



# BROADBAND STRATEGIC PLAN AND ROADMAP



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### City of Bangor Municipal Broadband Strategic Plan and Roadmap

#### Table of Contents

### **Contents**

Executive Summary2
Current State of Broadband in Bangor4
Goals of the City's Broadband Vision5
Overview of Data Gathering Efforts and Summit
Summary of Survey Data Collected11
Overview of Bandwidth Utilization within the Internet Industry14
Overview of Municipal Network Options16
Risks
Roadmap Next Steps
Conclusion
Appendix A: Bangor City Council Action 18-29821
Appendix B: Sector Workgroup Participants22
Appendix C: Glossary24
Appendix D: Short Survey / Paper Survey
Appendix E: Long Survey / Online Survey
Appendix F: Survey Results in Graphical Format
Appendix G: Municipal Network Diagrams

### **Executive Summary**

Mission Broadband, Inc. is pleased to provide the City of Bangor, Maine (City) with a Broadband Strategic Plan and Roadmap (Plan) as it relates to the City Council's Order of fiber as an essential infrastructure. (referenced in Appendix A)

Like many communities in America, the City of Bangor, is feeling the effects of gaps in broadband service within the community. Although there are multiple Internet Service Providers (ISP's) offering broadband services within the Bangor community, data gathered shows that nationally recognized problems such as the Homework Gap, insufficient access for remote workers & students, minimal investment by existing providers, affordability and the Digital Divide are real and present issues in the City. Mission Broadband acknowledges the steps the City is taking to develop a strategic vision of improving broadband accessibility and affordability are extremely prudent and forward looking.

From the July 23<sup>rd</sup>, 2018 Order, the City Council established a critical foundation for an ongoing dialogue around broadband access within the community. Since this action occurred, there have been a variety of interactions and communications with the community and stakeholders. These collaborations have explored and identified the current issues associated with lack of adequate and affordable broadband as well as the perceived benefits that could be realized with ubiquitous and affordable high-speed broadband service throughout the City. This Plan provides an overview of the information gathered to date, as well as the benefits, challenges and potential risks the City may face as it moves forward in its efforts. Strategic direction is outlined to provide the City with guidance for the next steps in achieving their broadband vision.

Through an iterative process of collaborating with the City's Economic Development team, Community Anchor Institutions (CAI's), businesses, the public sector and other stakeholders, a variety of data gathering tasks were conducted which have helped guide the development of this Plan. Other aspects overviewed in this Plan are the community's interest in supporting the exploration of a municipal broadband project as well as the potential usage and application of a broadband network.

Many factors need to be considered in developing a city-wide strategic broadband plan, to include; ownership models, capital expenses, operational expenses, financial feasibility, end user take rates, variations in end user costs, outside plant facilities, rights of way, central office facilities, electronics, etc. A determination of long-term success will be the utilization of the network as well as applications supported on the network and how those applications and services help to shape Bangor's future. All discussion and research to date supports that a robust, high-speed broadband network can positively impact education, economics, healthcare, transportation and other important aspects of a vibrant 21<sup>st</sup> century city.

Over the past seven months the City of Bangor and Mission Broadband have worked collaboratively to gather data from the public and key stakeholders connected to this issue. This work has shed light on five areas that are considered to be impacted by lack of ubiquitous broadband access. These five areas are:

- Economic Development
- Healthcare
- Public Safety
- Education
- Government/Environment/Transportation/Energy

This Plan summarizes the community concerns and perceived benefits that have been captured in each of these areas and provides recommendations for moving forward in this process. Listed below are recurring themes which have arisen during this process and are highly relevant to the discussion as well:

- How would the City benefit from ubiquitous high-speed broadband services?
- What short- and long-term impacts would the City experience by not improving broadband services?
- How does the City of Bangor solve the affordability issue surrounding any broadband solution?

The strategic plan outlined below is an overview of the current state of broadband in the City of Bangor. The plan also outlines the current efforts to understand the residential and business needs of a robust broadband network. As well, the Plan will identify municipal network models, risks and next steps for the City of Bangor. This current document will need to be updated as the City of Bangor continues with its broadband vision and deployment of a municipal broadband network.

#### Note on clarification of terms for the purpose of this Plan:

As you read the report it is important to understand the term "broadband" as well as the bandwidth speeds associated to this universally used term "broadband". A Glossary is located in Appendix C but for the sake of clarification the following reference will be beneficial.

The term broadband has been universally adopted to replace the terms internet and bandwidth, so when the term broadband is used, its use is referring to access to the Internet or World Wide Web (WWW).

When broadband speeds (bandwidth) are stated, they are referred to as download and upload (bandwidth) as well as asynchronous and synchronous. A download speed is the transfer of data from the internet to a device, such as a computer or router. An upload speed is the transfer of data from a device, such as a computer or router to the internet.

Asynchronous is defined when your download and upload speeds are being delivered at different bandwidths such as 25 Megabits per second (Mbps) /3 Mbps. Often the Mbps is left off and is simply referred to as 25/3.

Synchronous is defined when the download and upload speeds are being delivered at the same bandwidth such as 25/25.

The FCC defines adequate broadband as a download speed or 25 Megabits per second (MBPS) (bandwidth) and an upload speed of 3 Megabits per second (Mbps) (bandwidth) or 25/3.

Many experts and users in technology disagree with this definition of 25/3 as being adequate broadband and many businesses as well as households will not function effectively with this bandwidth. Mission Broadband supports the requirement for higher bandwidths than the FCC standard for today's uses and to provision for a reliable futureproof infrastructure. For the purpose of this document when broadband is referenced, the stakeholder community interviewed defines their use of necessary high-speed broadband as 100 Mbps/100Mbps and robust broadband as 1 Gigabit per second (Gbps)/1 Gbps.

### **Current State of Broadband in Bangor**

There are multiple ISPs providing services in the city of Bangor utilizing a variety of technologies to deliver service, fiber optic cable, copper cable, coaxial cable, fixed wireless and satellite. This information is derived using existing federal and state broadband mapping tools, provider websites and from direct surveys to Bangor residents and business as well as consultant's knowledge of local providers. The FCC national Broadband map also identifies multiple providers available throughout the City. Understanding the FCC mapping data is flawed, it does provide one source of data for review and comparison. The new Connect Maine mapping tool, still under refinement and updating, also indicates multiple ISPs providing service to all areas of the city. Both the FCC and Connect Maine data sources indicate every structure in the city of Bangor has access to at least 25Mbps / 3 Mbps. Analysis of the survey responses finds that Spectrum and Consolidated Communications have the majority of the residential subscribers in Bangor, at nearly 90%. The survey responses and work group sessions contradict this data and indicates gaps in broadband coverage.

For the business community, the survey data also supports similar subscriber rates for Small and Small Office/Home Office (SOHO) businesses. For larger businesses the market percentages captured by the different ISP's is more difficult to determine. These services are often sold in a customized manner and price points vary greatly depending on a variety of factors. Larger businesses in Bangor are more likely to have services delivered over fiber and in some parts of the City such as business parks there are multiple fiber options for businesses.

The availability of access to high speed internet and fiber optics is an issue in some areas, to include sections of downtown, and was mentioned several times during the sector workgroup sessions. This is due to the lack of available under the street infrastructure, conduits and vaults, for placement of new fiber optic cable and the high cost of placing new underground infrastructure by service providers. The City has addressed some of the underground infrastructure issues by requiring underground conduit be placed when a downtown street is opened up for other infrastructure work.

Service level issues were discussed in the workgroup sessions as well as reflected in the survey results. Reliability of a broadband service to perform without interruption throughout the course of a month was raised as a concern. Adequate bandwidth needs are not sufficient or consistent throughout the City. Service providers' customer service interactions were mentioned as below average by the workgroup sectors and survey respondents.

Broadband affordability is an issue with lower income households within the City. Although access to broadband services is available to these housing units, income levels prohibit the subscription to broadband service.

Overall, broadband access is available in most areas of the City but gaps in coverage are causing residential and business broadband access issues. High speed broadband is limited and not available on a wide scale across all sectors of the City. Affordability is an issue among the lower income residents and was discussed concerning small businesses. A lack of existing broadband service providers investing in a robust ubiquitous broadband infrastructure is a recognized concern for the current and future state of the City's requirements.

### **Goals of the City's Broadband Vision**

- Determine needs of city residents and businesses for broadband availability and desired bandwidth.
- Determine community areas impacted by lack of ubiquitous high-speed and robust broadband and projected benefits that could be realized in each area with ubiquitous high-speed and robust broadband.
- Evaluate, determine and prioritize broadband needs for the City and/or sections of the City.
- Determine support within the community for a municipally supported or owned broadband project.
- Determine best method of investing in broadband in Bangor in order to make high speed/robust internet access ubiquitous in Bangor by eliminating gaps in capacity, access and affordability.
- Explore the financial and operational viability of various Municipal Broadband Network Models. (Diagrams Appendix G)
  - Municipal owned and operated open access network
  - Public / Private Partnership
  - Blended municipal network
- Identify how to expand the municipalities' fiber footprint to enable Smart City capabilities and applications of the future.
- Promote digital literacy throughout entire community.
- Promote and plan for the use and wide-spread adoption of broadband technologies in government, energy conservation, transportation, health, education and public safety.
- Determine methods for addressing homework gap and digital divide.
- Ensure adequate internet for telework opportunities.
- Ubiquitous adequate broadband so every residence has access to telehealth.
- Quality high-speed broadband to promote economic development and the attraction/retention of residents.

### **Overview of Data Gathering Efforts and Summit**

Mission Broadband worked with the City of Bangor's Economic Development team throughout the summer and fall of 2019 to conduct information and data gathering sessions with sector groups from the following areas: economic development, education and health, government, digital inclusion, civic engagement and resource utilization, energy, environment and transportation, public safety and emergency response. These exercises concluded in a Summit that was held at City Hall on October 24<sup>th</sup>, 2019 and included the public as well as many previously involved stakeholders from the areas identified above. The following major areas of municipal interest were discussed and determined to be foundational to the broadband conversation: Economic Development, Healthcare, Public Safety, Education, Government/Environment /Transportation/Energy. These five primary areas align well with nationally recognized areas of concern arising from the broadband discussion. The impact that inadequate and unaffordable broadband has in each of these areas is discussed below as well as the perceived benefits that could be realized if the City of Bangor moves forward with a project to improve city wide broadband.

The underlying themes for the data gathering work were:

The effects of <u>not having</u> high-speed/robust, reliable and affordable broadband in the City of Bangor.

The effects of <u>having</u> high-speed/robust, reliable and affordable broadband in the City of Bangor.

#### **Economic Development**

Economic Development is often a key driver for communities considering the implementation of municipal broadband networks. The City of Bangor has a strong economy, however, participants in the data gathering efforts expressed concern that continued long term inadequate broadband services will have an adverse impact on the economy of Bangor. The ability of businesses to connect to the global digital economic landscape is vital to community health and growth. Some participants expressed frustration at having to perform simple functions at home such as transferring large data files online due to the slowness of their broadband service at work. The example of an employee of any business having the ability to perform online functions at home (not necessarily a Bangor resident) better than at their place of business does not seem appropriate in this digital era.

The following thoughts and concerns were expressed by stakeholders and the public during the data gathering process.

Lack of robust and affordable broadband in Bangor could have the following undesirable impact on economic development:

- Lead to continued inefficiencies in businesses performing online functions such as:
  - Video Conferencing
  - Uploading / Downloading files
  - Streaming services
  - Employee Training
  - Working with cloud applications
- Make it difficult to attract and retain businesses of all sizes.
- Make it difficult to attract and retain remote/virtual workers.
- Adversely impact digital literacy which limits pool of capable workers.

Having robust and affordable broadband in Bangor could have the following positive impacts on economic development:

- Increase efficiencies in businesses.
- Provide greater workforce attraction and retention.
- Provide greater remote and virtual access to Bangor businesses and talent.
- Benefit the tourism industry in Bangor.
- Allow the business community to better leverage the global economy.
- Help in attracting new businesses & stimulating home businesses.
- Provide better options for remote training for organizations.
- Improve Digital Literacy skills over time enabling a stronger workforce.

#### Healthcare

Telehealth is emerging as a critical solution to the crisis in healthcare costs and access. Healthcare continues to use many new telehealth technologies to deliver services such as, telemedicine, telepsychiatry, video conferencing, remote patient monitoring (RPM), mobile health (mHealth), electronic health records (EHRs), physical therapy (PT), patient portals, and picture archiving and communication system (PACS). Lack of adequate broadband services to households' limits healthcare providers' ability to offer these services to their patients. Telehealth technologies have real-world advantages in communities, helping with inadequate transportation resources, limited physician resources and limited emergency room availability. Ongoing remote patient care can limit trips for seniors, provide care for those with chronic diseases and help parents with pediatric needs. Consultation services between specialists and primary caregivers as well as field work for social workers take advantage of broadband services in the home. Advancements in technology allows remote diagnostics imaging to be transmitted to healthcare experts for review with immediate attention given to a patient as required. Healthcare and social services are using remote access for educational purposes, helping educate patients on their conditions and how to help themselves through diet, exercise and prescriptions. Hospice also utilizes household broadband access to support the families and nurses caring for their loved ones. Telemedicine services for mental health and addiction recovery services is helping battle the opioid crisis and holds the promise of delivering much needed treatment to those struggling with addiction who need daily clinical consults and live many miles from treatment centers.

The following thoughts and concerns were expressed by stakeholders and the public during the data gathering process.

Lack of robust and affordable broadband in Bangor could have the following undesirable impacts on healthcare:

- Lead to continued high costs for medical care.
- Lead to a lack of access to specialists or require travel to see specialists.
- Lead to increased hospitalizations and insurance costs if patients cannot be monitored remotely.
- Reduce the availability of critical social services and telepsychiatry services.

Having robust and affordable broadband in Bangor could have the following positive impacts on healthcare:

• Provide more cost-effective access to medical and psychological services via telemedicine and telepsychiatry services.

- Reduce travel burdens and costs for some patients.
- Enable expansion of services.
- Provide remote patient monitoring.
- Increased access to expertise.
- Provide more common access to Electronic Health Records.

#### **Public Safety**

Public Safety is also an important driver for communities considering the implementation of municipal broadband networks. Many benefits in the area of Public Safety can arise from the implementation of a municipal broadband network. It should be noted that the best and most secure approach to providing public safety benefits will come through the creation of a separate private network for Public Safety purposes. This will allow the City to use different fiber strands within the overall build to create a secure private network that is physically separate from the broadband infrastructure. One potential buildout model to be considered is to build out the fiber infrastructure required for a Smart City and then leverage that fiber for initial subscriber services.

The following thoughts and concerns were expressed by stakeholders and the public during the data gathering process.

Lack of robust and affordable broadband in Bangor could have the following undesirable impacts on public safety:

- Impact the City's ability to perform Smart City functions in the future.
- Impact the City's ability to keep pace with technological advances and applications in the area of Public Safety that could benefit the community.
- Reduce opportunities to use technology to increase efficiencies and lower the costs of municipal operation.
- Continue to impact the speed with which law Enforcement and First Responders can access information in emergency situations.

Having robust and affordable broadband in Bangor could have the following positive impacts on public safety:

- Allow for deployment of Public Safety technology devices.
- Allow Emergency Personnel and First Responders to have absolute priority on the network.
- Help dispatch provide real time data to first responders such as floor plans of buildings.
- Provide access to video and imaging in real time by placing cameras anywhere in the city.
- Allow responders to have access to more data.
- Allow for end to end control of municipal assets, to include streetlights.
- Allow for real time Traffic Control during local or regional emergencies.
- Remote monitoring of municipal systems and assets.

#### Education

Universal broadband coverage in America is essential for education at all levels. Through the Maine School and Library Network (MSLN), the schools and libraries in most Maine communities, including Bangor, have robust broadband service available, however, the nationally recognized "homework gap" persists and continues to affect many students throughout the State of Maine and in Bangor as well. This could have the result of impacting students who are

potentially more likely to fall behind academically. E-Learning and a growing industry of college online courses also require robust broadband service. New technologies such as Augmented Reality (AR) and Virtual Reality (VR) require highly robust broadband services and are increasingly being used in teaching methods.

Younger generations will learn and experience life in a completely digital era. Universal broadband is required to eliminate the digital divide which will only keep growing if things remain status quo. Online training often requires two-way video communication and students from all walks of life will increasingly use the internet to receive curriculum. Other segments of the population, such as homebound residents, and seniors, also need to access educational and job training resources through broadband connections.

The following thoughts and concerns were expressed by stakeholders and the public during the data gathering process.

Lack of robust and affordable broadband in Bangor could have the following undesirable impacts on education:

- Perpetuate the homework gap.
- Increase the digital divide.
- Decrease educational access to some K-12 students who do not have broadband at home.
- Decrease access to education services requiring high speed access for some students.
- Limit ability of participating in higher education online courses.

Having robust and affordable broadband in Bangor could have the following positive impacts on education:

- Resolve the homework gap.
- Narrows the digital divide.
- Access to online classes 24x7.
- Support new learning and teaching methods such as AR and VR.

#### Government, Energy, Environment and Transportation

A robust municipal broadband network in Bangor could provide benefits to all of the areas of Government, Energy, Environment and Transportation. The Internet of Things (IoT) will exponentially increase the number of devices that connect to the internet and allow real time information from a variety of new sources to inform decision making in all areas. The IoT will offer opportunities to improve efficiencies in water and utility systems and to place sensors to gather data in strategic locations to monitor streetlights, crowds, air pollution levels, water levels, waste management etc.

The City could also implement a process to notify citizens, or groups of citizens defined by geographic area (or some other criteria) immediately during emergencies, advertise open parking spaces to area drivers and reroute traffic based on traffic flows, weather or any number of other criteria. These are just a handful of many new applications and services based on the presence of reliable, fast broadband infrastructure.

The following thoughts and concerns were expressed by stakeholders and the public during the data gathering process.

Lack of robust and affordable broadband in Bangor could have the following undesirable impacts on Government, Environment, Energy and Transportation:

- Reduce constituent access to municipal services.
- Result in lost opportunities to improve efficiencies and reduce energy consumption.
- Result in lost opportunities for improved traffic management which could provide increased safety and speed of response benefits in emergency situations.

Having robust and affordable broadband in Bangor could have the following positive impacts on Government, Environment, Energy and Transportation:

- Allow for digital inclusion of entire community.
- Enhance communication and increase Civic Engagement.
- Support efficient utilization of resources, opportunity for expense and labor reduction.
- Provide interconnected transportation and utility systems.
- Provide improvements in the speed and accuracy of analysis, maintenance, and repairs.
- Allow the focus to be on functions and standardization and not the network itself.
- Lay the foundation for Smart City capabilities and applications such as:
  - Autonomous Vehicles
  - Waste Management
  - Traffic Management
  - Public Wi-Fi with Pertinent information for visitors and residents
  - Data Driven Decisions
  - Smart Lighting
  - Smart Roads
  - Other Emerging Applications

### **Summary of Survey Data Collected**

To supplement the data gathered through stakeholder meetings and the October 24<sup>th</sup> Summit a broadband survey was conducted within the community. This survey ran for a total of three and a half weeks, January 6<sup>th</sup>, 2020 to January 31<sup>st</sup>, 2020. A link to the survey was posted on the City's web site as well as social media pages. In addition, paper surveys were available at various city locations for the public to fill out. A sample copy of each survey can be found in Appendix D and Appendix E of this report along with a link to the online survey results and statistics. Additionally, the survey results in chart format have been presented in the Appendix F of the document.

## The aggregate data was gathered and compiled identifying the following trends and statistics:

- There were 644 respondents (547 residential, 93 business).
- 98% of respondents stated they have access to Internet service.
- 95% of respondents stated they have internet service installed.
- Of the 95% with internet service:
  - $\circ$  80 % have Spectrum.
    - o 9% have Consolidated Communications Inc. (CCI)
    - The remaining 11% of respondents were spread across 5 other (ISP's).
    - Note Roughly 18% of respondents indicated in addition to their internet service, they also use their mobile phone for Internet access.
- 43 or roughly 7% of respondents stated internet service was available to them but they chose not to subscribe to the service. Of these, 84% said either the install cost or the monthly service fee was too high.
- 47% of respondents said their current service does not meet their needs.
- When asked to rate their bandwidth speed, 44% stated they were satisfied or better.
- When asked to rate the reliability of their internet service, 48% stated they were satisfied or better.
- 45% of respondents stated they frequently experience interruptions while using the internet.
- When asked to rate their provider's customer service 28% of respondents stated they were satisfied or better.
- 33% of respondents provided upload and download speeds of their service:
  - $\circ$  of these respondents, 28% of the 34% fall below the FCC minimum of 25/3.
- Subscription Rates:
  - o 73% of respondents are paying between \$40 and \$80 per mo.
  - 48% of respondents are paying between \$60 and \$80 per mo.
  - $\circ$  21% of respondents pay more than \$80/mo.
  - $\circ$  20% of respondents pay less than \$50/mo.
  - Approximately 77% of respondents feel a fair monthly price is between \$20 and \$50.
  - Approximately 64% of respondents feel a fair monthly price is between \$30 and \$50.
  - Approximately 75% of respondents feel an affordable monthly price is between \$20 and \$50.
  - Approximately 57% of respondents feel a fair monthly price is between \$30 and \$50.

#### The survey data for the small business responses identified the following statistics:

- A total of 46 respondents identified as small businesses.
- 100% stated they have access to Internet service.
- 98% stated they have internet service installed.
- Of the 98% with internet service:
  - o 79% have Spectrum.
  - $\circ$  10% have Consolidated Communications Incorporated (CCI).
  - The remaining respondents spread across FirstLight and GWI and a single respondent stating that their service is included in their rental agreement.
  - Note 12% of these respondents reported having fiber installed for their service.
- 50% of respondents said their current service does not meet their needs.
- When asked to rate their bandwidth speed -40% stated they were satisfied or better.
- When asked to rate the reliability of their internet service 54% stated they were satisfied or better.
- 41% of respondents stated they frequently experience interruptions while using the internet.
- When asked to rate their provider's customer service 27% of respondents stated they were satisfied or better.
- 37% of respondents provided upload and download speeds of their service:
  - $\circ$  the average upload speed across these respondents was 8Mbps.
  - the average download speed across these respondents was 68Mbps with only three of the respondents having download speeds lower than the minimum(25Mbps) defined by the FCC definition of broadband.
- Subscription Rates
  - o 24% of respondents are paying between \$30 and \$69 per mo.
  - o 39% of respondents are paying between \$70 and \$89 per mo.
  - $\circ$  36% of respondents pay more than \$100 per month.
  - Approximately 77% of respondents feel a fair monthly price is between \$31 and \$50.
  - Approximately 67% of respondents feel an affordable monthly price is between \$31 and \$59.

## <u>The survey data for the SOHO (Small Office/Home Office) responses identified the following statistics:</u>

- A total of 39 respondents identified as SOHO businesses.
- 100% stated they have access to Internet service.
- 97% stated they have internet service installed.
- Of the 97% with internet service:
  - 87% have Spectrum.
  - o 3% have Consolidated Communications Incorporated (CCI).
  - o 3% have FirstLight.
  - $\circ~~6\%$  have GWI.
- 62% of respondents said their current service does not meet their needs.
- When asked to rate their bandwidth speed -39% stated they were satisfied or better.
- When asked to rate the reliability of their service, 59% stated they were satisfied or better.

- 41% of respondents stated they frequently experience interruptions while using the internet.
- When asked to rate their provider's customer service 27% of respondents stated they were satisfied or better.
- 41% of respondents provided upload and download speeds of their service:
  - the average upload speed across these respondents was 11Mbps.
  - the average download speed across these respondents was 61Mbps with only four of the respondents having download speeds lower than the minimum(25Mbps) defined by the FCC definition of broadband.
- Subscription Rates
  - 36% of respondents are paying greater than \$100 per mo.
  - 39% of respondents are paying between \$70 and \$89 per mo.
  - 24% of respondents pay between \$30 and \$69 per mo.
  - Approximately 70% of respondents feel a fair monthly price is between \$41 and \$59.
  - Approximately 50% of respondents feel an affordable monthly price is between \$41 and \$59.
  - $\circ$  17% feel an affordable monthly price is between \$30 and \$39.

### **Overview of Bandwidth Utilization within the Internet Industry**

#### Applications will continue to drive higher bandwidth requirements

It was only twenty years ago that a 56 Kbps dialup connection was a common way of connecting to the Internet. Contrast that with the current speed the FCC defines as broadband (25Mbps/3Mbps) and we see that 25Mpbs is 446 times faster than a 56 Kbps connection. A 100Mbps connection is 1,785 times faster than a 56 Kbps dial up connection. There is every reason to believe internet access speeds will continue growing exponentially over the next twenty years. While technologies that use copper, coax or wireless for last mile access to subscribers will continue to make advancements in speed and reliability, fiber will continue to outpace these other mediums and offer the best way that is currently known to future proof any network for the speeds that will be needed over the next twenty years.

Historically, internet bandwidth was primarily consumed in a downstream usage model by residential and commercial consumers. Files, emails and streaming services were downloaded to a user's location or device from the internet and the download speed was traditionally considered more important than the upload speed. Internet usage and bandwidth consumption models are changing with the proliferation of mobile devices as well as real time interactive voice and video services often embedded in social media and other emerging applications. These new communications paths have raised the importance of the upstream speed for all users of internet bandwidth. As stated earlier the FCC's current definition of broadband (25Mbps / 3 Mbps) provides for a very low upload speed that is unlikely to meet the needs of many current and near-term residential and business applications and services. Some of these applications are described in more detail below.

#### <u>Video</u>

The amount of video traffic being uploaded and downloaded on the internet is staggering. This video content consists of traditional streaming services like Netflix, Amazon Prime Video and YouTube as well as a plethora of applications that support real time video interaction on traditional and mobile devices like FaceTime, Skype, WebEx, and Zoom. Netflix and YouTube currently account for a very high percentage of traffic on ISP networks. Higher quality digital formats for video continue to emerge and require more bandwidth. 4K streaming is becoming more common and each 4K stream requires up to 25Mbps of bandwidth. The use of two-way real time video services personally and commercially will continue to rise and require increased bandwidth, speeds and reliability. However, two-way real time video requires symmetrical 25 Mbps (synchronous) bandwidth. Please note symmetrical 25/25 is much higher than the FCC standard of 25/3. Education, telemedicine and telepsychiatry offer promising new alternatives for accessing services and will require robust upload and download speeds to work effectively. This significant uptick in the use of real time video places greater importance on the upload speeds available to businesses and consumers.

#### **Transferring High Capacity Files**

Many businesses who operate partially or fully online require high speed, reliable bandwidth to create and publish high density content to the internet or to store and retrieve this content on corporate or cloud servers. The data gathering sessions with the workgroup sectors brought to light several stories from small business owners. One issue outlined was the need to do certain types of their work at home which required the transfer of large files from the business to the internet

because the connection at the business was simply not fast enough to do the transfer in a reasonable amount of time.

#### <u>Cloud</u>

Over the past ten years, many business applications that have traditionally run on a businesses' premise have moved to cloud based hosting and service models. Software as a Service (SaaS) has become the predominant business model for major application and software providers such as Microsoft (Office365), Google (Gmail, Google Docs etc.) and many other firms. Additionally, there are many options for cloud-based software for traditional business functions and services such as HR, Accounting, Inventory, Customer Service etc. Cloud services can provide many benefits to businesses and consumers over reliable high-speed Internet connections.

#### **Residential usage**

Residential usage of bandwidth will continue to accelerate at an alarming pace. In addition to all of the residential uses of bandwidth mentioned above, consumers will increasingly use the Internet of Things (IoT) which will allow in home monitoring of virtually any system as well as video cameras capturing home video footage and storing it in the cloud. Some studies estimate that as high as 80% of teenagers and young adults watch or participate in online gaming activities. Gaming presents a specific bandwidth challenge because unlike video traffic none of the gaming data can be cached so the amount of real time gaming data that needs to be passed upstream and downstream during a gaming session requires a very robust connection. Residential use can require broadband for K-12 homework in addition to high and college online classes.

#### **Emerging Applications and Technologies**

Many emerging applications and technologies will require reliable high-speed broadband connections in order to work effectively. Technologies such as Augmented Reality (AR) and Virtual Reality (VR) have the potential to revolutionize teaching and learning models, providing a new level of experiential learning for students from all walks of life. Artificial Intelligence (AI) promises to transform almost every industry, including healthcare (diagnosis, treatments), automotive (autonomous driving), manufacturing (robot assembly), and retail (purchasing assistance). AI technologies are becoming more mainstream and will increasingly be embedded in underlying technologies and systems. Accelerations in the fields of robotics and new technologies like 3D and 4D printing make it clear that some of the technologies being developed will simply not work on existing broadband infrastructure in many parts of the country.

#### **Other considerations**

Not to be alarmist but there is some early indication that a more robust broadband infrastructure in the U.S. would help deal more effectively with situations such as the current Pandemic we are experiencing. In the event school systems are closed, K-12 and secondary education could continue even with students at home provided the broadband infrastructure exists to ubiquitously support online classes. Additionally, a concern of the unfolding situation is that medical staff, facilities and resources will be overwhelmed. A robust broadband infrastructure would help patients be seen and evaluated, using telemedicine technologies, without requiring travel by potentially contagious patients. Employees may be required to work at home due to business closures or quarantines. Although the end to end processes do not exist for the above scenarios at this time, it is certainly evident robust broadband infrastructure is necessary.

### **Overview of Municipal Network Options**

There are many different ways a municipal network can be implemented with a wide range of ownership, operational and financial models. It is important for the City to understand the different models of municipal broadband networks and how each model can be implemented. Three models are outlined below, and each will be reviewed in more detail as the City's broadband project moves forward.

#### Municipal Owned and Operated Open Access Network

The municipality builds, owns and operates a network and allows Service Providers to compete and provide services over the network. The municipal level of ownership of the network and assets can vary widely from one community to the next. Each community must determine the extent to which it desires to own and participate in the construction and operation of the ongoing network. Open access networks can be dark fiber or active with electronics. In these scenarios there are different ways the network can be architected, managed and supported. The municipality may contract out some or all portions of the network engineering, construction, activation and operation functions. Municipalities subsidize the cost of the network for the Service Provider(s) which should offset retail rates of service.

#### Public / Private Partnership

The municipality partners with an existing service provider or with multiple service providers to build a network and provide services on the network. Municipalities subsidize the cost of the network for the Service Provider(s) which provides greater incentive for the service provider (s) to invest since they can achieve their ROI far sooner than if they had borne the entire cost of the build out or expansion. In the Public-Private-Partnership (PPP) model both the municipality and private partner(s), enter into a legal partnership and share the risks and rewards of the network deployment. An example of a type of PPP would be a partnership with an existing ISP in the community to build or expand that ISP's broadband infrastructure to meet the needs of the community. Recently, more and more municipalities are exploring establishing a PPP for deploying and operating last-mile networks. There are many different types of PPPs.

#### **Blended Municipal Network**

Municipality will own and operate zones or regions of the network. Existing and/or other Service Provider(s) will provide their own coverage areas within the city limits. In this model the municipality may choose to build out fiber infrastructure within a certain geography within the community. For example, for the purpose of ensuring that K-12 students in low income housing within the community have access to broadband for educational purposes. The Municipality may also choose to partner with a Service Provider to build or expand broadband infrastructure to achieve a specific purpose within the community such as Smart City infrastructure.

### Risks

The risks outlined below present themselves in the individual municipal network implemented. Each risk and level of risk will be evaluated and outlined for the broadband network models as the City's broadband network project moves forward and more data is collected.

#### **Financial Risks**

A decision to move forward with an investment to improve broadband in the Bangor community will require a strong commitment to the project by the City, the community and the project stakeholders. Funding of any broadband improvement network project involves risk and all variables must be properly evaluated and include the commitment and engagement of the community.

There are a variety of funding sources that must be explored, including bond issuance, debt financing (including government-based lending institutions like the USDA Rural Utility Service), grants, public-private partnerships, Connect Maine Authority, and broadband funding bills currently being considered at the federal level.

Survey data indicates the majority of the respondents (96.5%) currently subscribe to some sort of Internet service already. This is a strong indication of the demand and current subscription rate for broadband, and there would appear to be enough recurring revenue available from this demand within the Bangor community to support a municipal effort and investment to improve broadband. Although broadband subscription rates are high, a City owned, and operated broadband network would compete with existing service providers and a competitive analysis would need to be performed and studied. A complete and detailed financial analysis must be included in the City plans to gain a firm understanding of costs, funding sources, take rates and revenues over a set period of time to determine the feasibility of the project(s) size and options.

#### **Operational Risks**

With any municipal efforts to improve broadband network improvement, there is no guarantee of success. For example, the ongoing operation of a municipal owned and operated broadband network is complex and requires many skills and functions not common in most municipalities, such as specific broadband related Customer Service, Installation and Repair, Network Engineering and Construction. The City should not rely on the old approach of "if we build it, they will come". Firm customer adoption levels (take-rates) must be determined to develop actionable financial and operational models. The planning and development of the precise broadband expansion routes and areas of the city must be prioritized based on take rates, costs to maximize recurring revenue streams.

Operational risks can be lessened and shared if a municipality enters into a PPP. Partnering with an existing provider, maximizing the existing infrastructure, skills and operational functions can be leveraged to support the increased coverage base. Other options to employ could include a presubscription process, where subscribers commit to signing up during a promotional period, can often provide definitive take rate information to help support the financial and business models.

#### **Partnership Risks**

The building and operation of a broadband network is a complex task, requiring specialized skills. Selecting the right partner(s) to participate in the project will be critical to the success of the

project. How well the partner(s) provide Customer Service should be of critical importance in this process. Only 33% of survey respondents who have internet service stated they were satisfied or more than satisfied with the level of customer service they were currently receiving. In addition to maintaining levels of service and costs set by the City, partner(s) must execute on the construction and operational agreements and meet expected timelines. Contracts must be negotiated in a way that allows the City to hold some leverage over partners regarding committed timelines and Service Level Agreements (SLA).

#### **Public Relations Risks**

The participation of the City in efforts to improve broadband network improvement by investing in the construction of a network that could compete with private enterprise can cause some controversy within the community and with existing ISPs. There is potential opposition to the idea from residents, businesses and existing service providers and ISP's. Involving the community and key stakeholders from the beginning lends transparency which is important in order to gain public trust in the process. The City of Bangor has done a good job of engaging the public and key stakeholders in this process and these efforts must continue as the potential project moves forward.

#### **Competitive Risks**

There are several risks that come from the existing competitive landscape. As stated earlier, over 95% of residence and business are customers of existing internet providers. It is not certain any of the existing providers would be interested in a PPP. If the City were to determine that the best course of action would be to invest in a new municipal owned network, the competition to migrate customers would need to be assessed.

The competitive risk from the wireless 5G expansion is undetermined. The is much industry debate that 5G will solve the broadband issue in the immediate future. The technology is in its infancy in terms of deployment. 5G will likely evolve to become a more robust mechanism for broadband access but the timeframe for that is unknown.

Fiber will continue to outpace wireless technologies, including 5G, in terms of capacity and scalability for the foreseeable future. Cellular plans have traditionally been expensive for unlimited access and it is unlikely that will change with 5G. It is also interesting to note that the small cell technology of 5G requires many more cells per square mile, each of which needs fiber connectivity.

#### **Risks of doing nothing**

There are risks in doing nothing and letting market forces decide the future. It is unlikely an existing service provider is going to overbuild the City of Bangor without some sort of financial incentive and assistance on either a federal, state or local level. The current broadband issue throughout the country is a result of inadequate Return on Investment (ROI) for providers to expand their networks. The reality that Bangor is not considered unserved or underserved means getting state or federal funds would be difficult if not impossible without some additional legislation or changes in the agencies funding policies. Businesses and residents may choose to relocate to other communities with superior broadband over time. Potential businesses or new residents may choose not to move to Bangor due to lack of affordable and robust broadband options. Additionally, there could be lost opportunities for improvement of services and cost reduction in all the sector areas addressed earlier in this plan.

### **Roadmap Next Steps**

- > Present Broadband Strategic Plan and Roadmap to City Council.
- > City Council approval of Broadband Strategic Plan and Roadmap.
- > Review and update overall goals and priorities of City:
  - Fiber based ubiquitous network to all residents and businesses.
  - Focus on specific areas regarding affordable and adequate broadband services.
  - Finalize bandwidth requirements.
  - Select network model(s).
  - Expansion of City's private network and Smart City.
  - Timeline for each step and overall broadband project.
  - Affordability for low income households.
- Determine engineering effort needed for data collection of existing utility infrastructure and of existing structures. Data will be used in developing a comprehensive RFP for selected network models.
- > Review and identify network models (eliminate as determined by project team):
  - City owned and operated.
  - City owned with private contracted operator.
  - Private owner and operator.
- Administer a comprehensive Request for Proposal (RFP) to determine broadband design (network model), service providers, CAPEX and OPEX. Multiple RFP's may be used depending on the broadband network model(s) chosen by the City.
- A complete and detailed financial analysis to gain a firm understanding of costs, funding sources, take rates and revenues over a set period of time to determine the feasibility of the project(s) size and options.
- > Develop financial and operational models to support goals and priorities of broadband expansion.
- > Review and identify additional risks per network model from data collected.
- Negotiate Build-Out/Operational/Financial Models.
- Approval by Voters if Necessary.
- Implement Network Strategic Plan.

### Conclusion

The next generation of broadband is here. Mission Broadband deems high speed reliable broadband a key component for long-term community success. Many communities across America are developing a path to a sustainable robust broadband future by evaluating and determining a network model which best suits their needs, to include, building, owning and operating a broadband network. Bangor has positioned itself to be a destination community for living, working, entertainment, tourism, etc. A well thought out broadband plan is a continuation of Bangor's vision of today and the future.

The next steps outlined in this Plan are for the City to continue their pursuit of a robust broadband network for all residents and businesses. The guiding principles used in the workgroup session and the summit of accessibility and affordability will continue to be used throughout the decision-making process. Ownership and partnering network models will need to be decided by evaluating what is in the best interest of the City regarding, CAPEX, OPEX, service levels, affordability, sustainability, etc. Infrastructure engineering and a comprehensive Request for Proposal process will feed financial models to aid in the City's decision making.

Consultant recommends a continued effort of transparent communication regarding ongoing status to the City's constituents. The City's Economic Development team has done a good job organizing and communicating to businesses and residents this broadband effort and have been a key contributor with opening communication paths to the public. Communication will be an important factor as the City's broadband project moves along.

The continued growth of internet-based applications will place more need on a sustainable robust broadband network for all communities. Bangor's realization of this fact and their willingness to be proactive in the process, will prove beneficial for the City. Mission Broadband believes the roadmap outlined, combined with the City's proven commitment will result in a successful broadband future for the City of Bangor.

### **Appendix A: Bangor City Council Action 18-298**



CITY COUNCIL ACTION07/23/201818-298Council Meeting Date: 07/23/2018Item No: 18-298Responsible Dept: Community & Economic DevelopmentRequested Action: OrderMap/Lot: N/A

Title, Order

Declaring Fiber as Essential Infrastructure in the City of Bangor, Maine

#### Summary

This order will declare fiber as essential infrastructure in the City of Bangor, Maine. Reliable, high speed, affordable access to the Internet is imperative for Bangor residents, businesses, non-profit organizations, and visitors. The Internet is changing how humans interact with each other and with the world at large, as well as being a driving force for the current and future economy. The Internet creates opportunity for increased innovation for consumers, businesses, and government. Countries, states, and cities that prioritize and provide access to advanced Internet infrastructure such as fiber are surpassing those that do not in terms of social, economic, and knowledge development. Bangor must prioritize this infrastructure as an essential service, just as we have with water, sewer, and electricity.

#### **Committee Action**

Committee: Business & Economic Development Committee Action: Recommend for passage Meeting Date: 06/05/2018 For: 5 Against: 0

#### **Staff Comments & Approvals**

Introduced for: New Business

City Manager

**City Solicitor** 

icitor

Finance Director

### Appendix A: Bangor City Council Action 18-298 (continued)



#### CITY OF BANGOR ORDER

07/23/2018 18-298

Date: 07/23/2018 Item No: 18-298 Assigned to Councilor: Davitt

Declaring Fiber as Essential Infrastructure in the City of Bangor, Maine

Whereas reliable, high speed, affordable access to the Internet is imperative for Bangor residents, businesses, non-profit organizations, and visitors; and

Whereas the Internet is changing how humans interact with each other and with the world at large, as well as being a driving force for the current and future economy; and

Whereas the Internet creates opportunity for increased innovation for consumers, businesses, and government; and

Whereas countries, states, and cities that prioritize and provide access to advanced internet infrastructure such as fiber are surpassing those that do not in terms of social, economic, and knowledge development; and

Whereas Bangor must prioritize this infrastructure as an essential service, as with water, sewer, and electricity; therefore

Be it Ordered by the City Council of the City of Bangor that

Fiber and access to the internet is an essential service in the City of Bangor, Maine.

### **Appendix B: Sector Workgroup Participants**

#### **Economic Development Attendees:**

City of Bangor, Economic and Development - Tanya Emery, Tyler Collins, Mel Fongemie, Steve Bolduc

Eastern Maine Development Corporation – Lee Umphrey

Bangor Chamber of Commerce – Shelly Sund

Epstein Commercial Realty – David Hughes

#### **Education and Health:**

City of Bangor, Economic and Development - Tanya Emery, Tyler Collins, Mel Fongemie, Steve Bolduc

Husson University – Garth Cormier, Brien Walton

Bangor Schools – Betsy Webb

Eastern Maine Community College – Lisa Larson

Northern Maine Light – Rick Cowan

#### Government: Digital Inclusion, Civic Engagement & Resource Utilization:

City of Bangor, Economic and Development - Tanya Emery, Tyler Collins, Mel Fongemie, Steve Bolduc

Bangor Y – Jennifer Carlson

Penquis – Field Glover

Bangor Housing – Charles Lever

Bangor Public Library – Ben Treat

Bangor Savings Bank – Scott Blake

#### Energy, Environment and Transportation:

City of Bangor, Economic and Development - Tanya Emery, Tyler Collins, Mel Fongemie, Steve Bolduc

City of Bangor – John Cyr, John Theriault

#### Public Safety and Emergency Response:

City of Bangor, Economic and Development - Tanya Emery, Tyler Collins, Mel Fongemie, Steve Bolduc

Bangor Fire Department – Tom Higgins

Bangor Police Department – Wade Betters

City of Bangor – Patrick Cowan, Jeff Courtney

### **Appendix C: Glossary**

**3G:** The term for the 3rd generation wireless telecommunications standards usually with network speeds of less than1 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 or Asynchronous Bandwidth**: A connection in which the maximum transfer rate is different for download and upload speeds.

Augmented Reality (AR): a technology that superimposes a computer-generated image on a user's view of the real world, thus providing a composite view.

### 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.

Bandwidth: The capacity of an internet connection.

**Bond:** A fixed-income security in which a borrower borrows money from an investor for a specified period of time at fixed or variable interest rate.

**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.

### <u>C</u>

**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 healthcare 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.

**Community Needs Assessment:** An assessment of the deficiencies that exist in a community that are preventing it from reaching goals or desired results relating to broadband

**Connect Maine:** The Connect Maine Authority is a public instrumentality of Maine state government whose mission is to facilitate the universal availability of broadband to all Maine households and businesses and help them understand the valuable role it can play in enriching their lives and helping their communities thrive.

### **Appendix C: Glossary (continued)**

### 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 affordable 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.

**Digital Skills:** Any skills related to operating digital devices or taking advantage of digital resources.

**DOCSIS** (Data Over Cable System Interface Specification): The international telecommunications standard for cable signaling data and spectrum sharing.

Download speed: The rate at which data is transferred from the Internet to the user's computer.

**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

**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 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.

### G

**Grant:** A legal instrument reflecting a relationship between a government agency and a recipient. The main purpose of the relationship is to dispense money or resources in order to accomplish a public purpose. No substantial involvement is anticipated by the government agency during the recipient's completion of the activity.

### **Appendix C: Glossary (continued)**

### H

**Homework Gap:** The homework gap refers to the difficulty students experience completing homework when they lack internet access at home, compared to those who have access.

### Ī

**Internet of Things (IoT):** The Internet of things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

**Internet Service Provider (ISP) or also referred to as just Service Provider:** 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.

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 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

Maine School and Library Network (MSLN): The Maine School and Library Network provides internet access, email, web hosting, and other internet related services to almost 1000 schools and libraries across the state of Maine.

**Middle Mile:** The connection between a local network, also called a "last mile" connection, and the backbone Internet network.

#### N

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

### <u>0</u>

**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.

### <u>P</u>

**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.

### **Appendix C: Glossary (continued)**

### <u>R</u>

**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.

### <u>S</u>

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

**Smart City:** A community which uses different types of electronic internet of things (IoT) sensors to collect data and then uses insights gained form this data collection to manage assets, resources and services efficiently.

**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.

Symmetric/Synchronous bandwidth: an internet service with the same upload and download speeds.

### T

**Tax Increment Financing:** A public financing method through which future property tax increases can be diverted to subsidize community development and improvement projects.

**Tier 1 Internet Network:** A network of Internet providers that form a superhighway that allows users access to every other network on the Internet.

**Tier 2 Internet Network:** A network of smaller Internet providers that allow users to reach some portion of the Internet but that still purchase IP transit.

**Telemedicine:** The use of high-speed, high-capacity Internet to support long-distance healthcare services, patient and provider education and enhanced healthcare administration.

**Upload speed:** The upload speed is the rate that data is transferred from the user's computer to the Internet.

### V

**Virtual Reality (VR):** The computer-generated simulation of a three-dimensional image or environment that can be interacted with in a seemingly real or physical way by a person using special electronic equipment, such as a helmet with a screen inside or gloves fitted with sensors.

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

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

### **Appendix D: Short Survey / Paper Survey**

Short Form Instructions: Please fill out one survey for each location in Bangor that you are referencing (I.E. if you are a Bangor resident, and own a place of business in Bangor, please fill out a separate survey for that location).

1. Thinking about current your location IN BANGOR, which of the following best describes your location? (Please check all that apply.)

- □ Residential Primary Home
- □ Residential Rental
- □ Residential Vacation or Second Home
- □ Residential Telecommuter
- □ Small Office / Home Office (SOHO)
- □ Small Business (less than 100 employees)
- □ Large Business (More than 100 employees)
- □ Other (please specify)
- 2. Is internet service available at your location in Bangor?
  - □ Yes
  - □ No
- 3. Do you subscribe to Internet service at your location in Bangor?
  - □ Yes
  - □ No
- If yes, who is your current Internet service provider?

4. If you currently do not subscribe to internet service at your location in Bangor, why not? (Please check all that apply.)

- $\Box$  It's not available
- □ Installation price is too high
- □ Monthly service fee is too high
- $\Box$  I don't see the need for broadband
- $\Box$  I don't have a computer
- □ I use my mobile phone for Internet access
- $\Box$  Other (please specify)

5. What type(s) of internet service do you subscribe to at this Bangor location? (Check all that apply.)

- $\Box \qquad Cable Modem$
- $\Box \qquad DSL (Copper)$
- □ Satellite
- □ Fixed Wireless
- □ Cellular (Mobile Wireless)
- □ Fiber Optic
- □ Other
- □ Unknown
- $\square$  N/A

### **Appendix D: Short Survey / Paper Survey (continued)**

6. Does your current internet service in Bangor meet your needs?

- □ Yes □ No
- $\Box \qquad N \, / \, A$

Please provide detail for your answer:

7. Are you willing to answer more survey questions on this topic?

- □ Yes
- □ No

If yes, please go to www.bangormaine.gov/survey

### **THANK YOU FOR YOUR FEEDBACK!!!**

### **Appendix E: Long Survey / Online Survey**

Link to Online Survey Results: https://www.surveymonkey.com/results/SM-M9JWW3BR7/

Instructions: Please fill out one survey for each location you are referencing (I.E. if you own a business please fill out a separate survey for that location).

- 1. Thinking about your current location, which of the following best describes your location? (Check all that apply.)
  - □ Residential Primary Home
  - □ Residential Rental
  - □ Residential Vacation or Second Home
  - □ Residential Telecommuter
  - □ Small Office / Home Office (SOHO)
  - □ Small Business (less than 100 employees)
  - □ Large Business (More than 100 employees)
  - $\Box$  Other (please specify)
- 2. Is internet service available at your location?
  - □ Yes
  - □ No
- 3. Do you subscribe to internet service at your location?
  - □ Yes
  - □ No
  - □ If yes, who is your internet service provider?
- 4. If you currently do not subscribe to internet service at your location, why not? (Check all that apply.)
  - $\Box$  It's not available
  - □ Installation price is too high
  - □ Monthly service fee is too high
  - □ I don't see the need for internet service
  - $\Box$  I don't have a computer
  - □ I use my mobile phone for internet access
  - $\Box$  Other reasons (please specify)
- 5. What type(s) of internet service do you subscribe to at this location? (Please check all that apply)
  - $\Box$  Cable /Modem
  - DSL (Digital Subscriber Line Copper Line)
  - □ Satellite
  - □ Fixed Wireless
  - □ Cellular / Mobile Wireless (through a phone or tablet)
  - □ Fiber Optic
  - □ Other
  - □ Unknown
  - $\Box \qquad N \, / \, A$

### **Appendix E: Long Survey / Online Survey (continued)**

6. Does your current internet service meet your needs?

□ Yes □ No

 $\Box$  N / A

If no please provide details below:

- 7. How would you rate the speed of your internet service?
  - □ Not Satisfied / Poor
  - □ Somewhat Satisfied / Fair
  - □ Satisfied / Good
  - □ Very Satisfied / Excellent
  - $\Box \qquad N \, / \, A$
- 8. How would you rate the reliability of your internet service?
  - □ Not Satisfied / Poor
  - □ Somewhat Satisfied / Fair
  - □ Satisfied / Good
  - □ Very Satisfied / Excellent
  - $\Box$  N / A
- 9. Do you frequently experience interruptions while using your current service?
  - □ Yes
  - □ No
  - $\Box \qquad N \, / \, A$
- 10. How would you rate the customer service of your internet service provider?
  - □ Not Satisfied / Poor
  - □ Somewhat satisfied / Fair
  - □ Satisfied / Good
  - □ Very Satisfied / Excellent
  - $\Box \qquad N \, / \, A$

(For 11-16 if you do not currently have internet service please write N/A in the space provided)

11. If you know your internet speed, please provide below (Upload Speed/Download Speed):

/ (Available speed test services: <u>www.speedtest.net</u>; <u>www.speakeasy.net</u>; <u>www.naco.org/testit</u> - *testit* is an IOS/Android app)

12. How much do you currently pay per month for internet service at this location? \$\_\_\_\_\_ per month

### **Appendix E: Long Survey / Online Survey (continued)**

13.	Is your internet service bundled with other services (I.E. phone, cable TV)? <ul> <li>Yes</li> <li>No</li> <li>N / A</li> </ul>
14.	Number of internet users at this location:
15.	Number of K – 12 students at this location:
16.	Number of post-secondary students at this location:
17.	Number of devices regularly connected to the internet at this location:
18.	How many hours per week total do the subscribers at this location use the internet for the following reasons:          Entertainment:       Work:       Education:         Social Media:       Other:       N / A:
19.	Are you interested in learning more about how to use the internet (Digital Literacy)?
20.	What do you consider to be a fair monthly price for high speed, reliable internet service?
21.	What do you consider to be an affordable monthly price for high speed, reliable internet service?

- 22. If your location is a business, do you offer free Wi-Fi to your customers?
  - □ Yes
  - □ No
  - $\Box \qquad N \, / \, A$
- 23. If Bangor had access to high speed internet / broadband, do you believe this would benefit:
  - Economic Development
  - □ Education K-12
  - □ Education Post-Secondary
  - □ Tele-Health / Tele-Medicine
  - $\Box$  Aging in place
  - □ Telecommuting / Work-at-Home
  - □ Public Safety

### THANK YOU FOR YOUR FEEDBACK!!!

### **Appendix F: Survey Results in Graphical Format**



























### **Appendix G: Municipal Network Diagrams**



### Municipal Owned and Operated Open Access Network

### **Appendix G: Municipal Network Diagrams (continued)**



### Municipal Network – Public-Private Partnership