Isle au Haut Technology Considerations

Background

Axiom was the planning partner on a grant to assess and recommend an internet solution to serve Isle au Haut equitably across the entire island. Parts of the island currently receive poor to non-existent service. The island is currently served by TDS with a wireless backhaul microwave link to Stonington and from there through Swan's Island to the mainland. Recent upgrades to TDS's system have exacerbated the uneven service by enhancing service in the immediate vicinity of the tower near the town, while leaving others in their current state of service, which is poor.

Initial discussions with the Broadband Committee focused on technology options that might specifically address island wide inequities in service. A variety of options were considered and evaluated by Axiom.

TV White Space (TVWS)

TV White Space Technology is an emerging wireless internet solution that uses the old analog television spectrum to broadcast a fixed wireless signal from a tower (or location of height) to individual homes. Because of the unique properties of this technology it was an intriguing idea.

From an engineering standpoint, we evaluated a new tower location, potentially on IAH Power Company land and broadcasting to island residents. The topography and tree cover made this wireless solution impossible to guarantee service to all potential customers, especially the currently worst served customers on the far southeast corner of the island where service is slowest. In addition, the TVWS technology currently has limitations on its total backhaul, making it likely that even those able to receive a signal would not achieve more than 3-5Mbps download speeds. With an initial price tag of a couple of hundred thousand or more and a likelihood of upgrades or a new solution needed in the next 5 years, this was not something we would recommend to the community.

Other Wireless

We also evaluated other wireless technology, and these were all found to be unacceptable given the terrain. These other wireless technologies are not able to penetrate even moderate foliage and would have been difficult to serve even 50% of the homes on the east shore, given the topography and tree cover. Again, at a cost of $150,000 or more, a limited coverage area, and no guarantee that each home could receive a signal, this was not a solution we found viable.

DSL

The island's current internet provider, TDS, upgraded their DSL service within the last year or so. The Broadband Committee attempted to investigate the cost of upgrades to the current DSL system to get better service to underserved and unserved areas of the island. Given that the incumbent provider's upgrades have already occurred and that any enhancement of service would be paid for entirely by the town or from other local resources AND the limitations in service that DSL technology inherently has, this is not a solution we would recommend. Although we would not discourage further discussions with TDS, any DSL based solution would require additional funding/upgrades in the near future to keep up with technology. Note also that while the recent upgrades did occur, anecdotal reports are that the service reliability and speeds for many have not changed dramatically enough to consider this a good solution for the future.

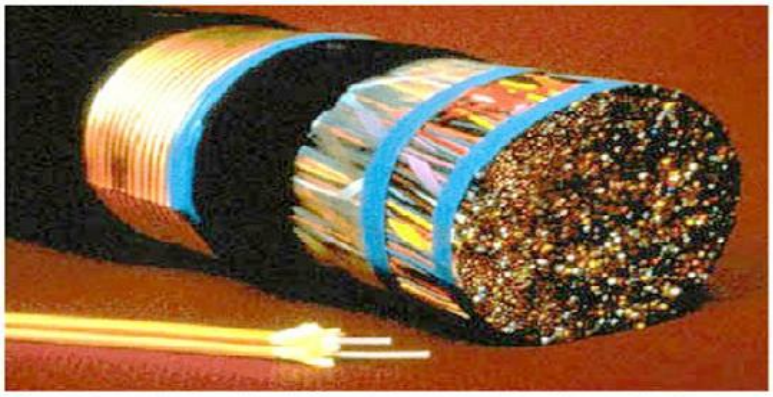
Based on these technology assessments we believe that the proposed fiber optic based hybrid solution is the best option for the Island.

Benefits of Fiber Optics

Fiber optic internet systems are just starting to emerge as viable solutions for residential and business last mile connections and Broadband Committees often get questions about the technology choice or the need for such systems. This section will help community members understand the benefits of fiber optics and its superiority over other technologies, including DSL.

- Fiber is a long-term investment in a community's future
- Fiber supports 21st 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

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.



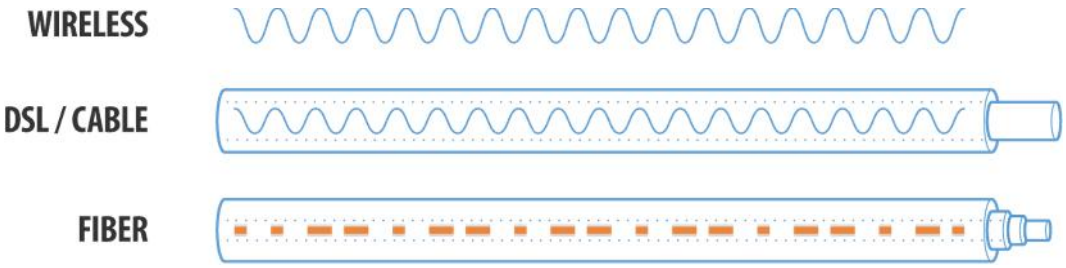
The optical fiber cable in the foreground has the equivalent capacity of the copper cable in the background.

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

Homes that are being served with DSL from the phone company or with other copper cable-based solutions have significant limitations in service because of how the technology works. In the case of DSL, not only is the driving technology outdated, but the old copper lines are susceptible to corrosion that can severely impact the reliability of a subscriber connection.

Furthermore, DSL is strictly limited in the distance it can push a signal (3-mile maximum), meaning those homes furthest from the telco equipment are faced with connections that often cannot reach even a 3Mbps download speed.

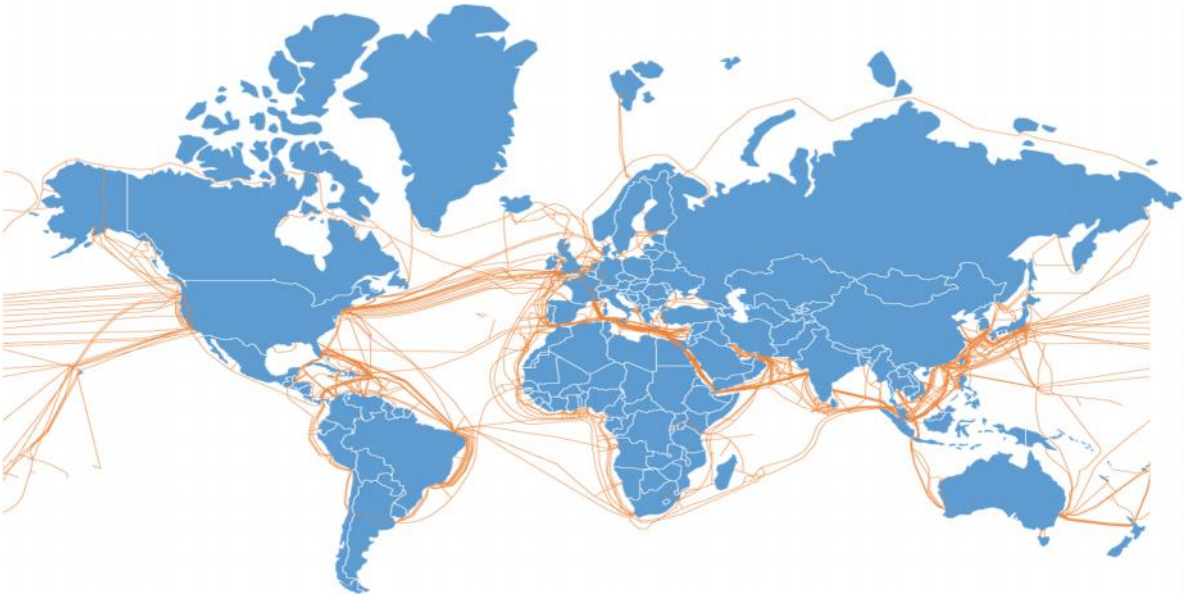
How it works is the secret to higher speeds



"Broadband" describes the fastest method of delivering high-speed internet to subscribers. While DSL utilizes existing telephone 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 (1000Mpbs) or much more per connection- 100 times faster than a 10Mbps DSL connection.

Wireless is an interesting choice and is certainly being utilized now in a variety of last mile, rural connections, and is emerging as a serious consideration 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 an option.

Will Fiber Become Obsolete Like other Technologies?



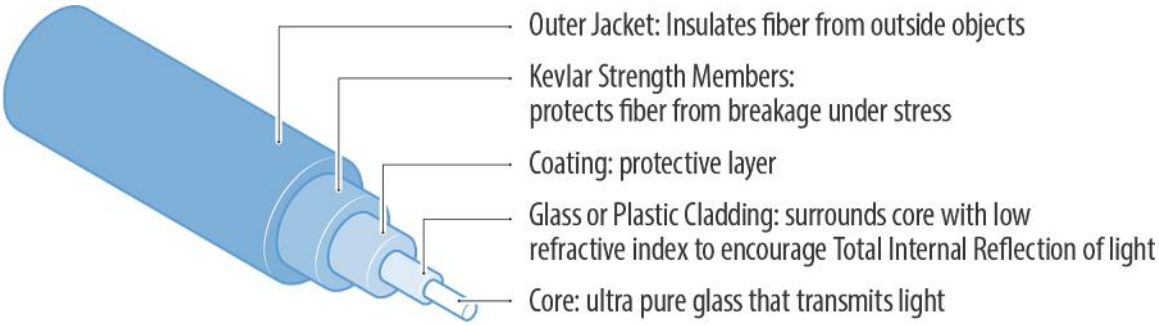
While we cannot predict the future, all indications are that fiber optic communication is here to stay for a very long time. Frankly, this technology has already been used for many, many years, which means that there are trillions of dollars of fiber installed globally. A whole industry has grown up 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 and Chattanooga and right here in Maine on Islesboro and Cranberry Isles, where FTTH (Fiber-to-the Home) networks are being deployed. While the Isle au Haut hybrid proposal is not as extensive as those projects any IAH customer will have the opportunity to connect with Fiber to the Home at their expense for the added benefits it provides.

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 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. Depending on the service, 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, 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 of a customer's current internet service 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.

Community Benefits

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

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

Education- Creating equal access for all eliminates "the homework gap" for those students that are increasingly required to complete assignments on-line but are unable to do so from their home because of a lack of an adequate internet connection. Adult learners also benefit from on-line learning options that utilize interactive video or other tools that those with better connections can access.

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

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The full design report from Axiom can be found on Isle au Haut town web site at:
http://www.isleauhautmaine.us/wp-content/uploads/2017/06/Design-Response-Fromn-Axiom.pdf
or by contacting any of the Broadband Committee members:

Donna & Charlie Hopkins
Sue & Stew Foelix
Roz Santospago