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**The Broadband Internet Services Market in January 2022:
5G, Cable, Fixed Wireless, Wi-Fi 6, and Fiber Are Benefitting Consumers**

by

Seth L. Cooper and Andrew K. Magloughlin *

I. Introduction and Summary

At the start of 2022, the broadband Internet services market is vibrant and poised to soon benefit more Americans than ever before. In a new comprehensive evidentiary study, we show that data for 2020 and 2021 demonstrates that competition among wireline, cable, mobile, and satellite broadband providers has remained strong – and in some cases has improved compared to 2019. Key breakthroughs of the past two years include the rollout of nationwide 5G services, surges in new subscribers to Xfinity and Spectrum Mobile cable wireless services, double-digit annual increases in fiber deployment to U.S. homes, rapid expansion of fixed wireless services, and the launch of Wi-Fi 6.

The broadband market has performed admirably in a tumultuous economy beset by lockdowns, labor shortages, and supply chain problems. To ensure that investment, innovation, and competition continue strong in 2022 and beyond, the FCC should make more spectrum available for commercial use. It also should issue a ruling to prevent unreasonable costs from being imposed on cable and wireline providers to attach to utility poles in unserved

areas. At the same time, the Commission should resist retrenchment on reforms, such as its 2018 *Small Cell Order*, that have reduced obstacles to building and upgrading wireless facilities. Similarly, the Commission should not delay transitions from 3G networks to 5G. And it should refrain from imposing public utility regulation on broadband Internet services – an approach that would not improve competition or expand access but instead would undermine investment and innovation.

The FCC's *2020 Communications Marketplace Report* analyzed the broadband services market through the end of 2019. Its report cited evidence of strong investment, innovation, and competition across wireless, wireline, cable, and satellite broadband platforms. Although the next iteration of the Commission's report is still a year away, several significant pro-consumer marketplace developments have taken place since 2019. This *Perspectives from FSF Scholars* draws on reports by industry, analysts, and government agencies to present an updated market overview, focused primarily on trends from 2020 and 2021. Available information detailed in this new study supports the conclusion that the market is effectively competitive, as growing numbers of Americans have access to more choices among broadband Internet services that continue to improve in speeds and in other performance metrics.

The FCC's Form 477 data indicates, at the end of 2020, 97.53% of the U.S. population had access to a fixed broadband service provider offering speeds of 25 Mbps/3 Mbps. That is up from 95.62% at the end of 2019. As of year-end 2020, 90.55% of the population in rural areas had access to at least one provider offering 25 Mbps/3 Mbps, up from 82.76% a year before. In tribal areas, 86.77% had access to at least one provider at those same speeds compared to 79.05% a year before. Additionally, 93.11% of the U.S. population had access to a provider offering 100 Mbps/10 Mbps at the end of 2020, up from 91.71% at the end of 2019. And 88.8% had access to a provider offering 250 Mbps/25 Mbps at the end of 2020, up from 87.12%. When satellite operators are included, 97.3% had access to three or more providers offering 25 Mbps/3 Mbps at the end of 2020.

Although Form 477 data might overstate actual network coverage, the continuous increases in the availability of broadband access are unmistakable and corroborated by other sources. Significantly, analysts estimate that access to fiber broadband expanded by double-digit percentages in 2020 and in 2021. According to RVA LLC, more than 54 million U.S. homes were passed with fiber in 2020, an increase of 10% over the prior year. And RVA found that fiber broadband availability to U.S. homes increased by another 12% in 2021.

Ookla found that median U.S. fixed broadband speeds increased to 134.10 Mbps/19.45 Mbps by November 2021. This marked a 32% increase in median download speeds and a 31% increase in median upload speeds since November 2020. Furthermore, Ookla found that median U.S. mobile download speeds rose to 53.31 Mbps, a 25% annual increase. And HighSpeedInternet.com reported that the national average for download speeds in 2021 across different platforms increased to 99.3 Mbps, doubling 2020's national average of 42.86 Mbps.

The rapid rollout of 5G wireless networks was one of the most significant developments in the broadband market over the last two years. At the end of 2019, the combined total of 5G

connections in the U.S. and Canada was only 587,000. But by the fall of 2020, AT&T, T-Mobile, and Verizon had nationwide 5G footprints. According to 5G Americas, total 5G connections in the U.S. and Canada grew to 9 million by September 2020. And that total surged to 56.5 million by September 2021. Multi-regional wireless providers and cable mobile virtual network operators (MVNOs) provide additional 5G service choices to U.S. consumers.

Indeed, the biggest new source of mobile broadband competition has come from cable MVNOs that combine Wi-Fi networks with leased spectrum. Xfinity Mobile reached a record 3.67 million wireless subscribers in the third quarter of 2021, its total subscriber figure having tripled in less than three years. Charter's Spectrum Mobile grew to 3.2 million subscribers in the third quarter of 2021, adding 1.1 million in just one year. And Spectrum Mobile's total subscribership has quadrupled over the last two years.

Improvements in broadband access and capabilities are the result of strong private investment. According to USTelecom, U.S. broadband providers invested \$79.4 billion in 2020, slightly less than the \$80.8 billion invested in 2019, but nevertheless strong in view of the year's economic upheaval. And the wireless industry reported that capital expenditures for 2020 rose to \$29.9 billion, a 3% increase over 2019 and a 13% increase over 2016.

Analysts project significant gains for consumers in 2022 and following, as more mobile providers supplement their existing 5G deployments with infrastructure utilizing newly freed, high-capacity mid-band spectrum. Fixed wireless access services will deliver increasing speeds to more households. Cable broadband providers continue to upgrade their speeds, and they are making technical progress with DOCSIS 4.0 as part of their 10G platform initiative. Residential fixed broadband services also will offer improved performance due to increasing consumer adoption of Wi-Fi 6 routers. And ongoing deployment of Space-X's satellite broadband service Starlink as well as planned satellite broadband deployments by OneWeb, Boeing, and Amazon are future entrants who could boost access in hard-to-reach areas.

To ensure that the broadband market remains vibrant, the FCC should take these steps:

- Clear more spectrum for commercial 5G use by authorizing auctions in the 3.1-3.45 GHz and 4.9 GHz bands and by setting a start date for the 2.5 GHz auction.
- Refuse to entertain requests to delay the sunset of legacy 3G networks so that mobile broadband providers can move forward with repurposing spectrum for 5G.
- Issue a ruling to clarify that utility pole owners cannot shift all pole replacement costs to broadband providers that are new attachers in unserved areas.
- Conduct a rulemaking to reinstitute, with adequate reasoning, exemptions for small cell placement from historic and environmental reviews for certain federal projects.
- Not retrench on infrastructure siting reforms like its *2018 Small Cell Order*, which reduced local regulatory obstacles to timely construction of wireless facilities.
- Refrain from imposing Title II public utility regulation on broadband Internet services because such regulation reduces investment and innovation incentives and does not expand broadband access.

If implemented, those broadband policy prescriptions will benefit consumers going forward.

II. Reporting on the State of the Communications Marketplace

The FCC's *2020 Communications Marketplace Report* provided a data-driven study of the communications market through the end of 2019. The report collected a multiplicity of data points spanning wireline, cable, mobile, satellite, and other broadband services – as well as video and other service sectors – with a primary focus on developments occurring in 2019.¹ Data cited in that report convincingly demonstrated that effective competition exists within those market sectors.² The Commission's *2021 Broadband Deployment Report* similarly examined broadband availability as of the end of 2019.³ Data collected in that report provided strong support for a conclusion that broadband Internet services are being deployed to all Americans in a reasonable and timely fashion.⁴

Congress requires future *Communications Marketplace Reports* to be prepared on a biennial basis,⁵ which means the next report likely will not be published until nearly a year from now. Meanwhile, the Commission has yet to release a notice requesting comments for its next *Broadband Deployment Report*, and thus a new iteration of that report won't be released anytime soon.

Here at the start of 2022, a refreshed picture of the market is needed. Publicly available reports by industry, market analysts, and government agencies provide strong evidence that broadband market competitiveness and availability advanced considerably during 2020 and 2021. This *Perspectives* study draws on those information sources regarding the last two years to offer a more current overview of the state of the broadband services market.

III. Competitive Conditions in the Broadband Services Market Have Benefitted Consumers

Available data shows that, in 2020 and 2021, overall competitive conditions in the broadband Internet access services market and across service sectors within the market remained equally strong or even improved compared to 2019. During the past two years, next-generation network infrastructure deployments and upgrades benefitted consumers with new or

¹ Communications Marketplace Report Docket No. 20-60, *2020 Communications Marketplace Report*, (released Dec. 31, 2020).

² For a review of the Commission's report, see Randolph J. May, Seth L. Cooper, and Andrew M. Long, "The FCC's Marketplace Report Substantiates the Extent of Competition," *Perspectives from FSF Scholars*, Vol. 16, No. 4 (January 25, 2021), at: <https://freestatefoundation.org/wp-content/uploads/2021/02/The-Communications-Marketplace-Report-Highlights-Intramodal—but-Understates-Intermodal—Competition-012521.pdf>.

³ Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, GN Docket 20-269, *Fourteenth Broadband Deployment Report* (released Jan. 19, 2021).

⁴ For a review of the Commission's report, see Andrew M. Long, "Lessons From the FCC's Broadband Deployment Report," *Perspectives from FSF Scholars*, Vol. 16, No. 10 (Feb. 25, 2021), at: <https://freestatefoundation.org/wp-content/uploads/2021/02/Lessons-From-the-FCCs-Broadband-Deployment-Report-022521.pdf>.

⁵ See 47 U.S.C. § 163.

significantly improved capabilities as well as better pricing options. The pro-competitive and pro-consumer state of the broadband services market is revealed by several indicators:

Improved Access to Fixed Broadband Services. According to Form 477 data submitted to the FCC,⁶ as of December 31, 2020, 97.53% of the U.S. population had access to a fixed broadband Internet service provider offering speeds of 25 Mbps/3 Mbps. This figure is up from 96.28% at the end of June 2020, and 95.62% at the end of December 2019. Meanwhile, increases in access to broadband among Americans in rural and tribal areas showed even more pronounced increases. As of year-end 2020, 90.55% of the population in rural areas had access to at least one fixed broadband Internet service provider offering speeds of 25 Mbps/3 Mbps, up from 82.76% a year before. And 86.77% in tribal areas had access to at least one provider at those same speeds compared to 79.05% a year before.

Additionally, 93.11% of the U.S. population had access to a fixed broadband service provider offering speeds of 100 Mbps/10 Mbps at the end of 2020. That is up from 91.71% at the end of 2019. And 88.8% had access to a fixed provider offering 250 Mbps/25 Mbps at the end of 2020, up from 87.12%.

Importantly, the above-cited figures do not include satellite broadband providers. Prior Commission reports on broadband deployment have acknowledged that both ViaSat and HughesNet offer advertised speeds of at least 25 Mbps/3 Mbps to nearly all Americans. When satellite broadband providers are included with all other fixed broadband technologies, Form 477 data indicates that, as of December 31, 2020, 97.3% of the U.S. population had access to three or more providers offering speeds of 25 Mbps/3 Mbps.⁷ That number is up from 95.3% at the end of 2019. Also, 93.14% of the population had access to at least one provider offering 100 Mbps/10 Mbps, up from 91.71% from a year before. And 59.81% had access to at least two providers offering 100 Mbps/10 Mbps, up from 55.94% a year before. Also, at the end of 2020, 88.8% of the population had access to at least one provider offering 250/25 Mbps speeds, up from 87.12% at the end of 2019.

It is generally conceded that Form 477 data typically overstates broadband coverage. Even so, it provides a baseline for observing improvements over prior reporting periods.

Fiber Broadband Deployment Continues Strong. Also, analysts' reports indicate that access to fiber broadband expanded significantly in 2020. According to RVA LLC Market Research & Consulting, more than 54 million U.S. homes were passed with fiber in 2020, an increase of 10% over the prior year.⁸ New Street Research forecasted that fiber-to-the-home (FTTH) deployments by the eight largest broadband providers would ramp up in 2021.⁹ And according to research published in early January of this year, fiber broadband now passes 60.5

⁶ FCC, Fixed Broadband Deployment Data: "Compare Broadband Availability in Different Areas," at: https://broadbandmap.fcc.gov/#/area-comparison?version=dec2019&tech=acfosw&speed=250_25&searchtype=county (last accessed Jan. 10, 2022).

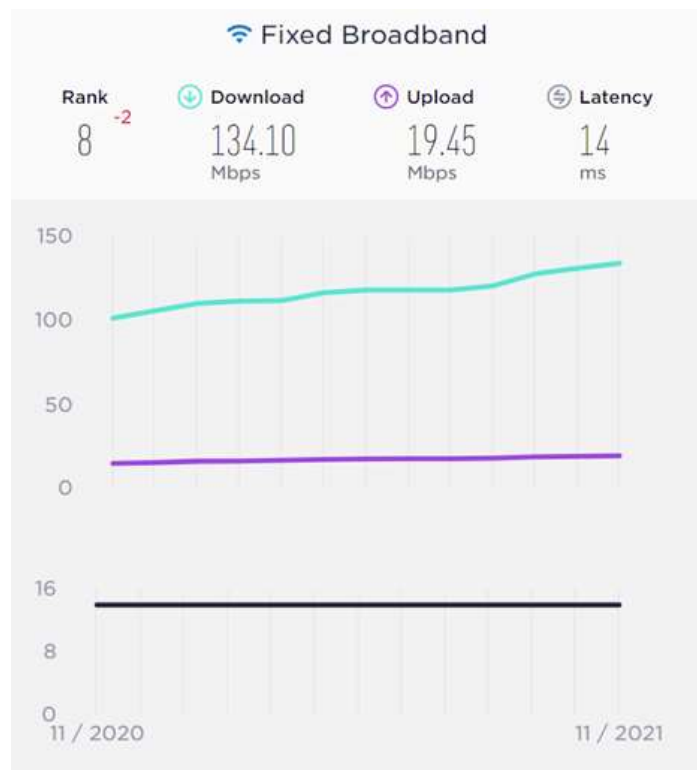
⁷ *Id.*

⁸ See Sean Buckley, Fiber Trends: What 2021 Promises for the Broadband Industry, *Broadband Communities Magazine* (Jan./Feb. 2021), at: <https://www.bbcmag.com/multifamily-broadband/fiber-trends-what-2021-promises-for-the-broadband-industry>

⁹ *See id.*

million homes in the U.S., a figure comprising 43% of all U.S. homes.¹⁰ RVA found that fiber broadband availability to U.S. homes increased by 12% in 2021.¹¹

Increased Fixed Broadband Speeds. Ookla found that median U.S. fixed broadband upload/download speeds increased to 134.10 Mbps/19.45 Mbps by November 2021.¹² This marked a 32% increase in median download speeds and a 31% increase in median upload speeds since November 2020. And based on speed tests apparently spanning both fixed and mobile broadband network technologies, HighSpeedInternet.com reported that the national average for download speeds in 2021 increased to 99.3 Mbps, doubling the national average of 42.86 Mbps in 2021.¹³



5G's Big Breakout and 4G LTE's Strong Performance Provide Competition in Wireless Broadband Services. One of the most significant developments in the broadband Internet services market in 2020 and 2021 was the rapid rollout of 5G wireless networks and accelerated adoption of 5G services by U.S. consumers. At the end of 2019, wireless broadband providers were only beginning to deploy 5G networks, and the combined total of

¹⁰ Fiber Broadband Association, Press Release: "Fiber Broadband Enters Largest Investment Cycle Ever" (January 5, 2022), at: <https://www.fiberbroadband.org/blog/fiber-broadband-enters-largest-investment-cycle-ever>.

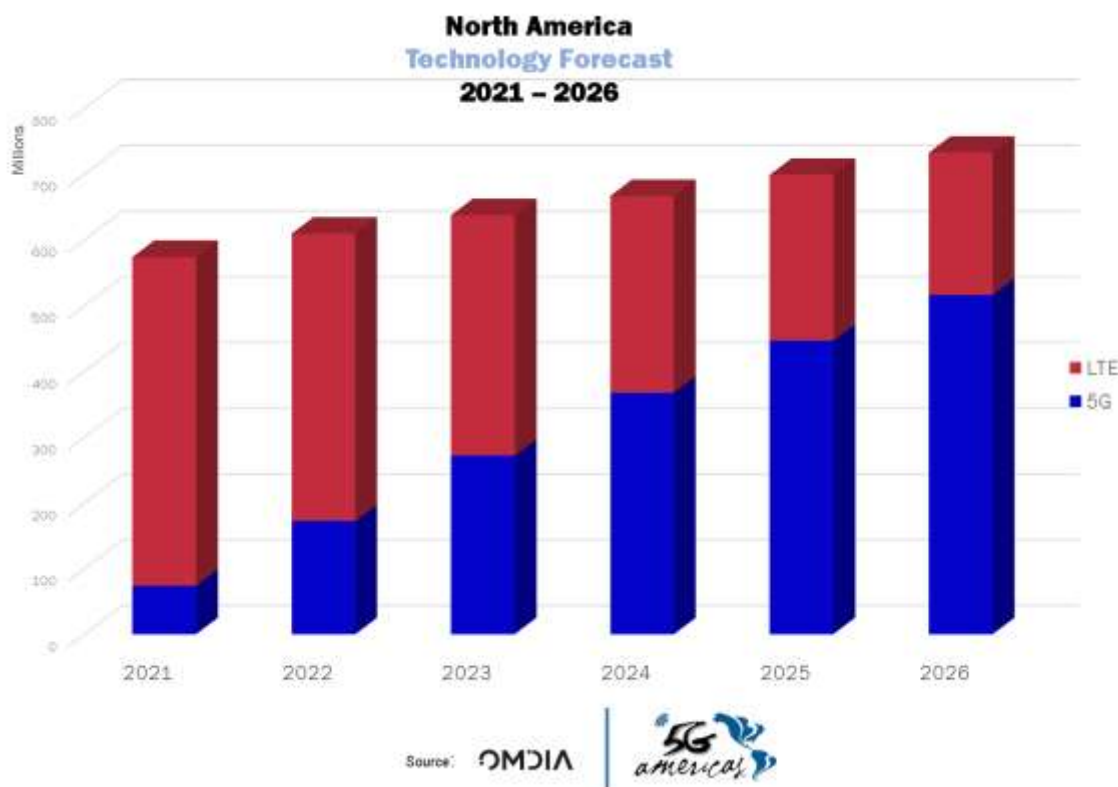
¹¹ See *id.*

¹² Ookla, "Speedtest Global Index" (United States) (Nov. 2021), at: <https://www.speedtest.net/global-index/united-states#fixed>.

¹³ Trevor Wheelwright (Cara Haynes, ed.). "The State of the Internet in 2021: Internet Speeds on the Rise Nationwide," HighSpeedInternet.com (Dec. 16, 2021), at: https://www.highspeedinternet.com/resources/state-of-the-internet#mobile_internet.

5G connections in North America (the U.S. and Canada) stood at about 587,000.¹⁴ But by the fall of 2020, the three major wireless broadband providers – AT&T, T-Mobile, and Verizon – had nationwide 5G footprints. And according to 5G Americas, by September 2021, the total number of 5G connections in U.S. and Canada grew to 56.5 million, an enormous 627% increase over the 9 million connections in September 2020.¹⁵ Multi-regional wireless providers and cable MVNOs provide additional 5G service choices to U.S. consumers. The availability of these next-generation services is a huge boon to consumers because 5G networks are more capacious than 4G LTE networks and they are expected to eventually deliver average speeds about ten times faster than LTE networks, with peak speeds as much as 100 times faster.¹⁶

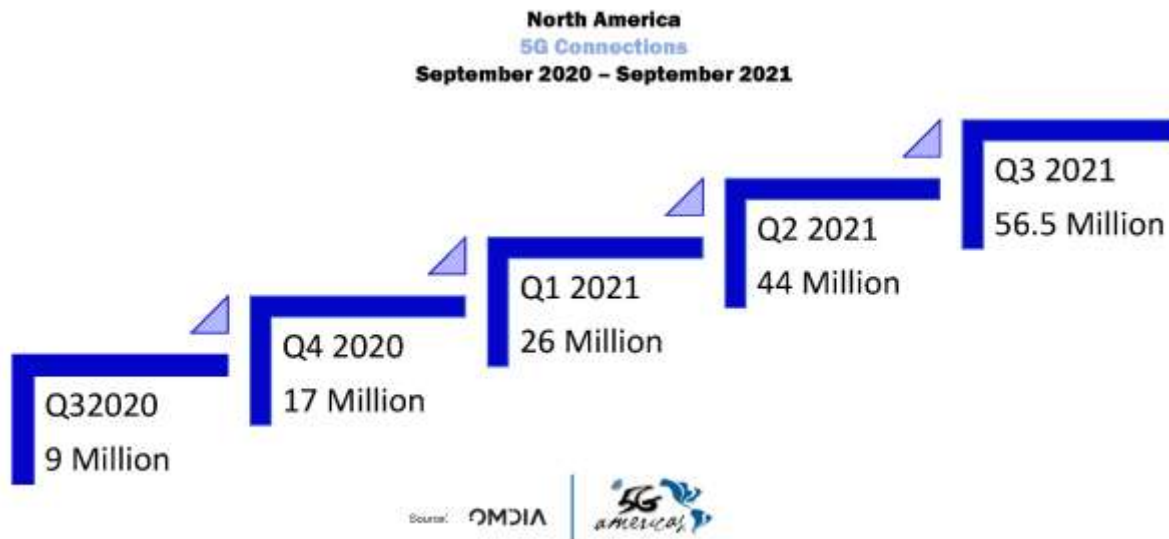
Although 5G connections continue to climb quickly, those numbers are still dwarfed by the combined 505 million 4G LTE connections in the U.S. and Canada, an increase of 7.6% from 469 million in September 2020. However, 5G Americas concludes that 4G LTE growth already has peaked. It projects that 5G will constitute the majority of mobile connections in 2024.



¹⁴ 5G Americas, Press Release: "5G Network Rollouts Accelerate as LTE's Long Tail Extends," (September 19, 2019), at: <https://www.5gamericas.org/5g-network-rollouts-accelerate-as-ltes-long-tail-extends/>.

¹⁵ 5G Americas & Omdia, "North America Statistics," (Sept. 2021), at: <https://www.5gamericas.org/resources/charts-statistics/north-america/>.

¹⁶ Sanjay Dhar, Tejas Rao, and Majed Al Amine, "Smart Cities: How 5G Can Help Municipalities Become Vibrant Smart Cities," Accenture Strategy (Feb. 27, 2017), at: https://www.accenture.com/_acnmedia/pdf-43/accenture-5g-municipalities-become-smart-cities.pdf.



Increased Mobile Broadband Speeds. Ookla found that median U.S. mobile download speeds rose to 53.31 Mbps in November 2021, a 25% annual increase.¹⁷ This increase was enabled by significant upgrades to 5G networks. Opensignal's October 2021 "5G User Experience Report" shows that T-Mobile's 5G network's average download speed is now 118.7 Mbps, more than doubling by 204% since January 2021.¹⁸ The same report also shows that Verizon's 5G network download speeds increased by 18% to 56.0 Mbps. Opensignal attributes T-Mobile's stellar performance to 2.5 GHz mid-band spectrum it acquired by merging with Sprint. The FCC marked another portion of this band for future auction so other carriers potentially can benefit from the same higher-capacity transmission characteristics. Although OpenSignal's report showed marginal decrease in AT&T's 5G speeds compared to January 2021, the speeds offered by AT&T's nascent 5G network can be expected to grow going forward, particularly as its C-Band enabled network services come online.



Cable MVNOs Spur Additional Mobile Broadband Competition. In addition to three competing nationwide mobile service providers – AT&T, T-Mobile, and Verizon – U.S. consumers have a choice among other providers, including multi-regional providers

¹⁷ Ookla, "Speedtest Global Index" (United States).

¹⁸ Opensignal, "5G User Experience Report" (Oct. 2021), at:

<https://www.opensignal.com/reports/2021/10/usa/mobile-network-experience-5g>.

UScellular, C Spire, and smaller local providers. UScellular serves approximately 4.4 million wireless subscribers,¹⁹ and although C Spire does not regularly release wireless subscriber numbers, it likely serves approximately about 1 million. DISH Network also is preparing to transition its Boost MVNO brand to a nationwide facilities-based mobile broadband service.²⁰ Also, Verizon's FCC-approved acquisition of Tracfone potentially will reduce prices for its 20.1 million customers by eliminating resale costs and bring stronger competition with carrier-owned MVNOs Cricket (AT&T) and Metro (T-Mobile).²¹

But the biggest new source of mobile broadband competition over the last two years has come from the remarkably successful growth of services offered by cable MVNOs that combine Wi-Fi network technologies with leased spectrum. Xfinity Mobile reached a record 3.67 million wireless subscribers in the third quarter of 2021, bolstered by a record 300,000 quarterly subscriber growth.²² And Xfinity Mobile's total subscriber figure has *tripled* in just under three years.²³ Likewise, Charter's Spectrum Mobile brand grew to 3.2 million subscribers in the third quarter of 2021, adding 1.1 million in just one year.²⁴ And Spectrum Mobile's total subscribership has *quadrupled* over the last two years.²⁵

¹⁹ UScellular, "UScellular Reports Third Quarter 2021 Results" (Nov. 2021), at:

<https://investors.uscellular.com/news/news-details/2021/UScellular-reports-third-quarter-2021-results/default.aspx>;

²⁰ See, e.g., DISH Network, Press Release, "DISH and Dell Technologies Will Build the Nation's First Open RAN 5G Edge Infrastructure (Jun. 17, 2021), at: <https://about.dish.com/news-releases?item=123509>.

²¹ See Application of Verizon Communications Inc. and América Móvil, S.A.B. de C.V. for Consent To Transfer Control of International Section 214 Authorization, Docket No. 21-112, Memorandum Opinion and Order ("*Verizon/TracFone Order*") (released Nov. 22, 2021); América Móvil, "América Móvil's Third Quarter of 2021 Financial and Operating Report," (Oct. 2021), at:

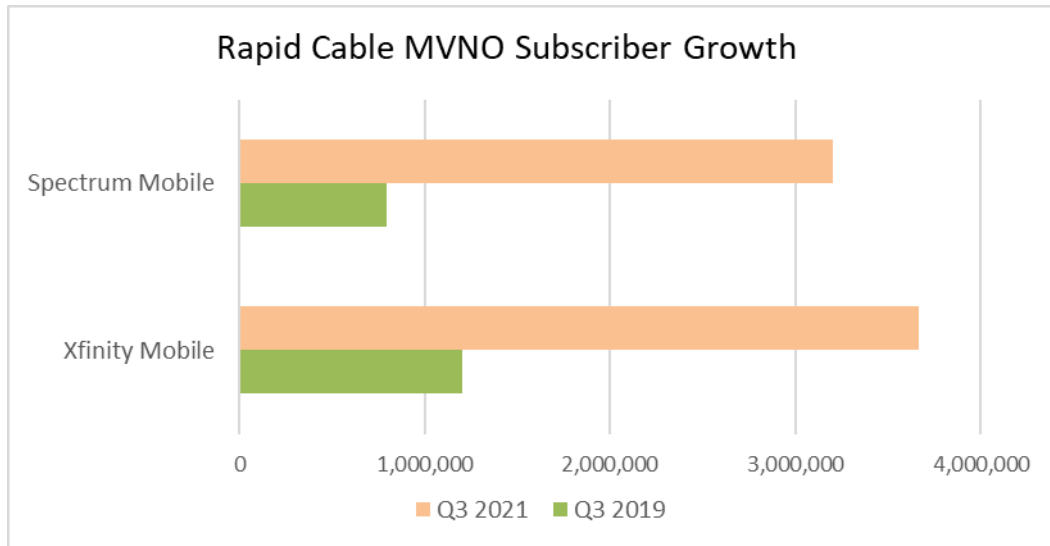
https://s22.q4cdn.com/604986553/files/doc_financials/2021/q3/3Q21.pdf.

²² Comcast, "Comcast Reports 3rd Quarter 2021 Results" (Oct. 2021), at: <https://www.cmcsa.com/news-releases/news-release-details/comcast-reports-3rd-quarter-2021-results>.

²³ Xfinity had 1.2 million subscribers at year-end 2019. See Comcast, Press Release: "Comcast Reports 4th Quarter and Full Year 2019 Results" (Jan. 23, 2020), at: <https://www.cmcsa.com/news-releases/news-release-details/comcast-reports-4th-quarter-and-full-year-2019-results>.

²⁴ Charter Communications, "Charter Announces Third Quarter 2021 Results" (Oct. 2021), at: <https://ir.charter.com/news-releases/news-release-details/charter-announces-third-quarter-2021-results>.

²⁵ Spectrum Mobile reported 794,000 subscribers as of the third quarter of 2019. See Charter Communications, Press Release: "Charter Announces Third Quarter 2019 Results (Oct 25, 2019), at: <https://ir.charter.com/static-files/76cf320f-4610-448b-9768-c1a27f2d2c2e>.

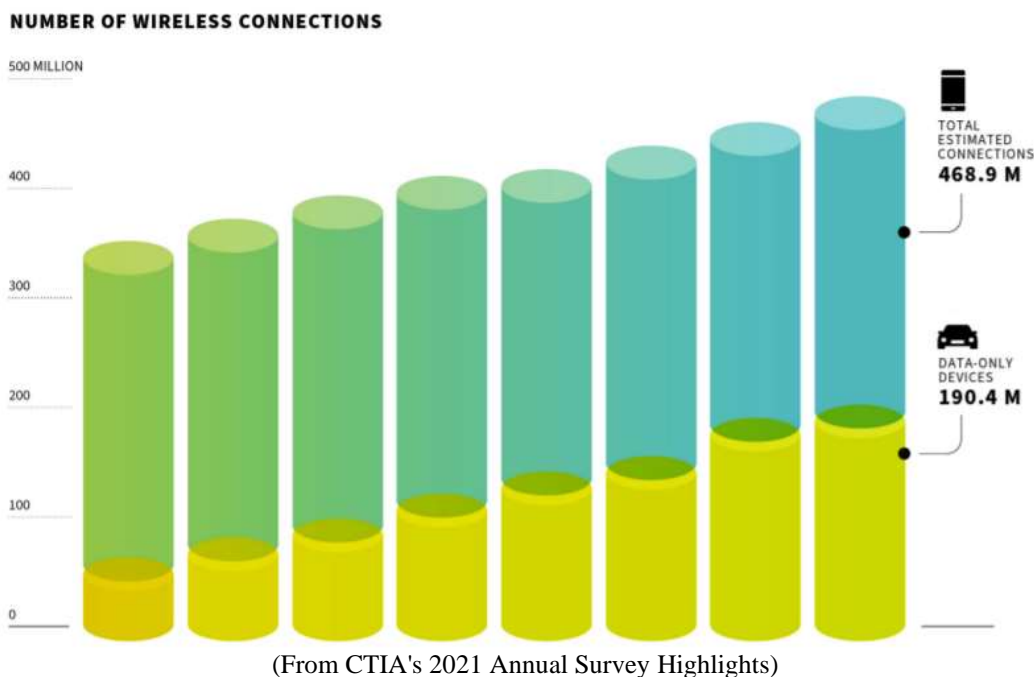


Mobile Demand Continues to Grow. The wireless industry reported that U.S. mobile data traffic increased from roughly 38 trillion megabits (MB) in 2019 to 42.2 trillion MB in 2020, an 11% annual increase during the heat of the pandemic.²⁶ Total U.S. mobile connections grew to 468.9 million and total U.S. data-only devices grew to 190.4 million in 2020. Also, interest in media and text messaging remains strong, as combined messaging traffic increased from 2.1 trillion in 2019 to 2.2 trillion messages in 2020.²⁷ Messages increasingly included higher bandwidth multimedia messaging service (MMS) formats, which grew by 28% for the year and include videos, GIFs, and images.

²⁶ CTIA, 2021 Annual Survey Highlights (July 2021), at: <https://api.ctia.org/wp-content/uploads/2021/07/2021-Annual-Survey-Highlights.pdf>.

²⁷ CTIA, 2021 Annual Survey Highlights.

Continued Growth of Data-Only Devices



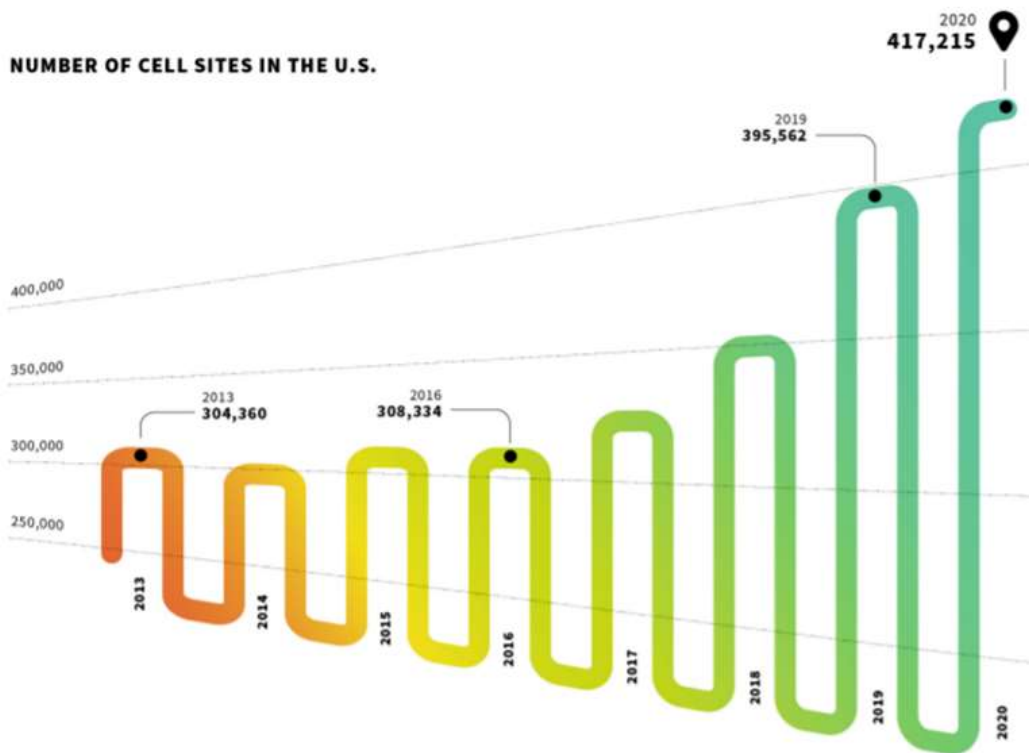
Mobile Price Cuts Reductions High Inflation. Despite high inflation, including a Bureau of Labor Statistics' Consumer Price Index (CPI) increase of 6.8% for all items over the last 12 months, the CPI for wireless telephone services declined by 0.4% between November 2020 and November 2021.²⁸ So even as price tags for goods and services across the economy increased in real terms, real wireless prices dropped slightly. And while it would not be surprising if continued economy-wide high inflation prompts small price increases for wireless services in 2022, strong competition in the market will continue to exert a countervailing downward pressure on prices.

Continued Wireless Infrastructure Deployment. CTIA reported that the number of cell sites in operation increased from 395,562 in 2019 to 417,215 in 2020, an increase of about 5%.²⁹ And carriers are investing billions in mid-band spectrum infrastructure rollout, which will lead to new deployments and improve existing infrastructure.³⁰

²⁸ Bureau of Labor Statistics, "News Release: Consumer Price Index – November 2021" (Nov. 2021), at: <https://www.bls.gov/news.release/pdf/cpi.pdf>.

²⁹ CTIA, 2021 Annual Survey Highlights.

³⁰ See, e.g., Kelly Hill, "Midband Spectrum Strategies: T-Mobile US," *RCR Wireless* (Sept. 15, 2021), at: <https://www.rcrwireless.com/20210915/5g/midband-spectrum-strategies-t-mobile-us>.



(From CTIA's 2021 Annual Survey Highlights)

Significant Number of Wireless-Only Consumers. According to an early 2021 survey by Pew Research Center, 15% of U.S. adults are "smartphone-only Internet users," a share that has doubled since 2013.³¹ Although a similar Pew survey from two years prior indicated that 17% of U.S. adults were smartphone-only Internet users, the existence of a core group of such users is unmistakable and their number may grow in years ahead. Indeed, Pew's survey found that 27% of lower-income adults are "smartphone-only" Internet users,³² an increase compared to two years ago. And according to a 2020 survey by Leichtman Research Group (LRG), 51% of U.S. adults that lack a home broadband subscription access the Internet via a smartphone, showing that mobile broadband is a meaningful alternative to home subscriptions.³³

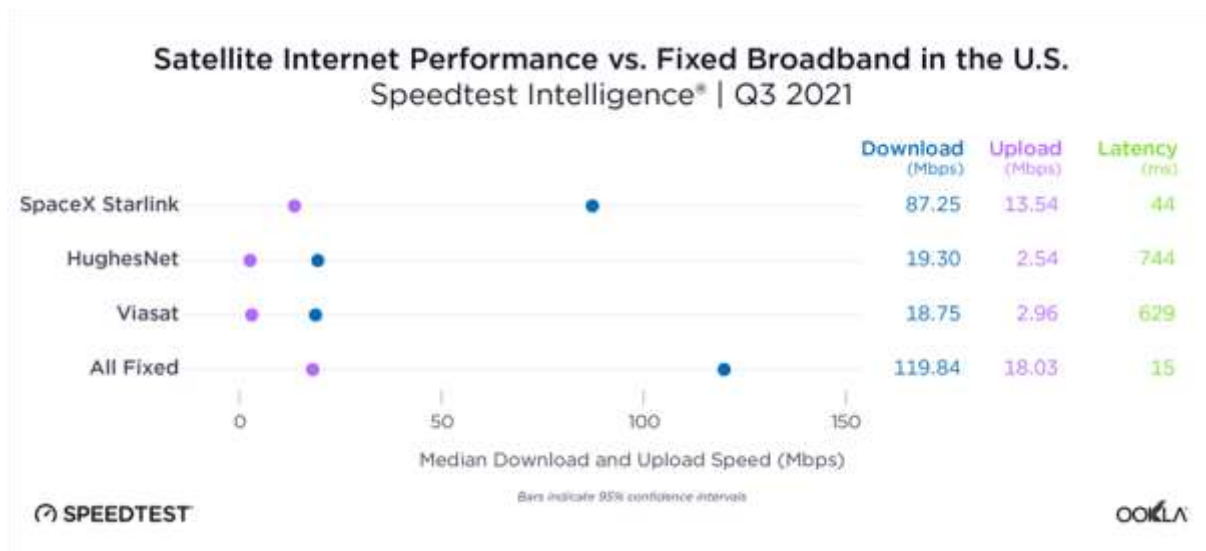
³¹ Pew Research Center, "Internet/Broadband Fact Sheet" (Apr. 2021), at: <https://www.pewresearch.org/internet/fact-sheet/internet-broadband/?menuItem=6ba9316e-006c-482d-be4b-69feb64c4be8>.

³² Emily A. Vogels, "Digital Divide Persists Even as Americans With Lower Incomes Make Gains in Tech Adoption," Pew Research Center (Jun. 22, 2021), at: <https://www.pewresearch.org/fact-tank/2021/06/22/digital-divide-persists-even-as-americans-with-lower-incomes-make-gains-in-tech-adoption/>.

³³ Leichtman Research Group, Inc. (LRG), "86% of U.S. Households Get an Internet Service at Home" (Dec. 28, 2020), at: <https://www.leichtmanresearch.com/wp-content/uploads/2020/12/LRG-Press-Release-12-28-2020.pdf>.

Starlink Spurred Stronger Satellite Broadband Competition. Despite its short time in operation, Starlink's low-Earth orbit (LEO) network has delivered satellite broadband with fast speeds and low latency. Ookla measured Starlink's median speeds at 87.2 mbps/13.54 mbps in late 2021, by far the fastest satellite broadband offering.³⁴ Starlink's performance is 452% faster for median download and 533% faster for median upload speeds than its closest operational competitor, HughesNet (19.3 mbps/2.54 mbps). Although Starlink's speeds have decreased from earlier in the year, this is almost certainly due to additions to its subscriber base of about 145,000,³⁵ up from the 90,000 it reported in August 2021.³⁶ Starlink's subscribership is expected to increase as it adds capacity to its network by deploying batches of new satellites each month.³⁷

Equally significant, Ookla measured Starlink's median latency as 44 ms, comparable to the 15 ms median latency for fixed broadband and just fractions of the triple-digit median latencies for satellite competitors HughesNet (744 ms) and Viasat (629 ms). Low latency is the critical technical advantage of deploying satellite networks in LEO, as compared to other orbital altitudes, because it reduces the signal delay that traditionally has made satellite broadband a lower-quality alternative to fixed services.



Other market entrants seek to replicate Starlink's success. The FCC has approved similar LEO constellations that Amazon, Boeing, and OneWeb plan to deploy this decade. Satellite-based delivery of high speed, low latency broadband services potentially will bring a new, high-

³⁴ Isla Mcketta, "Starlink Expands but Q3 2021 Performance Flattens in Some Areas," Ookla (Dec. 20, 2021), at: <https://www.speedtest.net/insights/blog/starlink-hughesnet-viasat-performance-q3-2021/>.

³⁵ Michael Sheetz, "SpaceX's Starlink Internet Service Has More Than 145,000 Users So Far," CNBC (Jan. 6, 2022), at: <https://www.cnbc.com/2022/01/06/spacex-starlink-internet-service-has-more-than-145000-users-so-far.html>.

³⁶ Michael Sheetz, "SpaceX Says Starlink Has About 90,000 Users as the Internet Service Gains Subscribers," CNBC (Aug 3, 2021), at: <https://www.cnbc.com/2021/08/03/spacex-starlink-satellite-internet-has-about-90000-users.html>.

³⁷ Amy Thompson, "SpaceX Lofts 49 Starlink Internet Satellites to Orbit in 1st Launch of 2022," Space.com (Jan. 6, 2022), at: <https://www.space.com/spacex-starlink-launch-success-january-2022>.

quality option in unserved and rural areas, especially those that are prohibitively expensive for deploying fixed broadband.

Evidence Indicates Strong Network Investment. According to USTelecom, U.S. broadband providers invested about \$79.4 billion in 2020, slightly lower than the \$80.8 billion invested in 2019, but keeping in line with the sustained, increasing investment in the market seen since 2017.³⁸ And the wireless industry reported that capital expenditures for 2020 rose to a record \$29.9 billion, a 3% increase over the year before and 13% increase over 2016.³⁹

IV. The Dynamic Broadband Internet Services Market Is Poised to Bring Consumers Further Benefits in 2022 and Beyond

It bears emphasis that effective market competition, strong investment trends, and continuing technological innovation taking place in the broadband Internet services market will benefit consumers going forward. In particular, 5G network access will expand, including through deployments in newly-repurposed C-band spectrum. Capacity and speeds for 5G services offered by AT&T and Verizon are likely to significantly improve as early as this month (January 2022), as both major providers begin operating their 5G networks in mid-band spectrum they acquired in the FCC's C-band auction. Reportedly, Verizon's 5G services using C-band spectrum will reach around 100 million U.S. consumers by March 2022, and AT&T's mid-band 5G network will reach 70-75 million by the end of 2022 and reach 200 million in 2023.⁴⁰ Apparently, T-Mobile's mid-band 5G network already reaches about 200 million.⁴¹

As more consumers acquire 5G-capable smartphones, they will benefit from next-generation network speeds and capacity. (In its year-end report for 2021, the Global mobile Suppliers Association (GSA) identified 614 5G phones worldwide, up more than 120% compared to the end of 2020. And it identified at least 857 commercially available 5G devices, an annual increase of over 155%.⁴²)

Importantly, enhanced 4G LTE- as well as 5G-enabled fixed wireless access service capabilities will continue to improve in 2022 and beyond, providing consumers a potent intermodal competitive choice for residential broadband services. AT&T, T-Mobile, and Verizon all are undertaking expansions of their residential fixed wireless access services.

³⁸ USTelecom, 2020 Broadband Capex Report (2021), at: <https://ustelecom.org/wp-content/uploads/2021/09/USTelecom-2020-Broadband-Capex-Report.pdf>.

³⁹ CTIA, 2021 Annual Survey Highlights.

⁴⁰ Verizon, Press Release: "Verizon exceeds 5G build plans for 2021; focuses resources on rapid C-Band expansion" (Dec. 21, 2021), at: <https://www.verizon.com/about/news/verizon-5g-ultra-wideband-rapid-c-band-expansion>; Mo Hatibeh, "AT&T is Preparing the Next Wave of 5G+" *AT&T Technology Blog*, (Oct. 21, 2021), at: <https://about.att.com/innovationblog/2021/c-band-5G.html>.

⁴¹ T-Mobile, Press Release: "T-Mobile's Game-Changing Ultra Capacity 5G Now Reaches 200 Million People Nationwide" (Nov. 15, 2021), at: <https://www.t-mobile.com/news/network/t-mobiles-game-changing-ultra-capacity-5g-now-reaches-200-million-people-nationwide>.

⁴² GSA, "5G Market Update: End of December 2021" (December 2021), at: <https://gsacom.com/reports/> (last accessed Jan. 11, 2022).

Wi-Fi 6e technologies will provide improved capacity and throughput on a more consistent basis to more devices than prior generations of Wi-Fi.⁴³ Deloitte Global has observed that Wi-Fi 6 devices have been outselling 5G devices and likely will continue doing so over the next years.⁴⁴ For 2022, Deloitte Global has predicted that at least 2.5 billion Wi-Fi 6 devices will be shipped worldwide compared to about 1.5 billion 5G devices. Presuming those international trends play out in the U.S. over the next few years, consumers in this country will experience enhanced Wi-Fi speeds and capacity. Equally important, consumers can expect to benefit from Wi-Fi 6 and 5G services working together in a complementary fashion to allow consumers to roam between different types of wireless networks.

Moreover, Wi-Fi 6 will work in tandem with next-generation cable broadband networks, as CableLabs has published specifications for DOCSIS® 4.0 as part of their 10G platform initiative to deliver multi-gigabit speeds.⁴⁵ Meanwhile, fiber broadband deployment is, by many indicators, likely to accelerate in 2022 and beyond. Several fiber providers, including AT&T, Consolidated, and Frontier, as well as numerous smaller providers, have announced plans to increase their fiber buildouts to more homes per year than in 2020 and 2021.⁴⁶

Competition in the broadband market is also likely to be enhanced in the near future on account of two additional factors. First, satellite broadband Internet offerings are likely to expand, perhaps significantly. As observed previously, satellite broadband providers, such as Starlink and future entrants OneWeb, Boeing, and Amazon, potentially will provide Americans a technological solution for providing high speed Internet access to the most difficult-to-reach rural and tribal areas. Those potential competitors would provide Americans with choices in addition to existing satellite broadband offerings by HughesNet and ViaSat. Second, disbursement of vast sums of money through federal spending programs on broadband can be expected to help accelerate deployment of broadband Internet services to previously unserved areas.

V. The FCC Should Take Actions to Encourage Continued Broadband Infrastructure Investment and Access for All Americans

Promptly Make More Spectrum Available. The FCC should proactively work to make additional spectrum resources available for commercial use, particularly in the mid- and lower-mid bands. The Commission should prioritize the lower 3.1-3.45 GHz band for study and timely repurposing.⁴⁷ It also should set a date for commencing an auction for the 2.5 GHz

⁴³ See Andrew Long, "Wi-Fi 6 Can Modernize Unlicensed Wireless," *Perspectives from FSF Scholars*, Vol. 15, No. 7 (February 7, 2020), at: <https://freestatefoundation.org/wp-content/uploads/2020/02/Wi-Fi-6E-Can-Modernize-Unlicensed-Wireless-020720.pdf>.

⁴⁴ Deloitte Global "Wi-Fi 6: Unsung, underexposed—and indispensable to the future of enterprise connectivity."

⁴⁵ See Andrew Long, "'10 G' Can Help Future-Proof Broadband Infrastructure," *Perspectives from FSF Scholars*, Vol. 15, No. 47 (September 11, 2020), at: <https://freestatefoundation.org/wp-content/uploads/2020/09/10G-Can-Help-Future-Proof-Broadband-Infrastructure-091120.pdf>.

⁴⁶ See Joan Engebretson, "Will Cable Broadband Market Share Decline as Telcos Deploy Fiber?" *Telecompetitor* (June 3, 2021), at: <https://www.telecompetitor.com/will-cable-broadband-market-share-decline-as-telcos-deploy-fiber/>.

⁴⁷ See Seth L. Cooper, "Fast Action on the Lower 3 GHz Band Will Secure America's 5G Future," *Perspectives from FSF Scholars*, Vol. 16, No.9 (February 18, 2021), at: <https://freestatefoundation.org/wp-content/uploads/2021/02/Fast-Action-on-the-Lower-3-GHz-Band-Will-Secure-Americas-5G-Future-021821.pdf>.

band. Although proposals for repurposing different spectrum bands are at different stages of development and each pose unique challenges, the Commission should take an all-of-the-above approach to advance every proposal that might realistically be suitable for commercial wireless uses – whether on a licensed or unlicensed basis.

Refuse to Mandate Continued Operation of 3G Networks. The FCC should not attempt to delay private network provider plans to sunset their 3G networks. Legacy 3G networks serve a dwindling subscriber base and the spectrum dedicated to 3G needs to be timely repurposed to 5G. Consumers will benefit from the improved speeds, capacity, and reliability of 5G enabled by timely spectrum repurposing. Moreover, the Commission lacks legal authority to prohibit the sunset of 3G networks.⁴⁸

Reduce Regulatory Barriers to Infrastructure Deployment. In 2022, the FCC should pursue reforms to reduce costly and unnecessary regulatory barriers to new infrastructure investment and deployment. Among other things, the Commission should conduct a rulemaking to clarify that it is unjust and unreasonable for utility pole owners to shift all pole replacement costs to new attachers in unserved areas.⁴⁹ The Commission also ought to conduct a rulemaking that would reinstitute, with stronger reasoning, exemptions for small cell construction from historic and environmental reviews attached to certain federal projects. A 2019 decision by the U.S. Court of Appeals for the D.C. Circuit vacated a prior attempt by the Commission to implement such reforms.⁵⁰ But the court's decision does not prevent the Commission from trying again, provided the agency supports it with a more persuasive rationale.⁵¹

Do Not Impose New Barriers on Infrastructure Deployment. The FCC should not repeal or constrict its infrastructure siting reforms like *2018 Small Cells Order*, which helped reduce local regulatory obstacles to new wireless facilities and upgrades.⁵² Timely construction or placement of new towers, base stations, antennae, and small cell equipment is necessary to reap the full potential of next-generation network capabilities and reach unserved Americans.

⁴⁸ See, e.g., Seth L. Cooper, "AT&T's 3G Sunset Will Make Way for Speedy 5G Services: Technology Transitions Shouldn't Be Delayed by Special Pleading," *Perspectives from FSF Scholars*, Vol. 16, No. 48 (September 13, 2021), at: <https://freestatefoundation.org/wp-content/uploads/2021/09/ATTs-3G-Sunset-Will-Make-Way-for-Speedy-5G-Services-091321.pdf>.

⁴⁹ See Andrew Long, "Charter to Commission: Pole Disputes Threaten Timely Deployment of Broadband Infrastructure," *The FSF Blog* (November 10, 2021), at: <http://freestatefoundation.blogspot.com/2021/11/charter-to-commission-pole-disputes.html>.

⁵⁰ *United Keetoowah Band of Cherokee Indians in Oklahoma v. FCC*, 933 F.3d 728 (D.C. Cir. 2019).

⁵¹ See Daniel A. Lyons, "D.C. Circuit Decision Represents Setback to Next-Generation Network Deployment Efforts," *Perspectives from FSF Scholars*, Vol. 14, No. 19 (Aug. 15, 2019), at: <https://freestatefoundation.org/wp-content/uploads/2019/09/D.C.-Circuit-Decision-Represents-Setback-to-Next-Generation-Network-Deployment-Efforts-081519.pdf>.

⁵² For a discussion of judicial decisions upholding infrastructure siting reforms and defending their constitutionality, see Randolph J. May and Seth L. Cooper, "Wireless Infrastructure Reforms Rest on Solid Constitutional Foundations: Congress Should Preempt Local Obstacles to 5G Deployment," *Perspectives from FSF Scholars*, Vol. 16, No. 29 (Jun. 8, 2021), at: <https://freestatefoundation.org/wp-content/uploads/2021/06/Wireless-Infrastructure-Reforms-Rest-on-Solid-Constitutional-Foundations-060821.pdf>.

Do Not Impose Public Utility Regulation on Broadband Internet Services. The FCC should not reimpose Title II public utility regulation on broadband Internet services. Economic theory leads to the conclusion that such regulation reduces incentives for private investment and innovation.⁵³ Reductions in network investment that followed the Commission's imposition of such regulation under its now-repealed 2015 *Title II Order* bears out that conclusion.⁵⁴ Also, no demonstrated problem market power or consumer harm exists to justify any such regulation. And net neutrality regulation does not enhance broadband market competition or expand broadband access to unserved Americans.

VI. Conclusion

Taken together, reports and data submitted and collected by industry, analysts, and government agencies support a conclusion that increasing numbers of consumers have access to broadband Internet services, that speeds are increasing, and that the market is effectively competitive. Infrastructure upgrades made in 2020 and 2021, including ongoing 5G and gigabit network deployments, are benefitting consumers with new services, improved capabilities, and competitive pricing options. Further benefits are to be expected from mid-band spectrum being put into use by AT&T and Verizon for 5G services, continued expansion of fixed wireless access services, increasing adoption of Wi-Fi 6 networks and devices, further fiber buildouts to U.S. homes, and future cable 10G platform capabilities.

In order to preserve an environment hospitable to the communications market's growth and vibrancy in and beyond 2022, the FCC should stick to light-touch regulatory policy concerning broadband. This will encourage private sector investment and innovation in next-generation networks but also keep broadband services clear of local regulatory roadblocks.

* Seth L. Cooper is Director of Policy Studies and a Senior Fellow and Andrew K. Magloughlin is a Legal Fellow of the Free State Foundation, a free market-oriented think tank in Rockville, MD. The views expressed in this Perspectives do not necessarily reflect the views of others on the staff of the Free State Foundation or those affiliated with it.

⁵³ See, e.g., FCC, Restoring Internet Freedom, WC Docket No. 17-108, Declaratory Ruling, Report and Order, and Order ("*Restoring Internet Freedom Order*") (released Jan. 4, 2018), ¶¶ 20, 88, 90-98, 149, 254.

⁵⁴ See, e.g., *id.* at ¶ 90-98.