

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC**

In the Matter of)
)
Inquiry Concerning Deployment of Advanced) GN Docket No. 20-269
Telecommunications Capability to All)
Americans in a Reasonable and Timely Fashion)

COMMENTS OF THE FIBER BROADBAND ASSOCIATION

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TABLE OF CONTENTS

I.	INTRODUCTION AND SUMMARY	1
II.	THE MARKET HAS CHOSEN ALL-FIBER NETWORKS AS THE ESSENTIAL INFRASTRUCTURE FOR FIXED BROADBAND SERVICE.....	4
III.	ALL-FIBER CONNECTIVITY IS ESSENTIAL FOR CONSUMERS, COMMUNITIES, AND INDUSTRY, INCLUDING 5G	9
IV.	THE COMMISSION SHOULD SET A GIGABIT SYMMETRIC BENCHMARK TO ENSURE ALL-FIBER INFRASTRUCTURE IS BEING DEPLOYED TO ALL AMERICANS IN A REASONABLE AND TIMELY MANNER	18
V.	CONCLUSION.....	20

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I. INTRODUCTION AND SUMMARY

The Fiber Broadband Association (“FBA”)¹ hereby submits comments in response to the Federal Communications Commission’s (“Commission’s”) annual Section 706 Notice of Inquiry (“NOI”) inquiring “whether advanced telecommunications capability is being deployed to all Americans in a reasonable and timely fashion” and on progress to close the digital divide.² For five years, the Commission has relied on the 25/3 Mbps speed metric as the sole benchmark to evaluate the deployment of advanced telecommunications capabilities and proposes to use that same metric once again in the Sixteenth Broadband Deployment Report.³ It does so despite evidence that the 25/3 Mbps benchmark is inadequate for the communications requirements of

¹ FBA is a not for profit trade association with more than 250 members, including telecommunications, computing, networking, system integration, engineering, construction, and content-provider companies, as well as traditional service providers, utilities, and municipalities. Its mission is to accelerate deployment of all-fiber access networks by demonstrating how fiber-enabled applications and solutions create value for service providers and their customers, promote economic development, and enhance quality of life. A complete list of FBA members can be found on the organization’s website: <https://www.fiberbroadband.org/>.

² *Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion*, GN Docket No. 20-269, Sixteenth Broadband Deployment Report Notice Of Inquiry, FCC 20-112 (rel. Aug. 19, 2020); 47 U.S.C. § 1302(b).

³ NOI at ¶ 11.

daily life in 2020 and beyond, as consumers need and are demanding higher performance broadband services and evidence demonstrates that providers have made gigabit performance the new baseline for broadband service.

As explained herein, while FBA does not object to the Commission establishing a benchmark for advanced communications capabilities to performance that may be satisfactory for today's average consumer – which should be at least 100/100 Mbps⁴ – the Commission should recognize that consumers increasingly require and are subscribing to much higher performance broadband service, particularly offered over all-fiber infrastructure. In fact, there is a consensus that fiber is the fundamental communications infrastructure for all 21st Century communications networks – even 5G relies on fiber – and indisputable evidence that all-fiber connectivity is far and away the market winner, as evidenced by widespread availability today and annual growth rates exceeding all previous wireline technologies. As AT&T's CEO, John Stankey, said earlier this week:

[P]riority #1 is to make sure that we're investing in our core businesses, and that's fiber and making sure that we have broadband connectivity on 5G. And when you think about it, those 2 aren't dissimilar. When you have a great 5G network, you're deploying a lot of fiber, and that's something that we think are married well. And we think we're in a very unique position because the fiber that we deploy, not only powers our wireless business, but it helps our consumer business and fixed broadband. It helps our enterprise customers and how we deal with them as well, and so we strategically want to make sure we're doing that.⁵

⁴ The Commission just released its most recent report on broadband access, which analyzes Form 477 data submitted at the end of 2018 – over 18 months ago – wherein it found, “[t]he median downstream speed of all reported fixed connections was 100 Mbps and the median upstream speed was 10 Mbps.” See “Internet Access Services: Status as of December 31, 2018,” Office of Economics & Analytics, Federal Communications Commission, at 8 (Aug. 17, 2020).

⁵ “AT&T at Goldman Sachs Communacopia Conference (Virtual),” Edited Transcript, Refinitiv StreetEvents (Sept. 15, 2020) (“AT&T CEO at Communacopia”), <https://investors.att.com/~media/Files/A/ATT-IR/events-and-presentations/jts-at->

The Commission too has effectively recognized the superior role of fiber when, in the Rural Digital Opportunity Fund (“RDOF”) *Report and Order*, it decided to award support to providers that offer the highest performance networks after the budget has cleared.⁶ It did so to

encourage[e] the deployment of networks that will be sustainable even as new advancements are made and which will be capable of delivering the best level of broadband access for many years to come, all while keeping funding within the Phase I budget. [As such], the auction will have selected the best possible service, at a competitive level of support, for the same number of consumers living in those areas, and this will result in more rapid and efficient funding for such deployment.⁷

Only all-fiber connectivity can provide the high-performing future-proof networks to which the Commission was referring.⁸

In light of the current market realities and consumer needs, the Commission’s proposal to rely again on 25/3 Mbps as the sole benchmark to measure the deployment of advanced telecommunications capability is all the more surprising. In the Sixteenth Broadband

goldman-transript-sept-15.pdf. *See also*, *Verizon CEO: Fiber build out is paying off for more than 5G*, Fierce Telecom (Jan. 30, 2020), <https://www.fiercetelecom.com/telecom/verizon-ceo-fiber-build-out-paying-off-for-more-than-5g> (“While Vestberg acknowledged that fiber played a key role in serving its cell sites, he said on the earnings call that fiber has more use cases ahead of it, specifically for business services. ‘I think this is one of the most critical assets in a network today – in today’s world, especially as we build Verizon Intelligent Edge Network and you want actually to start delivering the 5G experience that we’re expecting. . . . And I can tell you during 2019, I met so many large corporations that we now can actually work with, because our offering is so strong when it comes to fiber and 5G.’”).

⁶ *Rural Digital Opportunity Fund; Connect America Fund*, WC Docket Nos. 19-126 and 10-90, Report and Order, FCC 20-5, ¶ 21 (rel. Feb. 7, 2020) (“RDOF R&O”).

⁷ *Id.* at ¶ 21 (footnotes omitted).

⁸ Congress and the President also have acknowledged the critical role of fiber through enactment of federal “Dig Once” requirements aimed at facilitating installation of fiber in federally-funded highways. *See* Section 607, Broadband Infrastructure Deployment, the Consolidated Appropriations Act, 2018 (Pub. L. 115–141), Division P, Title VII (“MOBILE NOW Act”); 47 U.S.C. 1504.

Deployment Report, the Commission has the opportunity to be forward looking by setting a benchmark that will “ensure that the Commission’s efforts to close the digital divide are working and . . . guide future policymaking”⁹ to promote the deployment of fiber networks. Accordingly, FBA submits that should the Commission continue with the current benchmark of 25/3 Mbps or even increase this benchmark to a more apt standard of 100/100 Mbps, the Commission also should benchmark gigabit symmetric performance so that it is positioned to measure whether advanced telecommunications capabilities delivered by all-fiber networks are being deployed in a reasonable and timely fashion.¹⁰

II. THE MARKET HAS CHOSEN ALL-FIBER NETWORKS AS THE ESSENTIAL INFRASTRUCTURE FOR FIXED BROADBAND SERVICE

Over the last 15 years, all-fiber network growth has exploded. In 2003, 50,000 homes had access to all-fiber connectivity. By 2018, that number had increased 1000 times to nearly 50 million (40%) households. All-fiber deployments continue to surge with average increases of 10% annually.¹¹ As the Commission highlighted in the NOI, “fiber networks were deployed to roughly 6.5 million new homes in 2019” alone, marking “the second consecutive year of record-breaking single-year increases.”¹² By 2024, 50% of American households will be passed with

⁹ NOI at ¶ 1.

¹⁰ It was just a decade ago when former Chairman Genachowski announced his “100 Squared” objective – 100 Mbps to 100 million homes by 2020. It turns out that this substantially underestimated both the public’s needs and providers’ capabilities. By the end of 2018, more than 85% of consumers had access to 250/50 Mbps, and those numbers have continued to rise.

¹¹ See “North America, 2019 Advanced Broadband Report,” RVA, LLC for the Fiber Broadband Association, at 10 (Dec. 19, 2019) (“RVA 2019 Report”) available at www.fiberbroadband.org.

¹² NOI at ¶ 3.

fiber,¹³ and as discussed below, that number could reach 90% by 2029 with concerted efforts by government and industry.¹⁴ At the end of 2019, fiber networks also connected over 1 million commercial buildings and anchor institutions,¹⁵ and that number continues to rise. In fact, fiber is the fastest growing fixed communications network technology in the nation’s history,¹⁶ outpacing the growth rates of copper and coaxial last-mile transmission connectivity, which took 40 years and 25 years, respectively, to reach 40% of homes.

Beyond availability, all-fiber connectivity continues to climb, rising to second place behind cable, which has peaked and begun to decline. (Cable provider networks are building all-fiber infrastructure in greenfield areas, and some are even upgrading their HFC networks to all-fiber.)¹⁷ As for other fixed technologies, they have only a *de minimus* market share.¹⁸

All-fiber infrastructure is the fixed broadband market winner because fiber has multiple characteristics that set it apart from competing technologies. To begin with, fiber offers superior performance, widely offering 1 GB symmetrical data transmissions today, with 10 GB speeds

¹³ “U.S. Fiber Broadband Growth And Share,” RVA, LLC for the Fiber Broadband Association, at 2 (Sept. 6, 2020) (“RVA 2020 Market Study”) available at www.fiberbroadband.org.

¹⁴ See “All-Fiber Deployment Cost Study 2019,” Cartesian for the Fiber Broadband Association, at 2 (Sept. 10, 2019) (“Cartesian Cost Study”) available at www.fiberbroadband.org.

¹⁵ See e.g., *2019 U.S. Fiber Lit Buildings LEADERBOARD*, Vertical Systems Group (Apr. 2, 2020), <https://www.verticalsystems.com/2020/04/01/2019-us-fiber-leaderboard/> (“The number of on-net fiber lit commercial buildings exceeded one million in 2019 as network providers concentrated on U.S. footprint expansion.”).

¹⁶ See RVA 2019 Report at 18.

¹⁷ RVA 2020 Market Study at 3. In highly-competitive Tier 1 markets where fiber has its greatest availability and has had time to mature, fiber has taken 54% of the market, with cable broadband trailing in second place at 30% and all other technologies taking the remaining 16%. In markets served by Tier 2 and Tier 3 providers, where fiber is available, fiber has been even more dominant, achieving 62% of market share. *Id.* at 4, 5.

¹⁸ *Id.*

already being offered in some markets.¹⁹ Fiber is also future-proof, meaning it is readily scalable to provide higher performance to meet increasing consumer demands for decades to come simply by upgrading electronics.²⁰ As a result, fiber not only provides the performance that supports the enormous data flows engendered by video transmissions and other innovative applications that consumers rely on today, but it will meet these needs for decades to come.

Further, fiber is the most secure, reliable, and durable of the network technologies. Fiber technology offers greater network security because it is less vulnerable to cable tapping and hacking,²¹ and new innovations are making it even more impenetrable.²² Fiber reliability exceeds that of other network infrastructure because it is less susceptible than cable, DSL, fixed wireless, and satellite to inclement weather, electromagnetic interference, and other issues that degrade or destabilize service.²³ In particular, buried fiber networks have proven to be the most

¹⁹ See e.g., *10 Gig Internet*, Cedar Falls Utilities, <https://www.cfu.net/tv-internet/internet-service-info/10-gig-internet> (“We know customer demand for bandwidth and connection speed will continue to grow. . . . We view it as our job to offer a world-class communications network and get out of the way to see what our customers can do with no limitations. Most importantly, the business-ready infrastructure helps local companies succeed and positions Cedar Falls to compete nationally for new jobs and economic growth. The 10 Gig network is a platform built for innovation.”).

²⁰ A recent study shows the promise of fiber’s future. By combining different existing amplifier technologies into a hybrid system, engineers in the UK and Japan were able to achieve 178 terabits per second (Tb/s) through existing fiber infrastructure – fast enough to download the entire Netflix library in under a second. Irving, Michael, *Internet speed record shattered at 178 terabits per second*, *New Atlas*, (Aug. 20, 2020), <https://newatlas.com/telecommunications/internet-speed-record178-terabits-per-second/>.

²¹ *The Benefits of Fiber*, USTelecom (June 2, 2017), <https://www.ustelecom.org/the-benefits-of-fiber/>.

²² As the foundational transmission medium, optical fiber and cable are essential to supply chain security and consequently must rely on trusted suppliers to minimize vulnerability.

²³ *The Benefits of Fiber*, *supra* n.21; see also “Operational Expenses for All-Fiber Networks are Far Lower Than for Other Access Networks,” Fiber Broadband Association, at 7 (June 2020) (“FBA OpEx Study”).

robust transmission media, especially in areas prone to natural disasters, because fiber cables and associated materials are specifically designed to withstand water penetration and corrosion and because active electronics in fiber networks tend to be housed in well-constructed buildings and not in outdoor cabinets in the field or as radios attached to infrastructure. Thus, fiber allows data to flow over great distances without degrading so consumers can enjoy steady and stable internet connections.

In addition, all-fiber networks have low costs to operate and upgrade the network. A study completed by FBA concluded that the operational expenses (“OpEx”) of all-fiber networks are below other delivery mediums – fiber offers 50% OpEx savings over HFC and 63% over DSL – in large part because they have fewer active (i.e., powered) components from central office or headend to the home.²⁴

²⁴ FBA OpEx Study at 6-12. In a coaxial network, there are several powered elements from the headend to the subscriber, including the Cable Modem Termination System (“CMTS”) or Hybrid Fiber Cable (“HFC”) nodes spaced roughly every 2 km and up to five coaxial line amplifiers on a path to a home. For the most competitive DSL network (second generation very-high-bit-rate DSL or “VDSL2”), which ostensibly tops out at speeds of 100 Mbps symmetrical under laboratory conditions, cabinets with amplifying equipment are needed every 1 km. Conversely, all fiber networks can transmit up to 20 km without amplifying equipment. Each active component increases the costs to power, maintain, and upgrade a network. The number of active components also increases the potential failure points, which in turn translates into costs responding to customer service requests. In fact, the costliest part of providing service, and the greatest cost differential between fiber and HFC and DSL, is that of truck rolls. Additionally, the greater frequency of maintenance issues for HFC and DSL result in greater customer dissatisfaction, which increases the amount of customer churn. This results in lost revenue and increased costs due to provisioning and deprovisioning of customers and customer acquisition costs. In addition, while OpEx and upgrade costs for fiber are expected to remain flat over time, they are likely to increase for all other fixed broadband mediums because they will each require greater amounts of investment to replace aging facilities that are reaching their end of life – likely with durable and easily-upgradable fiber – and as they attempt to keep up with consumer demand. *See id.* at 7-8; *see also* *What Speeds Can I Expect on ADSL2+/VDSL2*, Sonic, <https://help.sonic.com/hc/en-us/articles/115007031987-What-Speeds-Can-I-Expect-on-ADSL2-VDSL2> (last updated Sept. 14, 2020).

As evidenced by past and current growth of all-fiber deployments, providers largely view the economics of deploying all-fiber networks on a total life cycle basis and find them favorable. Further, contrary to some perceptions, the economics of deploying all-fiber in rural areas do not vary considerably from urban deployments. A September 2020 report by MoffettNathanson explained that the higher costs to deploy all-fiber networks in rural areas as compared to urban areas is largely offset by greater penetration.²⁵ And this does not even account for the long-term costs savings from fiber's lower maintenance and upgrade costs.

Deploying all-fiber networks ubiquitously not only will ensure all Americans have the robust connectivity essential to their futures, it is within our grasp. As FBA has conveyed to the Commission, a study completed for FBA by consulting firm Cartesian showed that between innovative deployment models by all-fiber providers, government efforts to lower access to essential infrastructure, and efficiently provided government support, by 2029, all-fiber networks can be deployed to 80% of households with an additional \$52 billion of investment and 90% of households with \$18 billion more.²⁶ The fiber industry is actively playing its part. A study by FBA member Corning shows the costs to deploy fiber have already been driven down by industry-led investments in technology and deployment efficiencies.²⁷ The Commission can play its part in this proceeding by benchmarking advanced communications capability to gigabit symmetric performance and by ensuring its policies and investments are geared toward deploying all-fiber infrastructure.

²⁵ "Q2 2020 Broadband: The Footprint Expansion Game," MoffettNathanson (Sept. 10, 2020).

²⁶ See Cartesian Cost Study at 2.

²⁷ See "Getting More Gigabit Service from the Rural Digital Opportunity Fund," Corning, at 2 (Dec. 19, 2019).

The simple fact is that all-fiber networks are the fixed broadband market winner because it is the best investment. No other technology – cable, DSL, fixed wireless, or satellite – brings together all components of performance, reliability/security, and low operational and upgrade costs.²⁸ This has caused an industry-wide consensus that fiber is the only network technology that can support the ever-increasing demand by consumers for a superior experience from traditional broadband service. All-fiber network dominance in the fixed broadband market is a foregone conclusion. As such, by maintaining 25/3 Mbps as the sole benchmark, the Commission is ignoring the advanced communications capability – gigabit symmetric – that consumers are increasingly selecting today and will certainly opt for tomorrow. FBA submits that it is time for the Commission to catch up to consumers, providers, and the market and evaluate whether gigabit symmetric advanced telecommunications capability is being deployed to all Americans in a reasonable and timely fashion.

III. ALL-FIBER CONNECTIVITY IS ESSENTIAL FOR CONSUMERS, COMMUNITIES, AND INDUSTRY, INCLUDING 5G

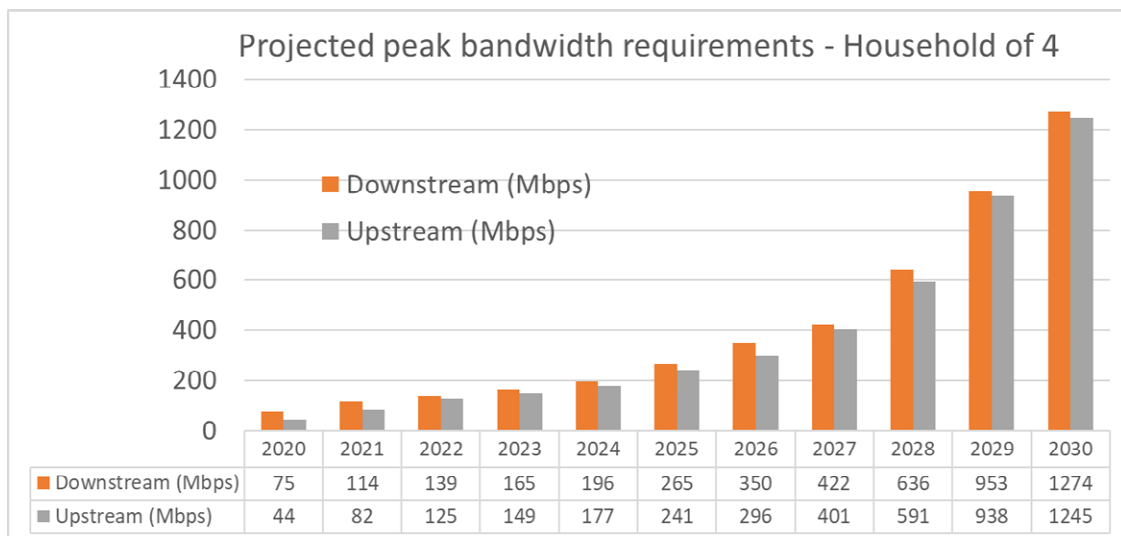
All-fiber connectivity is the clear market leader because consumers, businesses, 5G and various other providers demand high-performance broadband capabilities. An FBA study set to be released later this year shows that residential demand for both upstream and downstream bandwidth has been growing at a rate of 20-25% annually for over two decades – and it should continue such that peak bandwidth demands for a family of four in approximately seven years

²⁸ For additional evidence, see *The Case for Fiber to the Home, Today: Why Fiber is a Superior Medium for 21st Century Broadband*, EFF (Oct. 16, 2019), <https://www.eff.org/wp/case-fiber-home-today-why-fiber-superior-medium-21st-century-broadband>.

should exceed 400 Mbps symmetric and will grow even faster after that for the reasons set forth below.²⁹

This skyrocketing demand is because consumers are using more bandwidth hungry applications requiring both higher downstream and upstream speeds over an increasing number of devices. On any given day, multiple family members in a single household might connect to their home networks on separate devices at the same time to work and participate in online education, apply for jobs, review the latest news, share their views on Twitter, video chat with

²⁹ The graph below is based on the following bottom up calculation of bandwidth requirements for various uses.



Downstream		2020		2021		2022		2023		2024		2025		2026		2027		2028		2029		2030	
Bandwidth		Streams	Total	Streams	Total	Streams	Total	Streams	Total	Streams	Total	Streams	Total	Streams	Total	Streams	Total	Streams	Total	Streams	Total	Streams	Total
5	HD Video	2	10	1	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	4K Video	1	25	1	25	2	50	2	50	1	25	1	25	1	25	0	0	0	0	0	0	0	0
75	8K Video	0	0	0	0	0	0	0	0	1	75	1	75	1	75	2	150	2	150	1	75	1	75
40	AR/VR - Low	0	1	40	1	40	2	80	2	80	1	40	0	0	0	0	0	0	0	0	0	0	0
100	AR/VR - HD	0	0	0	0	0	0	0	0	1	100	2	200	2	200	1	100	2	200	1	100	1	100
500	AR/VR - Retinal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	500	1	500	2	1000	2
20	Gaming	1	20	1	20	1	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	Download/Updates/IoT	1	20	1.2	24	1.4	29	1.7	35	2.1	41	2.5	50	3.0	60	3.6	72	4.3	86	5.2	103	6.2	124
	20%																						
	Totals		75		114		139		165		221		290		360		422		591		938		1245

Upstream		2020		2021		2022		2023		2024		2025		2026		2027		2028		2029		2030	
Bandwidth		Streams	Total	Streams	Total	Streams	Total	Streams	Total	Streams	Total	Streams	Total	Streams	Total	Streams	Total	Streams	Total	Streams	Total	Streams	Total
5	HD Video	3	15	2	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	4K Video	0	0	0	0	2	50	2	50	1	25	1	25	1	25	0	0	0	0	0	0	0	0
75	8K Video	0	0	0	0	0	0	0	0	1	75	1	75	1	75	2	150	2	150	1	75	1	75
40	AR/VR - Low	0	1	40	1	40	2	80	2	80	1	40	0	0	0	0	0	0	0	0	0	0	0
100	AR/VR - HD	0	0	0	0	0	0	0	0	1	100	2	200	2	200	1	100	2	200	1	100	1	100
500	AR/VR - Retinal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	500	1	500	2	1000	2
2	Security/Monitoring	2	4	3	6	4	8	5	10	6	12	7	14	8	16	9	18	10	20	11	22	12	24
20	Gaming	1	20	1	20	1	20	0	0	0	0	0	0	0	0	2	40	0	0	2	40	2	40
5	Upload/Backups/IoT	1	5	1.2	6	1.4	7.2	1.7	9	2.1	10	2.5	12	3.0	15	3.6	18	4.3	21	5.2	26	6.2	31
	20%																						
	Totals		44		82		125		149		202		266		331		426		591		938		1245

friends and family on Zoom, utilize telehealth services, stream a movie on Netflix, or play Fortnite with opponents connected around the world. This demand and those uses are not just a phenomenon brought on by the COVID-19 pandemic; they were a preexisting reality. For example, a study conducted by the National Telecommunications and Information Administration (“NTIA”) found that in 2019, a third of Americans (roughly 51 million) used the Internet to work remotely and one fifth (about 43 million) used it to take classes or complete job training.³⁰ A separate study by Deloitte found that by the end of 2019, the average U.S. household had 11 connected devices.³¹

And, the COVID-19 pandemic has only accelerated demands for high-performance bandwidth connectivity. As AT&T’s CEO just explained, “[I]f I went and looked at the some of the trends that were going on in key parts of our business, COVID was kind of short of adrenaline, right? It just accelerated things that were happening and carry them forward.”³² OpenVault, which tracks broadband usage, found in a report issued this past May that median usage was up 60% from 2019 to 2020 and that upstream usage “rose sharply,” and that these usage increases are moving subscribers toward faster speeds.³³ Further, last month, OpenVault reported:

³⁰ *Nearly a Third of American Employees Worked Remotely in 2019, NTIA Data Show*, NTIA (Sept. 3, 2020), <https://www.ntia.gov/blog/2020/nearly-third-american-employees-worked-remotely-2019-ntia-data-show>.

³¹ Press Release, *Deloitte survey: Connectivity cravings drive consumer appetite for 5G, home automation, and more control of personal data* (Dec. 4, 2019), <https://www2.deloitte.com/us/en/pages/about-deloitte/articles/press-releases/deloitte-launches-connectivity-mobile-trends-survey.html>.

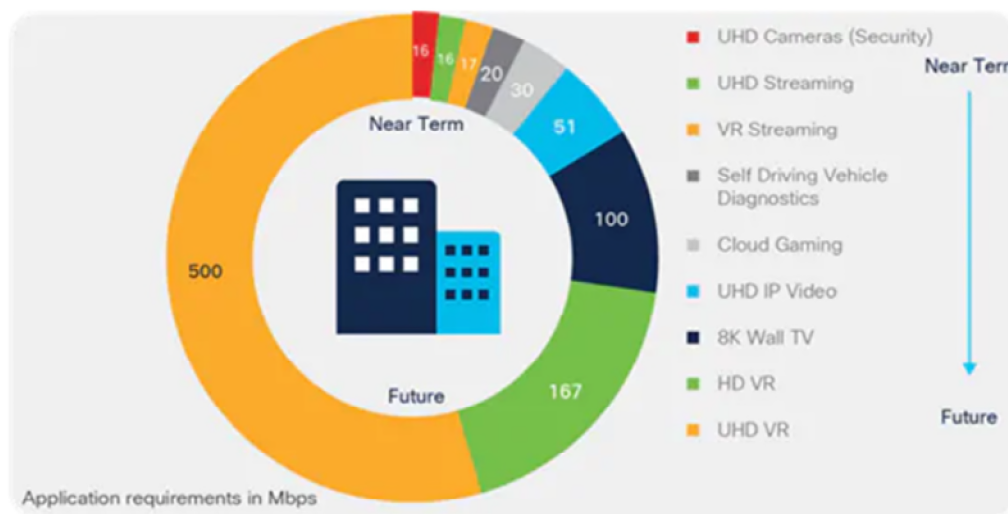
³² AT&T CEO at Communicopia.

³³ *COVID-19 Impact: Broadband Usage Jumps 47% IN Q1, Nears YE2020 EXPECTATIONS*, OpenVault (May 4, 2020), <https://openvault.com/covid-19-impact-broadband-usage-jumps-47-in-q1-nears-ye2020-expectations/>.

Consumers are continuing to increase reliance on upstream bandwidth and are opting for faster speeds to meet dramatically changed usage habits. The 2Q20 OVBI shows that nearly 5% of subscribers now receive connections of 1 gigabit or faster, up 133% year-over-year and up 75% in the last six months alone. About 61% of all subscribers now have connections of 100 Mbps or faster, a one-year increase of 27%.³⁴

Future increases in the need for substantially greater downstream and upstream bandwidth are being driven by an array of new technologies, including 8K video, virtual reality (“VR”) and augmented reality (“AR”). These technologies hold substantial promise for consumers and businesses, such as greatly improved virtual education, telemedicine, work from home, business, security, and entertainment, but we can only seize these opportunities by providing to all households in the country higher performance symmetric broadband service. According to the Cisco VNI report, “today’s bandwidth needs are a sliver of the future needs.”³⁵

Figure 13. Significant demand for bandwidth and video in the connected home of the future



³⁴ *OVBI: Upstream Broadband Usage, Faster Speeds Spike Higher in Q2 2020*, Open Vault (Aug. 11, 2020), <https://openvault.com/ovbi-upstream-broadband-usage-faster-speeds-spike-higher-in-q2-2020/>.

³⁵ See *Cisco Annual Internet Report (2018-2023) White Paper*, (Mar. 9, 2020), <https://www.cisco.com/c/en/us/solutions/collateral/executive-perspectives/annual-internet-report/white-paper-c11-741490.html>.

Key industry players are developing AR and VR systems that will enable home based Americans to experience a greatly enhanced quality of life – but only if they have the symmetric bandwidth that all-fiber networks provide. VR creates a physical presence in virtual worlds, and AR seamlessly merges the real world with virtual objects. According to ABI research:

AR and VR educational applications shift the learning process from passive to active, allowing students to interact with content and practice their knowledge in real-time conditions. Learning by experience leads to better understanding, enhances knowledge recall, and strengthens retention. Immersive and interactive experiences stimulate students’ motivation and increase their engagement level, which are fundamental factors for achieving learning goals.³⁶

However, both AR and VR applications will require much higher symmetric bandwidths than available to many Americans today – up to 5000 Mbps – to deliver a realistic experience to the end user, due to the cloud-based processing that enables cost effective consumer equipment.³⁷

According to GSMA Future Networks, “[t]he most significant factor with Cloud AR/VR solutions is the transfer of the processing capability from the local computer to the cloud. A high-capacity, low-latency broadband network allows for responsive interactive feedback, real-time cloud-based perception, rendering, and real-time delivery of the display content.”³⁸ For AR in particular, “[t]he upstream bandwidth for the sensor input to understand the real-world is

³⁶ *The Power of Augmented Reality & Virtual Reality for Education*, ABIresearch (May 22, 2019), <https://www.abiresearch.com/blogs/2019/04/25/power-augmented-reality-virtual-reality-education/>.

³⁷ “VR and AR Pushing Connectivity Limits,” Qualcomm Technologies, Inc. (Oct. 2018), <https://www.qualcomm.com/media/documents/files/vr-and-ar-pushing-connectivity-limits.pdf>.

³⁸ “Cloud AR/VR Whitepaper,”GSMA Future Networks (Oct. 26, 2019), <https://www.gsma.com/futurenetworks/wiki/cloud-ar-vr-whitepaper/>.

significant and can be as high or even higher than the downlink requirements.”³⁹ In sum, more than just being something that consumers want and enjoy, fiber is also what consumers need.

The COVID-19 emergency highlighted what FBA already knew to be true – to effectively participate in today’s society, families need access to the high performance broadband that only all-fiber networks can deliver. They cannot rely on 25/3 Mbps speeds, particularly when delivered via high-latency or low reliability services, when several family members are connecting multiple devices for the various activities discussed above, let alone frequent two-way video conferences for school, work, and telehealth doctor’s appointments, which have become typical during the pandemic.⁴⁰ A recent study by RVA, LLC for FBA conducted during the pandemic found that over 90% of respondents indicated the Internet is either somewhat or very important to their household, but consumers with low-performance broadband connections have had to ration their broadband (asking family members not to use the Internet during video conference calls) and have lost productivity due to time spent waiting for applications to load.⁴¹ In other words, the pandemic has shown that all-fiber connectivity has become essential.

³⁹ *Id.*

⁴⁰ A stay-at-home individual’s broadband needs, during the emergency, has often exceeded 50-100 Mbps both upstream and downstream, and this amount quickly rises when multiple people in a household seek access at once. *See Home Internet data usage surges amid COVID-19 crisis*, LightReading (Mar. 18, 2020), <https://www.lightreading.com/services/home-internet-data-usage-surges-amid-covid-19-crisis/d/d-id/758298>. An RVA, LLC study completed for FBA found that between 2019 and 2020, video conferencing increased by roughly 15% for business, 13% for education, 10% for healthcare, and 20% for family. “U.S. Broadband Internet Access In The 2020 Pandemic: Broadband Importance, Shifts, Differences, Stresses, And Divides,” RVA, LLC for FBA, at 5 (2020) (“RVA Pandemic Study”).

⁴¹ RVA Pandemic Study at 4, 9. Between the top and bottom broadband performance tiers, the bottom tier had over twice as much in-home rationing (48%) and hours per week of lost productivity (11 hours). *Id.*

The critical nature of all-fiber connectivity is especially important for rural Americans who rely more than their urban counterparts on online access for telehealth, education, civic engagement, communicating with family and friends, entertainment, and other applications. Many of these communities do not even have broadband at 25/3 Mbps. For example, an April 2018 Department of Education Report found that 18% of rural children do not have access to reliable broadband to do their homework.⁴² Another study found that rural residents who live more than an hour away from the nearest hospital tend to be the least likely to have the broadband connections they need to access telehealth services, and these residents tend to be older and sicker than their urban counterparts.⁴³ But because these consumers need to be able to use high-bandwidth applications that require symmetrical speeds, new deployments at 25/3 will be obsolete as soon as those residents are connected, only serving to widen the digital divide.

Beyond home use, all-fiber connectivity has become essential for communities and industry. Municipalities are increasingly deploying all-fiber networks to support smart city applications and spur economic growth through gigabit broadband service offerings to homes and businesses when the private sector has not stepped up to provide this performance.⁴⁴ In

⁴² See Berdik, Chris, *Rural Kids Face an Internet ‘Homework Gap.’ The FCC Could Help*, Wired (Nov. 12, 2018), <https://www.wired.com/story/rural-kids-internet-homework-gap-fcc-could-help/>.

⁴³ Carroll, Linda, *Until broadband access improves, telemedicine won’t help rural communities*, Reuters (May 20, 2019), <https://www.reuters.com/article/us-health-telemedicine-rural-internet/until-broadband-access-improves-telemedicine-wont-help-rural-communities-idUSKCN1SQ29W>.

⁴⁴ In August 2020, Lexington, KY became the largest gigabit city in the United States when its fiber network was completed through a public-private partnership with MetroNet, an all-fiber provider. *MetroNet Completes Construction of 100% Fiber Optic Network in Lexington, Lexington Becomes Nation’s Largest Gigabit City*, Business Wire (Aug. 25, 2020), <https://www.businesswire.com/news/home/20200825005826/en/MetroNet-Completes-Construction-100-Fiber-Optic-Network>.

industry, the reliability, high through-put, and rapid speeds make fiber the needed infrastructure for precision agriculture,⁴⁵ autonomous vehicles, remote surgery, and gaming while the future-proof and ubiquitous characteristics of fiber allow for improved functionality, monitoring, and efficiencies across the energy sector, including for smart grids. Additionally, the sensing capabilities that can ride on fiber optic cable allow for real-time automatic monitoring of building/structural integrity, oil/gas pipeline safety, water line leaks, border patrol, and seismic activity.

Fiber is also the essential underlying infrastructure for towers, wireless networks, small cell, and 5G deployments. As a general matter, to increase performance, mobile wireless providers aim to get the transmission “out of the air” and “into the ground” as quickly as possible, increasingly using fiber.⁴⁶ But when it comes to 5G, it is not a goal, it is a necessity – there are no 5G networks without fiber.⁴⁷ 5G networks rely on fiber for fronthaul, midhaul, and backhaul and to ultimately tie together existing cell sites and the hundreds of thousands new

⁴⁵ See, e.g., *The Invisible Advantage*, The John Deere Journal (Feb. 15, 2020), <https://johndeerejournal.com/2020/02/the-invisible-advantage/> (“For modern agriculture, rural broadband is nearly as indispensable as water and sunshine. Farmers use it not just to maximize the efficiency of their equipment, but also to keep an eye on global commodity markets, stay in touch with customers, and search for new markets around the globe.”)

⁴⁶ The Commission has noted that 80% of “wireless” use is Wi-Fi offload, and developments in wireless networks will depend on the availability of fiber backhaul. See *Lifeline and Link Up Reform and Modernization, Telecommunications Carriers Eligible for Universal Service Support, Connect America Fund*, WC Docket Nos. 11-42, 09-197, 10-90, Second Further Notice of Proposed Rulemaking, Order on Reconsideration, Second Report and Order, Memorandum Opinion and Order, FCC 15-71, ¶ 45 & n.134 (rel. June 22, 2015).

⁴⁷ For more discussion, see “The Road to 5G is Paved with Fiber,” A White Paper by the Fiber Broadband Association (Dec. 2017), <https://www.fiberconnect.org/page/paving-the-road-to-5g-with-fiber>; *Why Fixed 5G Will Never Completely Replace Wired Internet*, gvec.net (June 10, 2019), <https://www.gvec.net/fixed-5g-will-never-completely-replace-wired-internet/>.

small cell deployments that are needed⁴⁸ so that mobile providers can achieve the performance metrics they have promised.⁴⁹ Additionally, unlike traditional wireless networks where computing and processing power is co-located at the cell sites, 5G networks place more of the processing power in the network core, meaning these networks will need even more fiber connectivity to support data rates that are many times greater than in 4G networks.⁵⁰ Because of 5G's reliance on fiber, FBA estimates that for each square mile of small cells, providers will need to deploy approximately eight miles of fiber.⁵¹ That amounts to 250,000 miles of fiber in the top 25 U.S. urban areas alone. For perspective, in 2018, less than 50,000 miles of fiber were deployed to small cells.⁵² Finally, a 2018 survey of municipal officials shows a clear correlation

⁴⁸ *Industry Data*, CTIA, <https://www.ctia.org/the-wireless-industry/infographics-library/> (last visited Sept. 14, 2020) (“There are 154,000 cell towers today. To meet growing mobile data demands and win the Race to 5G Accenture projects we will need to install hundreds of thousands of small cells in the next few years. S&P Global Market Intelligence projects more than 800,000 small cells deployed by 2026.”).

⁴⁹ For example, Verizon explains that it has been able to introduce Verizon 5G Ultra Wideband thanks to its efforts to secure millimeter wave spectrum and deploy a massive fiber network. *What's the technology behind 5G?*, Verizon, <https://www.verizon.com/about/our-company/5g/what-5g>.

⁵⁰ In addition to upper millimeter wave band configurations for 5G, even mid-band and low-band configurations for 5G all require fiber. FBA notes that the O-RAN Alliance has a working group dedicated to transport requirements. *Transforming Radio Access Networks Towards Open, Intelligent, Virtualised And Fully Interoperable Ran*, O-RAN Alliance, <https://www.o-ran.org/> (last visited Sept. 14, 2020) (“WG9: Open X-haul Transport Work Group. This workgroup focuses on the transport domain, consisting of transport equipment, physical media and control/management protocols associated with the transport network”). See e.g., *White Paper: ORAN Use Cases and Deployment Scenarios White Paper*, O-RAN Alliance, Fig. 2 (Feb. 2020), <https://static1.squarespace.com/static/5ad774cce74940d7115044b0/t/5e95a0a306c6ab2d1cbca4d3/1586864301196/O-RAN+Use+Cases+and+Deployment+Scenarios+Whitepaper+February+2020.pdf> (showing the connectivity, the vast majority of which will be fiber, required among cell sites, edge clouds, and regional clouds).

⁵¹ This estimate assumes 60 small cells are spaced at 750 feet in each square mile.

⁵² RVA 2019 Report at 19.

between existing all-fiber networks in a community and accelerated deployment of small cell antennas.⁵³ We cannot accelerate 5G network deployment without in tandem accelerating the ubiquitous deployment of all-fiber infrastructure.

IV. THE COMMISSION SHOULD SET A GIGABIT SYMMETRIC BENCHMARK TO ENSURE ALL-FIBER INFRASTRUCTURE IS BEING DEPLOYED TO ALL AMERICANS IN A REASONABLE AND TIMELY MANNER

The Commission has stated that its top priority is to “bring[] to every American the economic, education, health, civic, and social benefits that a broadband connection provides.”⁵⁴ Because consumers have “voted” overwhelmingly for all-fiber infrastructure, viewing it as essential to accessing those benefits, the Commission should find it is an advanced communications capability that everyone can access. To achieve this, the Commission should establish gigabit symmetric performance as a benchmark for the Sixteenth Broadband Deployment report and going forward, which will allow the Commission to evaluate where all-fiber networks are being deployed to Americans in a reasonable and timely manner. As evidenced by the growth in all-fiber availability in many urban and suburban areas, such advanced communications capability is being provided; however, in other, principally rural areas, consumers and businesses are being left behind.

With the new information the Commission receives, it will be positioned to better target government support for deployments and reorient its policymaking to ensure it is actually closing the digital divide and does not leave anyone stranded. This is important because, as discussed above, while near-nationwide all-fiber deployments are possible within the next decade, it will

⁵³ “Status of U.S Small Cell Wireless/5G & Smart City Applications from the Community Perspective,” RVA, LLC for Next Century Cities at 8, 15 (Mar. 2018) available at <https://nextcenturycities.org/wp-content/uploads/5Gresearch.pdf>.

⁵⁴ NOI at ¶ 1.

take coordinated actions by the private and public sector to make that happen. One of the most beneficial assets the Commission can deliver is financial support. Late last year, U.S. Senators John Thune (R-S.D.), Amy Klobuchar (D-Minn.), and almost four dozen other Senators wrote Chairman Pai emphasizing that “[i]f our rural communities are to survive and flourish, our rural constituents need access to services that are on par with those in urban areas. By contrast, it would be an inefficient use of resources to promote services that cannot keep pace with consumer demand and the evolution of broadband in urban areas.”⁵⁵ As previously noted, the Commission took a step in the right direction by deciding to award RDOF support to the highest-performance network after the budget clearing round in the auction, but setting the gigabit symmetric benchmark will help guarantee that future awards will be targeted toward fiber.⁵⁶

The Commission can also calibrate some of its other efforts to ensure it is continuing to promote and facilitate broadband deployment. Over the past decade, the Commission has made strides toward facilitating access to utility poles, ducts, and conduits, most recently through the adoption of One-Touch Make-Ready.⁵⁷ The Commission also clarified rules for accessing state and local government rights-of-way, particularly to ensure providers are charged cost-based rates.⁵⁸ FBA commends these efforts and urges the Commission to be vigilant, continuously

⁵⁵ Letter to Chairman Ajit Pai, Federal Communications Commission, from Sen. John Thune (R-S.D.), Sen. Amy Klobuchar (D-Minn.), United States Congress (Dec. 9, 2019), available at <https://www.klobuchar.senate.gov/public/index.cfm/2019/12/klobuchar-thune-46-colleagues-urge-federal-communications-commission-fcc-to-promote-the-deployment-of-sustainable-broadband-networks-in-rural-america>.

⁵⁶ More financial resources are needed, and FBA continually advocates for Congress to allocate more to the Commission for disbursement.

⁵⁷ *Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Inv., et al.*, WC Docket No. 17-84, et al., Third Report and Order and Declaratory Ruling, 33 FCC Rcd 7705 (2018).

⁵⁸ *Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment et al.*, WT Docket No. 17-79, FCC 18-133, 33 FCC Rcd. 9088 (2018).

monitoring whether its regulations are working as intended and updating and refining them where necessary. The Commission should also enforce laws and regulations in a commercially reasonable timeframe. Additionally, the federal government should identify ways to remove state-level barriers to entry so that municipalities can develop fiber networks when private providers are not.⁵⁹ Finally, the federal government should strengthen its efforts to enhance workforce training and education for fiber deployments. Because of the many all-fiber networks currently being deployed across the country, FBA members are finding that getting and retaining skilled personnel is among the biggest chokepoints in deployments, even though these are good jobs with a good career path. FBA members are taking the initiative to help fill the gap, and some have received support from other government and educational institutions, but any additional workforce-development support from the federal government will help.

Together, the Commission's gigabit symmetric benchmark, targeted support, and new policymaking focus will facilitate all-fiber deployments that will ensure the digital divide is being closed shut.

V. CONCLUSION

For the reasons above, FBA urges the Commission to create a gigabit symmetric benchmark for the Sixteenth Broadband Deployment Report so that the Commission measures whether advanced telecommunications capabilities delivered by all-fiber networks are being deployed in a reasonable and timely fashion.

⁵⁹ Over 20 states limit or prohibit entry by municipalities, often even where private providers offer substandard service. *See Muni Broadband is Roadblocked or Outlawed in 22 States*, BroadbandNow (May 13, 2020), <https://broadbandnow.com/report/municipal-broadband-roadblocks/>.

Respectfully Submitted,



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