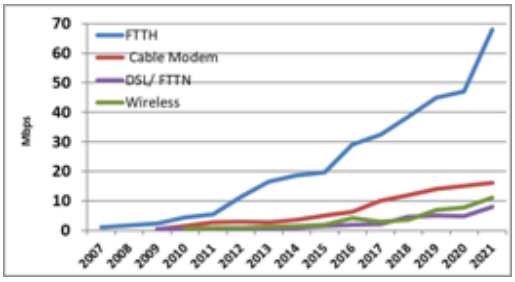
Fiber is the Fundamental Technology for 21st Century Communications

Over 30M Americans do not have the broadband infrastructure needed to meet the dated minimum FCC definition of 25/3 Mbps. Policymakers have proposed legislation with new minimum standards of 100/100 Mbps based on the economic and societal benefit of delivering robust broadband services to all Americans, especially those in rural and urban areas that have been left behind on the wrong side of the digital divide. Proposals of 100/20 Mbps are based on the limitations of non-fiber technologies, but rural America deserves the same capabilities as NFL cities where fiber broadband enables 100/100 Mbps service today.

Need for Symmetrical Networks

Studies used to oppose the need for symmetrical speeds are misleading. They focus on "average traffic" only and do not consider the current upload and download ratios at peak times for average users; the current upload and download average ratios of power users; or the need for growing or future applications.

- At peak periods for a typical user, household upload speed demands are often higher than download. As an example, according to the Zoom help center, upload requirements are often 25-50% higher than download. For three simultaneous HD video conferences in the home, about 7.5 Mbps down and 9.0 Mbps up is required.
- Background video activity must also be considered. Based on the 2021 study, homes with security cameras have 3.5 cameras. HD cameras constantly saving to the cloud require a total of 3 Mbps down and 10.5 Mbps up running in the background.
- At peak times of collaboration, a total of 10.5 Mbps down and 19.5 Mbps up is required.
- Most users have periods where they need high upload speeds. Some require very high upload speeds occasionally during the day - such as those uploading content to YouTube or livestreaming music concerts. Some users already require very high upload speeds the majority of their day – driven by their vocation (video editing, graphic design).
- Cable/DSL/wireless (and satellite) do not have the upstream capacity of fiber. Where fiber can effortlessly scale with demand, other technologies have upstream limitations.



Only Fiber Can Deliver the Required
Tested Upload Speeds – RVA Consumer Studies

Limitations of Current Broadband Technology vs. Fiber

Over the past quarter century, the technology delivering broadband has evolved from dial-up modems to DSL to Cable Hybrid Fiber Coax (HFC) to Fiber-to-the-Node (FTTN) to Fiber-to-the-Home (FTTH).

Technology neutrality made sense when bandwidth requirements were substantially lower than today's needs and copper-based networks could provide basic-level service without significant rationing. Copper technologies such as Dial-up and DSL have fully exhausted their capacity.

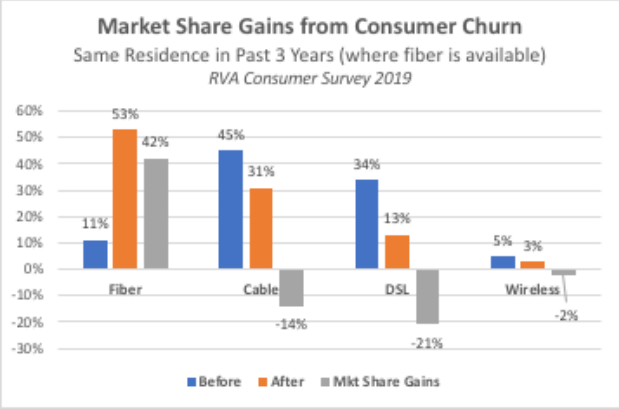
- Cable internet uses HFC networks which are reaching the end of the upgrade line. Extensive upgrades will result in a tipping point to FTTH, especially considering that HFC networks have at least 2x higher annual maintenance costs than FTTH[1].
- LEO Satellites (LEOS) are bandwidth limited and are best suited for niche applications. LEOS do not provide the foundation for our nation's critical infrastructure including 5G and 6G as does fiber and will not even reliably support 100/20 Mbps[2].
- Fixed wireless has limited bandwidth and lower reliability. The most capable type of fixed wireless, using millimeter waves, only works for short distances, must have a line of sight without buildings and tree leaves, and will never have the capability of fiber. [3]
- Wireless phones are not a substitute for fixed broadband. Use of smartphones as a primary broadband device declined from 20% in 2018 to 15% in 2021[4]. Data Caps limit the use of wireless broadband. Users with capped or throttled broadband use 20x-30x less broadband than users with uncapped broadband and 37% of subscribers do not use streaming media because they fear going over their data caps[5].
- Fiber Broadband is the only broadband infrastructure that offers virtually unlimited capacity. A single optical fiber has bandwidth of 50 THz, 100,000 to 5,000,000 times more capacity than the limited chunks of electromagnetic spectrum available for fixed wireless systems[6].
- Fiber has far less energy loss than other broadband methods and requires almost no troublesome electronic components in the network such as amplifiers and splitters, resulting in low maintenance cost.

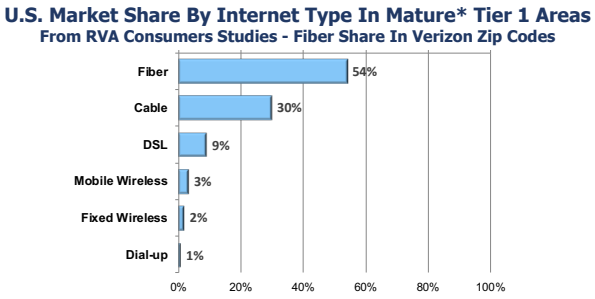
Consumers Want Fiber

When consumers change Internet providers in areas where FTTH is available, the majority of this "churn" moves from DSL or Cable to FTTH.

In highly competitive Tier-1 markets, fiber has achieved the highest market share, significantly beating cable despite significant product competition in these areas (DOCSIS 3.1) and considerable price/promotional competition.

In more exurban and rural areas covered by Tier-2 and 3 providers, where fiber broadband is available, fiber has been even more dominant – achieving a 62% market share (based on RVA consumer studies)[7].

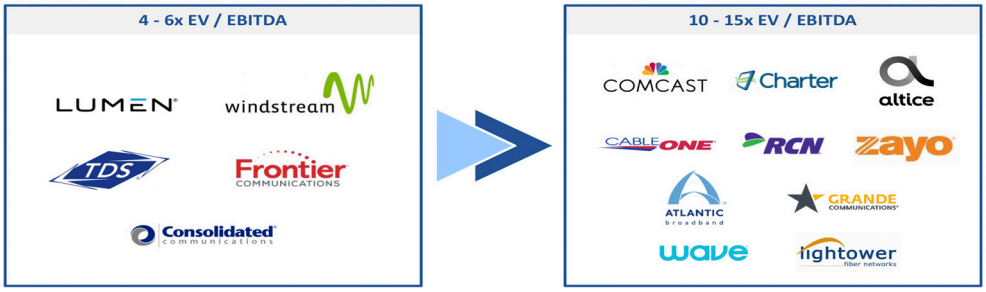




Fiber Is the Consumers' Choice in Tier 1 Markets, When Available

The Market Has Spoken - Wall Street Likes Fiber

Investors are rewarding companies investing in fiber. Service providers with copper-based broadband networks are trading at 5x EBITA (Earnings Before Interest, Taxes, Depreciation and Appreciation). By comparison, fiber-based broadband service providers have market caps 250% higher and are trading at 12.5x EBITA.

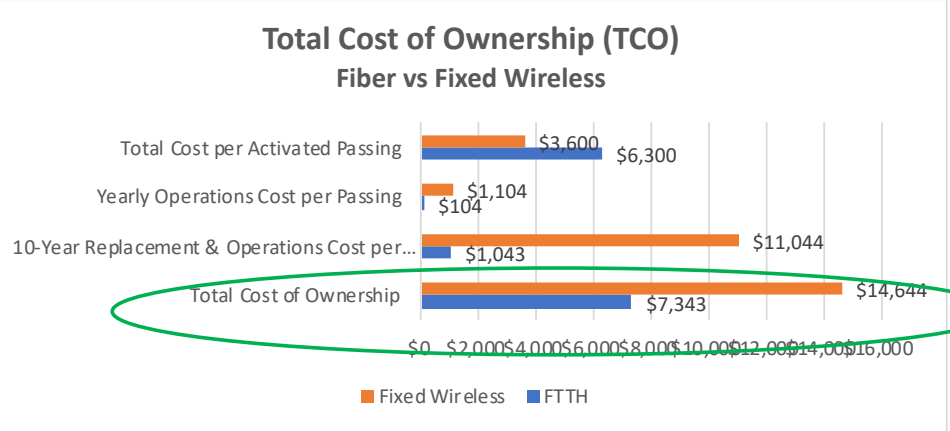


Source: New Street ResearchUpload Speeds

Fiber is Less Expensive (Total Cost of Owership)

Interim solutions, such as Fixed Wireless, cost less and are quicker to deploy. The initial deployment cost for fiber can be more expensive than Fixed Wireless (FWA) but the Total Cost of Ownership (TCO) demonstrates that fiber ends up being half the cost of FWA over time[8].

Fiber tops the competition on every dimension from high speeds and low latency to sustainability, security, reliability, and low maintenance. As we focus on building networks that will withstand the test of time, our nation and its leaders have a decision to make. The pandemic has changed the way we live, and only fiber can provide the necessary services we utilize in our everyday lives. If it's not fiber, it's not broadband.



Fiber TCO is Half the Cost of FWA and other Inter-

Endnotes

1 Fiber Broadband Association : Research

2 https://www.ntca.org/sites/default/files/federal-filing/2020-12/NTCA-FBA%20Section%20706%20Ex%20Parte.pdf

3 Comparison: Fixed Wireless Access vs. All-Fiber Networks, Fiber Broadband Association

4 Pew Research. https://www.pewresearch.org/internet/fact-sheet/mobile/

5 https://www.publicknowledge.org/blog/t-mobile-data-roaming-petition-proves-wireless-data-caps-are-about-market-power/

6 "Fixed Wireless Access vs. All-Fiber Networks for Broadband Access". Fiber Broadband Association Technology Committee, July 2021

7 It should be noted that cable is not always available in such areas.

8 Fiber Broadband Association Technology Committee 2021