Telecommunications Network Resiliency Briefing for Congressional Staff
"The Erosion of America's 9-1-1 System"

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I'm here today to speak about Network Resiliency, and I'm going to focus this discussion on the single most important thing our nation's telephone network supports: America's 9-1-1 System. I call this "Our Emergency Lifeline" because you, me and everyone in this room -- as well as citizens across the country -- depend on this system to summon help in an emergency. We educate our children from an early age to know how call 9-1-1 when they need to report an emergency.

When you call 9-1-1, you are connected to a specially trained professional working at a Public Safety Answering Point (PSAP), who determines the type of emergency you're reporting, routes your call to the appropriate emergency agency (such as law enforcement, fire or ambulance), and the 9-1-1 call taker can even provide direct assistance to you, such as coaching you through how to administer CPR.

If you call 9-1-1 in my fire district for a non-law enforcement emergency, my pager will go off and I will drop whatever I'm doing to respond promptly. This same kind of rapid, focused emergency response is happening all across our nation day and night. Since its establishment in 1968, America's 9-1-1 system has saved countless lives and helped victims avoid much worse outcomes if the 9-1-1 system wasn't there. It is truly a model for the world, and we have been improving it with new capabilities such as Enhanced 9-1-1, which allows the 9-1-1 call taker to know the reporting party's physical location, even if they aren't able to report that themselves.

So that's the good news. The bad news is that our excellent 9-1-1 system is now being eroded by private sector business decisions, public sector policy failures and the rise of new technologies our telecommunications system is rapidly adopting. And this erosion is especially evident in rural America.

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There are four major factors in the erosion of our 9-1-1 system that I'm going to touch on today:

<u>Loss of E-911 location information</u>

Every day, at PSAP's across the country, the percentage of 9-1-1 callers whose location can be automatically identified is dropping as customers move away from the traditional telephone system to use new technologies such as Voice Over IP, cell phones, Internet phones, etc. While cell phones may be able to use triangulation to determine their location and automatically report it to the 9-1-1 call taker, that's only possible when there are sufficient towers available. In many rural areas, if cell service is available at all, it's often available from a single tower in the area, making it impossible to accurately determine the reporting party's location.

Unraveling of network redundancy

A startling development that is being seen more and more in rural America is the loss of network redundancy as new technologies like fiber optic telecommunications are implemented. I will discuss this problem in detail in a moment. For now, I will just say that as early as 1995, the U.S. Commerce Department's National Institute of Standards and Technology warned that the "power of optical fiber technology is diminishing the number of geographic transmission routes," concentrating the flow of information and "resulting in an increase in network vulnerability." More on how this warning is becoming a dangerous new reality in a moment.

Neglect of the legacy physical plant

Traditional telephone companies are moving away from the copper-based phone system as fast as they possibly can. They are going wireless and/or using fiber to carry telcom traffic because it's much more profitable for them. These companies have little interest in or incentive to maintain their copper physical plant, a fact which was clearly displayed this past winter in California when a significant storm knocked out power, and in some cases telephone service too. AT&T used the storm as its rationale to declare a service "State of Emergency" that lasted for months while repair workers slowly and selectively restored telephone service, sometimes only when customers complained about AT&T's terrible performance to the media or the California Public Utilities Commission. By making this declaration, AT&T took advantage of a loophole in state regulations which allowed them to get around repair service standards which otherwise are in effect, except when they say it's an "emergency." Untold numbers of customers were out of service for days, weeks or even more than a month. This abuse of the process was so egregious that the CPUC is now in the process of revising their rules about such self-declared emergencies.

Introduction of new technologies

New technologies in themselves are not necessarily bad, but we need to be aware of the consequences of technological change and how new developments are making our 9-1-1 system more vulnerable. For example, Copper wires are able to carry electricity, which allows phone service to continue to work during a commercial power outage. This is a hallmark public safety characteristic of the traditional

phone network. Today, new technologies – fiber, wireless, VoIP – do not have that capability to maintain power independently. How will citizens reach 9-1-1 and stay in touch with family during a power outage, especially during a natural disaster? In addition, not all of the new technologies are compatible with additional safety devices such as the medical emergency alarms used by many elderly and disabled people. What will happen to those people who depend on these devices? We have a responsibility to ensure that our emergency system stays at least as good as it is now, and it certainly should not get worse as new technologies are adopted.

As we consider how these factors are eroding our 9-1-1 system, especially in the rural areas of this country, we have to ask ourselves: Is this what we want from United States policy? To let our excellent 9-1-1 system become degraded, leaving more and more citizens at risk? No member of Congress would ever take a public position supporting this change. But, largely by default, this is what's happening now to America's 9-1-1 system. Let me tell you what happened to me:

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On August 3rd last year, I was working at home writing software and suddenly the Internet went out. I checked my phone, the line was dead. And then my fire department pager alarm sounded: The dispatcher reported that there had been a traffic accident west of my small town. I was one of the first firefighters at the scene. Apparently, an oversized vehicle had snagged a section of fiber optic cable which was strung above ground and snapped it apart. What I didn't know was that this cable break caused telecommunications service to go down across a 40 mile section of the northern Mendocino County coast, and it also took out cell phone service in the north central part of our county where a major wildland fire was growing rapidly. Citizens were not able to access the 9-1-1 system because their telephone lines were down. The Sheriff could not use the reverse 9-1-1 system to notify people threatened by the wildfire of his evacuation orders. And in addition to these impacts on our emergency system, the phone outage impacted our local economy, our medical system and our communities in numerous negative ways.

After the outage, the Broadband Alliance of Mendocino County conducted a survey to understand the impacts of this event. It's available for you to review online, so let me read just one quote from the survey that reveals how serious this outage was for one family who still was connected to the Internet through their Comcast cable service while their phone line was dead:

"My Mother quit breathing and it took me awhile to get Skype up and running while continuing mouth to mouth and trying to reach a friend to call 911 for me. It was hell. She is OK now."

This person could not connect to the 9-1-1 system, but they had a mercifully bright idea to Skype a friend who did call 9-1-1 on their behalf.

What is especially galling about the Mendocino County fiber outage is that there was a second fiber line available to provide another path for the telephone network to connect, but AT&T had not linked that second line to the first. This raises the issue of network topology, which is the reason our telecommunications networks are becoming less reliable, especially in rural America. In the traditional telephone network, phone service is delivered through what are called "Central Offices" that are linked together to ensure that customers will stay connected even when a line breaks between two central offices. Telcos were required to build that redundancy into their system, but today they apparently believe they no longer have to meet this basic requirement of a resilient network.

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After the outage, we began researching what had happened and how it might be prevented in the future. I learned that there had been similar outages in the county to the north of us in 2006 and another in the county to the south of us in 2013. So as I prepared this presentation, I did a simple search on Google for fiber outages that impacted local 9-1-1 systems and in just a couple of search pages I soon had a dozen examples:

Winter 2006 – 2007: Humboldt County fiber cable outages impact thousands
(See Jim Hight's report "Blackout" prepared for Redwood Coast Rural Action)

August 5, 2008: Highland, Illinois outage shut down a town of 10,000
http://www.muninetworks.org/tags-230

January 26, 2010: Minnesota outage isolates two counties for 12 hours
http://www.mprnews.org/story/2010/02/03/north-shore-phone-outage

June 3, 2013: Pennsylvania fiber break cuts off 8,000
http://www.lehighvalleylive.com/breaking-news/index.ssf/2013/06/service_electric_cable_interne.html

May 10, 2013: Fiber outage isolates large region of northwestern Sonoma County
http://www.pressdemocrat.com/news/2224613-181/phone-service-disrupted-across-swath

November 2013: San Juan Islands endured a 10-day outage from severed fiber cable
http://www.fridayharbornow.com/severedfiberopticcable.htm

August 3, 2014: Mendocino coast outage cuts off 17,500 for 45 hours
http://www.co.mendocino.ca.us/bos/incidentreport.htm

December 18, 2014: Wisconsin outage cuts 200,000 off for seven hours

http://www.channel3000.com/news/adams-county-wis-dells-report-911-outage/30295488

December 19, 2014: Arizona outage cuts off Grand Canyon Rim communities
http://www.paysonroundup.com/news/2014/dec/19/squirrel-suspected-service-outage/

February 11, 2015: Fiber break cuts off 20,000 on western Hawaii Island
http://www.bigislandvideonews.com/2015/02/11/phone-and-cell-service-down-in-kona-police-say/
http://www.hawaii247.com/2015/02/11/hawaiiantel-outage-between-waikoloa-and-naalehu-due-to-cable-cut/

February 26, 2015: Arizona outage impacts residents north of Pheonix
http://www.usatoday.com/story/news/nation/2015/02/26/poliice-probe-arizona-outage/24043367/
http://www.timesfreepress.com/news/breakingnews/story/2015/mar/27/slashed-fiber-optic-cable-reveals-vulnerability-us-broadband/295732/

March 27, 2015: New Mexico fiber cut impacts thousands in north region
http://www.timesfreepress.com/news/breakingnews/story/2015/mar/27/slashed-fiber-optic-cable-reveals-vulnerability-us-broadband/295732/

April 24, 2015: Iowa cable damage cuts off four counties
http://www.thonline.com/news/breaking/article_cb132c7c-ea98-11e4-9c46-dfd68b21f658.html

I'm sure that I would have found many more examples if I had kept on searching, but I came across the following statistic from the Federal Communications Commission that revealed what I had found was just the tip of the iceberg: The number of outages on high-capacity fiber-optic lines in the U.S. more than doubled from 221 in 2010 to 487 in 2014. I'm sure that many of these outages occurred in well-served urban or suburban areas where network redundancy does exist, because telecommunications providers find it profitable to ensure a high degree of service reliability for the large numbers of customers served in those areas. But some significant portion of last year's 487 cable outages impacted rural America, where some of those outages cut off access to the 9-1-1 system.

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As I have shown, America's 9-1-1 system, our emergency lifeline, is being eroded by a variety of factors, particularly in rural America. The resiliency of traditional telecommunications networks is diminishing, and the question for policy makers is what to do about this growing crisis. There are no simple answers, but I can offer these three principles which we must keep forefront in our minds as we consider telecommunications policy issues at the federal level:

Make Public Safety the Top Priority

There is no higher responsibility for public policy makers than to ensure the safety of the public. America has achieved a great thing in the past half-century: We built an emergency reporting system which is a model for the world. But now we are allowing it to erode, and rural America is being especially impacted. We must not retreat from the public safety progress we have made. We must not accept any compromise to our vital 9-1-1 system. Each of us needs this system to work when we have an emergency. In all considerations of telecommunications policy, put public safety first, where it belongs. After all, in most cases, it is the public's own right of way that is being used to deploy America's telecommunications networks.

Address Network Vulnerability

We know our networks are at risk, and at least in rural America they are becoming more vulnerable. Rather than allow this trend to continue, policy makers must delve into the reasons this is happening and come up with solutions. In addition to requiring network redundancy and proper maintenance of legacy physical plants the public depends upon, policy makers must also determine how to ensure that new technologies which are dramatically changing the way people access telecommunications can be managed to reduce network vulnerability.

Keep Our Citizens Informed

The public does have a right and a need to know what is happening to our telecommunications system, particularly how these changes impact each of us. Many citizens have no idea that the phone they've used for decades is no longer as reliable as it was in the past. They purchase new types of telecommunications services without knowing that doing so has potentially made them more vulnerable in an emergency, when they can least afford taking such a risk. Agencies which protect the public need to know where networks are not redundant so citizens can be advised of alternative ways to access the emergency response system when their telephones aren't working. Although telecommunications companies assert that details of their network deployment is proprietary information, public safety agencies work with confidential information every day. Protocols can be created to protect the public while not harming business interests as we make sure that emergency service agencies have the information we need to ensure public safety.