

## Benefits of Fiber Optics

One of the major concerns with fiber systems is the up front cost. However, over time, other technologies would need to be replaced, upgraded or will be deemed obsolete. On the other hand, fiber will allow you to scale the bandwidth delivered as needed, all while using the same fiber distribution network over a period of decades.



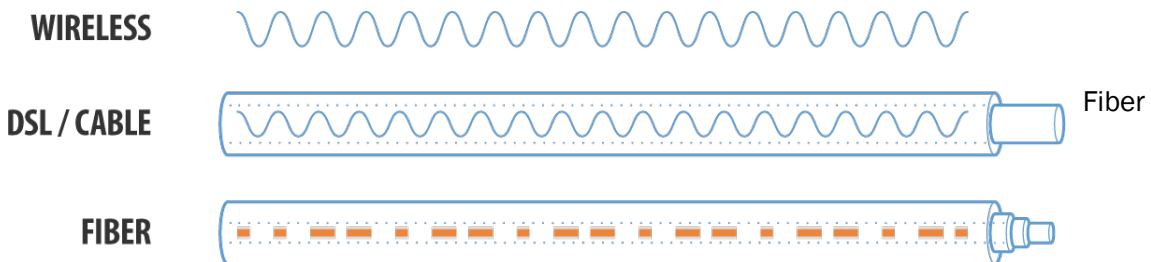
**The optical fiber cable in the foreground has the equivalent capacity of the copper cable in the background.**

Just one visual example will underscore the capabilities of a fiber connection versus a legacy copper networks connection. With today's technology, one fiber the thickness of a human hair can carry more data than 4,000 top-speed DSL lines.

Homes that are being served by copper, either through DSL from the phone company, or with co-ax from the cable company, have serious limitations in service because of how each technology works. In the case of DSL, not only is the driving technology outdated, but also the old copper lines themselves are susceptible to corrosion that can severely impact the reliability of the connection. Furthermore, DSL is severely limited in the distance it can push a signal (3 miles maximum), meaning that those homes furthest from the telco equipment are faced with connections that often cannot reach even a paltry 3Mbps download speed.

Naturally, questions arise about the capabilities of each technology and these differences should be carefully considered when building a network. We firmly believe that the benefits of having fiber connections to your businesses – and just as importantly, to your homes – are worthy of consideration, even with the cost associated with fiber.

How it works is the secret to higher speeds



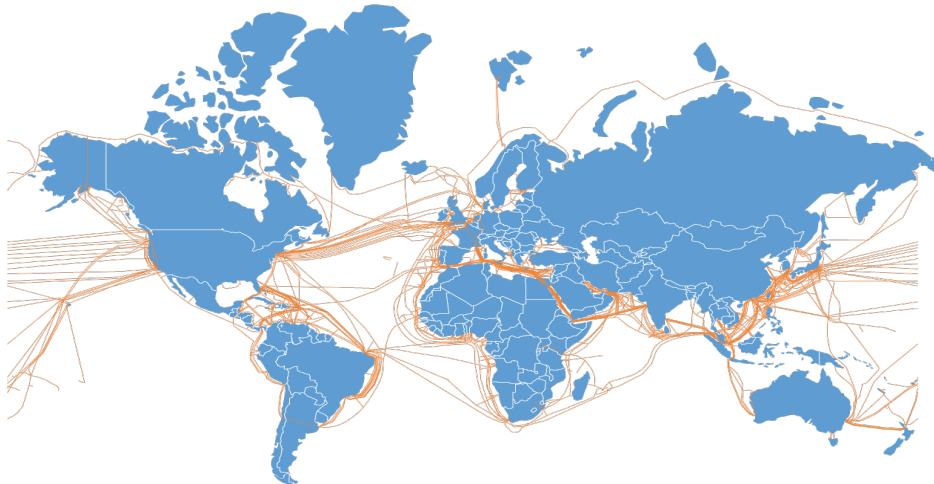
“Broadband” describes the fastest method of delivering high-speed internet to subscribers. While DSL and cable utilize existing phone and TV infrastructure to transmit data as

frequency “vibrations” over copper wires, fiber networks transmit data using light over specialized cables that contain glass fiber strands. Light moves at 186,000 miles per second, and this is what enables speeds of 1 Gig (1000Mbps) or much more per connection-100 times faster than a 10Mbps DSL connection and 10 times faster than a 100Mbps cable connection. In addition, both DSL and cable suffer from the limits of their own technology, making them less than ideal choices into the future.

Wireless is an interesting choice and is certainly being considered in major urban markets where the density of buildings makes fiber optic cabling expensive and complicated. Wireless service, while reliable, is not as reliable as fiber optics and can be susceptible to weather conditions and movement of outdoor equipment due to wind. Wireless also requires a direct line of sight; obstructions are not a friend of a wireless signal. While it has the capability to be as fast as fiber, reliability concerns and reliance on line of sight make wireless installations best suited to very dense urban, or certain rural situations where the physical environment allows for reliable, high speed wireless systems, where costs make wireless a serious consideration.

### Like other technology- is it going to become obsolete?

While we cannot predict the future, all indications are that fiber optics is here to stay for a very long time. Frankly, this technology has already been used for many, many years, which means that there are trillions of dollars of fiber installed globally. A whole industry has grown up around how to utilize fiber to its fullest capacity to make all of our lives better. This industry has proven very good at developing new electronics to push more and more data through existing fiber lines.



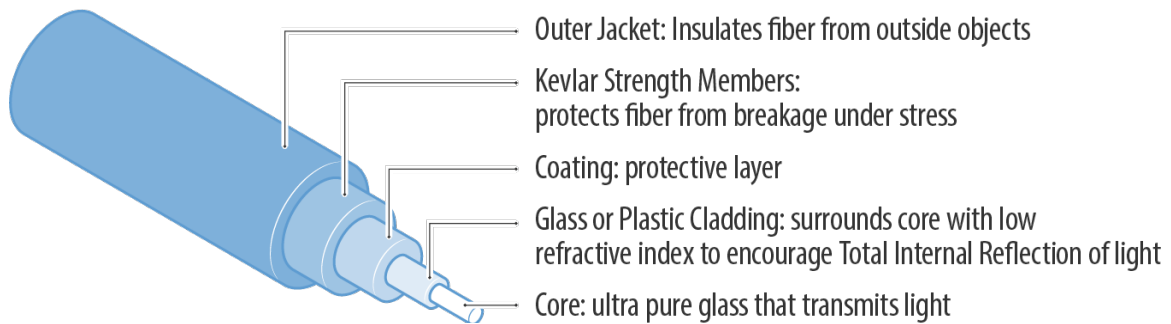
Most people think of fiber as a new technology, but in reality it has been used for “backbone” connectivity as far back as the 80s, with hundreds of fiber optic cables running across the sea floor all around the world.

What is new, is that fiber is starting to be used to serve homes in places like Austin, TX and Chattanooga, TN and right here in Maine on the islands of Islesboro and Cranberry Isles, where FTTH (Fiber to the Home) networks are being deployed. Because of the extensive network of fiber already deployed and continuing to be deployed, it is very unlikely that we would see any major shift in market forces that would make fiber optics obsolete. Most

telecom observers believe that 5G cellular technology is many, many years away from possibly replacing even a traditional DSL or cable connection.

### What is in a fiber-optic cable?

An individual optical fiber (the size of a human hair) is surrounded by several layers of material that strengthen and protect the fiber. A fiber-optic cable can have any number of “fibers” ranging from 1 to several 100s.



### Benefits of Fiber Technology

**Speed and Capacity.** Many experts say that FTTH connections are the only technology with enough bandwidth to support the projected consumer demands over the next decade.

**Future proof.** Because of fiber’s capabilities, new technological innovations are being invented every day to utilize fiber’s superior ability to transport tremendous amounts of data at blazingly fast speeds. Technologies such as 3D holographic high definition television and gaming will someday be everyday items in households around the world. FTTH will be able to handle the estimated 30 gigabit-per-second needs of such equipment... and this is just one technology. Think about the new ways that you use the internet that seem commonplace now that were not even conceived of 10 years ago.

**One delivery system.** Right now a consumer can receive telephone, video, audio, television and almost any type of data transmission using a single seamless FTTH connection. That trend will continue as consumers are given an increasing array of a la carte choices for how they receive their various communication and data and streaming choices. Subscribers are also realizing that receiving bundled services through a fiber connection can save money.

**Reliability.** Fiber is the most reliable connection you can have. In surveys across the state of Maine, the #1 complaint is reliability. An internet connection is becoming a necessity, not a luxury. When connectivity is interrupted or slowed down unexpectedly or inexplicably consumers are furious that they cannot accomplish the on line task, leading to a significant loss of productivity or time.

### Direct benefits to Communities

**Job Creation-** There are many examples of fiber networks creating jobs by either supporting existing businesses or attracting new ones

**Business Attraction-** When we say business attraction, we really mean businesses that are looking for the kinds of connections that can move large amounts of data, quickly- architects, designers, banks and other heavy users

**Entrepreneurship-** Fiber helps induce young people to locate and work from anywhere

**Education-** The “homework gap” is a growing policy concern in Washington, DC and Maine for those homes that do not have a connection or a substandard connection that does not allow for children to do their on-line homework or for adult learners to take classes or learn new skills that a 21<sup>st</sup> Century economy provides.

**Telemedicine-** The medical field and how patients and providers interact is undergoing seismic changes. One of those changes is the way patients are able to be seen, treated, monitored and are increasingly being given tools to manage their own health care, right from their home. A fiber connection has the capacity to manage these data transmission uses, which in turn facilitates our elders aging in place

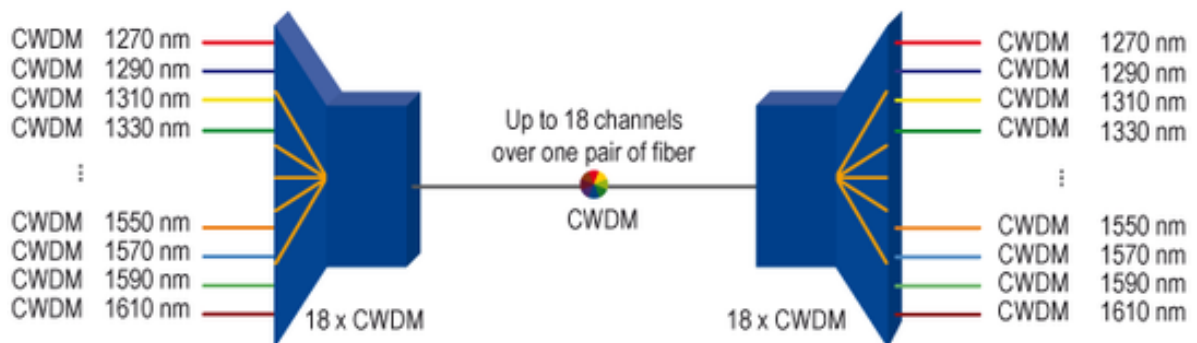
**Increased Home Values-** A Broadband Communities study indicated that FTTH networks increase the value of a \$300,000 home by an average of \$5,000-\$6,000. Another study by the FTTH Council in conjunction with the University of Colorado showed that homes with a FTTH connection are worth, on average, 3.1% more than homes that do not have a fiber connection

A fiber network can be leveraged to help communities differentiate themselves in positive ways. Letting the world know that you are on the cutting edge of realizing what homeowners and businesses are demanding to help them work or play online more efficiently, drives prominence for your town and encourages both in-migration and business growth.

## Proposed Fiber equipment

### CWDM (Coarse Wavelength Division Multiplexing)

Our cost estimates will use a fiber technology hardware called Coarse Wavelength Division Multiplexing (CWDM). This system allows up to 18 connections over a single fiber pair by having each connection operate on a separate light wavelength.



This allows multiple premise connections operating over a single fiber pair that can each carry up to 10Gbps (10,000Mbps), depending on the hardware used. This allows up to 180Gbps (180,000mbps) of data to be transmitted on a single fiber pair. 40G and 100G CWDM transponders are in the development pipeline.

What does this mean for you?

- Saves cost, because size of trunk cable has potential to be sized differently (smaller)
- Allows for inexpensive connections up to a Gigabit to each business or home and can increase to 10Gigs (10,000Mbps) with off-the-shelf hardware upgrades. Even 10G CWDM transceivers are relatively inexpensive today at about \$100/each
- Scalable, allows for a single fiber to serve up to 18 businesses or homes, can easily accommodate years of new growth with just a few additional strands of fiber

The CDWM solution saves cost, but not at the sacrifice of performance. First, the trunk line that will serve as the main line of fiber that is used to create “drops” (fiber connections) to each premise does not need to be as large, saving space, reducing tension and weight on the existing utility pole infrastructure that the truck line would be hung. Using CDWM allows the trunk line size and weight and cost to be reduced, while still offering excellent scalability. Weight and tension matter when you consider poles can cost up to \$3,000 a piece to replace. Every 10 poles of replacement cost you can avoid saves \$30,000. The size and weight of the fiber cable can have a direct relationship to potential pole replacements.

With inexpensive optics, up to 1Gbps (1000Mbps) could be offered to each home today. Unlike with cable, or even other fiber technologies (xPON), this is not a shared connection – the network truly supports a full Gig to each home. As time passes, we imagine a day when more than a Gig of service would be needed at each premise. At that time, optical equipment can easily be switched out to offer up to 10Gbps (10,000Mbps) of service for a robust upgrade that is both easy and inexpensive.

When looking at future proofing a network, this design allows for almost unlimited speed and capacity increases without changing the actual fiber deployment on the street. As fiber has become the chosen technology for connectivity, equipment providers continue to innovate by changing the hardware on each end of the fiber to increase capability, without having to reinvest in a whole new system. We are comfortable recommending a system that will easily last 20 years or more with relatively small, if any, equipment upgrades over the life of the fiber.

In short,

- Fiber is a long-term investment in a community’s future
- Fiber supports 21<sup>st</sup> century economic opportunities
- Fiber leapfrogs communities that are left behind to the front of the pack
- Fiber, over the long run, is a less expensive technology