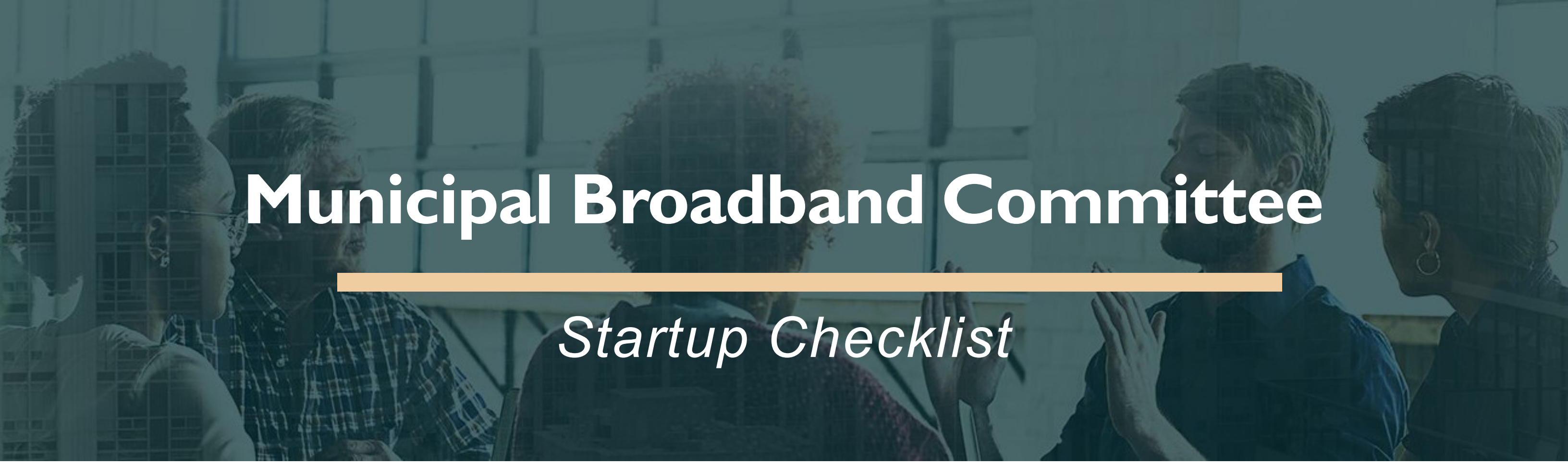

Municipal Broadband Committee

Startup Checklist

Create a committee

- ☐ **1.** Must be sanctioned by the Town/Village/City Board. Could be part of an existing committee or a new ad hoc committee.
- ☐ **2.** Include a variety of stakeholders
    - ☐ a. Residents
    - ☐ b. Businesses
    - ☐ c. Anyone who has subject matter expertise
- ☐ **3.** Establish purpose and goals (there are materials shared from other municipalities to assist in this)
    - ☐ a. Municipal requirements list
    - ☐ b. End result
    - ☐ c. Speeds
    - ☐ d. Monthly costs
    - ☐ e. Municipal costs
    - ☐ f. Engineering analysis
    - ☐ g. Explore long-term funding options
- ☐ **4.** Work with the Town administration/clerk to coordinate all logistics, create agendas and record minutes.

Identify Broadband Needs

- ☐ **1.** Conduct a community survey and gather data using the County Broadband Committee survey and recommended speed test.
- ☐ **2.** Include both residents and organizations such as businesses. This will establish a baseline, scope the problem, and help in the FCC and State broadband map challenge processes.
- ☐ **3.** This data is critical in defining your municipality as unserved, and is helpful in establishing what funding your municipality will qualify for. Broadband availability funds focus on communities that are unserved first and underserved second.
- ☐ **4.** Be prepared to contest the current FCC and State broadband coverage maps
- ☐ **5.** Publicize the survey through many channels.
- ☐ **6.** Update your Board regularly
- ☐ **7.** This is a good time to start compiling letters of support.
- ☐ **8.** Present to the public at municipal Board meetings
    - ☐ a. Include residents
    - ☐ b. Include businesses
    - ☐ c. Include anchor institutions

Select An ISP Partner

- ☐ **1.** Town/Village/City Board can help determine any criteria they want to include
    - a. Local/regional partner.
    - b. Customer service experience
    - c. Experience with FTTP (Fiber To The Premise)

    projects d. Service speeds and monthly rate plans

    - e. Broadband grant writing experience and success, etc.
- ☐ **2.** Meet with the ISP's and have them answer your criteria, consider any important municipal connections and public WiFi requests (Town Hall, Fire departments, anchor institutions, public beaches)
- ☐ **3.** Create a contract with the ISP

☐ **4.** Create a services agreement with the ISP, this articulates services the municipality will receive in return for their public investment in the FTTP network. There will generally be time-bound terms such as a number of years upon which review is then conducted.

5. ISP partners have grant writers on staff to assist in grant writing; talk to them about this.

6. ISP partners are part of the US Affordable Connectivity Program.

Engineering Analysis

☐ **1.** Utilize the County Finley & CCG Consulting Engineering report as a baseline.

☐ **2.** ISP partners can assist in this process for ground level engineering.

☐ **3.** This work product is a set of detailed construction-grade documents that will establish the cost of materials and amount of labor required for the project.

☐ **4.** Costs and processes will vary by ISP.

☐ **5.** County provided E-911 maps will assist in the engineering process.

☐ **6.** County provided road mileage which includes the municipal and state highway roads, will assist in the engineering process. This does ***not*** include private road mileage.

SOME INFORMATION ON ROAD MILEAGE FROM THE GIS COORDINATOR

Here is a short summary of what the roads layer is on the GIS map:

- Privately named roads (easements are unaccounted for unless given a formal name)
- Town roads
- Village roads
- City roads
- County roads
- State

The GIS program generates a length based on the distance of the line (road) from the projection currently being used in the map. From this, an estimated distance is delivered. These estimates are generally pretty accurate, but they are not precise to the exact number.

There's a number of factors why the GIS layer could be off from the true distances of the roads in each municipality. It really comes down to what is being considered as a "road" when this project is being conducted. As far as unnamed easements and other types are not being considered as a part of the GIS roads layer. These are separate layers and can be calculated on top of the roads layer if needed.

Another factor can be how the lines are drawn apart of the roads layer in GIS. The distinction comes down to that the line is being considered one 1 directional meaning it's a singular distance. If the project is accounting for each side of the road as separate distances then that would have to be considered as well.

GIS is not meant to be the true reflection of current distances or boundaries of any layers. They are merely a guide to assist in the correct answer.

Explore Funding Options – Grants

☐ **1.** State Funds- WI Public Service Commission grants. There will be various grant rounds available at different times with different funding sources.

☐ **2.** USDA Reconnect – will be announced Fall of 2022

☐ **3.** NTIA- Middle Mile is currently open until September 2022

☐ **4.** NTIA- BEAD Federal funding should be available Fall 2023-Spring 2024 per information from the WI Public Service Commission

☐ **5.** Capital Projects Fund- potential for Fall 2022

☐ **6.** E-rate Local school funds

- ☐ **7.** When grants are announced and opened for application there is typically an 8-12-week window to write and apply.
- ☐ **8.** It is beneficial and dire to have a majority of this work and decision making done, to allow the grant writers the time to compile information and ensure the application is in on time, and ***you have your funding mechanism chosen and approved***.
- ☐ **9.** Your ISP partner will have funding contributions towards the project that may be in the form of hardware, labor, engineering cost, etc.
- **10.** County contribution is $25 per address for each Township with participation factors including;
  - a. The Town is also a partner in the project.
  - b. The project is for (FTTP) Fiber To The Premise
  - c. The project is designed to be scalable.
  - d. The projects must be obligated by the end of 2024.

Informational Funding Options

- ☐ **1.** Local ARPA funds
- ☐ **2.** Local tax levy
- ☐ **3.** State Funds- Board of Commissioners of Public Lands

  https://bcpl.wisconsin.gov/Pages/LoanProgramHomePage.aspx
- ☐ **4.** National Funds- Connect Humanity

  https://connecthumanity.fund/
- ☐ **5.** Broadband.money

  https://discuss.broadband.money/home
- ☐ **6.** Blended finance.
- ☐ **7.** Grants need letters of support, start collecting from your community as soon as possible.

AON vs. PON

- ☐ **1.** The fiber design considered two technologies. Active Ethernet technology has been in widespread use for more than 30 years; passive optical network (PON) technology has been used for over 15 years. These are both mature technologies that are widely used and well-understood industrywide.
- ☐ **2.** There is no single best path forward
- ☐ **3.** There are best practices that can fit both networks
- ☐ **4.** See the provided detailed information on these two technologies.

Finley Broadband Infrastructure Engineering Assessment Report

GPON / XGS-PON – Passive Fiber Technology

For the last fifteen years, the industry standard for passive optical networks has been GPON. As recently as last year, there was still at least a 15% or greater price penalty for buying 10 Gbps PON technology using the XGS-PON standard. But recently, we've seen quotes for XGS-PON that are nearly identical in price to buying the GPON that's been the industry standard.

New technology is almost always more expensive for two reasons. First, manufacturers hope to reap a premium price from those willing to be early adapters. You'd think it would be just the opposite since the first buyers of new technology are the guinea pigs who have to help debug all of the inevitable problems that crop up in new technology. But the primary reason that new technology costs more is economy of scale for the manufacturers – prices don't drop until manufacturers start manufacturing large quantities of the new technology.

The XGS-PON standard provides a lot more speed. The industry standard GPON technology delivers 2.4 Gbps download and 1 Gbps upload speed to a group of customers – mostly often configured at 32 passings. XGS-PON technology delivers 10 Gbps downstream and 2.5 Gbps upstream to the same group of customers—a big step up in bandwidth over GPON.

The price has dropped for XGS-PON primarily from the use by AT&T in the U.S. and Vodaphone in Europe. These large ISPs and others have finally purchased enough gear to drive down the cost for manufacturers. One of the best features of XGS-PON is some manufacturers are offering this as an overlay onto GPON. The new technology requires swapping out some cards in a GPON network to provision some customers with 10 Gbps speeds. This means that anybody using GPON technology ought to be able to ease into the technology without a forklift upgrade.

XGS-PON is not a new technology, and it’s been around for at least five years. But the price differential stopped most network owners from considering the technology. Most CCG clients claim that their residential GPON networks average around 40% utilization, so there have been no performance reasons to need to upgrade to faster technology. But averages are just that, and some PONs (neighborhood nodes) are a lot busier, meaning that ISPs are having to shuffle customers to maintain performance.

With the price difference finally closing, there is no reason for somebody building a new residential network to not consider the faster technology. Over the next five years, as customers start using virtual reality and telepresence technology, there is likely to be a big jump up in bandwidth demand from neighborhoods. This is fueled by the fact that over 10% of homes nationwide are now subscribed to gigabit broadband service – and that’s enough homes for vendors to finally roll out applications that can use faster speeds.

A PON network can be designed in numerous configurations, but all designs include the same key elements. All networks start at a network core where the connection is made to the Internet. At this core, the ISP generally inserts the signals for the various products being delivered to customers.

From the core, there are direct fibers to Optical Line Terminal (OLT), which are the devices that provide the light source for customers. These OLTs can be located in the same location as the fiber core or can be spread around the city in neighborhood nodes, generally in huts or large cabinets.

There is one fiber leaving an OLT for each “PON”, which is the local network consisting of up to 32 customers. These fibers go to splitter cabinets, where each fiber is then “split” into the 32 separate fibers that go to customers. The splitter cabinets can be located at the same location as the OLT electronics, or they can be moved deeper into the network to be closer to customers. The name “passive” for the technology comes from the fact that the splitter site doesn’t require electronics or power – the splitting is just what it sounds like – one fiber is spliced and split into 32 individual paths. The paths between the splitter and each customer are “home runs”, meaning that there is a single dedicated fiber between a splitter site and each customer.

One of the biggest benefits of the GPON network is a saving in fibers in the network. Only one fiber is needed to serve an OLT, and one fiber goes from the OLT to each splitter. The fiber is only divided into individual customer fibers at the splitters, which can happen deep into the network.

One consideration when designing PON networks is the optical distance from an OLT port to the customer Optical Network Terminal (ONT). A design that allows for a 1.32 customer split has a distance limitation of 20 km (12.4 miles). That distance limitation is generally not a problem in city network but can be a challenge in rural areas.

The current vendors for PON equipment include Alcatel-Lucent, Adtran, DZS, Nokia, Juniper, and Calix.

<u>PON Advantages</u>

• <u>No electronics in the field</u>. PON uses passive splitters to distribute the bandwidth over the fiber to the customers. There are only two active components in the PON distribution network – the Optical Line Terminal (OLT) and the Optical Network Terminal (ONT). The OLT sits in an environmentally controlled hut or building, and the ONT sits on the side of the home or inside of the home.

• <u>Less field maintenance and more reliability.</u> Because PON uses passive splitters in the field, there are fewer powered network elements in the distribution network. This equates to less maintenance, fewer field personnel required, more reliability, and fewer managed network elements in the distribution network. A PON network also means less land and rights-of-way required due to less need for large powered huts.

• Less fiber needed. PON uses significantly fewer fibers than an active system. A PON network carries up to 64 customers (we recommend not more than 32) on one fiber, while an active network needs a home run fiber for each customer. Less fiber means lower capital costs, less loading on poles, quicker fiber installations with less splicing, and smaller fiber management systems.

• Higher density electronics. Because PON electronics have only one optical port for every 32 customers, the PON chassis in the OLT can serve a large number of customers in a small space. This means less space for electronics, less power usage, less air conditioning, and reduced backup power requirements.

• Ability to still use active Ethernet. Most PON manufacturers offer the option to serve some customers on active Ethernet in the same chassis by the use of a separate core card.

• Location Flexibility There are a lot more options for locating passive devices and placing them close to customers. Network owners can deploy both large, centralized splitter sites and widely distributed tiny splitter cabinets.

• Takes the best advantage of oversubscription. All of the customers in a neighborhood node share the bandwidth delivered to the node. This is a more efficient use of bandwidth than sending a dedicated amount of bandwidth to each customer.

PON Weaknesses

• Distance Limitation. Customers have to be within 12 miles of the OLT core electronics. This can present a challenge in large rural networks.

• More Complex Engineering. Because of distance limitations and splitter requirements, a PON network requires an engineering plan to make sure that the OLTs and ONT operate within the limitations of the network. This is not a major issue since industry engineers are well versed in designing PON networks.

• More customers are affected by a single fiber cut. Cutting one neighborhood fiber could put up to 32 to 64 subscribers out of service.

Active Ethernet (Active E)

An Active E network is essentially a fiber “home run” from the central electronics core, meaning that one fiber goes from the core electronics directly to each customer. This technology has several advantages and is well-suited for serving large businesses where the customer requires more stringent network uptime and higher bandwidth. An Active E network also can provide symmetrical data capabilities (upstream and downstream data rates are the same) at high data speeds. The downside to Active E is that more fibers are required in the network since fibers are not shared between customers. Electronic costs are generally also higher since there is a dedicated laser at both ends of the connection to every customer. Active E also has higher data capabilities and can inexpensively provide for data rates up to 10 gigabits per second. Faster speeds are possible, but with significantly higher electronics costs. One of the biggest advantages of Active E is that it’s easy to change the connection to a single customer as customer requirements change – the laser serving that customer can be changed without affecting any other part of the network.

The primary vendors in the Active E equipment market are Cisco, Calix, Adtran, and Nokia-Alcatel-Lucent. Since PON equipment has won a much greater market share than Active E equipment, this part of the industry has been in a bit of a decline for a few years.

Active Ethernet Strengths

•Greater distance. Where a PON has a 12-mile limit between the core electronics and the customer, an active connection can reach over 50 miles.

• Less engineering and planning. Since every fiber run is a home run between the electronics chassis and the customer, there is less engineering and planning needed to design and deploy an AON network. Engineering means just planning one fiber per passing.

• Pure IP Network. The active Ethernet network delivers pure native IP, meaning it could be plugged directly into customer modems or switches.

• Can deliver greater bandwidth. Lasers are available that can deliver speeds greater than 10 Gbps. Such lasers can be expensive, but they are easy to integrate into an active network.

Active Ethernet Weaknesses

• Uses more fiber than PON. With one fiber home run per customer, Active networks require significantly more fiber. This means larger fiber bundles to the same number of electronic chassis. This has an effect on capital costs, pole loading, conduit, and hand-hole sizing, etc. Larger fiber bundles require larger field huts to handle the larger fiber entrance. In a densely populated area, the size of the fibers can be unwieldy.

• Less dense electronics. Since there is a core laser for every customer connection, the electronic chassis support fewer customers in the same rack space. This means larger chassis and more rack space, which equates to more environmentally conditioned space and more and larger power and backup power at the electronics locations.

• More powered network elements. There are more field locations that require power. This means more failure points in the network, more field huts, more power, more battery backup, and generators.

• Expensive growth after construction. This may be the biggest drawback. It can be expensive to add new customers in the middle of the network because that means somehow adding more fiber between the electronics and customers.