

**BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA**



FILED

04/03/20
04:59 PM

Order Instituting Rulemaking Regarding
Emergency Disaster Relief Program.

Rulemaking 18-03-011
(Filed March 22, 2018)

**COMMENTS OF THE UTILITY REFORM NETWORK AND ACCESS HUMBOLDT
ON THE MARCH 6, 2020 ASSIGNED COMMISSIONER'S RULING AND PROPOSAL**

Andrew Afflerbach, Ph.D., P.E.
CEO and Chief Technology Officer
CTC Technology & Energy
10613 Concord St.
Kensington, MD 20895
(301) 933-1488
aafflerbach@ctcnet.us

Sean Taketa McLaughlin,
Access Humboldt
P.O. Box 157
Eureka, CA 95502
(707) 476-1798
seanmclaughlin_puc@accesshumboldt.net

Regina Costa
Telecommunications Policy Director
Christine Mailloux
Staff Attorney
The Utility Reform Network
685 Market St., Suite 1400
San Francisco, CA 94103
(415) 929-8876
cmailloux@turn.org
rcosta@turn.org

April 3, 2020

Table of Contents

I. Introduction..... 1

II. DISCUSSION..... 1

A. 1., 2. Applicability of Requirements1

B. 4. Back-up Power Requirement2

1. 4. (a) The Proposal Should Be Modified to Define Essential Communications Equipment
and Emergency Essential Services.....2

2. 4. (c) Essential Services Must be Continuously Available.....3

C. 5. (d) Critical Facility Location Information Sharing4

III. Conclusion 5

I. INTRODUCTION

Pursuant to the March 6, 2020 Assigned Commissioner's Ruling and Proposal ("Ruling" and "Proposal"), The Utility Reform Network ("TURN") and Access Humboldt hereby submit these responses to the questions concerning the recommendations contained in the Assigned Commissioner's Proposal.

TURN and Access Humboldt applaud the Commission's prompt effort to bolster network resiliency and improve the responsiveness of communications service providers to responders during disasters and public safety power shutoffs. These comments are presented in two sections. First, in these introductory Comments we briefly discuss issues that we believe require additional clarification. This is followed by our detailed responses to the questions posed in the Ruling and to the Proposal itself, addressed in Attachment A, the Declaration of Andrew Afflerbach, Ph.D. and P.E.

II. DISCUSSION

A. 1., 2. Applicability of Requirements

The Proposal rightfully envisions a broad definition of providers to which these requirements would apply. It is important to recognize that there are providers, services, and owners of equipment and infrastructure involved in carrying emergency alerts via voice, text messages, data, or streaming video that may not be subject to the Commission's jurisdiction. These may include, for example, independent Wireless Internet Service Providers ("WISPs"), municipal broadband providers, airport and venue WiFi providers, and tribal entities. The

services provided by such providers are essential for the customers using the service to receive emergency alerts and to contact first responders. During an emergency or commercial power outage, these services can cease to function. We urge the Commission, as part of its effort to ensure reliable communication, to identify and reach out to these providers to understand the measures they have taken to enhance network reliability and to educate and encourage the implementation of practices adopted in the Proposal. It is not enough to ensure that only some parts of state's public communication network are resilient in the face of an outage, especially if end users are still at risk of losing service. The Commission's work to implement these requirements must be part of a holistic effort to improve reliability of all communication during emergencies and commercial power outages in California. To accomplish this goal, not only will it be important to reach out to a wide variety of network providers, but it may also be necessary for the Commission or the Legislature to consider additional jurisdictional authority and support mechanisms to bolster reliable service, including for those data communication providers that do not currently operate under CPUC jurisdiction.

B. 4. Back-up Power Requirement

1. *4. (a) The Proposal Should Be Modified to Define Essential Communications Equipment and Emergency Essential Services*

The Proposal contains a list of essential communications equipment that we believe is adequate. We propose that the term "Essential Communications Equipment" should be added as a defined term in the Proposal. We also think that it is important to add a definition of "Emergency Essential Services," so that it is clear what services and functionality should continue to operate during emergencies. The goal is to ensure that networks continue to operate

during power outages so that emergency essential services are available to customers to the greatest extent possible. The proposal states that "[s]ervice must be sufficient to maintain access for all customers to 9-1-1 service, to receive emergency notifications, and to access web browsing for emergency notices." 2-1-1 information and referral services also provide essential service for non-emergency overflow traffic that could otherwise overwhelm 9-1-1 service. Web browsing is important if customers are to access outage maps, or detailed county public health alerts, for instance. All of these functions should be included in the definition of Emergency Essential Services. In addition, it is now common for state and local jurisdictions provide emergency information, medical information, and safety warnings using short streamed video, and short streamed video service should also be included in the Emergency Essential Services definition. As customers, we are aware that "emergency essential services" does not need to support services such as streaming movies. The streaming video could be provided at low definition, sufficient to provide customers with access to emergency information, such as video announcements from public health officers. We recognize that including streaming video may be a burden on a network, but at the same time customers need to have the ability to receive alerts and essential information provided by emergency officials. The Commission should also ensure that providers do not engage in network throttling that interferes with the ability of emergency officials and customers to use the services included in the Emergency Essential Service definition.

2. 4. (c) Essential Services Must be Continuously Available.

TURN and Access Humboldt support the proposed 72 hour back-up power requirement. However, it is important to ensure that essential services continue to operate after the 72 hour

period. As the Proposal notes, Californians rely on their phones and their internet during emergencies to reach out to first responders, get access to updated information and to connect with family and friends.¹ Californians have a reasonable expectation that these services will be operational.² The 72 hour period should enable providers to implement additional steps to ensure that service continues to function. These can involve measures such as refueling generators, utilizing alternative sources of local and regional power, installing supplemental equipment such as Cell on Wheels ("COWs") and Cell on Light Trucks ("COLTS") or utilizing satellite uplinks to ensure service continuity. The Staff Proposal should be revised to require providers to maintain "Emergency Essential Services" beyond the 72 hours to ensure customers have access to these services.³ In addition, providers should be required to explain how they will continue to provide essential services after 72 hours in their Backup Power Plans.

C. 5. (d) Critical Facility Location Information Sharing

TURN and Access Humboldt support this requirement and urges the Commission to revise the Staff Proposal to require live reporting, or at a minimum quarterly reports. This information is constantly evolving, and it is important for emergency responders to have up to date information as they plan for and address a myriad of types of disasters and outages. The Staff Proposal should also define the types of information to be included in this reporting more clearly and ensure that "critical facility location information" includes data on all types of the

¹ Staff Proposal at p. 1.

² Staff Proposal at p. 1.

³ Currently the Staff Proposal is not clear whether the intent is to require providers to demonstrate the ability to maintain these essential functionalities for a "minimum of 72 hours" and then allow providers to stop maintaining any services after the 72 hour period regardless of how long the outages last (see p. 3), or if the Proposal's intent is to require providers to, "maintain access to 9-1-1 and maintain the ability to receive emergency notifications and access web browsing for emergency notices for 100 percent of the customers in the event of a power failure" (p. 4) for as long as the power failure lasts.

Essential Communications Facilities, as defined in Section 1 of the Staff Proposal in the context of the back up power requirement.

III. CONCLUSION

TURN and Access Humboldt applaud the Commission's effort to address telecommunications network reliability, resiliency and timely provision of crucial information to state and local emergency services officials. The overarching goal of the Commission should be to ensure that the types of telecom network failures experienced by California telecom customers never happen again. It may not be possible to implement requirements that prevent all future telecommunications outages, but it is certainly possible to reduce them and improve the reliability of essential telecommunications services. We look forward to working with the Commission and parties to assist the Commission in ensuring that California's telecommunication networks are as reliable and resilient as possible.

Dated: April 3, 2020

Respectfully,

/s/

Regina Costa

The Utility Reform Network
785 Market St., Suite 1400
San Francisco, CA 94103
(415) 929-8876 ext. 312
rcosta@turn.org

Authorized to sign on behalf of
Access Humboldt

Attachment A

Declaration of
Andrew Afflerbach, Ph.D., PE

Declaration of Andrew Afflerbach, Ph.D., P.E.

Prepared on behalf of The Utility Reform Network
CPUC Docket R. 18-03-011
April 3, 2020

For ease of review, I have reprinted the Commission's questions from Section 4, Request for Formal Response, in italics. Each question is followed by my response.

4.1 Proposal for Ensuring Resiliency in Communications Provider Networks

1. Applicability of Requirements: The Proposal states that the requirements shall be applicable to all companies owning, operating, or otherwise responsible for infrastructure that provides or otherwise carries 9-1-1, voice, text messages, or data.

a) Is the definition of applicability reasonably tailored to ensure compliance over all communications service providers? Why or why not?

This definition is not tailored to ensure compliance over all communications service providers. One significant gap is that it does not include resellers of communications services that may operate Essential Communications Equipment (as listed on p. 3 of the Proposal). For example, resellers may operate telephone switches that interconnect with the telephone lines operated by telephone companies and would be used by the resellers to connect to 9-1-1, so the backup power requirement needs to apply to that and any other Essential Communications Equipment.

b) Which types of providers should be excluded because their services are not essential to reliable access to 9-1-1 and the distribution of essential emergency information?

We do not see any types of providers to exclude. Any large or small provider could theoretically be the only available or affordable option in some parts of the State—including not only major carriers, cable companies, and mobile wireless carriers (and resellers of any of the services), but also independent wireless internet service providers (WISPs). I understand there are jurisdictional limitations. Ideally, there is a holistic framework that includes large and small providers—even municipal broadband providers and airport and venue Wi-Fi providers. Smaller carriers may need support in this area to afford the needed resiliency.

2. Alternatively, D.19-08-025 defined communications service providers into the following categories: (1) facilities-based and non-facilities-based landline providers include 9-1-1/E9-1-1 providers, LifeLine providers, providers of Voice Over Internet Protocol [VoIP], Carriers of Last Resort [COLRs], and other landline providers that do not fall into the aforementioned groups; (2) wireless providers include those that provide access to E9-1-1 and/or LifeLine services; (2A) facilities-based wireless providers; and (2B) non-facilities-based wireless providers, include resellers and mobile virtual network operators [MVNOs].

a) For purposes of Phase II, should the Commission apply the definition from D.19-08-025, instead of the proposed definition in the Proposal?

Yes, the Commission should apply the definition from D.19-08-025, instead of the proposed definition in the Proposal. D.19-08-025 more fully encompasses the providers that should be included, in particular, by specifically including resellers.

3. Definition of Resiliency: The Proposal defines resiliency as the ability to recover from or adjust easily to adversity or change and is achieved by Providers through utilizing a variety of strategies. The proposal lists an array of strategies and provides definitions for each one.

a) Please provide comments on definition of resiliency in the context of communications service resiliency strategies and their definitions.

We recommend that the definition also incorporate recommendations from U.S. Department of Homeland Security (DHS), who identify three components to communications resiliency: 1) route diversity, 2) redundancy (additional or duplicate of communications assets to provide redundancy and/or load sharing in the event of failures) and 3) protective (hardening) and restorative measures. The strategies listed in the bullet points below the resiliency definition in the Proposal fit into these three pillars.

The DHS approach identifies route diversity as being so critical that it warrants its own pillar. The DHS approach then makes clear that there are, additionally, many other needed types of redundancy.¹

¹ Public Safety Communications Resiliency: Ten Keys to Obtaining a Resilient Local Access Network, p. 1, <https://www.dhs.gov/safecom/blog/2018/02/07/public-safety-communications-resiliency-ten-keys->

b) Please comment on any recommendations or modifications that should be considered to the proposed resiliency definition and resiliency strategies—provide a complete discussion for any recommendations or modifications.

Backup Power: Backup power is currently centered around fixed batteries, generators, mobile generators and refueling plans. In the future, other technologies may become important, including solar generation and fuel cells, so the definition should include these. A resilient provider will not only use the best tools available but will be continuously researching and innovating improved solutions.

Redundancy: Not only should wired routes and cell sites be designed with redundancy, but so should other components that will provide value, including redundant generators, redundant connections to power, redundant fuel contracts, redundant vehicles, and redundant staffing.

Hardening: No changes suggested.

Temporary Facilities: This section should be modified as follows to better explain how the use of temporary facilities will actually create resiliency (added text is noted in ***bold italic***):

“Network operators that own and maintain ***a sufficient supply of the appropriate type of*** temporary facilities (e.g., mobile cell sites, mobile satellite and microwave backhaul, etc. are able to restore service to their networks when facilities are damaged or destroyed. ***Network***

[obtaining-resilient-local](#), accessed March 24,2020; and Public Safety Communications Network Resiliency Self-Assessment Guidebook November 2018, p. 1, <https://www.dhs.gov/safecom/blog/2018/12/11/public-safety-communications-network-resiliency-self-assessment-guidebook>, accessed March 24, 2020.

operators must review past events and use best practices to determine the needed type and quantity of facilities, a plan for how to deploy them, a plan for making excess facilities available if other providers or require them, as well as a plan for where they should be stored.”

Communication and Coordination: This section should be modified as follows because of the need for planned contractual arrangements, not simply ad hoc communication and coordination: “Network operators that establish clear lines of communication and **have agreements in place to** coordinate with other Providers, other utilities, emergency responders, and the public are best positioned to maintain and restore service after a power outage or disaster.”

Preparedness Planning: “Network operators that maintain comprehensive preparedness plans and qualified staff are able to maintain and restore service to their networks quickly and effectively. **Operators must also use best practices in testing equipment and in undertaking training and preparedness exercises. Best practices must comprehensively test company procedures, equipment and staff and lead to continuous improvement in procedures, equipment and staff.”**

4) Backup Power Requirement

a) Please provide comments on the proposed backup power requirement.

With regard to the backup power requirement in the Proposal, the requirement contains an adequate delineation of essential communications equipment that should be included. We recommend that Essential Communications Equipment be a defined term, using the definition and examples stated here. Whether deliberately or not, Essential Communications Equipment does not appear to include power supplies and amplifiers in cable broadband systems—which, as noted in the comments by the Comcast in Phase I, although necessary to provide service to cable broadband customers, would require generators at thousands of locations across California and thus cannot be implemented in a short period of time.² We address the challenge of backup power in cable broadband networks in our responses to Question 4d and Question 5 below.

Because it is now common to provide information and instructions in the form of short streamed video (e.g., emergency information, medical information, safety warnings), the required service should also include that level of functionality. This can be streamed video and does not need to be high-definition. We recommend that the required functions, listed at the bottom of p. 3 of the Proposal and elsewhere, be defined as Emergency Essential Services, with

² Letter from John Gauder, Regional Senior Vice President, California Region, Comcast, to Marybel Batjer, November 18, 2019, p. 2 and A-2 to A-3 and A-5.; https://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/News_Room/NewsUpdates/2019/Nov.%202018%202019%20Comcast%20Response%20to%20President%20Batjer%20Nov.%2013%20Letter.pdf; also Letter from Sam Attisha, Senior Vice President and Region Manager, Cox Communications, November 18, 2019, p. 3 and Attachment 1, p. 1, and p 3-4., https://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/News_Room/NewsUpdates/2019/Nov.%202018%202019%20Cox%20Response%20to%20President%20Batjer%20Nov.%2013%20Letter.pdf

the addition of streamed video as describes above. Therefore, Emergency Essential Services is defined as 9-1-1 service, [the ability] to receive emergency notifications, [the ability] to access web browsing for emergency notices, [and the ability to receive information and instructions in the form of short streamed video (e.g., emergency information, medical information, safety warnings)]. We emphasize that Emergency Essential Services is the baseline service in an extended power outage and should not be a justification for provider throttling or content control in other settings.

b) How should “outage” be defined?

An “outage” is where commercial power or backhaul communications is out in the service area of the Provider, or where commercial power is out in an area where the Provider or its backhaul communications provider has critical infrastructure or Essential Communications Equipment (i.e., as defined below under “Backup Power Requirement”).

c) Should the length of the 72 hour backup power requirement be shorter, longer or indefinite? Please provide an analysis to support your recommendation.

In terms of backup power requirement, 72 hours is acceptable for battery time or on-site generator time without refueling—but the backup power plan (Question 5 below) needs to include a plan for continuous operation of each component of Essential Communications Equipment after 72 hours. The Proposal should clearly require Emergency Essential Services to

be available after 72 hours, and the specific approach taken by the carrier should be in its Backup Power Plan.

(d) What other backup power requirements or components should the Commission consider? Please provide an analysis to support your discussion of any additional requirements or components.

Any components on the network beyond the Essential Communications Equipment, that are necessary for the customer to receive access Emergency Essential Services, such as power supply locations in cable systems, must have backup power of 24 hours and the capability to attach a portable generator.

5) Backup Power Plans

The compliance requirement is well stated, but the last sentence should be “The plan shall describe the Provider’s ability to maintain access to the Emergency Essential Services for 100 percent of customers in the event of a power failure.”

Providers need to indicate quarterly what modifications have been made to the Plan in the previous quarter, and an updated plan needs to be provided each year. Because fire and other emergencies now happen in yearly cycles or more frequently, a less frequent reporting interval will not build in the improvements in procedures until the next round of disasters, with the

result that critical information will not be shared while it can still lead to statewide, industry-wide improvements.

If a Provider (for example, Charter, Comcast and Cox as stated in their responses to the Commission in Phase I) is incapable of maintaining service to customers for more than a few hours after an outage, even if the Essential Communications Equipment has backup power, because widely-distributed components cannot have adequate backup power, the Provider must 1) declare to customers in advance that its service is unlikely to operate during an extended outage, so that customers can find an alternative in advance, and 2) provide a road map to upgrading the network to provide service for 100 percent of customers in the event of a long-term commercial power outage (considering, for example, solutions such as expanded battery systems, solar panels, or microgrid).

The backup power plan needs to include all of the information requested in the Proposal, and also:

- For fixed generation sites—the number and type of generators and their run time
- Mobile generators and refueling trucks—should state the number and type or generators and their run time, and identify how many are situated in each California county or region
- GIS shapefiles with the locations of all Essential Communications Equipment and the route and type of wireline interconnection—to enable CPUC to assess whether there is sufficient redundancy, identify areas where providers may collaborate, find areas that are most vulnerable, and help CPUC prioritize areas for new infrastructure

- Number, type and location of all temporary facilities

a) Clean Energy Generation

No additions.

b) Waivers

At a minimum, local jurisdictions and competitive providers ought to be consulted on proposed waivers. Information about where waivers have been granted should be public.

(c) Critical Facility Location Information Sharing

Critical facility location information sharing with first responders should be updated quarterly or live. GIS shapefiles and data on all the type of Essential Communications Facilities listed on the bottom of p. 3 needs to be shared to identify whether there is sufficient redundancy and hardening to identify areas where Providers may collaborate, find areas that are most vulnerable, and help CPUC prioritize areas for new infrastructure.

(d) Critical Infrastructure Resiliency, Hardening and Location Information Sharing

GIS shapefiles of fiber routes connecting the Essential Communications Facilities needs to be shared quarterly or live. GIS shapefiles and data on Critical infrastructure are needed to identify whether there is sufficient redundancy and hardening to identify areas where Providers may

collaborate, find areas that are most vulnerable, and help CPUC prioritize areas for new infrastructure.

6) Emergency Operations Plans

(a) Additionally, the Proposal itemizes required content that the Providers must submit to the Commission. Please provide comments and analysis on this issue.

The update of emergency operations plans needs to be quarterly instead of yearly to align better with changes in circumstances.

The Provider public communications plan for Providers whose services will not operate if there is an extended widespread power outage needs to inform current subscribers of the likelihood their service will not continue operating and also include warning information on the website and other sales material.

(b) Should the proposed rule for Emergency Operations Plans include any other information that the Proposal does not address? Please explain why any additional information is legitimate and necessary for adoption.

Providers need to provide a description of the testing and emergency procedures performed since their November 18 submission, how many facilities and what infrastructure was tested, and the number of employees and contractors involved. Providers need to explain the lessons they learned and steps they are taking to improve procedures and infrastructure.

7) Current Mitigation Efforts

(a) Number of additional generators acquired (both fixed and mobile)

Providers should include the make, model, and run time; whether the location has redundant generators; what type of system is used to operate the failover between redundant generators; where the portable generators are placed or stored; and how the portable generators would be transported.

(b) Number of additional temporary facilities acquired (e.g., COWs, COLTs, etc.)

Providers need to describe the capabilities of the facilities relative to a permanent facility, identify where the facilities are stored, and describe how they are to be transported.

(c) Additional network redundancy built into network (e.g., logical and physical)

If fiber or wireline routes are built, Providers need to provide GIS shapefiles including routes, counts, and whether the routes are underground or aerial.

(d) Provide details on plans in the near, intermediate and long term to further harden facilities

Details need to include completion date, impact on the network, the dollar amounts invested, the region and customers affected by the hardening, and the expected impact for customers.

(e) Identify barriers to building resiliency into your networks.

No changes.

(f) Identify any other investments or cooperative agreements that will be made to build in more backup generation or minimize the need for backup generation

Information also needs to include dollar amounts invested, the region affected, and the impact for customers.

(g) Identify if communications service outages as a result of future public safety power shutoff events are expected. Identify specific locations and reasons where network outages are expected.

Providers need to compare their projection to 2019 and provide justification for the change or lack of change.

8. Other Topics for Commission Consideration

Providers need to address systematic problems—for example, if there is no way to harden a system for extended outages, what is the Provider’s alternative for its customers? Do customers need to buy a second service? Will the Provider be able to offer a second service (e.g., mobile, satellite) for customers? In the long term, will the Provider be migrating to a new technology?

The Commission also needs to work with quantitative benchmarks and goals to the greatest extent possible. Typically, only what is measured is accomplished.

The Commission needs to review reports of the location, duration and cause of outages. If the Commission is working with complete and accurate information about infrastructure and number of outages, measures the steps taken by the Providers, and measures progress in outages and other metrics over time, Providers will be more likely to make progress—and both the Commission and Providers will be able to evaluate the outcome and, if necessary, change their approaches.

Finally, the Commission needs to verify first-hand that steps have been taken. Commission staff needs to perform spot checks on back-up power at Essential Communications Equipment—verifying the generators and other equipment is in place and observing tests of the generators.

The Commission also needs to perform spot checks that redundant fiber routes are complete.

And, the Commission needs to verify that the Emergency Preparedness Exercise and other exercises and training are being performed as promised, ideally by staff being able to shadow the activities.

Attachment B

Andrew Afflerbach Resume

Andrew Afflerbach, Ph.D., P.E. | CEO and Chief Technology Officer

Dr. Andrew Afflerbach specializes in the planning, designing, and implementation oversight of broadband communications networks, smart cities strategies, and public safety networks. His expertise includes state-of-the-art fiber and wireless technologies, the unique requirements of public safety networks, and the ways in which communications infrastructure enables smart and connected applications and programs for cities, states, and regions.

Andrew has planned and designed robust and resilient network strategies for dozens of clients, including state and local governments and public safety users. He has delivered strategic technical guidance on wired and wireless communications issues to cities, states, and national governments over more than 20 years. He has advised numerous cities and states, including New York City, San Francisco, Seattle, Atlanta, Washington, D.C., and Boston, and served as a senior adviser to Crown Fibre Holdings, the public entity directing New Zealand's national fiber-to-the-home project.

In addition to designing networks, Andrew testifies as an expert witness on broadband communications issues. And he is frequently consulted on critical communications policy issues through technical analyses submitted to the Federal Communications Commission (FCC) and policymakers. He has prepared white papers on:

- Estimating the cost to expand fiber to underserved schools and libraries nationwide
- Conducting due diligence for the IP transition of the country's telecommunications infrastructure
- Developing technical frameworks for wireless network neutrality
- Streamlining deployment of small cell infrastructure by improving wireless facilities siting policies
- Limiting interference from LTE-U networks in unlicensed spectrum

As CTC's Chief Technology Officer, Andrew oversees all technical analysis and engineering work performed by the firm. He has a Ph.D. and is a licensed Professional Engineer.

Fiber Network Planning and Engineering

Andrew has architected and designed middle- and last-mile fiber broadband networks for the District of Columbia (Washington, D.C.); the city of San Francisco; the Delaware Department of Transportation; the Maryland Transportation Authority; and many large counties.

He oversaw the development of system-level broadband designs and construction cost estimates for the cities of Atlanta, Boston, Boulder, Palo Alto, Madison, and Seattle; the states of Connecticut and Kentucky; and many municipal electric providers and rural communities. He is overseeing the detailed design of the city-built fiber-to-the-premises (FTTP) networks in Westminster, Maryland; Alford, Massachusetts; and Holly Springs and Wake Forest, North Carolina.

In Boston, Andrew led the CTC team that developed a detailed RFP, evaluated responses, and participated in negotiations to acquire an Indefeasible Right of Use (IRU) agreement with a fiber vendor to connect schools, libraries, public housing, and public safety throughout the City. This approach was designed to allow the City to oversee and control access and content among these facilities.

Columbia Telecommunications Corporation

Wireless Network Planning and Engineering

Applying the current state of the art—and considering the attributes of anticipated future technological advancements such as “5G”—Andrew has developed candidate wireless network designs to meet the requirements of clients including the cities of Atlanta, San Francisco, and Seattle. In a major American city, Andrew led the team that evaluated wireless broadband solutions, including a wireless spectrum roadmap, to complement potential wired solutions.

In rural, mountainous Garrett County, Maryland, Andrew designed and oversaw the deployment of an innovative wireless broadband network that used TV white space spectrum to reach previously unserved residents. To enhance public internet connectivity, Andrew provides technical oversight on CTC’s Wi-Fi-related projects, including the design and deployment of Wi-Fi networks in several parks in Montgomery County, Maryland.

Andrew also advises local and state government agencies on issues related to wireless attachments in the public rights-of-way; he leads the CTC team that supports the Texas Department of Transportation (TxDOT) and many large counties on wireless attachment policies and procedures.

Public Safety Networking

Andrew leads the CTC team providing strategic and tactical guidance on FirstNet (including agency adoption and other critical decision-making) for the State of Delaware and Onondaga County, New York. In the District of Columbia, he and his team evaluated the financial, technical, and operational impact of building the District’s own public safety broadband network, including the design of an LTE system that provided public-safety-level coverage and capacity citywide. This due diligence allowed the District to make an informed decision regarding opting in or out of the National Public Safety Broadband Network.

Andrew currently is working with the State of Delaware to evaluate LTE coverage gaps throughout the state to assist agencies in their choice of public safety broadband networks. On the state’s behalf, he and his team are also conducting outreach to AT&T and other carriers to evaluate their public safety offerings. He is performing similar work as part of CTC’s engagement with El Paso County, Colorado.

Earlier, Andrew led the CTC team that identified communications gaps and evaluated potential technical solutions for the Baltimore Urban Area Security Initiative (UASI), a regional emergency preparedness planning effort funded by the U.S. Department of Homeland Security (DHS).

He previously served as lead engineer and technical architect for planning and development of NCRnet, a regional fiber optic and microwave network that links public safety and emergency support users throughout the 19 jurisdictions of the National Capital Region (Washington, D.C. and surrounding jurisdictions), under a DHS grant. He wrote the initial feasibility studies that led to this project for regional network interconnection.

Smart Grid

Andrew and the CTC team provided expert testimony and advisory services to the Public Service Commission of Maryland regarding Advanced Metering Infrastructure (AMI). CTC provided objective guidance to the staff as it evaluated AMI applications submitted by three of the state’s investor-owned utilities (IOUs). This contract represented the first time the PSC staff had asked a consultant to advise them on technology—a reflection of the lack of standards in the Smart Grid arena.

Broadband Communications Policy Advisory Services

Andrew advises public sector clients and a range of policy think tanks, U.S. federal agencies, and non-profits regarding the engineering issues underlying key communications issues. For example, he:

- Provided expert testimony to the FCC in the matter of the preparation of the **national broadband plan** as a representative of the National Association of Counties (NACo) and the National Association of Telecommunications Officers & Advisors (NATOA).
- Served as expert advisor regarding broadband deployment to the U.S. Conference of Mayors, NACo, National League of Cities, Public Knowledge, New America Foundation Open Technology Institute, and NATOA in those organizations' filings before the FCC in the matter of determination of the deployment of a **national, interoperable wireless network in the 700 MHz spectrum**.
- In connection with the FCC's ongoing **Open Internet proceeding**, advised the New America Foundation regarding the technical pathways by which "any device" and "any application" regimes could be achieved in the wireless broadband arena as they have been in the wireline area.
- Provided expert technical advice on the **700 MHz broadband and AWS-3 proceedings** at the FCC for the Public Interest Spectrum Coalition (including Free Press, the New America Foundation, Consumers Union, and the Media Access Project).
- Served as technical advisor to the **U.S. Naval Exchange** in its evaluation of vendors' broadband communications services on U.S. Navy bases worldwide.
- Advised the **U.S. Internal Revenue Service** regarding the history of broadband and cable deployment and related technical issues in that agency's evaluation of appropriate regulations for those industries.
- Advised the Stanford Law School Center for Internet and Society on the technical issues for their briefs in the **Brand X Supreme Court appeal** regarding cable broadband.

Broadband Communications Instruction

Andrew has served as an instructor for the U.S. Federal Highway Association/National Highway Institute, the George Washington University Continuing Education Program, the University of Maryland Instructional TV Program, ITS America, Law Seminars International, and the COMNET Exposition. He developed curricula for the United States Department of Transportation.

He taught and helped develop an online graduate-level course for the University of Maryland. He developed and taught communications courses and curricula for ITS America, COMNET, and the University of Maryland. His analysis of cable open access is used in the curriculum of the International Training Program on Utility Regulation and Strategy at the University of Florida.

Andrew has also prepared client tutorials and presented papers on emerging telecommunications technologies to the National Fire Protection Association (NFPA), NATOA, the National League of Cities (NLC), the International City/County Management Association (ICMA), and the American Association of Community Colleges (AACC). He taught college-level astrophysics at the University of Wisconsin.

EMPLOYMENT HISTORY

1995–Present	CEO/Chief Technology Officer, CTC Previous positions: Director of Engineering, Principal Engineer, Senior Scientist
1990–1996	Astronomer/Instructor/Researcher University of Wisconsin–Madison, NASA, and Swarthmore College

EDUCATION

Ph.D., Astronomy, University of Wisconsin–Madison, 1996

- NASA Graduate Fellow, 1993–1996. Research fellowship in astrophysics
- Elected Member, Sigma Xi Scientific Research Honor Society

Master of Science, Astronomy, University of Wisconsin–Madison, 1993

Bachelor of Arts, Physics, Swarthmore College, 1991

- Eugene M. Lang Scholar, 1987–1991

PROFESSIONAL CERTIFICATIONS/LICENSES

Professional Engineer, states of California, Delaware, Georgia, Illinois, Maryland, and Virginia

HONORS/ORGANIZATIONS

- Disaster Response and Recovery Working Group, FCC’s Broadband Deployment Advisory Committee (BDAC)
- Association of Public-Safety Communications Officials (APCO)
- Board of Visitors, University of Wisconsin Department of Astronomy
- National Association of Telecommunications Officers and Advisors (NATOA) Technology and Public Safety Committees
- Armed Forces Communications and Electronics Association (AFCEA)
- Society of Cable and Telecommunications Engineers (SCTE)
- Institute of Electrical and Electronic Engineers (IEEE)
- Charleston Defense Contractors Association (CDCA)

SELECTED PUBLICATIONS, PRESENTATIONS, and COURSES

- “Small Cell Standards and Processes: Protecting Community Assets, Interests, and Public Safety,” prepared for NATOA, Feb. 2019
- “SB 937: Wireless Facilities – Installation and Regulation,” Testimony before the State of Maryland Senate, Feb. 2019
- “HB 654: Wireless Facilities – Installation and Regulation,” Testimony before the State of Maryland General Assembly, Feb. 2019
- “The Three “Ps” of Managing Small Cell Applications: Process, Process, Process,” Dec. 2018
- Declaration in Response to FCC’s Order, “Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment,” prepared for the Smart Communities and Special Districts Coalition, filed with the FCC, Sept. 2018
- Declaration in Response to the Proposed T-Mobile/Sprint Merger, prepared for the Communications Workers of America, filed with the FCC, Aug. 2018
- “A Model for Understanding the Cost to Connect Anchor Institutions with Fiber Optics” (co-author), prepared for the Schools, Health & Libraries Broadband Coalition, Feb. 2018
- “How Localities Can Prepare for—and Capitalize on—the Coming Wave of Public Safety Network Construction,” Feb. 2018
- “Network Resiliency and Security Playbook” (co-author), prepared for the National Institute of Hometown Security, Nov. 2017
- “Mobile Broadband Service Is Not an Adequate Substitute for Wirelines” (co-author; addressing the limitations of 5G), prepared for the Communications Workers of America, Oct. 2017
- “Technical Guide to Dig Once Policies,” April 2017

- “Streamlining Deployment of Small Cell Infrastructure by Improving Wireless Facilities Siting Policies,” prepared for the Smart Communities Siting Coalition, filed with the FCC, March 2017
- “How Localities Can Improve Wireless Service for the Public While Addressing Citizen Concerns,” Nov. 2016
- “LTE-U Interference in Unlicensed Spectrum: The Impact on Local Communities and Recommended Solutions,” prepared for WifiForward, Feb. 2016
- “Mobile Broadband Networks Can Manage Congestion While Abiding by Open Internet Principles,” prepared for the New America Foundation’s Open Technology Institute – Wireless Future Project, filed with the FCC, Nov. 2014
- “The State of the Art and Evolution of Cable Television and Broadband Technology,” prepared for Public Knowledge, filed with the FCC, Nov. 2014
- “A Model for Understanding the Cost to Connect Schools and Libraries with Fiber Optics,” prepared for the Schools, Health & Libraries Broadband Coalition, filed with the FCC, Oct. 2014
- “The Art of the Possible: An Overview of Public Broadband Options,” prepared jointly with the New America Foundation’s Open Technology Institute, May 2014
- “Understanding Broadband Performance Factors,” with Tom Asp, *Broadband Communities* magazine, March/April 2014
- “Engineering Analysis of Technical Issues Raised in the FCC’s Proceeding on Wireless Facilities Siting,” filed with the FCC (<http://apps.fcc.gov/ecfs/document/view?id=7521070994>), Feb. 2014
- “A Brief Assessment of Engineering Issues Related to Trial Testing for IP Transition,” prepared for Public Knowledge and sent to the FCC as part of its proceedings on Advancing Technology Transitions While Protecting Network Values, Jan. 2014
- “Gigabit Communities: Technical Strategies for Facilitating Public or Private Broadband Construction in Your Community,” prepared as a guide for local government leaders and planners (sponsored by Google), Jan. 2014
- “Critical Partners in Data Driven Science: Homeland Security and Public Safety,” submitted to the *Workshop on Advanced Regional & State Networks (ARNs): Envisioning the Future as Critical Partners in Data-Driven Science*, Internet2 workshop chaired by Mark Johnson, CTO of MCNC, Washington, D.C., April 2013
- “Connected Communities: How a City Can Plan and Implement Public Safety & Public Wireless,” submitted to the International Wireless Communications Exposition, Las Vegas, March 2013
- “Cost Estimate for Building Fiber Optics to Key Anchor Institutions,” prepared for submittal to the FCC by NATOA and SHLB, Sept. 2009
- “Efficiencies Available Through Simultaneous Construction and Co-location of Communications Conduit and Fiber,” prepared for submittal to the FCC by the National Association of Telecommunications Officers and Advisors and the City and County of San Francisco, 2009, referenced in the National Broadband Plan
- “How the National Capital Region Built a 21st Century Regional Communications Network” and “Why City and County Communications are at Risk,” invited presentation at the FCC’s National Broadband Plan workshop, Aug. 25, 2009