Starlink Summary: February 2021

By Ben Fineman, Michigan Broadband Alliance

Starlink is a new satellite internet service provider using low Earth orbit satellites. Traditional satellite internet service has been provided by geosynchronous satellites, which as a consequence of their orbital altitude have a high latency. And since there are relatively few satellites (HughesNet for example has only five total satellites) capacity is limited and services are data capped. Low Earth orbit satellites solve these issues with a very low orbital altitude yielding low latency, and many more satellites yielding greater capacity. This brief paper summarizes the current status of Starlink and its anticipated impact on rural broadband in MIchigan.

Current Status

Starlink targets launching 12,000 satellites to reach full operation. When comparing this to the total of 2,298 that made up a total of all satellites in orbit in 2019, this seems like an ambitious number. Yet today Starlink has more than 1,000 satellites in orbit with more launching on a weekly basis. With this initial constellation Starlink has successfully brought online over 10,000 beta customers. At this point there is no reason to believe that Starlink will not achieve their target of 12,000 total satellites.

Beta testers of the Starlink service are seeing between 50-150Mb download and 5-40Mb upload, at latencies comparable to terrestrial service, with no data caps. This meets the current FCC metric for broadband service of 25Mb download and 3Mb upload. While beta testers are experiencing reliability issues that impact real-time applications such as Zoom calls, it is expected that these issues will resolve as more satellites are put into orbit. Beta testers pay $499 one time and $99/month.

Future Uncertainty

The main uncertainty around Starlink today is capacity, and how this capacity will affect availability, speeds, prices, and data caps. Even with many more satellites, the capacity of each satellite is limited, and only a finite number of satellites will be overhead at any given time. In low density areas this will not be an issue, since the total number of users on visible satellites will be low. But for denser areas (including rural areas that are in proximity to suburban or urban areas), it is likely that the capacity of visible satellites could be saturated, causing Starlink to do one of the following:

1) raise prices to decrease demand,
2) limit availability,
3) lower speeds,
4) implement data caps, or
5) allow saturation resulting in degraded service to some subscribers.

Terrestrial ISPs are looking closely at Starlink's ability to deliver following an award of $885.51M in the recent Rural Digital Opportunity Fund auction that would otherwise have gone toward funding terrestrial infrastructure. These are funds awarded in exchange for Starlink bringing service to a specific set of 642,925 homes and businesses. Consulting firm Cartesian conducted an analysis on the behalf of the Fiber Broadband Association and the Rural Broadband Association. The findings were that assuming Starlink is successful in launching all 12,000 satellites, based on current information and utilization projections 56% of these 642,925 subscribers will experience Starlink service degradation due to congestion, and the experience will be worse if Starlink allows subscribers outside of their RDOF award areas. (More reading)

Technical Comparison to Fiber Optic

One point of confusion is that Starlink has been marketed as being "faster" than fiber. While it is true that Starlink has the potential to reduce latency over long distances, this is not the measure of "speed" that most users care about – for most users, the important "speed" metric is *bandwidth*. Fiber is unequivocally faster when it comes to bandwidth. The highest speed yet reported in the Starlink beta is 215 Mbps. Contrast this with fiber, where 1,000 Mbps (1 Gbps) home connections are common, and providers in some markets are starting to provide 10,000 Mbps (10 Gbps) connections. When looking to the future – Starlink has stated a goal of being able to provide 10,000 Mbps (10 Gbps) service. But to do this would require the most or all of the capacity of a single satellite, which would mean using the up most or all of the Starlink capacity for an area of about 75,000 square miles (each satellite in the lowest orbital shell is planned to cover a 500 km diameter area). In contrast a fiber optic network can provide 10,000 Mbps service to every home in a neighborhood, and future capacity is virtually unlimited: The current speed record using a standard fiber optic cable is held by researchers at the University College of London, who were able to communicate through a single fiber optic cable at more than 178 Tbps (178,000 Gbps, or 178,000,000 Mbps).

It is likely that Starlink will be able to provide service at a marginally lower latency over long distances. The reason for this is because light travels at a speed that is about 1/3 slower in fiber versus through open air, and Starlink plans to use lasers to communicate directly between satellites. For almost all practical applications this is irrelevant – even latency sensitive home users such as competitive gamers will likely see little or no difference when using Starlink versus a fiber connection. Where this level of latency is relevant is in finance, specifically algorithmic and electronic trading, where computers being the first to automatically initiate trades can yield additional profits for traders. But this niche use case is not relevant for home users and non-financial business users.

Economic Comparison to Wireline Technologies

It is likely that Starlink, if executed successfully, will prove to be a good investment for SpaceX. Starlink has estimated that the total cost of their initial deployment will be at least $10B. This will yield a global constellation of satellites that can provide service not just to the United States but also arbitrarily many subscribers from other nations around the world. This not only lays the foundation for a good business case but has the potential to make a huge impact in nations

with little existing communications infrastructure, and to connect more of the 47% of the world's population that still do not use the internet.

But, our focus is on Michigan citizens, especially the 1,000,000 or more who still lack access to broadband at home. If successful, Starlink will bring broadband service to a significant number of these citizens. So with Starlink coming is it worth it for communities to pursue other options?

For one example, we can look to the NRTC consortium of cooperatives, who recently received a preliminary award from the Rural Digital Opportunity Fund to build gigabit fiber to almost 45,000 Michigan households. One of the NRTC members is Midwest Energy and Communications (MEC), who plans to use these funds to provide service at their current price points, which includes a 1,000 Mb (1 Gb) service for $99/month. These households will receive service ten times faster than Starlink, with upload speeds that are fifty times faster, for the same price - and without future congestion concerns. MEC also offers lower tiers of service including 50Mb for $50/month, which provides a more economically accessible option. Communities can pursue strategies to incentivize investments and grant-seeking in their areas from providers like MEC.

For another example – Lyndon Township citizens recently completed construction of the municipally owned fiber network that they voted to fund with a property tax. For the average Lyndon property owner, the property tax comes out to about $23/month. Lyndon Township residents are now able to subscribe to 1,000 Mb (1 Gb) service for $70/month, or about $93/month total including the average tax. Lyndon Township also offers lower tiers of service including 50Mb for $35/month, or $58/month total including the average tax. And when the bond that the tax is financing is retired, Lyndon residents will continue to receive broadband service for the base monthly fee only. Buried fiber infrastructure has an estimated usable life of between 40-60 years, or longer.

So while pursuing investment in fiber can absolutely benefit a community, the priorities, economic possibilities, and will to engage will vary widely. Some communities, such as those in very low-density areas such as the rural Upper Peninsula, may do well to wait for future Starlink deployments. However, many other communities may not wish to resign themselves to perpetuation of life on the wrong side of the digital divide and continue pursuit of strategies that can provide long-term solutions to the broadband gap.

Should I Sign Up for Starlink?

Now that anyone can sign up for the Starlink beta by putting down $99, many Michigan residents are asking themselves "should I sign up for Starlink?" The Starlink beta costs $499 one time and $99/month, with no long-term contract, with new deployments expected later this year. For residents with existing access to cable and fiber, Starlink would be a clear downgrade. But for others without broadband, the primary risk is the loss of that initial $499 investment, should Starlink not work out or should another service become available soon. The question of whether this risk is worth is directly related to how much you are paying now, and how desperate you are for a better solution. Many residents are already paying hundreds of dollars

a month for cellular services – for these residents, a $499 investment could quickly be recouped through saving money at $99/month. Other residents may be in areas that have received RDOF funding awards – but RDOF build obligations do not conclude until mid 2027, so using Starlink as a stop gap may be prudent. Finally, other residents may want better service but can get by on what they have for now – those residents may be well served to wait until Starlink is out of beta, to see what the final prices and service levels look like. Residents should also be aware that T-Mobile and Verizon are expanding their truly unlimited home cellular services, and though rural coverage is still limited, residents fortunate enough to be in coverage areas may have access to cellular service with similar performance to Starlink at lower prices.

Conclusion

These is no question that low Earth orbit satellites, and Starlink specifically, will be transformative for global broadband connectivity. For Michigan many communities, Starlink will be a game changer as the bar for the minimum level of internet connectivity is raised. But communities who are interested in achieving long-term digital equity would be well served to continue their work toward building future-proof terrestrial broadband infrastructure.