

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of)	
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)	
Reliability and Continuity of)	PS Docket No. 11-60
Communications Networks, Including)	
Broadband Technologies)	

COMMENTS OF VERIZON

Verizon’s role as both a wireless company and a wireline company providing backhaul services to wireless service providers offers us a unique perspective on the reliability of networks during times of natural disaster. Our networks serve both our own wireless customers and other wireless companies, and we look forward to bringing this perspective to the newly established Disaster Recovery Working Group of the Broadband Deployment Advisory Committee. As the Public Notice recognizes, the severity of the storms during the 2017 and 2018 hurricane seasons and the wireless industry’s challenges in restoring backhaul networks in particular areas—notably Puerto Rico and the Florida Panhandle—underscore the importance of wireless providers incorporating best practices into the design and procurement of backhaul-related services.¹ We have done that, but each new event provides an opportunity to determine areas of possible improvement. Chairman Pai’s establishment of the new working group thus represents a timely and important opportunity for all stakeholders involved—not just wireless and wireline companies, but state and local governments and electric utilities—to learn from this experience

¹ See *Public Safety and Homeland Security Bureau Seeks Comment on Improving Wireless Network Resiliency to Promote Coordination Through Backhaul Providers*, Public Notice, PS Docket No. 11-60, DA 18-1238 (Dec. 10, 2018).

to consumers' benefit. The Commission should let the new working group collaborate to determine any next steps to improving wireless backhaul for future disasters.

I. Backhaul Providers and Wireless Companies Will Apply Lessons Learned During the 2017-2018 Hurricane Seasons.

As Verizon and other wireless companies have explained, the major storms of the 2017 and 2018 hurricane seasons significantly affected networks that provide backhaul for wireless providers, but in different ways. Flooding was a principal cause of backhaul problems during Hurricanes Harvey and Florence. Wind damage (e.g. downed trees) and flooding affected backhaul throughout much of Florida in Hurricane Irma. As we detailed for the Bureau last month, fiber cuts created by downed trees and utility poles and ongoing recovery work were the principal cause of Verizon's backhaul outages for Hurricane Michael and for those service providers affected by Hurricane Maria in Puerto Rico. And backhaul networks suffered major physical damage during recent wildfires.

Because different types of disasters affect networks differently—and because wireless companies design and invest in their networks in different ways for competitive and other business reasons—there is no one-size-fits-all approach to protecting backhaul networks. Wireline and wireless companies thus need the flexibility to design their networks based on the disaster risks in a potential area and the economic viability of particular practices. Wireless providers follow a number of best practices to prevent outages in their networks, including: purchasing physically diverse services when economically viable and warranted by the risk; minimizing damage to underground facilities when working; mutual aid; provisioning of

alternate systems like microwave and satellite; and coordination with emergency management agencies and utilities in emergency response and restoration.²

As previously explained to the Commission, Verizon has already incorporated these and other safeguards into its internal practices and applied them extensively in the 2017-2018 hurricane seasons and the major California wildfires.³ CSRIC best practices, for example, already recommend that service providers: “coordinate hurricane and other disaster restoration work with electrical and other utilities as appropriate;” “consider tertiary carrier/transport methods such as satellite, microwave or wireless to further reduce point of failures or as ‘hot transport’ backup facilities;” and “placing all power and network equipment in a location to increase reliability in case of disaster (e.g., floods, broken water mains, fuel spillage).”⁴ We utilized each of these best practices in our Hurricane Michael recovery efforts and in other hurricane events, as detailed in our earlier filings.⁵ And we recently used several of these practices extensively during the recent California wildfires.⁶

² See CSRIC Best Practice Nos. 11-9-0566 and 11-10-0731 (diverse interoffice and backhaul transport facilities, including self-healing fiber ring topologies); 11-10-0741 (protecting underground facilities); 11-9-1031 (mutual aid); 11-10-1036 (use of wireless alternate backhaul systems); and 11-10-5226 (liaison with local government agencies and utilities).

³ See Verizon Comments, PS Docket No. 18-339, at 3-9 (Dec. 17, 2018) (“Verizon Hurricane Preparedness Comments”).

⁴ See CSRIC Best Practice Nos. 9-7-1050 9-7-5214, 9-9-0655, and 11-9-0655. The CSRIC IV 2014 working group report on backhaul networks lists several other relevant best practices relating to network redundancy and service restoration. *CSRIC IV, Working Group 9, Infrastructure Sharing During Emergencies—Transport Subcommittee Shared Services*, Report, at 8-12 (Dec. 2014), available at https://transition.fcc.gov/pshs/advisory/csric4/CSRIC_WG%209_Transport_Final_Recommendations_11-24-2014.pdf.

⁵ See Verizon Hurricane Preparedness Comments at 3-10; Verizon Comments, PS Docket No. 17-344, at 3-7 (Jan. 22, 2018).

⁶ See <https://www.verizon.com/about/news/california-wildfire-network-updates>.

In addition, providers almost uniformly secure fuel for powering generators, secure staffing and support for restoration crews, and maintain a spare inventory of electronic components and fiber. Verizon also holds disaster recovery reviews with all backhaul providers before every storm season. We review fiber routes, discuss lessons learned from previous storm seasons, and establish strategies for approaching and responding to potential threats to network integrity. Verizon has further improved the effectiveness of an already redundant network architecture by limiting the geographical impact of an outage due to loss of backhaul by limiting the number of cell sites that can operate on an unprotected single fiber link and associated backhaul equipment. And at traffic hubs, where the traffic of more sites is aggregated, we design and maintain fully redundant fiber routes back to our data centers where practical. All of these practices mitigate the impact of any single point of failure within the network due to backhaul loss.

As Verizon's 2017-2018 experience also attests, pursuing a particular best practice will involve trade-offs for service providers, consumers, and local governments.⁷ Aerial fiber is generally *less* vulnerable to cuts than underground fiber, which is frequently cut due to road maintenance and other construction activities. And when cuts to aerial fiber occur, they ordinarily take less time to repair. But in events like Hurricane Michael, aerial fiber was more vulnerable to wind damage from trees and utility poles. Where underground fiber deployment is merited, it is often more costly and takes longer to deploy than aerial fiber, and installation and repair can impose greater burdens on local governments infrastructure budgets and consumers' commute times. And mutual aid arrangements, while beneficial, should not serve as a "crutch"

⁷ See Verizon Hurricane Preparedness Comments at 11-12 (describing the reliability trade-offs between aerial and underground fiber).

that enables a service provider to under-invest in its own network resiliency and service restoration resources, at the expense of facilities-based competition. These trade-offs will become even more acute as the wireless industry deploys additional cell sites and fiber backhaul to support the high speed 5G networks and services that consumers and businesses demand.

II. Verizon Incorporates Extensive Network Reliability Safeguards in Its Wireless Network—and Makes Those Safeguards Available As a Backhaul Provider to Wireless Companies Willing to Invest in Them.

Verizon is both a wireless purchaser of backhaul network capabilities nationwide and a seller of those capabilities to wireless providers in many markets in the United States. From either perspective, the resiliency of a wireless provider's backhaul network depends primarily on one thing: the wireless provider's willingness and ability to invest in the equipment, fiber and personnel resources necessary to deploy, maintain and restore a reliable backhaul network. All these considerations are reflected in the commercial agreements negotiated between backhaul providers and their wireless provider customers, which already enable the parties to formalize economical and comprehensive network reliability practices.

Verizon's practice as a wireless provider, for example, is to pursue physically diverse fiber ring paths; dual diverse entrances into switching facilities; service level agreements with prompt notification and repair benchmarks when cuts occur; and minimum reliability standards for both underground (conduit), and aerial fiber deployment. For conduit, this includes minimum depth, conduit material and thickness parameters, and appropriate safeguards for conduits that cross roads, railways, and bridges. For aerial fiber, this includes material and sag/tension standards and compliance with applicable pole attachments rules. And for all fiber, this includes minimum standards for emergency repair (including 24/7 availability and

monitoring), and service restoration credits that incentivize the fiber provider to restore service expeditiously.

Verizon's own backhaul service offerings to wireless providers likewise accommodate all these reliability safeguards—subject, of course, to the wireless provider's willingness to make those necessary reliability investments in the first instance. In Verizon's experience, wireless companies have significant incentive to obtain contractual arrangements that address network reliability issues and will opt for a new provider if reliability concerns are not met. And backhaul providers have significant incentive to meet wireless providers' demands in order to retain the latter's business.

These contractual arrangements also comprehensively govern wireless and backhaul providers' coordination and information sharing activities for service restoration, including through nondisclosure agreements as needed. Backhaul providers monitor their networks 24/7 and both (1) notify their wireless provider customers when service-affecting outages are detected and (2) respond to inquiries from them through pre-established channels of communication, both at the account management and network operations levels. This is in addition to coordination efforts at venues such as the federal National Coordination Center for Communications (NCC), where major wireless and backhaul providers (including Verizon) routinely participate, and at state and local government-supported emergency operations centers (EOCs).

III. The Commission's BDAC Disaster Response Working Group Will Assess How to Better Apply Existing Best Practices In Light of Recent Disaster Events.

Every hurricane and disaster event results in new lessons learned. In the wake of Hurricane Michael, for example, we are reassessing our allocation of aerial versus buried fiber and the redundancy of our fiber rings in the Florida Panhandle generally, particularly in light of our forthcoming deployment of a 5G network and services in Panama City. We will make

further investment in satellite assets for deployment to areas affected by Category 4/5 hurricane events. And our experience working with other stakeholders at local government EOCs showed how those EOCs can effectively supplement the coordination efforts of the NCC and statewide Emergency Management Agencies (EMAs).

Chairman Pai's mandate for the Broadband Deployment Advisory Committee (BDAC) Disaster Response Working Group squarely tees up these issues.⁸ The Working Group presents a well-timed venue to evaluate how the communications industry's experience in the 2017-2018 hurricane season, and events like the recent California wildfires, can instruct how we enhance and apply those best practices in particular circumstances. For example, the increasingly widespread availability of affordable, portable and scalable satellite-based backhaul is a relatively new development, so stakeholders might consider the circumstances and types of disasters in which the use of that equipment would be most helpful to consumers. And while local governments do not always have the resources to establish their own EOCs during and after a disaster, the industry's experience with Bay County after Hurricane Michael could provide some lessons for service providers, utilities, and state and local governments on standing up and meaningfully participating in an effective EOC, whether supported at the state or local level. The fact that the Working Group includes a broader group of government and industry stakeholders can provide added value to the process.

⁸ See *Chairman Pai Announces Members of BDAC Disaster Response and Recovery Working Group*, FCC News Release (Nov. 1, 2018) ("The Working Group is charged with recommending measures that can be taken to improve the resiliency of broadband infrastructure before a disaster occurs, as well as actions that can be taken to more quickly restore broadband infrastructure following a disaster ... [and] with developing best practices for coordination among wireless providers, backhaul providers, and power companies during and after a disaster.").

Working through the BDAC will address the Commission's concerns more effectively and expeditiously than either expanding the Wireless Resiliency Cooperative Framework to include backhaul providers, or pursuing a stand-alone backhaul providers' reliability framework. Not only do backhaul providers represent a broader cross section of the communications industry (e.g. wireline, cable, fixed wireless, satellite, and dark fiber), they have different business models and use different technologies to support backhaul links. And as explained above, the extent to which best practices are incorporated into a backhaul network is more dependent on a wireless provider's resiliency practices and business decisions.

Verizon looks forward to participating in the Disaster Response Working Group and applying its experience in the 2017 and 2018 hurricanes to improve and enhance how service providers use best practices to protect their networks from and timely restore service after major disaster events.

Respectfully submitted,

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