

An Assessment of Shadow Wood's Technology Infrastructure Options

There are three main objectives of the Shadow Wood Infrastructure Committee (SWIC) and the Technology Infrastructure Program:

1. Drive cost savings for the residents of Shadow Wood (SW),
2. Obtain reliable service that meets the needs of current and future residents thus future-proofing the community,
3. Ensure that SW's technology infrastructure is on par with (or better than) that of neighboring communities

This article will focus on items 2 and 3, specifically looking at the community's options as they relate to video (broadcast TV and streaming), Internet and phone services.

The Existing Service Providers

There are currently two wireline providers of these services in SW (Comcast and CenturyLink), two satellite video providers (Dish and DIRECTV), and multiple mobile or cellular carriers (we'll use the terms "cellular" and "mobile" instead of "wireless" to avoid confusing things with Wi-Fi). In this discussion we will look at the two wireline providers as they own the existing cables and electronics serving Shadow Wood.

Comcast (CMCSA) and CenturyLink (CTL) deliver Internet, video and phone services through their respective existing facilities. Both companies use fiber cabling and the latest hardware in their backbone networks which connect SW to the rest of the world. Unfortunately, the same cannot be said for the infrastructure inside SW, which is significantly older. Thus, overall service reliability rests primarily on the service providers' existing buried cables and in-community electronics, some of which have been discontinued by the manufacturer (i.e., the manufacturer no longer produces the equipment and may not have replacement parts):

- CenturyLink uses a fiber-to-the-curb approach to deliver service, with copper wires attaching customers' homes to the CTL network. The CTL SW infrastructure also includes various electronics necessary to run the network and transform the light signals carried by the fiber to the electrical signals carried into the home.
- CMCSA uses a combination of fiber and coaxial cabling to serve its customers. This is known as a hybrid fiber-coaxial network, or HFC. The CMCSA fiber cables terminate at nodes that convert light signals to electrical signals. These electrical signals are then carried to the individual homes via copper coaxial cabling.

So now that we have an idea of what is in our community and how it impacts our service, we know that we have two main options at this point:

1. Do nothing and hope that these companies will address facility performance issues quickly as they pop up.
2. Take steps to ensure that the community's needs are addressed now and into the future.

While option 1 seems painless in the sense that it does not require any immediate action on the part of the residents, it may not be a good long-term plan because it will ultimately result in continuing service degradation. In the current market, companies spend their capital where they believe they will get the best return, opting to patch existing networks as opposed to completely overhauling or replacing them (unless of course these maintenance costs far exceed the cost to replace). Consumers make decisions like this every day--do I replace that aging AC unit or repair it? How about the leaky roof--fix or replace? The ultimate decision comes down to what makes the best financial sense.

So how does this relate to our current providers?

One of these providers already has a significant percentage of SW residents as their customers (approximately 85% for Internet and more than 82% for video). Some might call this a captive audience of sorts. The likelihood of this company spending a significant amount of money to improve their SW infrastructure is not all that great considering they already have most of the available customers and revenue. However, history shows if they feel that the risk of losing customers or the cost to repairing failing facilities is growing, they may invest in the community.

The other company counts a much lower percentage of SW, about 11% for Internet, as customers. It is unlikely that this company will invest heavily unless they have some assurances that they will get a larger percentage of the available business.

So it is clear that the only way to get either company (actually any company for that matter) to make a long-term investment in the community is to guarantee they get a decent return on their investment. This is the reason companies pursue bulk commitments.

Copper Vs. Fiber Vs. Mobile Technology

Shifting gears to technology, there has been some discussion of the existing copper versus fiber versus next generation mobile technologies under development.

Generally speaking, copper is a very dated technology, in use since the late 1800's. While it is true that copper cables do a very good job of conducting electrical signals, they are subject to problems due to water damage and ensuing corrosion and electromagnetic interference (think about the days when you could hear a neighbor's conversation over your landline phone after a heavy rain). The fact that the cables are buried does not completely mitigate weather-related problems because buried cables are also exposed to moisture from wet ground. Certain cables are also susceptible to pitting due to in-ground electrical charges like lightning strikes hitting the cables. This pitting causes tiny holes that expose the cable to more water intrusion.

Copper is also limited from a forward-looking perspective because it simply cannot handle the growing demand for broadband service. An example of this, when more people use a HFC network, the internet may slow, especially during peaks when everyone gets home. Coaxial cable upload speeds are also very limited when compared to download speeds. Granted this is supposed to be addressed in the future through what is sometime called Full-Duplex Data Over Cable Service Interface Specifications (DOCSIS) 3.1, but that seems to be a bit down the road.

So it is pretty clear, when looking at overall reliability and technology limitations, that copper is a choke point when it comes to accessing the rest of the network world. This brings us to fiber.

Fiber optic cabling, or simply fiber, has been in use since the 1970's, although it was not used in the local loop (i.e., all the way to a customer's home) until the mid-2000's. Since then customers have been moving to fiber from copper at amazing rates. Making this last connection to the home is commonly referred to as "Fiber To The Home" (FTTH).

But fiber did not cease to evolve; there have been a series of improvements in the industry that allow fiber to be placed in a person's home in a virtually undetectable manner. This method of installation ensures a clean, fast connection all the way back to the network.

Fiber is significantly more reliable than copper, with trouble rates typically being reduced by 80% or more. This is because fiber is not impacted by water intrusion (it doesn't corrode like copper) or electromagnetic interference (it doesn't conduct electricity). As such, many companies, including all of the companies receiving the SW Request for Proposal (RFP) are moving to fiber for their wireline networks because of its increased reliability, lower maintenance cost and expanded capabilities.

Fiber offers a cleaner signal, passing light over a great distance at faster speeds with minimal, if any, degradation. Copper, on the other hand passes an electronic signal which degrades over distance. This means that fiber can handle faster data transfer rates and provide cleaner video and voice. In fact, the only thing limiting fiber's capabilities are the provider's electronics in their network and at the customers' homes.

Because of its ability to transmit signals so quickly and cleanly, fiber also serves as the backbone of cellular networks. Though many believe that mobile networks are completely wireless, this is not the case. Cellular networks rely on fiber to connect their antennae (or cell sites) to their backbone in a seamless manner. Simply put; without fiber you do not have a cellular network capable of handling today's traffic.

There is much talk these days about the bigger cellular companies testing newer mobile technologies like 5G. 5G technology relies on something called network densification, which involves deploying many smaller cell sites as opposed to a few large towers. These smaller cell sites sit closer to the customers' location and are connected to the mobile provider's backbone via fiber.

While 5G looks to be very promising, we are, by all accounts, at least three years from an initial commercial deployment. Beyond this, it will be a number of years after the initial deployment before we have all the necessary infrastructure (small cells and associated fiber network) in place to have a 5G network that matches the capabilities of FTTH.

Conclusions

So, the best infrastructure available at this time is FTTH. It will not only support today's demands, but those of the future as well--including those of 5G networks. In addition, its reliability is far superior to that of existing copper networks, ensure high reliability and a good customer experience for many, many years.

The table below summarizes the various technologies currently available or being developed and the various issues that ultimately determine the level of service reliability and customer satisfaction.

Summary of Factors Influencing Service Reliability & Customer Satisfaction

Considerations	Existing Community Infrastructure	Fiber to the Home (FTTH)	Next Generation Wireless (e.g., 5G)
Availability	Now	Installation required	Past 2020 (Exact date unknown)
Longevity	20 years old, Questionable	20++ years	5-10 years
Community Costs & Terms	No cost to the community (aside from annual price increases)	Cost defined by Bulk Contract (TBD) and can be better controlled from the outset	Unknown
Typical Data Speed	What we currently experience: 20Mbps - 150Mbps	Speed can be approx. 10 times faster than most current speeds-- approaching 1 Gbps	Unknown at this time but faster than currently available >100Mbps
Reliability	Existing facilities will continue to degrade over time	Significantly greater data capacity, reliability and securely protected within conduit	Requires fiber as the basis of the service, but technical issues still need to be overcome and roll out will focus on major cities

This paper was written by one of our Shadow Wood residents who has recently retired from an executive position with Verizon. In this capacity, he was responsible for the development and implementation of emerging technologies in the telecommunications field. As such, he is well qualified to assess both our current and potential future technology delivery choices.