

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC

In the Matter of)	
)	
Ensuring Customer Premises Equipment	)	PS Docket No. 14-174
Backup Power for Continuity of)	
Communications)	
)	
Technology Transitions	)	GN Docket No. 13-5
)	
Policies and Rules Governing Retirement Of	)	RM-11358
Copper Loops by Incumbent Local Exchange)	
Carriers)	
)	
Special Access for Price Cap Local Exchange	)	WC Docket No. 05-25
Carriers)	
)	
AT&T Corporation Petition for Rulemaking	)	RM-10593
to Reform Regulation of Incumbent Local)	
Exchange Carrier Rates for Interstate Special)	
Access Services)	
)	

**COMMENTS OF THE FIBER TO THE HOME COUNCIL AMERICAS ON THE
TECHNOLOGY TRANSITIONS NPRM**

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SUMMARY

The Fiber to the Home Council Americas (“FTTH Council” or the “Council”) respectfully submits these comments in response to the Federal Communications Commission’s (“FCC’s” or the “Commission’s”) Notice of Proposed Rulemaking (“NPRM”) in the Technology Transitions proceeding. The Council’s comments focus on two issues: the continuity of power for customer premises equipment (“CPE”) and notification of retirement of copper facilities for retail customers. In both instances, the FTTH Council submits the service providers and their vendors are behaving responsibly, providing sufficient customer notice and capabilities. Consequently, there is no need for the Commission to adopt new regulatory regimes.

First, the proposed battery backup regulations are not warranted because the market already provides multiple options for consumers to access emergency communications during a power outage, including through wireline and wireless service offerings. In addition, all-fiber network providers understand their obligation to ensure residential subscribers can access emergency communications during power outages. Fiber providers give subscribers notice that their voice service will not be powered during electrical power outages unless they have backup power. Virtually all providers install an uninterrupted power supply (“UPS”) device within or next to the optical network terminal (“ONT”) at the customer premises. Providers enable subscribers to monitor the power status of these batteries or do it themselves, and they either provide information about replacement of batteries or do it themselves. In discussions with providers and as indicated in the attached declarations, the Council has found no instance in which subscribers have objected to or complained about these practices. That is to be expected. Not only do all-fiber providers offer sufficient, reliable backup power, but consumers’ views on what are reasonable backup requirements and capabilities have evolved. Today, only

approximately 28% of residences take line-powered voice service, and that number continues to decline. Consumers instead have either elected to take voice service with UPS backup or use their mobile wireless service. Accordingly, there is no backup power problem that warrants the imposition of a new regulatory regime by the Commission, especially one that imposes costs inhibiting, or even possibly tipping the balance against, all-fiber deployments. Instead, the Commission should encourage, including by establishing best practices, providers to enable reliable backup power and monitor developments.

As for whether providers should give notice to residential consumers prior to replacing copper facilities with all-fiber networks, the Council submits this would impose a significant cost with no benefit. These regulations also are not technology neutral or competitively neutral. All-fiber networks are vastly superior to copper facilities in performance and reliability, and they provide reasonable backup power at the customer premises during outages. As a result, the base of copper subscribers has declined substantially and, as all-fiber deployments accelerate, this trend is certain to continue. Not only is copper “on its way out,” the NPRM contains no credible, systematic evidence that installing fiber produces any harm. Isolated instances where a consumer might prefer line-powered copper is no justification for inhibiting deployments that all agree are essential for our nation’s future. Thus, there is no sound rationale to impose additional costs of notice requirements on providers making these risky investments that policymakers, consumers, and communities so greatly desire.

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COMMENTS OF FIBER TO THE HOME COUNCIL AMERICAS ON THE TECHNOLOGY TRANSITIONS NPRM

The Fiber to the Home Council Americas (“FTTH Council” or the “Council”) respectfully submits these comments in response to the Federal Communications Commission’s (“Commission’s”) Notice of Proposed Rulemaking (“NPRM”) in the Technology Transitions proceeding.¹ The FTTH Council’s mission is to accelerate deployment of all-fiber access networks (including fiber to the home (“FTTH”)) by demonstrating how fiber-enabled

¹ See *In the Matter of Ensuring Customer Premises Equipment Backup Power for Continuity of Communications*, PS Docket No. 14-174, *Technology Transitions*, GN Docket No. 13-5, *Policies and Rules Governing Retirement of Copper Loops by Incumbent Local Exchange Carriers*, RM-11358, *Special Access for Price Cap Local Exchange Carriers*, WC Docket No. 05-25, *AT&T Corporation Petition for Rulemaking to Reform Regulation of Incumbent Local Exchange Carrier Rates for Internet Special Access*, RM-10593, Notice of Proposed Rulemaking and Declaratory Ruling, FCC 14-185 (rel. Nov. 25, 2014) (“Technology Transitions NPRM”).

applications and solutions create value for service providers and their customers, promote economic development, and enhance quality of life. The FTTH Council's members represent all areas of the broadband access industry, including telecommunications, computing, networking, system integration, engineering, and content-provider companies, as well as traditional service providers, utilities, and municipalities. The FTTH Council has more than 300 entities as members.² Because of its members' experience and expertise in deploying and operating FTTH networks, the Council has a great interest in this proceeding. Its comments focus on two issues: continuity of power for customer premises equipment and notification of retirement of copper facilities for retail customers. In both instances, the FTTH Council submits the service providers and their vendors are behaving responsibly, providing sufficient customer notice and capabilities, and, consequently, there is no need for the Commission to adopt new regulatory regimes.

I. INTRODUCTION AND SUMMARY

For more than a decade, there has been a consensus among policymakers, wireline providers, consumers, and communities to drive the deployment of all-fiber infrastructure throughout the country. Because of their virtually unlimited performance capabilities and reliability, all-fiber networks provide the kind of frictionless environment that propels access to and production of a vast world of content, including by enabling consumers to instantly exchange valuable health, education, and social information and engage fully in civic activities. It thus is no surprise that our nation's leaders—from President Obama to a series of FCC

² A complete list of FTTH Council members can be found on the organization's website: <http://www.ftthcouncil.org>.

Chairmen and Commissioners, to Members of Congress—have all endorsed expedited deployment of all-fiber networks.³

Of course, all-fiber network deployment involves significant risk, particularly in less dense areas. The upfront investment is substantial, and all-fiber providers must compete with established wireline, and even wireless, providers. The Commission recognized this reality in the *Triennial Review Order* and decided not to mandate the unbundling of FTTH facilities by incumbent local exchange carriers (“LECs”).⁴ It later facilitated deployment of all-fiber networks in a number of ways, including by lowering barriers to local video franchising and most recently by establishing the Rural Broadband Experiments program, providing billions of dollars to support fiber connectivity.⁵ Congress too has facilitated deployment of all-fiber

³ See Barack Obama, President of the United States, Remarks by the President on Promoting Community Broadband at Cedar Falls, Iowa (Jan. 14, 2015) (“President’s Cedar Falls Speech”); see *In the Matter of Technology Transitions*, GN Docket No. 13-5, *AT&T Petition to Launch a Proceeding Concerning the TDM-to-IP Transition*, GN Docket No. 12-353, *Connect America Fund*, WC Docket No. 10-90, *Structure and Practices of the Video Relay Service Program*, CG Docket No. 10-51, *Telecommunications Relay Services And Speech-to-Speech Services for Individuals with Hearing and Speech Disabilities*, CG Docket No. 03-123, *Numbering Policies for Modern Communications*, WC Docket No. 13-97, Order, Report and Order and Further Notice of Proposed Rulemaking, Report and Order, Order and Further Notice of Proposed Rulemaking, Proposal for Ongoing Data Initiative, FCC 14-5 (rel. Jan. 31, 2014), Statement of Chairman Thomas E. Wheeler at 104 (“Technology Transitions Order”); see American Recovery and Reinvestment Act of 2009 (“Recovery Act”), Pub. L. No. 111-5, 123 Stat. 115.

⁴ See *In the Matter of Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers, Implementation of the Local Competition Provisions of the Telecommunications Act of 1996, Deployment of Wireline Services Offering Advanced Telecommunications Capability*, CC Docket Nos. 01-338, 96-98, 98-147, Report and Order and Order on Remand and Further Notice of Proposed Rulemaking, FCC 03-36 (rel. Aug. 21, 2003) (“Triennial Review Order”).

⁵ See *In the Matter of Connect America Fund, ETC Annual Reports and Certifications*, WC Docket No. 10-90, 14-58, Report and Order and Further Notice of Proposed Rulemaking, FCC 14-98 (rel. July 14, 2014) (“Rural Broadband Experiments”).

networks, especially in rural areas, through the Broadband Stimulus⁶ and traditional Rural Utilities Service programs.⁷

Building on this base of government commitment to all-fiber networks, communities are now in a race to either get private sector providers to deploy them or construct these networks themselves. Communities recognize this infrastructure is critical for their future, and no one wants to be the last to get it. All-fiber networks not only are essential for community development, they also lie at the foundation of the content industry's future. With frictionless transport, all-fiber networks enable the production and exchange of enormous amounts of content. That is why high-tech firms, such as Google, are directly deploying them or indirectly encouraging their deployment.⁸

In regard to issues raised in the NPRM, first, all-fiber network providers understand their obligation to ensure residential subscribers can access emergency communications, including during power outages. They provide subscribers with notice that their voice service will not be powered during electrical power outages unless they have backup power for customer premises equipment ("CPE"). Virtually all providers install an uninterrupted power supply ("UPS") device either within or next to the optical network terminal ("ONT") at the customer premises. Providers enable subscribers to monitor the power status of these batteries or do it themselves, and they provide information about replacement of batteries or do it themselves. In discussions with providers and as indicated in the attached declarations, the Council has found no instance in which subscribers have objected to or complained about these practices. That is to be expected.

⁶ See generally Recovery Act, sec. 6001, 123 Stat. at 512.

⁷ See *id.*; see also Broadband Initiatives Program ("BIP"), 74 Fed. Reg. 33,104 (July 9, 2009).

⁸ See Google Fiber, *All Current Cities* (last accessed Feb. 2, 2015), available at <https://fiber.google.com/cities/>.

Not only do all-fiber providers offer sufficient, reliable backup power, but consumers' views on what are reasonable backup requirements and capabilities have evolved. Today, approximately 28% of residences take line-powered voice service, and that number continues to decline.⁹ Consumers instead have either elected to take voice service with UPS backup or use their mobile wireless service. Accordingly, there is no backup power problem that warrants the imposition of a new regulatory regime by the Commission, especially one that imposes costs inhibiting, or even possibly tipping the balance against, all-fiber deployments. Instead, the Commission should encourage, including by establishing best practices, providers to enable reliable backup power and monitor developments.

As for whether providers should give notice to residential consumers prior to replacing copper facilities with all-fiber networks, the Council submits this would impose a significant cost with no benefit. These regulations also are not technology neutral or competitively neutral. As discussed above, all-fiber networks are vastly superior to copper facilities in performance and reliability, and they provide reasonable backup power at the customer premises during outages. As a result, the base of copper subscribers has declined substantially and, as all-fiber deployments accelerate, this trend is certain to continue. Not only is copper "on its way out," the NPRM contains no credible, systematic evidence that installing fiber produces any harm. Isolated instances where a consumer might prefer line-power copper is no justification for

⁹ According to the Centers for Disease Control, 44% of Americans "cut the cord" and are wireless-only households. See Stephen J. Blumberg, Julian V. Luke, *Wireless Substitution: Early Release of Estimates From the National Health Interview Survey, January – June 2014* (last accessed Feb. 2, 2015), available at <http://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless201412.pdf>. Of the 56% of Americans that currently have a wireline home phone, only half of them (or 28%) receive service through switched access (presumably copper) service. The remaining 28% are VoIP subscribers. See Industry Analysis and Technology Division, Wireline Competition Bureau, *Local Telephone Competition: Status of December 31, 2013* (Oct. 2014), available at https://apps.fcc.gov/edocs_public/attachmatch/DOC-329975A1.pdf.

inhibiting deployments that all agree are essential for our nation's future. Thus, there is no sound rationale to impose additional costs of notice requirements on providers making these risky investments that policymakers, consumers, and communities so greatly desire.

II. ALL-FIBER NETWORKS PROVIDE SUPERIOR PERFORMANCE CAPABILITIES AND RELIABILITY

Underlying and driving the ongoing transition from TDM to IP-based networks is the fact that all-fiber networks provide far superior performance capabilities and are more reliable than copper-based networks.¹⁰ Fiber networks provide bandwidth that is orders of magnitude greater than what is currently possible with copper-based networks. Perhaps more importantly, fiber networks are capable of scaling to even greater speeds simply by upgrading equipment.¹¹

Not only do all-fiber networks provide superior performance capabilities, but there is overwhelming evidence that fiber networks are “more reliable than any other communications medium” currently available.¹² Unlike copper, which is prone to corrosion, all-fiber networks are impervious to flooding.¹³ Moreover, all-fiber networks are “all-passive,” meaning there is no

¹⁰ See Technology Transitions Order, Statement of Chairman Thomas E. Wheeler at 104 (“Our communications are rapidly transitioning to IP-networks – and that’s a good thing. The move from the circuit-switched networks of Alexander Graham Bell to the new networks of the Internet Revolution is all around us – with expanded deployment of fiber, with new forms of wireless, with bonded copper and coaxial cable. These transitions – plural – are a good thing because IP networks are more efficient, which can enable better products, lower prices, and massive benefits for consumers.”).

¹¹ See *The Superior Performance and Technical Characteristics of Fiber to the Home Networks*, FTTH Council at 11 (Jan. 29, 2015), available at <http://www.ftthcouncil.org> (“Superiority of Fiber White Paper”); see also *Modernizing the E-rate Program for Schools and Libraries*, WC Docket No. 13-84, Report and Order and Further Notice of Proposed Rulemaking, ¶ 4 (rel. July 23, 2014) (“In most cases, a 1 Gbps fiber connection can be readily scaled to a 10 Gbps with upgraded networking equipment.”).

¹² See Superiority of Fiber White Paper at 13.

¹³ *Id.* For example, in Illinois, a field technician reportedly found a FTTH splice box that was filled with water. The technician only encountered the water-logged box because he was sent to install a new service. The fiber provider did not receive a single outage-complaint and it appears that the flooded splice box did not impact any of the fiber services provided. See *id.*

live power needed in the field.¹⁴ This makes fiber networks less prone to outages and increases the likelihood that consumers will maintain power during inclement weather.¹⁵ Industry reports show that FTTH networks have maintained power and connectivity through storms, traffic accidents, and power outages when traditional copper cabling systems have failed.¹⁶ Moreover, since fiber networks do not conduct electricity, houses and businesses wired with fiber are less likely to experience power surges or suffer damage by lightning than if they were wired with copper.¹⁷

Additionally, all-fiber optic networks have a longer usable life than copper networks. In contrast to copper lines, fiber-optic cables that were installed nearly 35 years ago continue to operate just as well today as they did when they were first put into service.¹⁸ Conversely, copper networks in use for roughly the same amount of time are degrading, further reducing the quality and reliability of service.¹⁹

Recognizing the benefits of all-fiber networks over copper networks, consumers are clamoring for an upgrade.²⁰ In other words, the benefits of all fiber are so great that they dwarf any potential benefits of line-powered copper.²¹ In fact, some consumers have even offered to

¹⁴ *See id.* at 5.

¹⁵ *See id.* at 14.

¹⁶ *See id.* at 13.

¹⁷ *See id.* at 14. Even during power outages, consumers do not see much value in line-powered copper services as copper's performance capabilities are far too limited for those consumers' needs. *See* Declaration of Alan Jones, C Spire, PS Docket No. 14-174, GN Docket No. 13-5, RM-11358, WC Docket No. 05-25, RM-10593, ¶ 7 (Jan. 28, 2015) ("Jones Decl.").

¹⁸ *See* Superiority of Fiber White Paper at 13.

¹⁹ *See id.* at 7.

²⁰ *See e.g.* Declaration of George O'Neal, GVTC Communications, PS Docket No. 14-174, GN Docket No. 13-5, RM-11358, WC Docket No. 05-25, RM-10593, ¶ 9 (Feb. 2, 2015) ("O'Neal Decl.").

²¹ *See* Jones Decl., ¶ 7.

pay directly for the cost of bringing fiber to their communities.²² Service providers are starting to meet this demand, and today, nearly 22.7 million households are actively marketed with all-fiber services and more fiber is slated to be built.²³ As the NPRM notes, AT&T and CenturyLink have announced plans to explore and implement all-fiber networks in cities across the country.²⁴ Most recently, Google reported that it will expand its gigabit fiber service to Atlanta, Georgia; Nashville, Tennessee; Charlotte, North Carolina; and Raleigh and Durham, North Carolina.²⁵ Google already offers its gigabit service in Provo, Utah; Kansas City, Missouri and Kansas; and Austin, Texas; and the company is reportedly in talks to bring fiber to five additional cities.²⁶ Where service providers are not stepping up to meet community demand, communities and local electric cooperatives have built fiber networks themselves. More than one hundred municipalities and electric cooperatives have already started to deploy all-fiber networks for their citizens.²⁷ Communities in Kentucky,²⁸ Louisiana,²⁹ Massachusetts,³⁰

²² See O’Neal Decl., ¶ 9.

²³ See *FTTH Progress and Impact, Understanding the FTTH Landscape to Enable Better Business Decisions*, presentation by Michael Render at the FTTH 2014 Conference & Expo, at 16-17 (June 23, 2014), available at <http://www.ftthcouncil.org> (“FTTH Progress and Impact”).

²⁴ See Technology Transitions NPRM, ¶¶ 15, 18. Cox has also announced that it will offer gigabit speeds by 2016, starting with networks in Phoenix, Las Vegas, and Omaha. See Press Release, *Cox Communications Kicks Off Plan to Offer Residential Gigabit Speeds: Phoenix, Las Vegas, Omaha Chosen As First Markets* (May 22, 2014), available at <http://cox.mediaroom.com/index.php?item=753>.

²⁵ Brian Fung, *These Four Lucky Cities Are Now Officially Getting Google Fiber*, The Washington Post (Jan. 27, 2015), <http://www.washingtonpost.com/blogs/the-switch/wp/2015/01/27/these-four-lucky-cities-are-now-officially-getting-google-fiber/>; see also Google Fiber, *All Current Cities* available at <https://fiber.google.com/cities/>.

²⁶ *Id.*

²⁷ For a list of municipal and electric cooperative all-fiber deployments, see Coalition for Local Internet Choice, <http://www.bbpmag.com/search.php?s0=1&cols=-co-st-an-se-ty-mu-sup-a&st=&ve=&gr=&te=&se=&ty=-munpprele&qco=&qme=&qan=&qus=0&qmu=&qsu=&qpa=&qin=0>.

²⁸ See Lisa Gonzalez, *High Speed in the Blue Grass State: Russellville’s Gig*, Community Broadband Networks (Jan. 23, 2014), <http://muninetworks.org/content/high-speed-blue-grass-state-russellvilles-gig>.

Tennessee,³¹ and Virginia³² each have made significant investments to bring an all-fiber network to their front doors and have (or will soon) reap the benefits of fiber connectivity.

Most recently, President Obama underscored the importance of ubiquitous fiber deployment, noting that high-speed broadband is no longer considered a luxury, but rather a necessity.³³ These networks, he remarked, are used to help entrepreneurs and small businesses compete on a global scale, provide students access to online learning, and allow workers to find employment opportunities.³⁴

III. USE OF TRADITIONAL TELEPHONE COPPER NETWORKS HAS BEEN DECLINING FOR 15 YEARS AND WILL CONTINUE

As demand for all-fiber networks continues to rise, demand for and use of traditional telephone copper networks has been steadily declining for nearly a decade, and it will only continue to do so. Since cable operators, FTTH overbuilders, and mobile providers entered the market, the vast majority of consumers have opted for voice services from non-line-powered

²⁹ See Carol Wilson, *FTTH Deployments Face Predatory Cable Pricing*, Connected Planet (Sept. 28, 2009), <http://connectedplanetonline.com/independent/news/ftth-deployments-face-pricing-0928/>.

³⁰ See Debra Scherban, *Crocker Communications to Provide Internet Service for Leverett's Own Broadband Network*, Gazettenet.com (Sept. 2, 2014), <http://www.gazettenet.com/home/13387776-95/crocker-communications-to-provide-internet-service-for-leveretts-own-broadband-network>.

³¹ See Sandy Teger and Dave Waks, *Putting Jackson, Tennessee on the Fiber Map*, The Broadband Home (May 31, 2004), http://www.broadbandhomecentral.com/report/backissues/Report0405_7.html.

³² See BVU Authority, About Us, http://www.bvuoptinet.com/templates/default.php?url=about_us_history&turl=inside_3col_std_template.htm (last viewed Aug. 28, 2014).

³³ See President's Cedar Falls Speech.

³⁴ See *id.* During the President's speech, he said, "This is about helping local businesses grow and prosper and compete in a global economy. It's about giving the entrepreneur, the small businessperson on Main Street a chance to compete with the folks out in Silicon Valley, or across the globe. It's about helping a student access the online courses and employment opportunities that can help her pursue her dreams."

wireline providers or mobile wireless providers, instead of from traditional copper networks.³⁵

In fact, this past year, more Americans than ever “cut the cord” from wireline telephone service, opting to rely on wireless service alone.³⁶ For example, in Mississippi and Idaho, nearly 50% of consumers have cut the cord.³⁷

In fact, less than 28% of wireline voice services are currently offered via line-powered copper.³⁸ Voice over Internet Protocol (“VoIP”) products (e.g. cable, FTTH, and nomadic VoIP) make up approximately 28% of the wireline market, while 44% of consumers “rely exclusively on wireless service.”³⁹ Vulnerable populations like senior citizens and low-income households are also going “wireless first” at an increasingly rapid rate.⁴⁰ Nationwide, wireless penetration is above 100%.⁴¹

In response to the decrease in consumer demand for traditional telephone service via copper network, incumbent LECs are increasing their transition to next-generation fiber networks. Since January, the FCC has posted over twenty public notices for incumbent LEC-proposed copper retirements, and it expects that number will continue to rise in both frequency

³⁵ Declaration of Ben Lovins, Jackson Energy Authority, PS Docket No. 14-174, GN Docket No. 13-5, RM-11358, WC Docket No. 05-25, RM-10593, ¶ 7 (Feb. 2, 2015) (“Lovins Decl.”).

³⁶ See Drew Desilver, *CDC: Two of Every Five U.S. Households Have Only Wireless Phones* Pew Research Center: Fact Tank (July 8, 2014), <http://www.pewresearch.org/fact-tank/2014/07/08/two-of-every-five-u-s-households-have-only-wireless-phones/> (“Pew Fact Tank”).

³⁷ See Jones Decl., ¶ 7; see also Pew Fact Tank (“An analysis last year of first-half 2013 data found that Idaho had the highest percentage of wireless-only households – 52.3%”).

³⁸ See *supra* note 9.

³⁹ See *id.*

⁴⁰ See Pew Fact Tank (stating that 56% of “poor” households and 46% of “nearly poor” households have wireless phones but no landline.).

⁴¹ See CTIA, *CTIA Wireless Quick Facts*, available at <http://www.ctia.org/your-wireless-life/how-wireless-works/wireless-quick-facts> (“Wireless penetration in the U.S. now exceeds 104%, and 97% of consumers may choose from at least three carriers.”).

and geographic scope.⁴² As the NPRM states, a number of incumbent LECs are steadily transitioning wire centers from copper facilities to fiber and all-IP networks.⁴³ Verizon has already transitioned two wire centers from copper to fiber and anticipates transitioning six more.⁴⁴ AT&T is also increasing its fiber networks and announced that it will expand its U-verse network with FTTH “GigaPower” in 100 cities.⁴⁵ Though AT&T will continue to maintain some of its copper loops and/or subloops, it has said that, “as that [copper to fiber] migration continues and accelerates . . . ILECs must be free to superintend their networks and to retire network elements that have been rendered anachronistic, that no longer perform optimally, or that are unduly costly to maintain.”⁴⁶ In the *Technology Transitions Order*, the Commission has even acknowledged this “ongoing technological evolution of wired infrastructure (*e.g.*, copper-to-fiber).”⁴⁷ This transition will continue. Indeed, the Commission has recognized the permanence of this transition.⁴⁸

⁴² See Technology Transitions NPRM, ¶ 17.

⁴³ See *id.*

⁴⁴ See *id.*

⁴⁵ See *id.*, ¶ 18.

⁴⁶ *Id.*

⁴⁷ *Technology Transitions, AT&T Petition to Launch a Proceeding Concerning the TDM-to-IP Transition, Connect America Fund, Structure and Practices of the Video Relay Service Program, Telecommunications Relay Services And Speech-to-Speech Services for Individuals with Hearing and Speech Disabilities, Numbering Policies for Modern Communications*, GN Docket No. 13-5, GN Docket No. 12-353, WC Docket No. 10-90, CG Docket No. 10-51, CG Docket no. 03-123, WC Docket No. 13-97, Order, Report and Order and Further Notice of Proposed Rulemaking, Report and Order, Order and Further Notice of Proposed Rulemaking, Proposal for Ongoing Data Initiative, FCC 14-5, fn. 52 (rel. Jan. 31, 2014).

⁴⁸ See Technology Transitions NPRM, ¶ 7.

IV. THE COMMISSION SHOULD CONTINUE, IF NOT ACCELERATE, EFFORTS TO FACILITATE AND ENCOURAGE ALL-FIBER DEPLOYMENTS

Recognizing the value of all-fiber networks, the FCC has implemented a number of programs that facilitate fiber deployment throughout the country. Beginning with the *Triennial Review Order*, the Commission eliminated most unbundling requirements for broadband services, “making it easier for companies to invest in new equipment and deploy high-speed services that consumers desire.”⁴⁹ The Commission further explained that it was establishing a “regulatory foundation that seeks to ensure that investment in telecommunications infrastructure will generate substantial, long-term benefits for all consumers.”⁵⁰ As a result of the lower barriers to entry imposed by the *Triennial Review Order*, FTTH deployment increased 5,300%.⁵¹

Next, in 2007, the Commission lowered the barriers to entry for local video franchising to avoid hindering fiber deployment. The Commission concluded that competitive entrants in the video market were deploying “new fiber-based facilities” and that a new entrant’s video offerings would directly affect its roll-out of new broadband services.⁵² Accordingly, the Commission adopted limits on local franchising authorities’ abilities to impose requirements on competitive franchise applications to encourage new entrants.⁵³

⁴⁹ *Triennial Review Order*, ¶ 4.

⁵⁰ *Id.*, ¶ 5.

⁵¹ *See In the Matter of Implementation of Section 621(a)(1) of the Cable Communications Policy Act of 1984 as Amended by the Cable Television Consumer Protection and Competition Act of 1992*, MB Docket No. 05-311, Report and Order and Further Notice of Proposed Rulemaking, FCC 06-180, fn. 148 (rel. Mar. 5, 2007) (“Video Franchising Order”).

⁵² *See id.*, ¶ 14; *see also* Statement of Chairman Kevin R. Martin (“Quite simply, the ability to sell video services over these fiber networks may be a crucial factor in getting those fiber networks deployed.”)

⁵³ *See Video Franchising Order*, ¶ 1.

A few years later, FCC Chairman Julius Genachowski announced the “Gigabit City Challenge,” calling for at least one gigabit community in all fifty states by 2015.⁵⁴ At the time, high-speed fiber connections were only available in 14 states.⁵⁵ Through the Gigabit City Challenge, these new high-speed fiber connections would spur innovation and incentivize investment in high-tech industries.⁵⁶

Then, in 2014, the Commission adopted the *Rural Broadband Experiments Order*, which was designed to further support the deployment of all-fiber networks.⁵⁷ By allocating \$100 million for the construction of voice and broadband-capable networks, the Commission incentivized providers to build out their infrastructure in rural, high-cost areas and those areas that are extremely difficult to serve.⁵⁸ By November 2014, the Commission received 600 separate bids representing nearly \$885 million worth of projects.⁵⁹

Congress has also taken an active role in facilitating the deployment of all-fiber networks, particularly in rural areas where connectivity is needed the most. As part of the American Recovery and Reinvestment Act of 2009 (“Recovery Act”), Congress appropriated nearly \$7.2 billion to the National Telecommunications and Information Administration (“NTIA”) and the

⁵⁴ See *FCC Chairman Genachowski Issues Gigabit City Challenge To Providers, Local, and State Governments To Bring At Least One Ultra-Fast Gigabit Internet Community To Every State In U.S. by 2015*, News (rel. Jan. 18, 2013).

⁵⁵ *Id.*

⁵⁶ *Id.*

⁵⁷ See *Rural Broadband Experiments*, ¶¶ 1, 6.

⁵⁸ *Id.*, ¶ 5.

⁵⁹ See *Rural Broadband Experiments Draw Interest From Almost 200 Applicants*, News (rel. Nov. 12, 2014).

Department of Agriculture’s Rural Utilities Service (“RUS”) for the Broadband Technology Opportunities Program (“BTOP”) and the Broadband Initiatives Program (“BIP”).⁶⁰

Through BTOP, America added or improved more than 110,000 miles of broadband infrastructure and brought high-speed internet connectivity to nearly 20,000 community institutions.⁶¹ Moreover, fiber networks funded through the BTOP brought connectivity to schools, libraries, hospitals, and public safety facilities.⁶² This new broadband infrastructure is predicted to raise the economy’s potential output for years to come.⁶³ Through the BIP, providers have deployed 62,307 miles of fiber, which is estimated to bring new or improved broadband access to 728,733 consumers within five years.⁶⁴

These efforts to promote the deployment of all-fiber networks demonstrate that these networks are an essential part of our nation’s future. Therefore, the Commission should continue, if not accelerate, its efforts to facilitate and encourage all-fiber deployments.

V. BECAUSE ALL-FIBER DEPLOYMENTS HAVE SIGNIFICANT RISK, THE COMMISSION SHOULD NOT IMPOSE NEW REGULATORY OBLIGATIONS UNLESS WARRANTED BY IDENTIFIABLE AND SIGNIFICANT PROBLEMS

The Commission should not impose regulations on the industry unless there is a market failure or some other compelling, evidence-based reason to do so. Further, there are costs to

⁶⁰ See Recovery Act; see also BTOP, 74 Fed. Reg. 33,104 (July 9, 2009) (stating “the Recovery Act provides RUS and NTIA with \$7.2 billion to expand access to broadband services in the United States.”).

⁶¹ Executive Office of the President, Council of Economic Advisors, *The Economic Impact of the American Recovery and Reinvestment Act Five Years Later*, Final Report to Congress at 41 (Feb. 2014), available at http://www.whitehouse.gov/sites/default/files/docs/cea_arra_report.pdf (“Economic Impact of the ARRA Report”).

⁶² See *id.*

⁶³ See *id.* at 33.

⁶⁴ See U.S. Department of Agriculture, *Rural Utilities Service Broadband Initiatives Program Quarterly Report* (last accessed Feb. 2, 2015), available at http://www.rurdev.usda.gov/Reports/RUS_BIPStatus_Report_Q3_2014.pdf.

regulation, including undermining investment in broadband infrastructure. Therefore, the Commission should not impose the NPRM's proposed requirements for battery backup and retail customer notification of copper retirement.

The Commission has long recognized the significant risks and costs associated with deploying all-fiber networks. In the 2003 *Triennial Review Order*, the Commission explained that last-mile fiber network deployments require large upfront fixed and sunk costs.⁶⁵ The most significant of these costs results from laying fiber in the ground, and these “[s]unk costs increase risk as well as an entrant’s cost of failure, which in turn can increase the cost of capital and discourage entry.”⁶⁶ As a result, and as explained above in Section IV, the Commission has sought to lower barriers to entry and investment for FTTH providers, for example, by declining to require unbundling of fiber loops and by facilitating video franchising. This approach has worked, spurring FTTH deployment and the resulting economic growth. Despite the growth in fiber network investments, they remain risky, especially in less dense rural areas.⁶⁷

Service providers recognize the significant risks associated with deploying all-fiber networks and perform complex cost-benefit analyses to determine whether to deploy. For example, fiber provider GVTC utilizes an eleven-factor rubric to determine whether it is financially viable to convert a copper network to FTTH, taking into consideration issues such as projected penetration rates and the state of the existing copper facilities.⁶⁸ Consequently, the

⁶⁵ See *Triennial Review Order*, ¶¶ 205-06, 274 (finding that “the costs of FTTH loops are both fixed and sunk, and deployment is expensive.”).

⁶⁶ See *id.*, ¶ 88.

⁶⁷ See *id.*, ¶ 205. In the *Rural Broadband Experiments*, the Commission recognized that rural builds are risky bets based on their significant upfront costs. See *Rural Broadband Experiments Order*, ¶ 71.

⁶⁸ See O’Neal Decl., ¶ 7.

addition of a new regulatory regime will deter fiber investment in those communities and, where they raise costs for consumers, will impede broadband adoption where providers do build.

In the NPRM, the Commission proposes to impose new backup power and copper retirement notification regimes on providers of all-fiber networks.⁶⁹ These new requirements would add significant additional costs—and risk—to FTTH providers’ deployment calculus, tipping the balance against additional investment. And yet, these proposed obligations do not reflect identifiable problems that providers or their customers have witnessed. For instance, since it first began deploying all-fiber networks in Mississippi, FTTH provider C Spire has not received any inquiries or complaints from consumers about its battery backup practices or copper retirement process.⁷⁰ Similarly, JEA (a provider in Jackson, Tennessee) has not received any complaints about its battery backup practices, and has found that “subscribers are not concerned about moving from line-power copper loops to FTTH infrastructure with battery backup for their voice service.”⁷¹ GVTC also has not received complaints about its battery backup practices or its replacement of line-powered copper with FTTH infrastructure.⁷² These providers are not outliers, but rather reflect consumers’ choice to adopt next-generation broadband, notwithstanding its need for battery backup to function during power outages.

For these reasons, the Commission should not impose new regulations unless they are warranted by evidence identifying a market failure or significant problems related to battery backup or copper retirement notifications. Indeed, absent such a pressing need, these regulations

⁶⁹ See Technology Transitions NPRM, ¶¶ 31-48, 60-76.

⁷⁰ See Jones Decl., ¶¶ 7, 12.

⁷¹ See Lovins Decl., ¶¶ 14, 15.

⁷² See O’Neal Decl., ¶¶ 9, 11.

threaten to tip the balance against additional fiber deployment and would unnecessarily delay the enormous benefits that all-fiber networks bring to communities where they are available.

VI. ALL-FIBER PROVIDERS HAVE ACTED RESPONSIBLY TO PROVIDE BACKUP POWER; NO NEW REGULATIONS ARE WARRANTED

In the NPRM, the Commission seeks comment on the costs and benefits of imposing battery backup power requirements on non-line-powered, fixed-voice service providers.⁷³ Under the Commission’s proposal, providers of facilities-based fixed voice services that are not line-powered by the provider would be required to assume responsibility for provisioning backup power with the capability to power their customers’ CPE during the first eight hours of an outage.⁷⁴ Further, providers would be required to provide sufficient power for “minimally essential communications,”—i.e., making 911 calls and receiving emergency alerts and warnings.⁷⁵

As explained herein, the Council submits that the Commission’s proposed backup power regulations ignore (1) the dramatic changes in the market for voice services; (2) the responsible behavior of providers in giving consumers notice and enabling use of or access to backup power; and (3) the significant costs—with negligible benefits—that the proposed regulations will impose. For these reasons, no new requirements for battery backup are warranted. Instead, the Commission should encourage the continued development of industry best practices that provide consumers with adequate notice and choice about backup power options.

First, the proposed regulations are not warranted because the market currently provides adequate emergency communications solutions for consumers. As explained in Section III

⁷³ See Technology Transitions NPRM, ¶ 42.

⁷⁴ See *id.*, ¶ 35. After the first eight hours, the “burden” of providing such backup power would fall to the consumer. See *id.*, ¶ 38.

⁷⁵ See *id.*, ¶ 34.

above, the market for voice services has changed dramatically in the last few years. Forty-four percent of Americans have “cut the cord” on POTS service and rely exclusively on wireless service for their voice communications needs.⁷⁶ Those consumers who subscribe to fixed voice services generally also have a wireless voice solution to connect to 911 during an emergency or power outage. As Americans continue to adopt mobile phones as their primary voice communication tool, the availability of wireless devices for emergency communications will only increase.

Given this evolving market, the NPRM appears to address the wrong issue. The issue is not, as the Commission would have it, how to ensure that providers of fixed voice services meet a pre-established standard for backup power. Rather, the issue is how to ensure that consumers have adequate access to emergency communications during outages, regardless of the underlying technology. Viewed in this way, the Commission’s proposed backup power regulations miss the mark. The NPRM simultaneously imposes unnecessary regulations on responsible actors in one segment of the market, while failing to capture competing technologies (*e.g.*, wireless voice) that are not contemplated by the rules and already provide an emergency communications lifeline for consumers. In other words, the proposal ignores the tremendous diversity in the market for emerging communications technologies and therefore poses the wrong problem and pursues a solution where the costs outweigh the benefits.

Second, the proposed regulations are not warranted because all-fiber network providers take seriously their obligation to ensure residential subscribers can access emergency communications, including during power outages.⁷⁷ FTTH providers notify subscribers that their

⁷⁶ See Drew Desilver, *CDC: Two of Every Five U.S. Households Have Only Wireless Phones* (July 8, 2014), <http://www.pewresearch.org/fact-tank/2014/07/08/two-of-every-five-u-s-households-have-only-wireless-phones/>.

⁷⁷ See Lovins Decl., ¶ 6.

voice service will require backup power to operate during an electric power outage.⁷⁸ Moreover, virtually all FTTH providers also install a UPS device either within or adjacent to the ONT. UPS devices generally provide eight hours of standby time, with as many as two hours of talk time.⁷⁹ Further, providers will monitor battery status or enable their subscribers to monitor the power status of these batteries themselves, and will provide customers with information about how to replace their batteries or perform the replacements for their customers. For example, while C Spire’s customers are responsible for monitoring and replacing their batteries, JEA remotely monitors its batteries and sends technicians to replace any battery with low or no power.⁸⁰

Third, industry efforts to notify consumers about battery backup availability have been effective, and there has been no evidence of consumer harm. In its discussions with its members, the FTTH Council has not found a single instance in which customers have complained about or objected to a FTTH provider’s backup power practices.⁸¹ The Council also has found that subscribers are unconcerned about switching from line-powered copper loops to FTTH infrastructure with battery backup for their voice service.⁸² For these reasons, it is not surprising that the NPRM fails to identify any case in which a FTTH provider’s backup power practices, or

⁷⁸ See Jones Decl., ¶ 11; *see also* Lovins Decl., ¶ 13.

⁷⁹ See Jones Decl., ¶ 9; Lovins Decl., ¶ 9; Declaration of David Russell, Calix, PS Docket No. 14-174, GN Docket No. 13-5, RM-11358, WC Docket No. 05-25, RM-10593, ¶ 5 (Jan. 30, 2015) (“Russell Decl.”).

⁸⁰ See Jones Decl., ¶ 10; Lovins Decl., ¶ 11. JEA also checks—and, if necessary, replaces—backup battery power as a routine part of customer service calls and upon subscriber request. *See* Lovins Decl., ¶ 11.

⁸¹ See Jones Decl., ¶¶ 7, 12; Lovins Decl., ¶¶ 14-15; O’Neal Decl., ¶¶ 9, 11.

⁸² See *e.g.* Lovins Decl., ¶ 14. Subscriber’s lack of concern is in part attributable to the near ubiquity of mobile phones, which consumers can use during power outages and which can be easily recharged in a number of ways, including in a person’s automobile. *See id.* For this reason, the Council echoes Commissioner Pai’s sentiment that, “now that most consumers have mobile phones, [we] doubt all of them will want to pay the cost of a new carrier-installed battery backup for their landline.” *See* Technology Transitions NPRM, Statement of Commissioner Ajit Pai at 71.

a FTTH subscriber's access to backup power, were insufficient.⁸³ In fact, the evidence suggests the opposite: subscribers continue to clamor for all-fiber networks even after being informed about backup power needs. Further, when given the choice, virtually all subscribers have not opted to retain line-powered copper over FTTH networks. Given the responsible behavior of FTTH providers and the lack of demonstrable harm, the Commission should not impose new regulations mandating battery backup power for fixed voice services.

Fourth, the Commission's regulations will impose a substantial cost on providers without any attendant benefit for consumers. As one example, JEA has indicated that if it were required to upgrade its existing battery backup units, it would increase costs by \$435 per premises, including costs associated with a new transformer, a higher voltage power ring, battery assembly, and labor costs.⁸⁴ Not only will such costs harm consumers, they will also delay deployment. GVTC has indicated that imposing additional regulations "will only delay" GVTC's efforts to deploy FTTH networks, particularly in rural areas.⁸⁵ In addition to harming both consumers and the business case for fiber deployment, the proposed backup power rules stand to undermine the very goals that the NPRM purports to address. Specifically, by imposing additional costs on providers of fixed voice services, the Commission will create further incentives for broadband providers to drop their voice offerings, driving more consumers to cut the cord and seek wireless solutions—which lack battery backup requirements—for their voice communications needs.

Instead of new regulations, the Commission should encourage the continued development of best practices to facilitate the availability of battery backup power notice and choice for consumers. For example, the Communications Security, Reliability, and Interoperability Council

⁸³ See generally, Technology Transitions NPRM, ¶¶ 11-13, 31-48.

⁸⁴ See Lovins Decl., ¶ 10.

⁸⁵ See O'Neal Decl., ¶ 13.

(“CSRIC”) IV, Working Group 10, has prepared two productive reports that address the issue of CPE backup power.⁸⁶ First, in June 2014, Working Group 10A released a report focused on consumer notifications for CPE backup power, including a series of recommendations for ways that service providers should educate consumers about backup power needs and capabilities.⁸⁷ Then, in September 2014, Working Group 10B released a report identifying nine common residential use cases and best practices for CPE backup power in each of the nine scenarios.⁸⁸ Importantly, neither of the working groups’ final reports recommended that the Commission establish new regulations to address battery backup provisioning and notification. And while the Working Group 10B report suggested “a more proactive approach by the FCC and industry” to address battery backup issues, it did not suggest that regulation was needed to achieve that goal.⁸⁹

For these reasons, the Commission should not impose its proposed regulations, which are unnecessary and would only serve to increase costs and even possibly tip the balance against all-fiber deployments. Instead, the Commission should encourage, including by establishing best practices, FTTH providers to enable reliable backup power and monitor developments in the market for backup power solutions.

⁸⁶ See CSRIC, Working Group 10A, CPE Powering – Consumer Outreach, Final Report – CPE Powering (June 2014), *available at* http://transition.fcc.gov/pshs/advisory/csric4/CSRIC_IV_WG--10A_Final-Report_061814.pdf (“CSRIC Working Group 10A Final Report”); CSRIC, Working Group 10B, CPE Powering – Best Practices, Final Report – CPE Powering (Sept. 2014), *available at* <http://transition.fcc.gov/pshs/advisory/csric4/CSRIC%20WG10%20CPE%20Powering%20Best%20Practices%20Final%20Draft%20v2%20082014.pdf> (“CSRIC Working Group 10B Final Report”).

⁸⁷ See generally CSRIC Working Group 10A Final Report.

⁸⁸ See generally CSRIC Working Group 10B Final Report; see also Russell Decl., ¶¶ 6-7.

⁸⁹ See CSRIC Working Group 10B Final Report at 19.

VII. ALL-FIBER PROVIDERS HAVE ACTED RESPONSIBLY TO NOTIFY CUSTOMERS WHEN CONVERTING COPPER TO ALL-FIBER FACILITIES; NO NEW REGULATIONS ARE WARRANTED

In the NPRM, the Commission also seeks comment on a proposal to update its rules requiring providers to notify customers of copper retirement.⁹⁰ Specifically, the Commission proposes to require providers to provide a litany of notifications before upgrading copper networks to fiber. Among other copper retirement obligations in the proposal, the Commission proposes to require incumbent LECs to provide direct notice of copper retirements to retail customers, specifying the form, content, and timing of the notice, and prohibiting upselling.⁹¹ In addition, it would expand the right to comment on copper retirement notifications to include members of the public.⁹² Lastly, the Commission proposes to require incumbent LECs to certify their compliance with the copper retirement rules.⁹³ As with the Commission's battery backup proposals, the Council submits that the Commission's proposals on copper retirement notifications to retail customers would impose significant costs with no benefit, and therefore are not warranted.

First, copper retirement notifications to retail customers are not warranted because providers have acted responsibly to notify customers before upgrading their networks from copper to fiber. For instance, prior to converting a customer to FTTH where the copper loop has deteriorated and needs replacement, GVTC will inform its customer about the need and receive approval to access the customer's premises.⁹⁴ In fact, because upgrades require GVTC to access a customer's property, the company must obtain customer consent before upgrading on-premises

⁹⁰ See Technology Transitions NPRM, ¶ 55.

⁹¹ See *id.*, ¶¶ 73, 82.

⁹² See *id.*, ¶ 77.

⁹³ See *id.*, ¶ 82.

⁹⁴ See O'Neal Decl., ¶ 8.

copper plant.⁹⁵ In addition, where all but a small number of customers have yet to convert from copper to FTTH in any area, GVTC informs the subscriber via certified letter.⁹⁶ GVTC has found that its customers approve of these conversion practices, and it has received no customer complaints.⁹⁷ Indeed, the opposite is true: customers have offered to pay GVTC to bring fiber to their communities.⁹⁸ As a result, the additional burdensome regulations that the Commission proposes are not necessary to provide retail customers with notice about copper retirement.

Second, copper retirement notifications to retail customers are not warranted because the vast majority of consumers recognize the superiority of fiber over copper in performance and reliability, including during power outages.⁹⁹ As described in Section II, because of their imperviousness to water and lightning, FTTH networks contain distinct advantages over copper wiring, which is conductive and provides a direct path to the home for surges induced by lightning. This does not happen with FTTH, because the fiber does not conduct electricity.¹⁰⁰ In fact, fiber optic cable manufacturers routinely receive reports from service provider customers of fiber cables surviving various events (*e.g.*, storms, traffic accidents, etc.).¹⁰¹ Second, consumer demand is shifting sharply away from copper facilities. For example, C Spire has stated that its “consumers do not see line-powered copper service as having much, if any, value, even during power outages.”¹⁰² Nationally, the base of copper subscribers has declined substantially: only

⁹⁵ *See id.*

⁹⁶ *See id.*

⁹⁷ *See id.*, ¶ 9.

⁹⁸ *See id.*

⁹⁹ *See FTTH Progress and Impact* at 44-47.

¹⁰⁰ *See Superiority of Fiber White Paper* at 5.

¹⁰¹ *See id.* at 13.

¹⁰² *See Jones Decl.*, ¶ 7.

28% of voice service lines are line-powered copper and that number is declining.¹⁰³ Moreover, as more providers deploy all-fiber networks to meet consumer demand, the trend away from copper facilities is certain to continue. In short, consumers are aware of the issues, and clamor for providers to upgrade to fiber. Consumers understand the enormous benefits of fiber service when compared to copper, and have sought such services in droves. As such, imposing broad notification provisions on a market that has moved beyond copper is unnecessary. The Commission’s proposed regulations, far from meeting consumer demand for fiber, would only serve to delay fiber deployment and the economic and social benefits that those networks enable.

Third, the NPRM contains no credible, systematic evidence that replacing copper with fiber produces any harm. As demonstrated above, copper networks are “on the way out.” Consequently, isolated instances where a consumer might prefer his or her line-powered copper is no justification for halting deployments that all—including the Commission—agree are essential for our nation’s future. Therefore, there is no need to impose the costs of additional, burdensome copper retirement notice requirements on providers, which have been making the capital-intensive investments that consumers demand, and that communities need for future competitiveness.

Fourth, these proposals would impose substantial costs on providers, both in terms of providing the required notice and delaying the transition to all-fiber networks in isolated cases. In the NPRM, the FCC proposes a staggering array of new notice requirements for retail customers that would impose an inordinate burden on providers seeking to replace outdated copper plant with fiber. For example, the notification procedures will exact a direct cost on

¹⁰³ See *supra* note 9.

providers, which would need to meet detailed delivery, form, content, and timing requirements.¹⁰⁴

With respect to delivery requirements, it requires providers to “directly provide notice through electronic or postal mail to all retail customers affected by the planned copper retirement.”¹⁰⁵ In so doing, a provider must either give the notice through postal mail—a direct cost to the provider—or, if obtaining notice through e-mail, then it must “obtain express, verifiable, prior approval from retail customers to send notices via e-mail regarding their service in general, or planned network changes in particular.”¹⁰⁶ The carrier must also allow a customer to reply directly to such e-mails, and must monitor undeliverable messages, and provide an alternative notice for customers with undeliverable e-mails.¹⁰⁷ These e-mails, while eschewing the direct costs of a postal mail notification, would impose perhaps even greater costs on providers, which would need to obtain consent, monitor outgoing emails, and potentially follow up with undeliverable messages via postal mail.

The NPRM also contains a number of detailed content requirements and restrictions for the notification messages.¹⁰⁸ Under proposed Section 51.332(c)(2), the notice must contain the existing network change notices under 47 C.F.R. § 51.327, in addition to new notifications that the consumer will be able to retain their service from the provider, unless that statement “would be inaccurate,” in which case the provider must describe the changes to the customer’s service.¹⁰⁹ Providers also would be required by the regulations to include specific language regarding public

¹⁰⁴ See Technology Transitions NPRM, Appendix A.

¹⁰⁵ See *id.*, § 51.332(b)(3).

¹⁰⁶ See *id.*, § 51.332(b)(3)(ii)(A).

¹⁰⁷ See *id.*, § 51.332(b)(3)(ii)(B)-(C).

¹⁰⁸ See Technology Transitions NPRM, ¶¶ 65-67.

¹⁰⁹ See Technology Transitions NPRM, Exhibit A, § 51.332(c)(2)(ii).

comment procedures, and would be prohibited from using the notices to “upsell” services.¹¹⁰ Together, these content requirements would impose unnecessary compliance and maintenance costs on providers, on the marginal chance of complaint from retail customers, almost all of whom welcome an upgrade from copper to fiber infrastructure. Finally, the Commission proposes to require providers to certify their compliance with the notification rules,¹¹¹ and to provide a period for public comment and response, adding further costs for providers that are already behaving responsibly.¹¹²

Fifth, the proposed copper retirement notices are not technology neutral. Specifically, these notices are targeted at the subset of wireline providers seeking to upgrade their infrastructure from outdated copper plant to all-fiber networks. In a competitive broadband market where consumers have a choice between fixed and mobile offerings, imposing dramatic new costs on wireline providers will unfairly tip the market for broadband services toward mobile services. As a consequence, the proposed rules will impose a significant burden on wireline access networks, without imposing any burdens on competing network types. For this reason, the proposed copper retirement notification requirements for retail customers should not be adopted.

For all of these reasons, the Commission’s proposal is unwarranted. Fiber is the network of choice for our modern communications needs, and fiber deployment is an important

¹¹⁰ While the Council opposes the Commission’s proposed copper retirement notices to retail customers, if the Commission ultimately requires such notices, it should allow service providers to explain the superiority of all-fiber networks. Accordingly, the Commission should not impose its proposed ban on “upselling.” *See* Technology Transitions NPRM, ¶¶ 71-76. Instead, the Commission should allow providers to describe the benefits of all-fiber networks and fiber-enabled technologies that could better serve their customers’ current and future needs.

¹¹¹ *See id.*, § 51.332(d).

¹¹² *See id.*, § 51.329(c).

Commission goal for our nation's future. At the same time, providers in the market have acted responsibly to notify retail customers prior to replacing copper plant with fiber, and have heard no complaints about the process. Imposing the proposed regulations would unduly increase costs for providers and their consumers, would delay fiber deployment, and would significantly harm our national objectives to promote next-generation networks and all of the benefits they bring.

VIII. CONCLUSION

FTTH providers have acted responsibly to notify consumers and provide choice with respect to the availability of battery backup power and the transition from copper to all-fiber networks. Imposing additional regulations would impose immense costs without redeeming benefit. Therefore, the Commission should not adopt the new regulations proposed in the NPRM and discussed herein.

Respectfully submitted,



FIBER TO THE HOME COUNCIL AMERICAS

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February 5, 2015

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of)	
)	
Ensuring Customer Premises Equipment Backup Power for Continuity of Communications	)	PS Docket No. 14-174
)	
Technology Transitions	)	GN Docket No. 13-5
)	
Policies and Rules Governing Retirement Of Copper Loops by Incumbent Local Exchange Carriers	)	RM-11358
)	
Special Access for Price Cap Local Exchange Carriers	)	WC Docket No. 05-25
)	
AT&T Corporation Petition for Rulemaking to Reform Regulation of Incumbent Local Exchange Carrier Rates for Interstate Special Access Services	)	RM-10593

DECLARATION OF ALAN JONES

1. My name is Alan Jones. I am Vice President, OSP Operations, for C Spire. My business address is 1018 Highland Colony Parkway, Ridgeland, MS 39157.

2. I have been in the communications industry for 18 years. Until recently, I was involved exclusively in various engineering capacities in the wireless industry. Today, I oversee all outside plant operations for C Spire, including its Fiber to the Home deployment.

3. C Spire is a member of the Fiber to the Home Council, and I submit this Declaration in support of the comments of the Fiber to the Home Council in the above-referenced proceedings.

4. C Spire, in business since 1988, is a telecommunications-based diverse technology company and the nation's largest privately held wireless communications provider.

Its primary service area is in the southeastern U.S., with headquarters in Ridgeland, MS, and it has nearly 1 million wireless subscribers. In addition to mobile services, C Spire offers a “Home Phone Replacement” fixed voice service. The service has standard calling features but does not support alarm systems, fax machines, or dial-up modems. C Spire supplies the customer premises device at no charge. The price for this service is \$20 per month with a two-year contract.

5. In 2014, C Spire began to deploy a fiber to the home (“FTTH”) “overbuild” network to several markets in Mississippi. It has turned up service in three communities and continues constructing plant in additional markets.

6. While there is variation from market to market, C Spire’s primary wireline competitors in its operational FTTH markets are AT&T, Comcast, and MetroCast. For video service, it also competes with direct broadcast satellite providers. As discussed above, C Spire provides fixed and mobile wireless voice service. In addition, there are other mobile wireless providers that offer voice service in C Spire’s FTTH markets.

7. As a provider of wireless and wireline communications services for many years, C Spire knows first-hand how consumers view the importance of accessing emergency communications and the ways they have chosen to do so. Put simply, in C Spire’s experience, consumers do not see line-powered copper service as having much, if any, value, even during power outages. In Mississippi today, nearly 50 percent of households have “cut the cord” and use their wireless device exclusively for voice service. For wireline networks, because of its superior performance capabilities and high reliability, fiber is the physical medium of choice, and providers are deploying it as rapidly as possible. Today, most consumers view their wireless device as sufficient to use during power outages, especially since it can be easily recharged in

their cars. Additionally, they see battery backup power for wireline service as sufficiently robust since most outages are brief in duration.

8. C Spire believes wireline network operators should provide subscribers with reasonable access to emergency communications services, including during power outages. It seeks to ensure its FTTH network has sufficient backup power, and, as discussed below, it provides battery backup for customer premises equipment

9. C Spire's FTTH network uses Gigabit Passive Optical Network ("PON") technology. It currently places the Optical Network Terminal ("ONT") on the outside of each premises to convert optical to electronic signals, and it has plans to begin installing interior ONTs. C Spire installs its battery backup as an independent unit directly next to the ONT. It has the following capabilities and characteristics:

Standby Time – up to 8 hours

Talk Time – approximately 2 hours, depending on number of hand-sets

Average Lifetime before Replacement – 7 years

Cost of Battery Device – Approximately \$42

Cost of Battery -- Approximately \$16

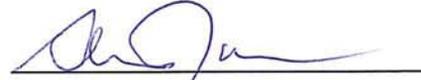
10. C Spire supplies the battery with the ONT installation. Monitoring is performed by the customer. A replacement battery can be obtained from numerous sources at competitive prices.

11. C Spire informs subscribers about its use of a battery backup for voice service.

12. C Spire recognizes it has offered FTTH services for a limited time, but so far, it has not received inquiries or complaints about its battery backup practices.

I declare under penalty of perjury that the foregoing is true and correct to the best of my information and belief.

Executed on January 28th, 2015



Alan Jones

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of)	
)	
Ensuring Customer Premises Equipment	)	PS Docket No. 14-174
Backup Power for Continuity of)	
Communications)	
)	
Technology Transitions	)	GN Docket No. 13-5
)	
Policies and Rules Governing Retirement Of	)	RM-11358
Copper Loops by Incumbent Local Exchange)	
Carriers)	
)	
Special Access for Price Cap Local Exchange	)	WC Docket No. 05-25
Carriers)	
)	
AT&T Corporation Petition for Rulemaking	)	RM-10593
to Reform Regulation of Incumbent Local)	
Exchange Carrier Rates for Interstate Special)	
Access Services)	

DECLARATION OF BEN LOVINS

1. My name is Ben Lovins. I am the Senior Vice President of the Telecommunications Division for Jackson Energy Authority (“JEA”). My business address is 119 East College Street, Jackson, TN 38301.

2. I have been in the communications industry for 26 years with significant work in operations, head-end engineering, product and service deployment, video programming and services contract negotiations, and additional administrative responsibilities. I received a Bachelor of Science Degree in Organizational Leadership as well as a Master in Business Administration Degree from Union University.

3. I serve on the Board of Directors for the Fiber to the Home Council, and I submit this Declaration in support of the comments of the Fiber to the Home Council in the above-referenced proceedings.

4. Jackson Energy Authority (“JEA”), based in Jackson, Tennessee, is one of a few public utilities in the United States offering customers all major utility services. JEA provides electric, gas, propane, water, wastewater, and broadband services to approximately 40,000 residences, businesses and industry in Jackson, Tennessee and portions of Madison County. The Company also supplies propane to customers not on JEA’s natural gas system. Ten years ago, JEA deployed a Fiber to the Home (“FTTH”) communications network in its service territory. Today, that network has approximately 18,000 subscribers of which about 6,500 take its voice service.

5. JEA competes in its service territory with two wireline providers, AT&T and Charter Communications. For video service, it also competes with direct broadcast satellite providers. For voice service, it also competes with mobile wireless providers, who have captured a large and growing share of the market.

6. JEA takes seriously its responsibility to provide all its subscribers with reasonable access to emergency communications services, including during power outages. It works to follow industry best practices for network backup capabilities, and, as discussed below, it provides battery backup for customer premises equipment.

7. JEA has seen consumers’ attitudes evolve towards and use of different methods and practices to enable them to have reasonable access to emergency communications services during power outages. Prior to the advent of competitive alternatives, consumers had no choice but to take line-powered voice service from the incumbent local exchange carrier. However,

over the past 15 years, cable operators, FTTH overbuilders, and mobile providers have entered the market, and consumers have opted to move their voice service from the incumbent. As a result, today the vast majority take voice service from “non-line-powered” wireline providers and from mobile wireless providers. Even for consumers continuing to obtain voice service from AT&T, most all also take mobile wireless voice service. This demonstrates that consumers find they do not require access to line-powered copper to have reasonable access to emergency communications during power outages.

8. In the following sections, I discuss JEA’s specific customer premises equipment battery backup practices for its FTTH network.

9. JEA’s FTTH network uses Broadband Passive Optical Network (“PON”) technology, but this year it will begin deploying even higher-performance Gigabit PON technology. For either type of technology, an Optical Network Terminal (“ONT”) is placed on the outside of each premise to convert optical to electronic signals. While battery backup capability can be located within the ONT, JEA places its battery backup in an independent unit directly next to the ONT. It has the following capabilities and characteristics:

Battery Technology – AGL Sealed Lead Acid

Standby Time – 8 hours

Talk Time – approximately 2 hours, depending on number of hand-sets

Time to Full Charge after Discharge – 3 hours

Average Lifetime before Replacement – 5 years

Cost of Battery Device – Approximately \$100

Cost of Battery -- Approximately \$15-\$25

10. When JEA converts to GPON technology, it will not need to replace the AGL Sealed Lead Acid battery back-up units. If JEA is required to increase the capabilities of these units, however, it would be forced to install new equipment at each customer premises. JEA estimates the cost of the upgrade per premises as follows:

New transformer, cables and connectors - \$85

Higher voltage power ring - \$150

Battery assembly - \$80

Labor for upgrade on premises - \$120

Total cost of upgrade - \$435

While these costs may be passed through to the customer, based on its experience, JEA does not believe customers would find value in this upgrade.

11. JEA supplies the battery with the ONT installation. Each battery is monitored by the PON element management system. In the event the battery is low or not holding a charge, an “alarm” is created, and the information is relayed to the network control center through operational reporting processes. JEA then sends a technician to replace the battery, which may take from one to several days after the alarm is sounded. When on a service call for other purposes, technicians will check the battery and replace it if shows a low power level. JEA also will check a battery upon request of a subscriber and replace it if necessary.

12. If a new customer requests service at a residence where an ONT and battery have been installed but the system has not been operated in the last 60 days, JEA’s standard procedure is to complete a new installation of the ONT and new battery for that phone customer.

13. JEA informs subscribers about its use of a battery backup for voice service.

14. In JEA's experience, subscribers are not concerned about moving from line-power copper loops to FTTH infrastructure with battery backup for their voice service. Not only does the battery backup enable service during virtually all but the most catastrophic power outages, but few consumers are without a mobile phone which they can use in emergency situations during power outages and which can be easily recharged in a number of ways.

15. JEA has not received complaints about its battery backup practices. Additionally, in the 10 years that I have been with JEA, I do not recall any instance where a consumer has inquired about whether we offer line-powered voice service or where a subscriber, given a choice to receive JEA's FTTH service, has opted to keep line-powered voice service.

I declare under penalty of perjury that the foregoing is true and correct to the best of my information and belief.

Executed on February 02, 2015


Ben Lovins

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of)	
)	
Ensuring Customer Premises Equipment Backup Power for Continuity of Communications	)	PS Docket No. 14-174
)	
Technology Transitions	)	GN Docket No. 13-5
)	
Policies and Rules Governing Retirement Of Copper Loops by Incumbent Local Exchange Carriers	)	RM-11358
)	
Special Access for Price Cap Local Exchange Carriers	)	WC Docket No. 05-25
)	
AT&T Corporation Petition for Rulemaking to Reform Regulation of Incumbent Local Exchange Carrier Rates for Interstate Special Access Services	)	RM-10593

DECLARATION OF GEORGE O'NEAL

1. My name is George O'Neal. I am Vice President, Network Services, for GVTC Communications. My business address is 36101 FM 3159, New Braunfels, TX 78132.

2. As Vice President-Network Services, I am responsible for all planning, engineering and operations of GVTC's broadband, phone and cable networks. I also manage the company's service center, installation and repair teams, inventory, facilities, and fleet. In that capacity, I led the transition of GVTC's legacy phone network onto a more-reliable IP-based platform and am a key architect of GVTC's \$35 million fiber network expansion, which replaces older copper wiring with state-of-the-art fiber optics. The fiber network enables GVTC to offer customers its full suite of services including phone, high definition cable television, high speed Internet and security monitoring.

3. I joined GVTC in 2006. Prior to that, I worked for seven years at Alltel, serving in several network management positions. From 1995 to 1999, I worked for SBC Communications Inc. I am a graduate of the United States Military Academy and hold a degree in mechanical engineering.

4. GVTC is a member of the Fiber-to-the Home Council, and I serve on the Council's Board of Directors. I submit this Declaration in support of the comments of the Fiber-to-the Home Council in the above-referenced proceedings.

5. GVTC operates as an incumbent local exchange carrier and a competitive local exchange carrier over a combination of copper and fiber networks in communities near San Antonio, TX. In aggregate, it provides voice service to more than 40,000 customers. In areas where it has upgraded its network to fiber to the home ("FTTH"), it provides video and high-speed broadband service in addition to voice service. It has approximately 17,000 video subscribers and 34,000 broadband subscribers.

6. In 2004, GVTC made the strategic decision to upgrade its infrastructure to FTTH to enable it to offer advanced communications services, and it began converting its copper network to FTTH ("brownfield builds"). In 2006, it decided that all new-builds would be FTTH ("greenfield builds"). Today, its FTTH network passes approximately 65 percent of the "rooftops" in its service territory. Over its FTTH network, it offers a suite of advanced services, including "gigabit" broadband Internet access service.

7. Despite the great demand for service over fiber facilities, there is significant risk in deciding to undertake a brownfield FTTH build. GVTC has developed a complex matrix of 11 factors upon which it can base such a decision, including projected penetration rates for services and state of the copper facilities. Once it decides that investment in FTTH facilities is

warranted for a community, it first builds plant passing each “rooftop.” It then notifies each consumer about the availability of its fiber-based services. When a consumer subscribes to service, it installs a fiber drop to the home, along with the optical network terminal (“ONT”) and other customer premises equipment, to enable FTTH services. It needs access to the home to install the ONT and other customer premises equipment.

8. GVTC also will convert a subscriber to FTTH in two other instances. First, it will install FTTH where the copper loop has deteriorated and needs to be replaced. Prior to undertaking this work, GVTC informs the subscriber and receives approval to access the subscriber’s premises. Second, because it is costly to keep operating and maintaining the additional equipment required to serve customers on copper loops (*e.g.* electronics in remote terminals), when there are only a small number of customers in a community that have yet to convert from copper loops, it will inform them via certified letter that GVTC will need to replace that loop with FTTH.

9. GVTC has found that its current copper to FTTH conversion practices are acceptable to its subscribers, and it has received no complaints because it is removing line-powered copper loops or because it is offering new services or new bundles of services. Rather, it finds consumers are clamoring for fiber and the services provided over FTTH infrastructure. It even has had consumers offer to pay directly for the cost to bring fiber to their community.

10. Given GVTC’s practices, the lack of any concern expressed by its subscribers, and the great interest in having access to FTTH, the various regulatory proposals in the Notice of Proposed Rulemaking in the above-referenced proceedings that GVTC would need to abide by when converting a subscriber from copper to FTTH are unnecessary and would impose unreasonable costs on GVTC. As noted, GVTC already sends notification to subscribers, and it

cannot convert a subscriber without obtaining access to the premises from the subscriber. In those few instances, where it needs to convert a subscriber because the copper has deteriorated or where only a few subscribers still use copper facilities, it already provides sufficient notice and has a track record of working with subscribers to meet their service needs. Further, making GVTC wait for 30 days prior to converting a subscriber and giving a subscriber a right to comment to the Commission addresses no demonstrable problem and would impose a cost on GVTC. Finally, GVTC does not engage in any improper “upselling” at the time of a conversion, and no additional regulation is required here as well.

11. When GVTC provides VoIP service over its FTTH network, it installs a device with backup power next to the ONT. This device enables voice service during power outages. Standby time for the battery is approximately 8 hours, and talk time is approximately 2 hours. GVTC monitors the battery for low power and replaces the battery when a low power “alarm” sounds, although it may take several days to install the replacement battery. GVTC has had no complaints about its battery backup practices. This is not surprising since traditional wireline voice service is rapidly declining as customers rely increasingly on mobile wireless service, even where they continue to subscribe to wireline service.

12. In sum, as one of the most experienced FTTH providers in the country, GVTC has a real understanding of what subscribers require in the process of converting from copper to FTTH facilities and what backup power meets their emergency communications needs. The satisfaction of its subscribers demonstrates GVTC’s care and concern.

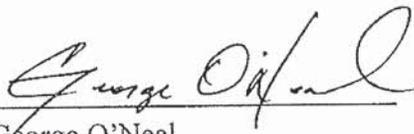
13. GVTC regularly examines the business case for converting additional communities to FTTH to determine where it can obtain a sufficient return on the investment. As discussed above, deploying FTTH is a risky investment, and for many communities in less dense

areas, it may be too risky. Yet, GVTC believes it should try to bring them FTTH services.

Should the Commission impose additional regulations increasing the cost of deployment, it will only delay GVTC's efforts to deploy this much sought after service.

I declare under penalty of perjury that the foregoing is true and correct to the best of my information and belief.

Executed on February 2, 2015


George O'Neal

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of)	
)	
Ensuring Customer Premises Equipment	)	PS Docket No. 14-174
Backup Power for Continuity of)	
Communications)	
)	
Technology Transitions	)	GN Docket No. 13-5
)	
Policies and Rules Governing Retirement Of	)	RM-11358
Copper Loops by Incumbent Local Exchange)	
Carriers)	
)	
Special Access for Price Cap Local Exchange	)	WC Docket No. 05-25
Carriers)	
)	
AT&T Corporation Petition for Rulemaking	)	RM-10593
to Reform Regulation of Incumbent Local)	
Exchange Carrier Rates for Interstate Special)	
Access Services)	

DECLARATION OF DAVID RUSSELL

1. My name is David Russell. I am a Solutions Marketing Director with Calix, and I work in the company's office in Minneapolis, MN.

2. I have been in the communications industry for 31 years focusing on broadband access, including copper, cable and fiber optic infrastructures. I served for two years on the Board of Directors of the Fiber to the Home Council and was Chairman of the Board for one year.

3. Calix is a member of the Fiber to the Home Council, and I submit this Declaration in support of the comments of the Fiber to the Home Council in the above-referenced proceedings.

4. Calix is a global provider of broadband communications access systems and software. The Calix Unified Access portfolio, which includes customer premises Optical Network Terminals (“ONTs”), allows service providers to connect to their residential and business subscribers and deploy virtually any service over fiber- and copper-based network architectures. Calix equipment is deployed in networks serving over 100 million subscriber lines in total, and its solutions have been deployed by the vast majority of local exchange carriers in the U.S.

5. Fiber to the home (“FTTH”) customer premises equipment, ONTs are often deployed with an Uninterrupted Power Supply (UPS) connected to the ONT. This UPS converts 120 VAC power to 12 VDC power and includes a lead acid battery. Typically, standby power is for eight hours.

6. Because of Calix’s expertise and experience in designing, manufacturing, and overseeing the installation of ONTs, it has a great interest in ensuring its service provider customers can offer emergency communications services, including during power outages. I served as a member of the Federal Communications Commission’s Communications Security, Reliability and Interoperability Council IV on CPE Powering, Working Group 10. Working Group 10A issued a final report on CPE Powering—Consumer Outreach in June, 2014. Working Group 10B issued a final report on CPE Powering—Best Practices in September, 2014.

7. The Best Practices report, with which I was more involved, focuses on backup powering for the provision of residential VoIP service and examines nine residential use cases. For each use case, the working group sought to provide best practices for backup power. In some of these cases, backup power capability is supplied today. For others, particularly cordless phones, there is no backup power. The Working Group found that “one clear trend across all

VoIP use cases is that battery backup is increasingly being offered as an option to the consumer, with the cost and maintenance of the UPS and batteries being a consumer's responsibility."

Thus, given these provider practices and increase in consumer subscription to VoIP services and use of cordless phones, the group sought to put forth practices that would achieve greater reliability, especially for cases that do not currently have a backup power option.

8. A key underlying premise of the Working Group's report is that consumers have numerous choices for voice service, both wireline and wireless, and accordingly, wireline and over-the-top providers using wireline networks should offer consumers the option to purchase battery back-up for the device performing the Analog Telephone Adapter ("ATA) function.

9. The report also stressed the need for service providers to educate consumers about backup power, including by informing them about what happens if there is no backup power capability, how to use backup power so it lasts as long as possible, and how to monitor and replace batteries. Finally, the report recognized that battery backup power lasts a limited time and that solutions were needed for outages that are of a much longer duration.

I declare under penalty of perjury that the foregoing is true and correct to the best of my information and belief.

Executed on January 30, 2015



David Russell

The Superior Performance and Technical Characteristics of Fiber to the Home Networks

Fiber to the Home Council

January 2015

EXECUTIVE SUMMARY

For over a century, wireline networks have relied on physical copper transmission media. But, copper can no longer support the performance capabilities we require and, as it continues to age, it becomes increasingly unreliable. All-fiber (including fiber to the home (FTTH)) facilities are today's preeminent wireline communications network technology, and network providers are accelerating their deployments of this infrastructure.

Only FTTH offers the fastest speeds, highest reliability and is future proof. This paper will compare the technologies in use today and demonstrate that FTTH is the far superior choice for wireline broadband investment.

We first describe the three main wireline access technologies – traditional twisted pair copper networks owned and operated by phone companies, cable hybrid fiber coaxial (HFC) networks, and FTTH. Then we compare the performance and reliability of the first two to the third. And we demonstrate that fiber is faster, more resilient, and more reliable than any rival.

DESCRIPTION OF WIRELINE ACCESS TECHNOLOGY OPTIONS

This section briefly explains the three primary wireline network access technologies: 1) conventional copper-based networks; 2) hybrid fiber coaxial cable networks (deployed by cable service providers); and 3) passive fiber optic networks (PONs), the most common form of FTTH service.

Conventional Copper-Based Telephone Access Infrastructure (Twisted Pair)

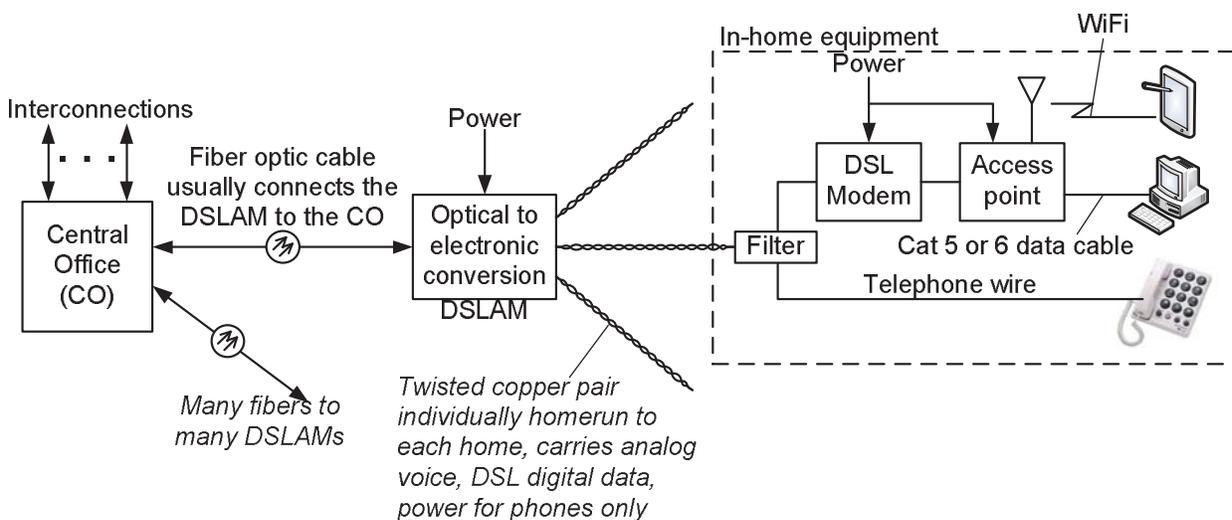


Figure 1. Traditional Telephone (Twisted Pair) Technology

Figure 1 depicts a typical copper-based telephone network. Signals are gathered at the *central office* (CO). Older networks feed signals over copper wire trunk lines from the CO to distributional nodes designated to serve certain groups of end-users. Signals run from each node to individual homes via twisted copper pairs (so-called “homerun copper”).

More modern copper networks feed signals over a fiber trunk line from the CO to a Digital Subscriber Line Access Multiplexer (DSLAM) – the analog of a node in a traditional all-copper network. The DSLAM converts optical signals for transmission to individual homes. One DSLAM may serve several dozen to several hundred homes.

Copper-based networks deliver three distinct transmissions to each home: analog voice, data, and power. The data transmission uses one of several technologies commonly known as DSL, or digital subscriber line. This signal funnels data to the home and may support video if the twisted pair has sufficient bandwidth. The power transmission enables the operation of corded home telephones.¹

¹ Electricity supplied by the twisted pair can only power corded telephones in the home, typically up to about five phones. In more modern copper networks, the DSLAM supplies the power (which creates the necessity of providing

Hybrid Fiber Coaxial Cable Access Infrastructure Cable Television

Hybrid Fiber Cable (HFC) networks use fiber optics to deliver signals to a distributional node, and then convert the signals to ride coaxial cable to subscribers.

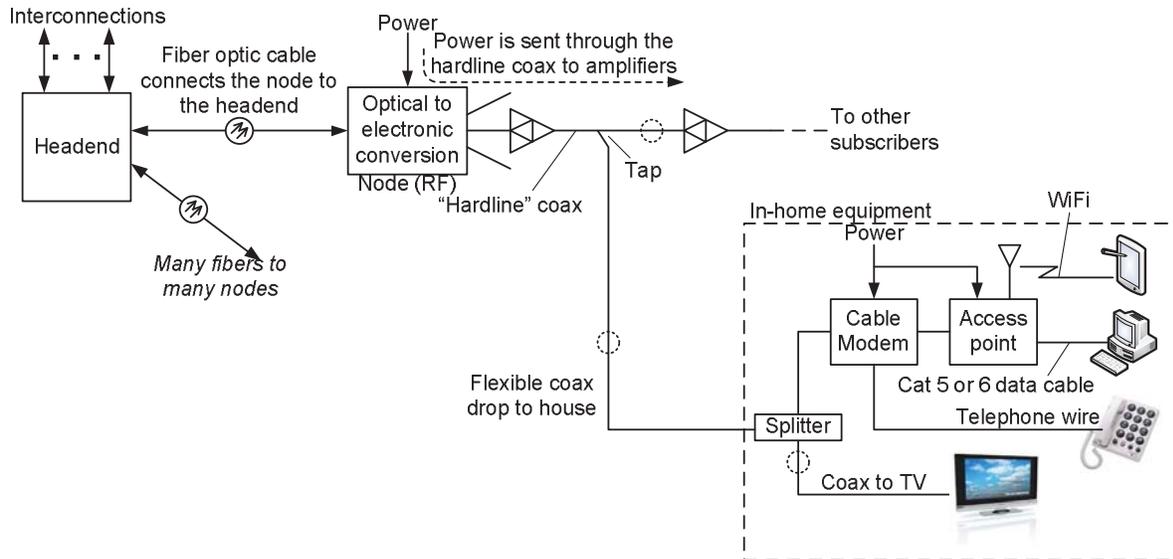


Figure 2. Cable Television HFC Network

Figure 2 depicts an HFC network. All signals are gathered together at a headend, which is analogous to a copper network's central office.

Nodes serve as optical-to-electrical conversion points in the network (analogous to DSLAMs discussed in the previous section).² Fiber lines between headend and node are technologically different but functionally similar to those connecting central office and node in telephone networks. Both transmit data, television, and voice signals.

In HFC networks, signals are modulated onto radio frequency (RF) carriers, each with a unique channel. Most RF carriers transmit video, but some also transmit data, including voice calls. The RF signals are then modulated onto the optical carrier.

Nodes convert the signals back to RF for transmission to subscribers. The conversion process (and the reverse process for upstream communications) is simple and only requires a small piece of equipment. In aerial plant, the node is mounted on a pole in a sealed enclosure. In underground plant, the node is protected by a similar sealed enclosure, usually with an additional outer steel casing for added protection.

a backup power source onsite with the DSLAM). In all-copper networks, the CO supplies the power (for which it is easier to provision a backup source). Thus, DSL subscribers do not require backup power for corded home phones.

² Some networks utilize intermediate distribution points called hubs between the headend and node layers. The hub layer is tangential to our argument. We exclude further explanation here.

Taps line the coaxial plant and transmit a portion of the RF signals to the homes of subscribers. Inside the home, the signal splits. One or more television sets (often through set top boxes, not shown in Figure 2) and a cable modem, which converts RF signals to data through one or more Ethernet connections, all receive a portion of the signals. The cable modem may also enable voice calling.

Each node often includes a power supply. The commercial grid powers each node and an eight-hour battery serves as a backup power source. Some nodes can connect to a portable generator for supplemental backup power.

Two amplifiers are illustrated in Figure 2. Dual triangles, one inside the other, are used to indicate that the amplifiers augment signals traveling in both directions (in different frequency bands). RF amplifiers positioned along the line between nodes and homes help overcome cable attenuation and passive losses of electrical signals. Each time a tap sends power to a home, some of it is lost in transmission. The amplifiers compensate for the lost power. Amplifiers are active devices powered through the coaxial cable. (This type of coaxial cable is called *hardline*, because it is made of semi-rigid materials for low – but far from zero – signal loss.) As is the case with telephone networks, a cable connection can power up to five corded – but not cordless – home phones.³

³ Cable modems always require local power at the residence, which may be supplied by an internal battery, an external uninterrupted power supply, or a combination of both.

Fiber-to-the-Home (FTTH) Access Infrastructure

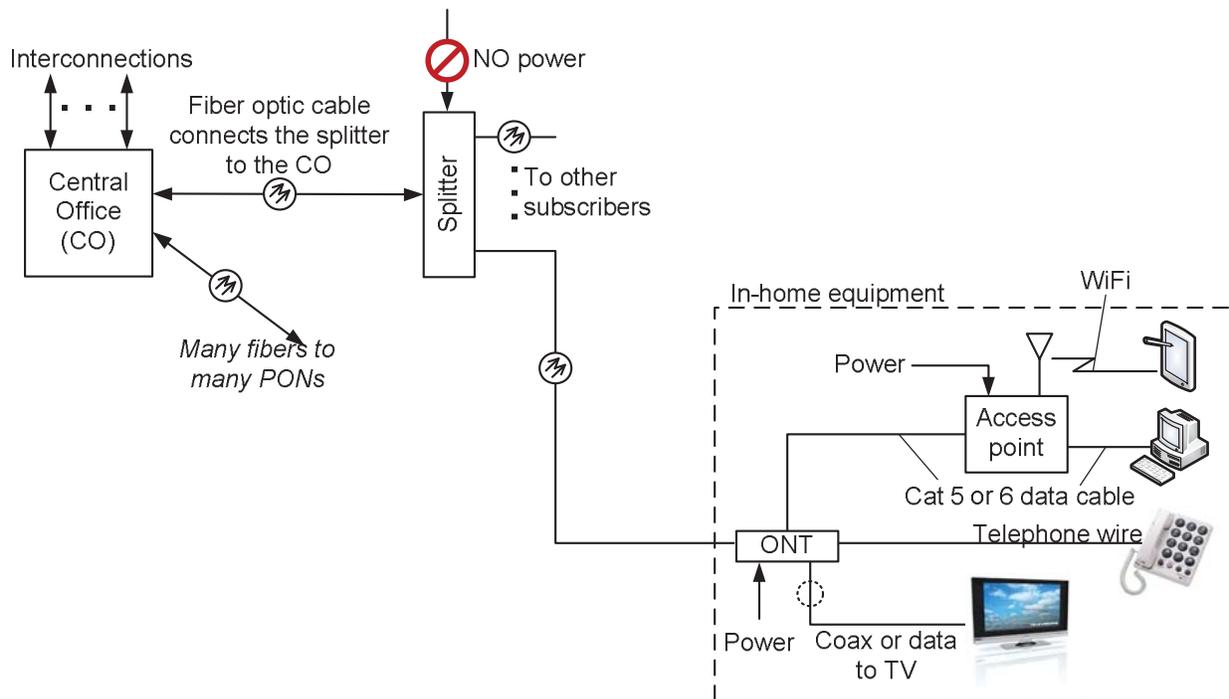


Figure 3. FTTH Passive Optical Network

Figure 3 depicts the most common form of FTTH, the *passive optical network* (PON). There is another form of FTTH called Active Ethernet (AE) or Point-to-Point (P2P), which has a slightly different architecture, but shares relevant primary features with PONs.⁴

Fiber carries signals to and from the CO using binary transmission. Depending on the operator, fiber may also transmit RF modulated optical carrier on a different wavelength. At a given distributional point, the trunk signal splits to serve a designated group of subscribers.

Unlike the distributional nodes in copper and cable networks, signal splitters on fiber networks are completely passive – they do not require a power source. This architecture eliminates powering problems in the field because FTTH does not require a connection to the electrical grid and thus, does not require any source of backup power either.

Eliminating the necessity of an external power source liberates network operators from the substantial cost of maintaining primary and secondary power sources for distributional plant and significantly improves network reliability vis-à-vis copper and cable networks.

FTTH fiber splitters boast exceptional reliability and rarely fail – even when submerged in contaminated water, as may occur in weather emergencies.

⁴ Here we use telephone network terminology in labelling the network's origination point "central office."

Twisted pair and HFC systems, which have active equipment in the field, are susceptible to equipment failure. Because equipment is susceptible to temperature and aging, cable operators frequently schedule between one and four visits per year to each amplifier and node, at a cost of a few hundred dollars each. The cost and frequency of visits depends to an extent on the bandwidth of the system and when it was built. FTTH utilizes passive fiber splitters, which are formed in silicon or by fusing several fibers together under high heat. Fiber networks have grown substantially in the past decade, and yet the industry lacks quantitative fail rate data because known incidence of failure in the field is negligible.

The fiber is connected to a device called an ONT (optical network terminal), also known as an ONU (optical network unit), on an outside wall, either outside or inside the home. The ONT communicates with devices in the home through one or more wired and/or wireless Ethernet connections and may include analog voice interfaces for standard telephones. With the amount of bandwidth fiber provides, it is not only possible but common to send video over data (IPTV, or internet protocol television). This almost always requires a set top box (not shown) between the television and the ONT. Depending on the operator, some or all programs may be transmitted on RF, as with cable. And depending on the services a subscriber purchases this may or may not require a set top box.

As is the case with the other technologies, fiber networks supply data to an access point located on the subscriber's premises. The access point often includes firewall protection for data appliances (computers, tablets, etc.) and wireless interfaces. In some cases the access point features are incorporated in the ONT.

COMPARISON OF ACCESS TECHNOLOGIES

Performance (Speed)

Traditional Telephone Network

The major problem with traditional copper-fiber technology is the twisted pair cable itself. The twisted pair construction allows only very limited bandwidth by today's standards.

The cable consists of two small, insulated copper wires that carry signals between the DSLAM and subscribers.

Large bundles of twisted pair cables exit the DSLAM and split repeatedly to connect to end-users. In order to carry all of the signals, especially the DSL signal, each twisted pair must meet a number of specifications. Among the most important is *characteristic impedance* –a measure of the ratio of voltage to current that the twisted pair needs for efficient transport of signals. The characteristic impedance of the cable must match the fixed impedance of both the originating and terminating equipment, or the speed of DSL service will suffer drastically.

The characteristic impedance of the twisted pair is a function of the diameter of the copper wire, the type and quality of the insulation, and the tightness and consistency of the twisting. Many factors can degrade characteristic impedance, including moisture adsorption and age-related degradation. Breaks and repaired sections in the cable can cause an “impedance bump,” which would not impact voice service, but may disrupt DSL transmission.

Depending on several of the above criteria and on the number of wire pairs in the same cable bundle, *crosstalk* from one set of wires to another may also hamper DSL performance.

Finally, both wires in each twisted pair must be balanced with respect to ground, meaning that they must exhibit identical stray capacitance and resistance to ground. A new twisted pair is usually well balanced, but balance can degrade over time due to handling and degradation of wire insulation. The equipment on each end must ensure that exactly the same current exists on both wires, each moving in opposite directions. This balance is crucial to the performance of the circuit.

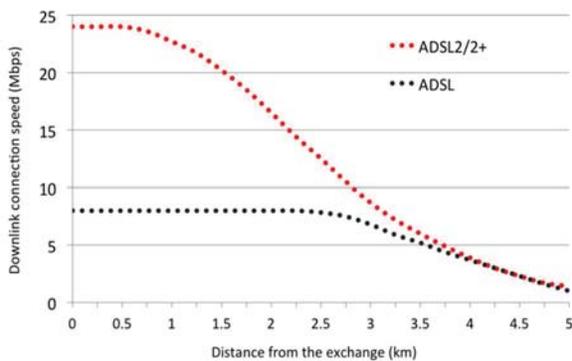


Figure 4. Example of How Distance Affects DSL Speed

Figure 4 illustrates how distance (cable length from a DSLAM⁵ – referred to as an *exchange* in the figure – to the subscriber) affects downstream data speed, assuming high quality twisted pair cable.

Figure 4 plots the distance from the CO or DSLAM on the horizontal axis and expected downlink speed on the vertical axis.⁶

Speed remains constant with distance for ADSL⁷ through 2.5 km (about 1.6 mile) at 8 Mb/s – too slow to satisfy high quality video requirements and likely slower than consumers expect and demand. If an end-user with ADSL2/2+ is located close to a DSLAM, she may enjoy speeds up to 24 Mb/s downstream, but this maximum begins dropping 0.75 km (less than half a mile) from the DSLAM. End-user speeds begin to drop around 3 km (1.9 miles) from the DSLAM. At 3.5 km, the speed differential between ADSL and ADSL2/2+ begins to approach zero and the data speed of both continues to decline as distance increases.

Note that Figure 4 illustrates performance expectations for pristine wire. Actual performance will rarely, if ever, achieve such speeds.

Other permutations of DSL network design can sometimes be used to increase speed, such as using more than one wire pair to transmit signals. Using multiple wire pairs is often referred to as *pair gain*, and results in almost a doubling of speed. However, the technique requires more expensive equipment at both ends, and depends on the availability of additional pairs of wires. This approach is neither practical nor cost-effective in the long run.

Another method of enhancing DSL speeds, involves telephone companies extending fiber lines and moving DSLAMs closer to end-users, thereby shortening the length of sub-optimal copper cables. While these methods marginally improve performance, they also increase the clutter of street furniture, power access points, backup batteries, and other necessary equipment essential to service but costly to maintain and vulnerable to failure.

Ultimately, an end-user within half a mile of a DSLAM who enjoys a pristine cable connection, could achieve speeds up to 24 Mb/s. This pales in comparison to FTTH: fiber achieves speeds of 1 Gb/s or more at distances up to 12.5 miles (equivalent to 20 km).

⁵ DSLAMs are distributed around the telephone company’s service area, and the distance from a DSLAM to any one house is based on “the luck of the draw,” or how far that house happens to be from the DSLAM (or CO if no DSLAM is used, but in that case, the distance is likely much farther, and hence the speed much lower).

⁶ Uplink speeds are usually substantially slower than downlink speeds and tend to figure less prominently when evaluating performance.

⁷ ADSL stands for Asymmetric Digital Subscriber Line.

HFC

Unlike DSL systems, cable systems' data speeds are not a function of distance – the nature of the medium permits the subscriber farthest from an origination point to enjoy the same data speed as the subscriber nearest an origination point. Instead, maximum speed depends on the revision of the cable modem specification supported by the cable modem and the headend, and on the subscription speed of a particular customer. Today's actual download speeds tend to be in the tens of Mb/s (megabits per second). The highest widely advertised cable bandwidth is about 100 Mb/s. Upstream speeds are often significantly lower. Because data access is shared by a number of subscribers, this can create traffic bottlenecks if sharing is executed too aggressively.⁸

Cable achieves data (including voice) and video transmission by dividing the downstream spectrum, or available frequency range, into 6 MHz wide channels.⁹

Cable systems are characterized in part by the number of channels they can carry, which is determined by the maximum frequency the system is capable of handling. The nodes and amplifiers (Figure 2), and sometimes the coaxial cable itself, limit the maximum frequency.¹⁰

Data is carried in cable TV systems using equipment conforming to one of several standards known as the DOCSIS (Data-Over-Cable Service Interface Specifications). Several DOCSIS standards have been defined, each adding capabilities to the preceding specification. The original DOCSIS specification was 1.0, released in 1997. Future revisions were 1.1, 2.0, and 3.0. Revision 3.1 is under development as this is written.

If each channel can carry 38 Mb/s of data (after some DOCSIS overhead is eliminated), the maximum capacity of a system is 4.4 Gb/s, shared among the typically 350 to 500 subscribers on an individual node. This is not an insignificant bandwidth, but the variety of services transmitted absorbs this level of capacity fairly quickly. The following statistics are typical of cable:¹¹

⁸ All residential data is shared at some level regardless of access mode. The entire internet is a shared data transmission medium. As long as sharing is intelligently managed, this does not present a problem. Without sharing the transmission medium at some point, data access would be prohibitively expensive, and the Internet would not have progressed as it has.

⁹ 6 MHz wide channels are used in North America and some other locations for historical reasons. The FCC originally set up 6 MHz wide “chunks” of frequencies, called *channels*, to carry analog TV. Other widths could have been chosen (7 and 8 MHz are used in Europe). Even now that the majority of transmission is digital, it remains convenient to divide the spectrum into 6 MHz channels. As a practical matter, today each 6 MHz channel can carry about 38 Mb/s of downstream data. Techniques to expand the capacity of individual channels are in the works with the DOCSIS 3.1 specification, but are not available today.

¹⁰ The maximum frequency has risen from about 220 MHz in the early 1970s to 1 GHz today. Because field upgrades lag the technologically achievable maximum, the majority of systems handle a maximum frequency of 750 MHz. This can support 116 channels downstream. The downstream frequencies start at 54 MHz to match FCC allocations for over-the-air TV).

¹¹ Each cable operator must decide how to allocate the available frequencies between standard and high definition TV programs and data. These numbers are typical for MPEG-2 video transmission, which is most common today. More efficient techniques, most notably MPEG-4, are available, but many cable boxes and consumer TVs predate MPEG-4. These devices present a significant obstacle to upgrading to new technology.

- One analog television program absorbs a full 6 MHz channel.
- One 6 MHz channel can serve about ten standard definition digital programs or a combination of two high definition and one standard program (but this arrangement could compromise video quality).
- One channel can transmit approximately 38 Mb/s of data.

For earlier DOCSIS data standards, DOCSIS 2.0 and earlier, 38 Mb/s was the highest speed data that could be delivered to any one subscriber, because the system was capable of providing only this much usable data per home (and that data was shared among many homes).

With the advent of DOCSIS 3.0, which is fairly widely deployed today, it became possible to bond several channels (4 to 8 are common), to achieve download speeds of 150 to 300 Mb/s (DOCSIS 3.0 takes some overhead, slightly reducing the combined bandwidth gain), shared over a group of subscribers. But this technique boosts data by sacrificing video channels. If an operator decided to trade standard definition video channels for more data, increasing speeds from a downstream rate of 38 Mb/s of data to almost 300 Mb/s would eliminate 70 TV program channels. Certain techniques, such as switched digital video, have been developed to mitigate the loss of channels, but these tend to be expensive to implement.

A newer data standard, DOCSIS 3.1, is under development and is designed to improve the speed per channel, but the amount of gain available will depend on the quality of the network. Some industry participants are concerned about mutual interference between the DOCSIS 3.1 signals and cellular data in the lower frequency regions. The extent of the problem has not yet been determined. Interference would negatively impact performance.

The root of the interference problem lies in the coax network design itself: data is carried on radio frequency (RF) carriers. Any leakage between the coax and free space (and leakage goes both ways) creates the potential for interference. FTTH transmits in optical form; there is no potential for interference.

FTTH

Typically, one fiber from the headend is split among 32 subscribers, though sometimes plants are built with up to 64 subscribers served by one fiber from the CO. The data rate on the fiber ranges from 1 Gb/s (1,000 Mb/s) to 10 Gb/s, depending on the technology being used. This provides an enormous amount data per subscriber! The slowest fiber connection boasts *ten times* the capacity of the *fastest* cable connection. By comparison, cable seems pedestrian and copper appears grossly inadequate.

Furthermore, while the data rates possible on copper plant are approaching theoretical limits, American society continues to use just a tiny fraction of fiber's prodigious capacity. When demand becomes apparent, end equipment can be changed out, and the same fiber can be used at

even higher speeds. In short, without requiring expensive outside plant construction, fiber is almost infinitely expandable to suit any need for increased speed.

HOW TECHNOLOGIES MATURE

A useful way to illustrate the potential for future development of a technology is the maturation curve, sometimes called the S curve (Figure 5). We placed the three technologies addressed here on their respective places along the curve.

The early development stage requires substantial investment in return for relatively little progress. Some technologies never exit this phase and fail.

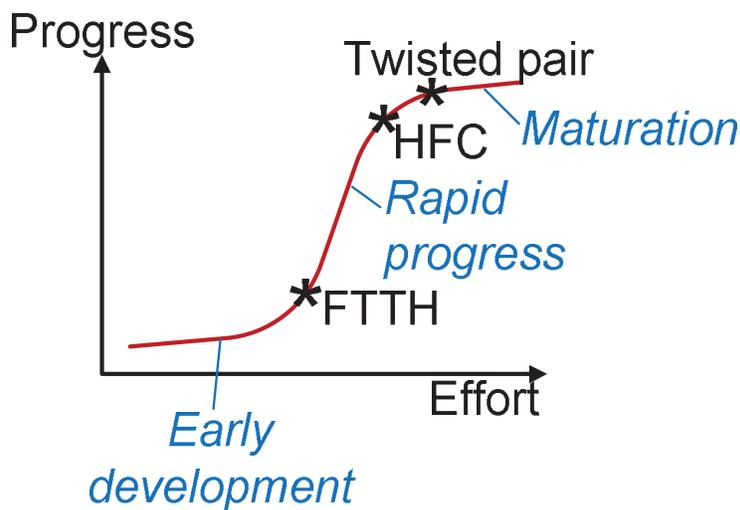


Figure 5. Technology Maturation Curve

The next stage begins at initial rollout when the technology is mature enough to enable rapid deployment. The final stage is maturation, in which society has reaped almost all of the benefit to be had from the technology.¹²

Twisted pair telephone cable was invented more than century ago. It is now in the mature phase. HFC's architecture is not quite as far along the curve; the coax portion holds it back. Coax for distribution is about 60 years old.¹³

FTTH emerged from the early development stage in the last 10-15 years, and has entered the rapid progress phase. End-user fiber connections are the same as the trunk lines carrying hundreds of Gb/s of data across long distances. FTTH does not yet support these speeds because such high bandwidth buildouts are expensive and end-users do not demand (and would be unable to find any applications for) such speeds.

As demand for faster connections develops however, operators can upgrade speeds by simply replacing the equipment at the termini of the fiber lines. Whereas copper and HFC networks are restrained by the transmission lines themselves, fiber performance is only restrained by the quality of the terminating equipment.

¹² Note that the curve does not completely flatten, because there is always a little more that can be done with the technology, but since it is mature, progress slows significantly.

¹³ Some cable operators are installing another form of FTTH called RFoG as an interim step to FTTH. RFoG boasts only some of the advantages of fiber.

OVERALL NETWORK RELIABILITY

Traditional Telephone Network

The first reliability problem with this system is the need for power at the DSLAM. Power is usually sourced from the commercial grid at the location of each DSLAM. In case of power failure, the DSLAM may include battery backup sufficient for up to eight hours of operation.¹⁴ The backup batteries include a power allocation to operate corded phones in subscribers' homes. A generator might be trucked to the DSLAM if an outage was forecasted to last more than eight hours. Of course, in a case of wide-spread outage such as Hurricane Sandy, it is unlikely that the service provider will have enough generators to support all DSLAMS.

The second problem is the state of the copper twisted pair. Because the majority of the American communications network was constructed in the late-19th and early 20th centuries, when copper was the standard means of transmission, large networks of legacy twisted pair wiring remains in place. But this wiring is old and aging; it is becoming brittle and unlike fiber, copper networks are susceptible to the effects of flooding and other storm-related damages. Because copper pairs are almost always allocated one per subscriber, restoration after a service failure requires manual splicing (and likely replacement) of each pair – a long and tedious process.

When Hurricane Sandy hit New York in October 2012, surging seawater caused the failure of millions of copper pairs, resulting in the prolonged outage of the telephone system.

HFC

The commercial grid also powers the cable network with battery backup. The power supply may be located at individual nodes or may be located somewhere else in the network. There are no federally required standards for how long battery backups should last, but the cable industry tends to use the same eight-hour standard as the telephone industry. Again, the network may be compatible with connecting a portable generator for supplemental backup power.

Taps are distributed along the coaxial plant. These extract a portion of the RF signals from the coaxial cable, and send it to the homes of subscribers. Inside the home, the signal is split, with a portion going to television sets (often through a set top box, not shown) for video. A portion of the signal goes to a cable modem, which converts the RF signal to data, usually on one or more Ethernet connections. The cable modem may include the circuitry needed to serve telephones. It will power corded phones but not cordless phones, the same as with telephone company service.

¹⁴ The requirement for eight hours of backup power does not appear to be codified in any national set of rules, but it is an industry-accepted de facto standard for telecommunications backup. However, some states and localities may have franchise requirements that mandate backup powering.

In practically all cases today, the cable modem/telephone interface draws power from the home's electrical outlets, not from the cable plant.¹⁵ Subscribers tend to be amenable to placing batteries in the cable modem for backup. Often today a cable operator will give a subscriber the option of either purchasing a battery to be installed in the modem (the condition of which may be monitored by the operator), using an external uninterruptible power supply (UPS), or doing without backup power. If the battery is installed in the modem, it is generally sized for about eight hours of standby power, after shutting down all equipment not needed to support the telephone.

FTTH

There is overwhelming evidence that fiber is more reliable than any other communications medium currently deployed. While we don't know fiber's maximum lifespan because fiber optics for telecommunications is only about 35 years old, many of the earliest fibers placed into service are still functioning as well as they did the day they were installed.ⁱ

FTTH is impervious to the effects of flooding, and as previously discussed, the field equipment is usually all-passive, so power is not needed in the field.

We know of one case involving an early FTTH system in Illinois in which field technicians found a splice box filled with water. They didn't know it was filled with water until a technician opened the enclosure to add new service. The subscribers served by the flooded splice box did not experience any service interruptions.

Fiber optic cable manufacturers routinely receive reports from customers of fiber cables surviving various events (storms, traffic accidents, etc.), often when such events cause the failure of metallic cabling systems. For example, after Hurricane Sandy, Verizon's network in New York suffered extensive flooding, which destroyed the copper cable then in use, but fiber cables continued to function.

A good measure of reliability is customer trouble report rates; the lower the rate, the more reliable the system. Following Hurricane Sandy, Verizon conducted a telling study that compared the customer trouble report rate for their Broad Street CO, which had been rebuilt with fiber, with their other COs in New York State – most of which have copper-based home connections. The trouble rate for the fiber-based CO was about 1/8 that of all COs for the study period.ⁱⁱ

¹⁵ In the 1990s, the early days of cable telephony, cable companies experimented with designs that extracted electricity from the nodes through the tap and used it to power the modem inside the home. The industry eventually concluded that it was too difficult to send power down the drop to the modem for a variety of technical, economic, and regulatory reasons.

The desire of major carriers to invest in fiber rather than replace aging and/or damaged copper circuits provides yet further evidence that the communications industry firmly supports the new medium.

“But in the storm's wake, Verizon sees an opportunity to modernize its network. While the company has buried fiber optic lines beneath much of its territory, it still serves about a third of its footprint via century-old copper wire technology. Copper is not only slower than fiber; it's also more vulnerable to failing when wet. Instead of fixing damaged copper lines, Verizon plans to replace many of them with fiber, which will be better able to weather future floods,” Levendos said.

Chris Levendos, Vice President – National Operations at Verizon, Inc.

As with the cable television scenario, FTTH requires power in the subscriber's home at the ONT. Power supplies for ONTs are available that have internal monitored batteries that can be easily replaced by a subscriber. The subscriber can also elect to deploy an external UPS. As with copper-based terminals, the internal battery works is designed to supply power for eight hours, but some new products extending this standard battery life have recently come to market.

One ONT manufacturer we spoke with reported an eight and a half hour battery life using a computational algorithm that takes into account worst-case situations. Another manufacturer reported eleven hours of life, based on measurement. The same manufacturer also reported that its battery could automatically cut the power supply with four hours of life remaining at which point the subscriber could decide whether and when to restore the backup supply and use the remaining power.

Yet another manufacturer reports promising laboratory work and predicts that four rechargeable AA batteries could eventually last up to three days in standby mode.ⁱⁱⁱ This is achieved by using advanced, low-power circuitry, and intelligently shutting down unused circuits, as well as restructuring data to minimize superfluous processing. While this product is not on the market yet, it exemplifies private industry's great progress in response to competitive pressures.

Because fiber is nonconductive, FTTH also offers protection from lightning and power surges to the home. One operator that overbuilt conventional service providers noted that one of its biggest failure incidents occurred at an outside ONT because the installer failed to remove the copper wiring previously used by the telephone and cable operators.¹⁶ The operator serves a high lightning area and induced surges on these left-over copper conductors have caused problems. Such incidents are inevitable with technologies that bring conductive conduits to the house: surges induced by lightning, transients on the power grid, or other electrical disruptions have a direct path to the home. FTTH is invulnerable to such disturbances.

FTTH is also immune to radiating signals or picking them up off the air, eliminating long-standing problems with other media. And it is impervious to the effects of flooding and salt environments.

¹⁶ Darryl Brown, Director of Product Management – ADTRAN, private correspondence.

CONCLUSION

Fiber to the home is unrivaled by any contemporary technology. Fiber boasts speeds ten times faster than the best widely advertised cable connection and hundreds of times faster than outmoded DSL connections.

A commonly used metric for speed is downstream speed on a given medium divided by the number of subscribers sharing a connection. Note that the actual speed experienced by a subscriber is faster than this due to sharing. For example, 300 customers sharing 300 Mb/s from a single cable operator would experience average speeds of 1 Mb/s on paper. But because of sharing, that same operator can advertise speeds *up to* 100 Mb/s service under the assumption that not all subscribers will use the connection simultaneously.¹⁷

Depending on the technology used, FTTH offers downstream speeds of 1,000-10,000 Mb/s divided among 32 subscribers, for an average of 31 to 310 Mb/s per subscriber. This compares directly with the above 1 Mb/s per subscriber for cable. Because of differences in technology, telephone company DSL is a little harder to compare, but actual (not average) speeds per subscriber frequently range from 3 to 6 Mb/s, with a few subscribers lucky enough to enjoy up to 24 Mb/s. If we were to compute an average speed per subscriber, it would be lower, typically less than 1 Mb/s, depending on the connection from the CO to the DSLAM.

Copper and cable networks are prone to failure in poor weather conditions and degrade quickly. Fiber's failure rate since its original implementation as a communications medium is infinitesimal and the material is remarkably resilient to degeneration.

Copper and cable require expensive, permanent field plant that depends on electricity. Fiber networks are all passive; they require no mainline power source and thus, no backup source. Fiber nodes remain fully functional regardless of disruptions to the commercial grid.

While telephone and DSL networks are hampered by transmission speeds that rapidly decay less than 2 km from a node or DSLAM, fiber networks can maintain 1 to 10 Gb/s speeds (depending on the technology) at distances up to 20 kilometers from a splitter.

While cable networks force end-users to sacrifice either performance or service choice due to the bandwidth limitations of their transmission lines, fiber networks are restrained only by terminating equipment. Such equipment can be replaced easily and cheaply and the fiber lines themselves provide bandwidth to exceed any potential contemporary need.

By any measure, fiber has been demonstrated the undisputed superior choice for broadband investment.

¹⁷ Assumes DOCSIS 3.0, with eight bonded channels. Earlier DOCSIS standards will deliver significantly lower speeds.

REFERENCES

ⁱ Corning, Inc., *Frequently Asked Questions on Fiber Reliability*, WP5082, issued September 2010. Available at www.corning.com/WorkArea/downloadasset.aspx?id=35209

ⁱⁱ Guru Pai, *The Evolving Network*, Monday Keynote Presentation at FTTH Conference 2014, available at <http://www.ftthcouncil.org/p/do/sd/sid=1395&type=0> (membership required to access)

ⁱⁱⁱ *FTTH technology in the Aftermath of Sandy* - Peter Vetter, <https://www.youtube.com/watch?v=0W91z1ByY2o>