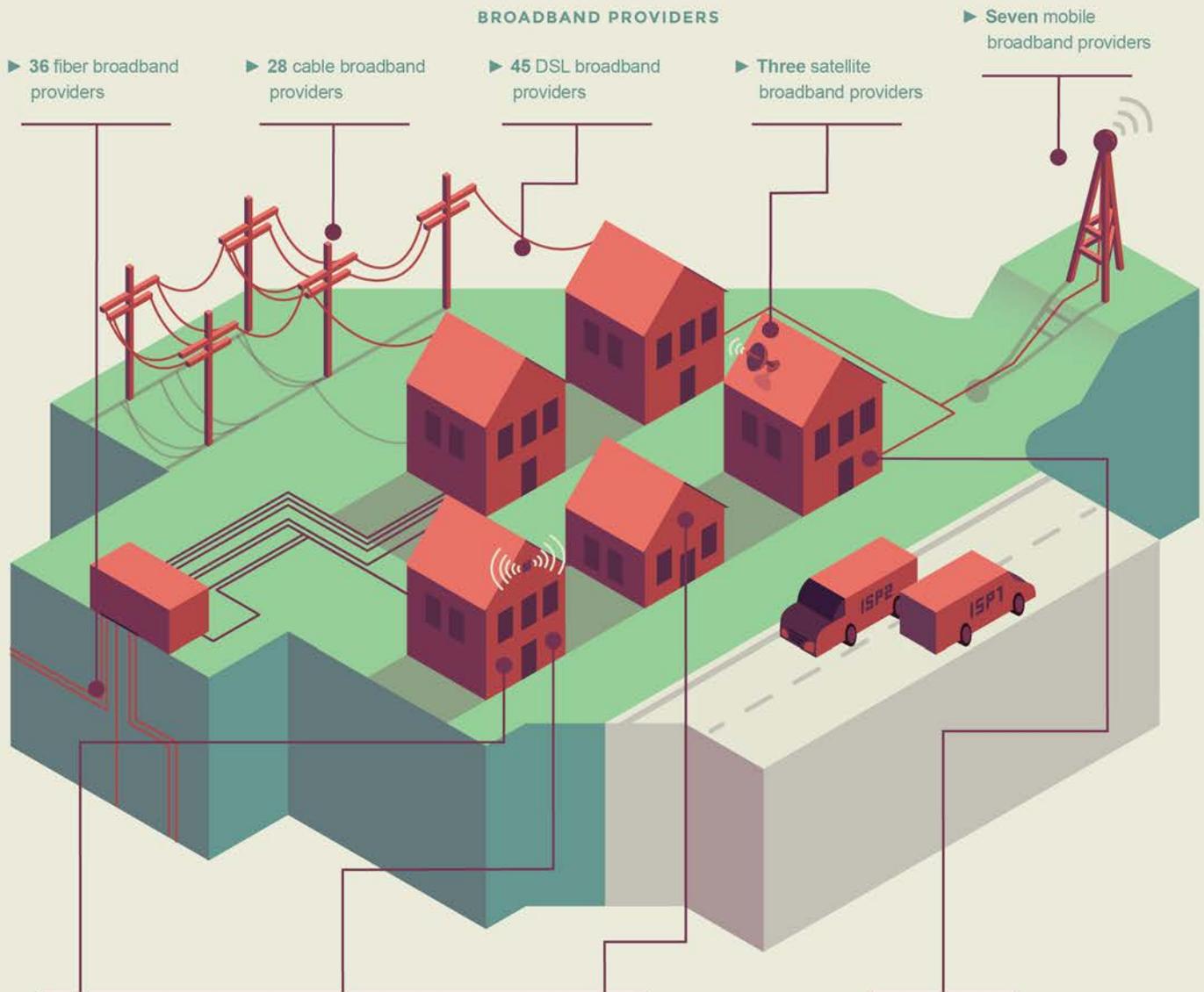# CHAPTER 4.
Communications Recommendations

CURRENT STATE OF MICHIGAN'S COMMUNICATION INFRASTRUCTURE

Infrastructure systems in Michigan should enhance residents' quality of life, enable economic growth, and create a strong foundation for vibrant communities. In order to obtain safe, reliable, and resilient communications systems in the 21st century, we must first understand the current reality of communication infrastructure in Michigan:

BROADBAND PROVIDERS

▶ **36** fiber broadband providers

▶ **28** cable broadband providers

▶ **45** DSL broadband providers

▶ **Three** satellite broadband providers

▶ **Seven** mobile broadband providers

BROADBAND ACCESS

▶ Of Michigan households, **12 percent** lack access at national benchmark speeds.

▶ More than **450,000 households** still lack access to advanced broadband service.

▶ Certain areas of the state have low density of households, businesses, and institutions, which results in limited or no return on investment for delivering service to these places, thus creating a gap in investment.

BROADBAND ADOPTION

▶ Of Michigan households, **27 percent** do not subscribe to broadband service.

▶ In many cases, adopting a broadband connection can be out of reach for residents due to the technology required or expensive service delivery.

▶ There is a lack of digital literacy and/or technical skills to understand and utilize broadband connection.

In order to unlock the potential of new technology, Michigan must ensure that secure, reliable, affordable, and universal advanced communications services are available to all residents. Affordable, high-speed broadband[2] service is essential for the advancement of education, health, public safety, research and innovation, civic participation, e-government, and economic development.

The Internet is already a part of everyday life for most Michiganders. People and businesses depend on it every day for communication, banking, commerce, leisure, and more. While access to the Internet and technology has, in many respects, made daily life easier, it comes with the risk that someone could access our private information. High-profile examples of cyber attacks have seemingly become more prevalent in daily life—from the recent hack of the Democratic National Committee, to attacks on the electric grid in Ukraine, to a breach of around five million Yahoo! accounts. As more devices connect online, and more information is shared over the Internet, the risk of cyber attacks increase.

> *It is vital to the safety of Michigan residents and the state's economic prosperity that critical information and assets are protected from cyber security threats.*

Michigan must also recognize the way that current and emerging technologies are converging to create new opportunities and encourage an adaptive model that can enable new delivery methodologies for broadband such as fiber-optics, wireless, satellite, and other technologies yet to be developed. The most enduring and powerful technological changes on the horizon are the Internet of Things[3] (IoT) and artificial intelligence/machine learning (AI).[4] Combined, these technologies will transform the way in which we experience daily life. Technological innovation will enable a variety of new modes of human interaction and societal transformations, from aging in the home to viewing transportation as a service.

The IoT comprises an expansive system of connected remote sensors that can communicate real-time information, both to one another and a central controller, and perform remote control functions. Essentially, the IoT creates a connection between the physical and the digital worlds. Imagine a large office building that can monitor and control the pace of its elevators to optimize departures of cars from an attached parking structure, and sync with traffic lights, as well as with intelligent vehicles to minimize traffic congestion during rush hour. This system, as imagined, offers several potential benefits—including reduced fuel consumption, fewer greenhouse gas emissions, less time spent in traffic, and possibly even fewer collisions. These technologies will depend on communications infrastructure that can adapt to new demands and the changing nature of

---

[2] Broadband is a descriptive term for evolving digital technologies that provide consumers a signal switched facility offering integrated access to voice, high-speed data service, video-demand services, and interactive delivery services (FCC January 28, 2014).

[3] IoT is the network of physical objects that contain embedded technology to communicate and sense or interact with their internal states or the external environment (Gartner 2016).

[4] Machine learning is a technical discipline that aims to extract certain kinds of knowledge/patterns from a series of observations. Depending on the type of observations provided, it splits into three major sub disciplines: supervised learning, where observations contain input/output pairs (a.k.a. labeled data); unsupervised learning, where those labels are omitted; and reinforced learning, where evaluations are given of how good/bad a certain situation is (Dawson 2016).

technology. As potential technological changes are identified, the State will need to ensure changes are developed deliberately, to protect the safety and security of individuals while balancing with concerns about privacy and autonomy.

The Internet of the 21st century will have a profound effect on the economy and lives of Michigan's residents. It will measure the quality of the air we breathe and the water we drink. It will benefit the quality of our commute and speed the flow of goods along the supply chain, ultimately to the consumer in a better and less expensive way. It will enhance public health and public safety; help the aging population stay independent longer and enhance the quality of the healthcare we receive; help us more efficiently consume energy; help enhance productivity from Michigan's crops; keep us safer and help deliver richer educational and recreational experiences for Michigan residents and visitors.

This chapter outlines a series of recommendations to ensure that Michigan is a communications leader, and that the state is prepared for the pervasive use of Internet-connected sensors and beacons, and that a priority is placed on ensuring network connectivity is available to people everywhere.

Recommendations Key

EP   Economic Prosperity   **HE**   A Healthy Environment

QS   Reliable, High-quality Service   **VI**   Value for Investment

0-2   Implementation Start (in years)   **0-2**   Implementation Complete (in years)

4.1 MAKING MICHIGAN A SMARTER STATE

Where is Michigan today?

Technologies offer tremendous potential; it is predicted that by the year 2020, there will be an estimated 50 billion things connected to the Internet, but there is still uncertainty about the number, type, and application of new technologies. There are no widely accepted technical standards for the IoT, including data storage, management, and sharing among stakeholders. This uncertainty makes it difficult to determine how Michigan must prepare itself for the future, yet the State lacks policies related to implementation of the IoT, specifically regarding to the ownership and sharing of data, security controls, and privacy. Any new policies and regulations must be properly balanced so Michigan can realize the benefits that stem from greater access to data, data sharing, and shared services. Where these technologies do exist, Michigan can leverage its buying power to help define product development and accelerate the maturation, effectiveness, and deployment of technologies.

For the most part, the technical capabilities required to achieve the vision of a "smarter state" have yet to be invented, and it is possible that some of the necessary components to achieve this will remain undeveloped during the next 30 to 50 years. According to the International Telecommunication Union (ITU)—an international organization charged with standardizing communications technologies, such as the 5G wireless network roadmap—the technology required to properly enable the IoT will not be broadly defined and available before 2020 (ITU September 2016).

> **21st Century Smarter State**
>
> 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.

What does a 21st century Michigan look like?

Michigan is a global leader in the development, deployment, and adoption of new technologies, and the creation of smart environments and communities. This includes leading in the promotion of technologies that support smarter city[5] development; adoption of low-power, wide-area networks and state-of-the-art wireless technology networks; research into communications technology such as AI, machine-to-machine communication and machine learning; and deployment of IoT

---

[5] Cities are becoming "smarter," through better predictive analytics and real-time decision making as governments, businesses, and communities increasingly rely on technology to overcome the challenges from rapid urbanization. What makes a smarter city is the combined use of software systems, server infrastructure, network infrastructure, and devices to better connect several critical city infrastructure components and services: administration, education, healthcare, public safety, real estate, transportation, and utilities. The concept of the smarter city is pushing Chief Information Officers in federal, state, and local governments and their technology teams to further evaluate emerging technologies and engage with key stakeholders within and outside of their organizations to provide city administration and residents with better information and outcomes.

technology through flexible policies and regulations. Michigan also builds upon its rich history in transportation and logistics innovation by continuing to develop and commercialize technologies required for the next generation of intelligent vehicles, as well as manned and unmanned aerial vehicles (see section 6.9: Intelligent Vehicle Technology recommendations). Michigan's leadership position is underpinned by a robust cyber security ecosystem,[6] and its established partnerships with the automotive, financial, healthcare, education, energy, military, law enforcement, critical infrastructure, and the private/public sectors. These advances promote a more connected, smarter Michigan that uses interactive, interconnected technology to identify and address problems before they become too big to solve.

Technology also promotes more effective collaboration—resulting in better service for businesses, visitors, and residents—and expands the economy while dramatically increasing Michigan's attractiveness as a place to live, work, and play. Technology will provide value to aging and disabled populations, including housing, transport, healthcare, communication and community support services, leisure, and culture (Skouby et al. 2014). Technologies will serve to create smart and enabling environments where people will find themselves empowered (Coetzee 2016). Smart infrastructure that leverages IoT technology and services can be transformative by improving mobility, wayfinding, communication, and access to information for the aging and populations with disabilities. A smarter Michigan will be safer, healthier, and more efficient for everyone.

Given the rapid pace of changes in technology, Michigan's progress is measured and reviewed annually to ensure its place as a top-five state, with a thorough review of the broader goals and benchmarks occurring every four years.

Some of the opportunities offered in a 21st century Michigan will include:

- Highways that allow commuters to quickly find an alternate route and avoid congestion from a highway accident
- Transit stops that provide easily accessible route information for visitors or other passengers
- Destinations that recognize return visitors and welcome them with information they can use to make their experience more enjoyable
- Street lights that make communities safer by prompting city workers to replace the light bulb before burning out
- Technology that alerts law enforcement of crime or suspicious activity as it happens so they can arrive on the scene sooner
- Infrastructure that monitors water quality and water level and alerts government officials to maintenance issues before larger, more costly problems develop
- Healthcare devices that allow patients to monitor their symptoms and alert them if they need to seek treatment
- Homes that allow residents to age in place

---

[6] To keep pace with the ever-evolving and persistent cyber threats, Michigan's focus is on prevention, detection, response, and accountability, while increasing our key partnerships within the automotive, financial, healthcare, education, energy, military, law enforcement, critical infrastructure, and private/public sectors.

How do we get there?

4.1.1 The State of Michigan should create the Consortium on Advanced Networks (see recommendation 4.2.1) to develop a vision, a plan, and execution roadmap to enact the state's digital transformation by investing in emerging technologies, supporting academia in research related to the IoT, building an adaptive IoT workforce, and forming appropriate policies to create a smarter state. Ensuring appropriate security measures are included in all IoT implementation projects should be part of this roadmap. The Building the 21st Century Economy Commission, established by Governor Snyder in June 2016 to develop a comprehensive economic vision for Michigan, should consider this recommendation during their deliberations.

Estimated investment needed: Will utilize existing staff resources

(EP) (0-2) (0-2)

4.1.2 The Michigan Economic Development Corporation (MEDC), in partnership with relevant state agencies, should create a fund to support efforts that will make Michigan a global leader in smart technology development and deployment. The fund will provide seed and matching funds to key stakeholders to incentivize innovation, research, and development on advanced communications and other smart technologies (including AI; machine-to-machine communication; machine learning; and transportation, water, wastewater, and stormwater technologies). The fund will also support cities in identifying, implementing, and funding smart technology investments that appropriately serve their communities.

Estimated investment needed: $10 million of state funds annually

(EP) (3-5) (3-5)

4.1.3 The DTMB should actively participate in relevant workgroups and committees of the National Association of Chief Information Officers and the International Telecommunications Union to position Michigan as a technological leader.

Estimated investment needed: Will utilize existing staff resources

(EP) (0-2) (0-2)

4.1.4 The Michigan Infrastructure Council (see Chapter 3) should engage in P3s to ensure IoT adoption is included in infrastructure planning and retrofit technologies are considered, pursued, and incorporated as they become available for upgrades and maintenance activities to existing and future infrastructure.

Estimated investment needed: Will utilize existing staff resources

(EP) (3-5) (3-5)

4.2 IMPROVING BROADBAND ACCESS AND ADOPTION

Where is Michigan today?

Michigan has made a concerted effort over the past decade to expand the availability of broadband services by leveraging federal programs, such as the Universal Service Fund and the Connect America Fund. Through incentives provided through these federal programs and investments made by the state's broadband providers, Michigan has come a long way in improving broadband access and adoption. Michigan's current achievement for broadband access and adoption is detailed below in Exhibit 8.

EXHIBIT 8. Broadband Access and Adoption: Current State, Goals, and Gaps
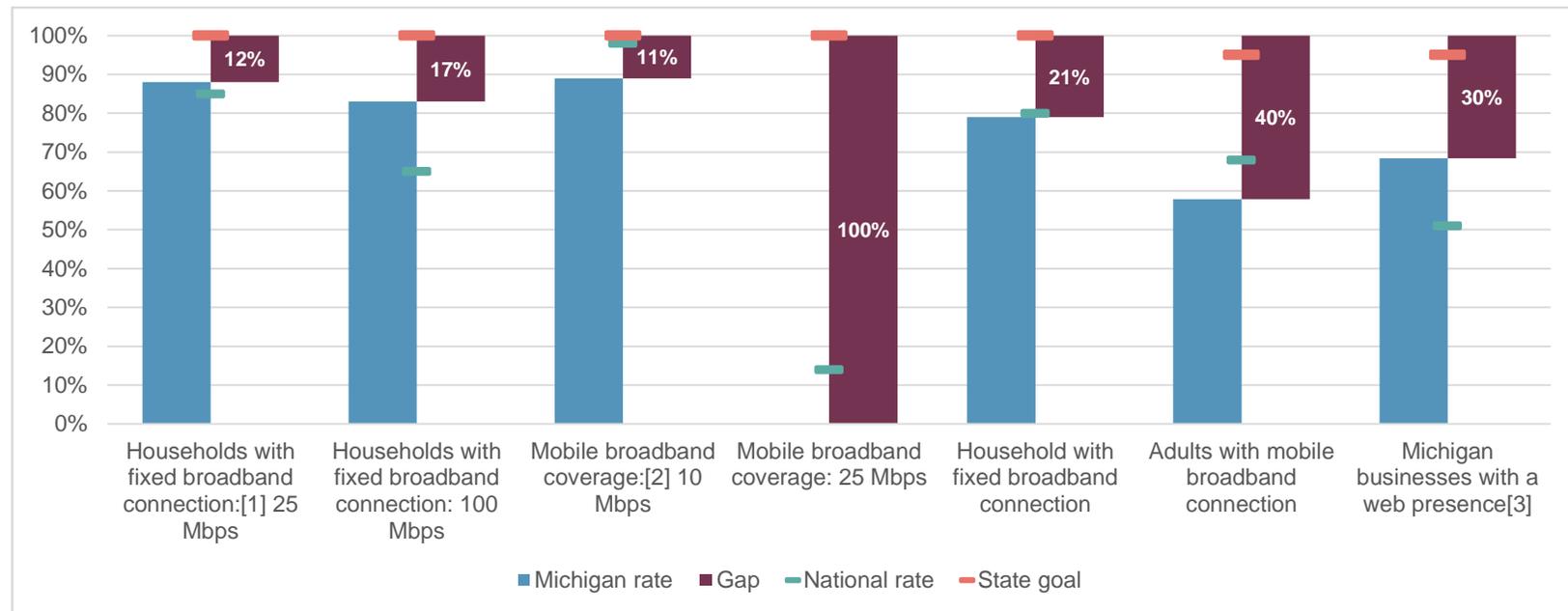
Source: Connect Michigan 2015; National Broadband Map 2014; U.S. Census Bureau 2016; Pew Research 2016; Todd 2015.

Despite efforts, there are still barriers to achieving these goals and addressing the gaps between the current and desired future states:

- Certain areas of the state have low density of households, businesses, and institutions, which results in limited or no return on investment for delivering service to these places—thus creating a gap in investment.
- The processes for installing communications infrastructure can often be long and cumbersome.
- There is limited federal, state, and local government authority to encourage or require broadband deployment in underserved areas.
- In many cases, adopting a broadband connection can be out of reach for residents, due to the technology required or service delivery being too expensive.
- Some people may not be aware of how broadband adoption can impact their quality of life.
- There is a lack of digital literacy and/or technical skills to understand and utilize a broadband connection.

What does a 21st century Michigan look like?

Michigan is a top-five state for broadband access and adoption, recognizing that broadband access is vital to ensuring residents and businesses to succeed. The deployment of broadband technology provides a range of potential benefits, such as expanded access to healthcare and educational resources, economic opportunities, and improved public safety, among other benefits. Michigan's residents and businesses have access to affordable advanced broadband services, even in previously unserved and underserved areas, and tools and training are available to adopt a broadband connection.

By promoting broadband access and adoption, thus creating a "broadband superhighway," Michigan will:

- Enable interconnection of assets across infrastructure types, such as transit, water systems, energy, and governmental services
- Ensure every business has access to advanced broadband networks to enable local economic growth
- Ensure every student in the state has high-speed broadband network access at school and at home to enhance learning opportunities, eliminate the "homework gap"[7] for P–20 students, grow opportunities for workforce career development, and increase the opportunity and percentage of Michigan residents attending, and graduating college
- Connect state and local governments in order to provide new, improved, enhanced, and more efficient services to their constituencies
- Improve and expand the ways transportation, healthcare, tourism, and other industries deliver products and services

---

[7] The homework gap refers to the disadvantage for students especially those from low-income households who lack broadband access at home. This makes it more difficult to do school work that increasingly relies on Internet access (Pew Research Center April 2015).

Michigan's position as a top-five state for broadband access availability for residents, businesses, and institutions means that:

- 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[8] 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.

As a top-five state for broadband adoption—where residents, businesses, and institutions have the opportunity and ability to fully engage in digital society and the digital economy—Michigan has achieved the following goals:

- 95 percent of residents have adopted a fixed and mobile broadband connection at home by 2024.
- 95 percent of Michigan businesses have a Web presence by 2020.
- All community anchor institutions have adopted a fixed broadband connection by 2024.

How do we get there?

4.2.1 The Governor should issue an executive order establishing the Michigan Consortium on Advanced Networks, an advisory body comprising stakeholders from the nonprofit, public, and private sectors and academia. The group would be charged with improving coordination among stakeholders in addressing mobile and fixed broadband access and adoption issues in the state, as well as making Michigan a smarter state. The Consortium would comprise individuals representing varied interests, such as state government, telecommunications providers, broadband providers, video service providers, wireless carriers, and more. The Governor would appoint the members of the Consortium, including its chair(s). The Consortium would also provide advice and counsel to the Michigan Infrastructure Council on communications-related infrastructure. In addition to helping Michigan become a smarter state (see recommendation 4.1.1), the Consortium would perform the following advisory functions:

- **Policy coordination:** Recommend policy changes to improve mobile and fixed broadband access in the state, including streamlining and expediting permit and approval processes for locating and constructing new broadband infrastructure.
- **Technical assistance:** Support local and state agencies in working with the private sector to increase mobile and fixed broadband access in Michigan, such as providing guidance on the creation of P3s to support the joint use of existing horizontal and vertical assets and

---

[8] Community anchor institutions are schools; libraries; medical and healthcare providers; public safety entities; community colleges and other institutions of higher education; and other community support organizations and agencies that provide outreach, access, equipment, and support services to facilitate greater use of broadband service by vulnerable populations—such as low-income residents, the unemployed, and the elderly (FCC November 18, 2011).

network facilities to reduce over-building; expedite new connections for residents, businesses, and institutions; encourage economies of scale in rural communities; and support installing universal conduits for new construction projects.

- **Asset management:** Continue and expand efforts to map and research mobile and fixed broadband access and adoption to more efficiently respond to changing needs of communities, residents, businesses, institutions, and private-sector broadband providers.

- **Digital literacy education:** Expand, improve, and create pragmatic digital literacy programs at the state and local level. The programs should respond to the digital literacy and technology training needs of Michigan businesses and support a tech-savvy workforce, as well as inform consumers, businesses, tribal governments, and community anchor institutions about the importance of fixed and mobile broadband availability and adoption. Educational activities could include convening an annual statewide broadband conference with the purpose of providing an opportunity for cross-sector collaboration and the sharing of best practices in the expansion of mobile and fixed broadband access, adoption, and use across the state.

- **Funding options:** Provide funding—and help identify funding and financing from all available sources and programs—to entice investors to provide affordable mobile and fixed broadband access to households and businesses statewide, making Michigan a top-five state for mobile and fixed broadband access and adoption:

  - Providing a subsidy[9] to stimulate private sector investment that makes available state-of-the-art broadband access to the portion of Michigan's population that currently doesn't have access to at least 10Mb/1MB fixed broadband service because of low population density and other factors that make service delivery uneconomical for providers.

  - Creating a financing program to remove the installation cost barrier for customers who want to pay for one-time costs for conduit or equipment to prepare the site to receive commercially available broadband connections to their home or building;

  - Developing a grant or revolving loan program to assist local units of government and private sector broadband providers in collaboratively establishing P3s to support the sharing and joint use of existing horizontal and vertical assets and network facilities to reduce over-building; expedite new connections for residents, businesses, and institutions; encourage economies of scale in rural communities; and support installing universal conduits for new construction projects across the various levels of right-of-way jurisdictions.

  - Monitoring and maximizing funding opportunities that support the adoption of mobile and fixed broadband among families and individuals that qualify for the

---

[9] According to the Federal Communications Commission's (FCC's) Connect America Cost Model, the estimated subsidy required to make it economical for private sector broadband providers to invest in installing fiber-to-the-premises broadband access with a download speed of 100 Mbps infrastructure in rural areas of the state is approximately $2.2 billion over 25 years ($89 million annually). Of this total subsidy amount, $645.7 million can be provided by the FCC's Connect America Fund, leaving a balance of $1.57 billion in subsidies needed over the next 25 years. This subsidy combined with the private investment it would stimulate—which is estimated to be an equal or greater amount—represents the estimated total cost of connecting the 17 percent of Michigan's population that currently do not have access.

federal lifeline program, but who do not have access to a low-cost mobile and fixed broadband program.[10]

Estimated investment needed: $50 million of state funding, annually over ten years[11]

QS 0-2 11+

4.3 SECURING MICHIGAN'S DIGITAL INFRASTRUCTURE

Where is Michigan today?

While Michigan is already a top performer in cyber security[12] preparedness, the rate of advances in technology means that Michigan must constantly improve to stay ahead of threats (Spidalieri 2015). In order to provide state-of-the-art cyber security, Michigan must address several barriers. Currently, Michigan's public sector struggles to attract and retain top talent in the cyber field, due to significant wage discrepancies between the public and private sectors. Michigan has attempted to address this wage gap by creating an information technology (IT) student assistant classification and an entry level IT classification for students with associate's degrees, developing a performance pay schedule for longer-term high performing IT staff, and increasing new IT employee salaries upon hiring. Also, entities working in Michigan's cyber security ecosystem lack an exemption from Freedom of Information Act (FOIA) legislation, which creates a barrier to sharing cyber threat and vulnerability information between and amongst public and private entities.

The state's experience as a cyber security leader makes it evident that strong collaboration is an important step in ensuring this ecosystem remains strong and committed. Michigan has engaged private and public experts through recurring conferences and Chief Security Officer Kitchen Cabinet meetings, leveraged the Michigan Cyber Range, and formed the Michigan Cyber Civilian Corps to share best practices and network with seasoned cyber professionals.

What does a 21st century Michigan look like?

As more and more information gets shared and interactions occur online, Michigan will set industry standards in cyber security by finding innovative ways to defend critical information, manage access and identity management, and embrace new and emerging technologies. Michigan

---

[10] The FCC's Lifeline program provides discounts on phone service for low-income consumers. The Commission expanded the program to include broadband services in 2016 (FCC August 11, 2016).

[11] Note that the recommended $50 million annual investment is not enough to fully implement this recommendation, but the Commission is also recommending identifying funding from other available sources and programs—such as the Connect America Fund—to fill the gap.

[12] Cyber security encompasses a broad range of practices, tools, and concepts related closely to those of information and operational technology security. Cyber security is distinctive in its inclusion of the offensive use of information technology to attack adversaries (Walls 2013).

maintains its security and cyber-readiness through ongoing revision and refinement of the following five elements:

- A published cyber security strategic plan
- A published incident response strategy
- Governance structures and regulatory mechanisms in place to fight cyber crime
- Capacity and systems in place to support timely and coordinated information sharing of cyber threat intelligence across agencies and stakeholders
- Investment in cyber security research and development, education, and capacity building

How do we get there?

4.3.1 DTMB should develop a ubiquitous enterprise log management as a service system, or cyber hub,[13] that allows the cyber security ecosystem to understand new, emerging and historical cyber threats by leveraging advanced and predictive analytics. This will allow Michigan and their partners to detect, respond to, and mitigate cyber incidents through real-time analysis.

Estimated investment needed: $3 million of state funding annually for two years

QS · 0-2 · 0-2

4.3.2 DTMB should work to build a cyber-focused workforce, in partnership with the Merit Network, by continuing efforts of the Regional Cybersecurity Education Collaboration (RCEC). The vision of the RCEC is collaboration between the higher education community and key private sector partners to address the widening gap between the supply of skilled cyber security professionals and the demand for those skills. The overall goal is to provide a robust cyber security curriculum to institutions throughout Michigan via a mix of face-to-face and distance learning courses at two-year and four-year colleges.

Estimated investment needed: $1 million of state funding annually for two years, and private donations for scholarships

QS · 0-2 · 3-5

---

[13] A cyber hub is designed to operationalize existing cyber data, information, and intelligence for the cyber security ecosystem to establish a common operating picture by leveraging predictive and real-time analytics. Cyber hubs provide decision making support to enable organizations to anticipate and respond to cyber events.

4.3.3 DTMB should increase Michigan Civilian Cyber Corps (MiC3) membership to 200 members and invest in development and training for the MiC3. This increase in membership will ensure small and medium-sized organizations have a low-cost cyber security option in case of attacks. In addition, the corps will also support the cyber ecosystem in case of large-scale attacks to Michigan's critical infrastructure.

Estimated investment needed: $2 million annually for five years from state and private funds

QS 3-5 3-5

4.3.4 The Governor should create a shared virtual chief information security office (CISO) to provide consulting and advisory services to multiple local governments. Led by the chief information security officer, the virtual CISO will develop, implement, monitor, and support cyber program activities for multiple local governments. The virtual CISO would also serve as a conduit for cooperation among and between local governments and other state, federal, and nonprofit agencies to support the mission of cyber security. Participating agencies would pay for this service through annual fees.

Estimated investment needed: $750,000 of state funding total over two years

QS 0-2 0-2

4.3.5 DTMB should enhance threat intelligence gathering and sharing among states, federal agencies and private sector partners develop responses to common threats, in keeping with guidance published by the National Institute of Standards and Technology.

Estimated investment needed: $3 million of state funding annually for five years

QS 3-5 3-5

4.3.6 DTMB should advocate for changes to the state's Freedom of Information Act (FOIA) exemptions—which currently prevents Michigan agencies from communicating and coordinating with infrastructure asset owners about cyber and physical security threats/attacks—to allow for appropriate exemptions for agencies protecting Michigan's critical infrastructure. This could cover any communications between the government and private entities, as well discussions on defensive measures. Exemption in terms of cyber threat information is key because, it protects any vulnerability systems may have discovered as well as cyber security assessments and plans. It also protects any additional information that may be included in the data shared.

Estimated investment needed: Will utilize existing staff resources

QS 0-2 0-2

4.3.7 Entities within the cyber security ecosystem should collaborate to develop a public awareness campaign and other learning opportunities to educate residents, consumers, and families about the reality of online risks and promote cyber safety practices among residents, particularly children and businesses. The public outreach program could include ways to alert residents and businesses about serious security failures, potentially delivered via MiPage. The vision is a system like a recall notification program for things like routers, Internet cameras, audio and video recording equipment, consumer devices (e.g., Amazon Echo, deadbolts, and Internet-connected locks). Residents purchase these items through normal retail channels, but are rarely provided with security updates or patches.

Estimated investment needed: $1.25 million to $2 million of state funding, annually for five years

QS 3-5 3-5

4.3.8 Work with the cyber security ecosystem and other entities to design and encourage the adoption of a curriculum focusing on technology throughout the science, technology, engineering, and mathematics (STEM) education system to ensure the next generation's workforce is prepared to take on the challenges related to information technology and cyber security.

Estimated investment needed: $960,000 of state funding annually (for staffing and materials) for five years

QS 3-5 3-5

4.3.9 Michigan should develop a next-generation solution to centrally manage identity and authentication management for workers, partners, and residents. This includes a mature identity framework based on a consumption-based application program interface application economy, rather than pushing identity to individual applications. These enhancements will position Michigan to offer high-quality user experiences, maintain better security, and operate a less complex IT environment.

Estimated investment needed: $5 million initially to develop, then $3 million annually for five years

QS 3-5 3-5