Starlink for Home, Travel and Preparedness

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This month, I take a look at another "ham adjacent" topic with application in the shack, wherever it is, and for preparedness. Everyone has probably heard of Starlink and the deployment of it in Western North Carolina to quickly restore internet access after Hurricanes Helene and Milton destroyed much of the infrastructure there. I and another club member have recently installed Starlink at our homes due to poor internet performance of our land-based internet providers. A 7-minute video that provides a good overview of Starlink use cases, service, costs and hardware can be viewed at PC Mag Starlink Review.

Starlink is a satellite-based internet service. In contrast to previous systems, which typically used a few GSO (geostationary orbit) satellites, Starlink uses thousands of LEO (low-earth orbit) satellites. This reduces the distance (and time) for the radio signals to travel back and forth between the satellite and user's antennas. The time in milliseconds (ms) for a signal to travel round trip from your PC, tablet or phone to the Starlink satellite and then to the Starlink ground station and finally to the internet content server is known a "latency".

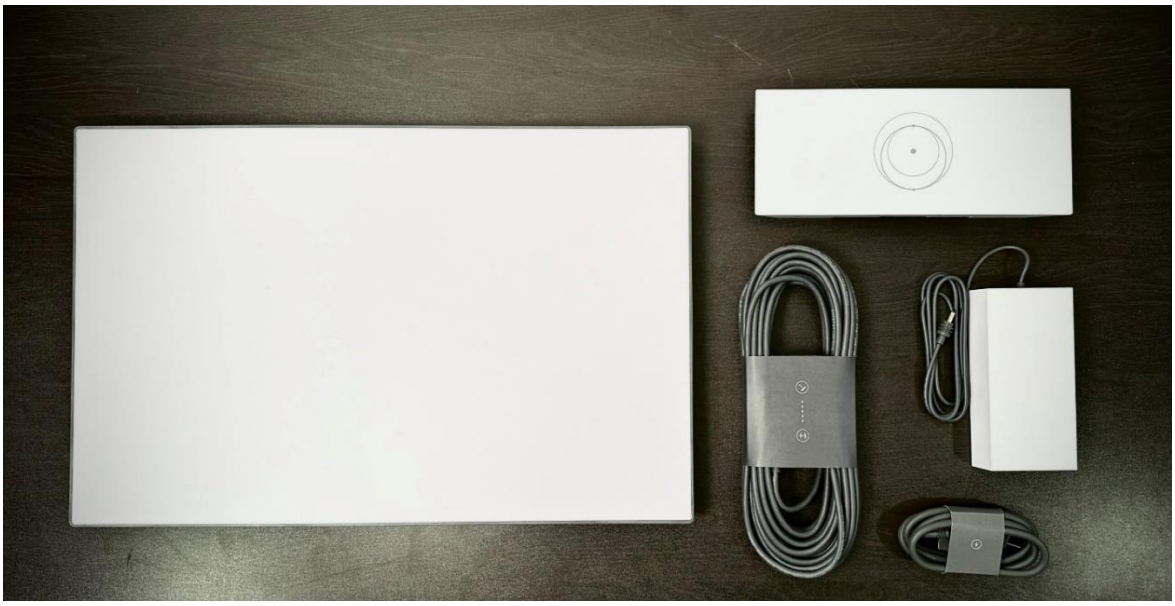
The time for the four-radio links (two round-trips from home to satellite to ground station and back) can be a significant portion of the total system latency. For Starlink with its LEO satellites orbiting at about 340 miles above the earth, radio wave travel time is 7.4 ms and total system latency is typically 30 - 60 ms. In contrast, GSO systems which orbit about 22,000 miles above the earth, radio wave travel time is 488 ms and total system latency can be 600 to over 900 ms. At my home, Starlink's latency is typically 20 – 30 ms, although there have been very infrequent extremes of up to 100 ms.

One thing that is different with Starlink service is that the download and upload speeds can vary quite widely. The speed is dependent on the many factors including distance to the satellite, the number of users connected to that satellite, overall system load, weather conditions, obstructions, etc. I have experienced speeds up to about almost 300 Mbps, but speeds are typically in the 70 – 150 Mbps range at my location. Speeds will typically be lowest during high use periods such as between 6pm and 11pm each day.

Strarlink has several service plans intended for use at home, land mobile, maritime, aviation and businesses. The standard Residential installation kit is well-designed and simple to setup. Starlink says that you must have a clear view of the sky. Since my property is wooded, I was concerned about obstructions blocking the signal. I moved the antenna several times and elevated it about 17' on a pushup pole to get good connectivity. While there are still obstructions (the phone app maps those for you), I consider the performance to be very good. The phone app also has a tool to help you align the antenna northward for best performance.

The antenna is a flat panel about 15" x 23" (see photo below at upper left) and comes with a kickstand to mount on the ground or a table for testing. Various mounts for poles, fascia boards / external walls or roofs are optional. The version 4 Starlink antenna technology is quite amazing. The antenna uses a phased-array of small antennas mounted on a PC board. The directionality is controlled by microprocessors forming a beam of radio waves that can be steered over a 110° view of the sky. This is how the signal is maintained with the fast-moving LEO satellites as they pass overhead. Previous generations of the antenna used motors to physically move the antenna to follow the satellites. Version 4 provides higher connection speeds, lower latency and promises to be more robust and reliable.

The antenna is connected to the router (upper right in photo below) by a provided 50' POE (power-over-ethernet) cable with weatherproof RJ-45 connectors. The router, in turn is powered by a "power brick" (center right in photo below) plugged into normal AC power. My system typically uses less than 30 - 40W of power. The router includes 2.4GHz, 5GHz and 6GHz wi-fi radios as well as 2 ethernet jacks with up to gigabit speed.



Starlink has been readily adopted by the RV and camping communities. In most cases, RV'ers use Starlink plugged into a 120 VAC outlet just like home users. However, there are third-party devices that allow the Starlink system to be powered by lead acid or lithium-ion batteries. The router operates on 12 – 30 VDC, so that is not an issue. The antenna, however, requires 57 VDC provided over its ethernet cable. The third-party devices power the modem and inject the correct DC voltage into the antenna cable. Of course, an inverter-based battery system or power bank could be used to provide 120 VAC in a portable operation as well. A YouTube video on operating Starlink using battery power is at Battery-Powered Starlink. There are many other YouTube videos on this topic if you are interested. This makes fast internet capable off-grid virtually anywhere in the world.

Starlink also makes a Starlink Mini antenna. It is only 10.2" x 11.75" and contains the modem and router functions. The Mini can operate on as low as 12 VDC and up to 40 VDC, making it directly compatible with 12 V or 24 V battery systems or even PD (power delivery) power banks for emergency use. One YouTuber put together a rugged portable setup for that purpose. The Mini and roaming service can be quite a bit more expensive than the standard residential service (see below), so I think that this would be difficult to justify in most cases.

So far, I have been very impressed with Starlink internet, however, there are some downsides. The primary one is cost. The standard starter kit is $300 - $500 depending on any special pricing offered at the time. In some areas, including mine, there is a $100 "congestion" fee where demand is high compared to the available bandwidth. Residential service is $120 / month. There is a 30-day free trial period, no contracts and the service can be paused without penalty if you travel extensively. Many retailers sell Starlink kits, but these may not include the 30-day free trial, so buyer beware. Roaming, maritime and aviation kits and plans are higher priced and the plans may have usage limits.

The second major downside is lack of in-person service. Installation is on-your-own. Starlink is extremely easy to get up and running – it literally took me 5 minutes to setup and connect my phone. However, optimization may take some effort. All customer support is remote, there are no Starlink technicians that come to your location if you encounter problems, however, third-party companies may offer such services.

If you live in a rural setting and are unhappy with your internet provider options, Starlink is certainly worth considering.