TESTIMONY

OF

KYLE MALADY
SENIOR VICE PRESIDENT – GLOBAL NETWORK OPERATIONS AND ENGINEERING

BEFORE THE

SUBCOMMITTEE ON EMERGENCY PREPAREDNESS, RESPONSE, AND COMMUNICATIONS

COMMITTEE ON HOMELAND SECURITY

UNITED STATES HOUSE OF REPRESENTATIVES

"RESILIENT COMMUNICATIONS: CURRENT CHALLENGES AND FUTURE ADVANCEMENTS"

September 12, 2012

Good afternoon, Mr. Chairman and members of the Subcommittee. I am pleased to appear before you today on behalf of Verizon to discuss our company's role in the provision of 911 services, the impact that a severe storm had on the 911 network in Northern Virginia in late June, the lessons we have learned from that event, and the subsequent steps we have taken to further solidify our resilience to natural disasters and commercial power outages.

Verizon Designs Its Network to Make 911 Service Available Even in a Crisis.

Verizon provides service to more than 1,500 911 call center locations (referred to as "Public Safety Answering Points" or "PSAPs") around the country. The role of our network is to connect callers to the personnel trained to respond to emergency calls in each PSAP. Verizon is proud to be a part of the larger 911 ecosystem, and we take very seriously the important role our networks plays in ensuring 911 services are available around the clock – and, particularly, in times of crisis. Accordingly, Verizon designs its network to be fault tolerant so that we can continue to provide 911 services even during natural disasters and the commercial power loss and network damage that often come with them.

Our 911 network designs include multiple levels of diversity and redundancy, so that – if a particular call route is not working – we can send the call over another route to make sure it gets through to the PSAPs. Similarly, Verizon equips its critical facilities with back-up power sources, so that – in the event we lose commercial power at those facilities – the network will continue operating and callers can still place 911 calls reliably. Specifically, Verizon deploys a combination of built-in batteries and generators at critical facilities to support operations during a commercial power failure; the batteries provide an immediate source of power following the loss of commercial power until the generators go online (which is designed to occur automatically), and then the batteries act as the back-up power source should the generators fail.

In these and other ways, Verizon tries to prepare for all reasonable contingencies in its emergency planning to ensure that the 911 network is available whenever needed. But emergency preparedness is not static; it is an ever-changing and ongoing process. So, if our systems do not work as planned or if a storm or other event reveals opportunities for further improvements, Verizon has been and will be proactive in implementing appropriate changes. Verizon recently experienced just such an event, and we have learned valuable lessons that will allow us to improve our ability to handle 911 calls and serve PSAPs on a going-forward basis, even when we lose commercial power to our own facilities.

The June 29, 2012 Derecho and Its Impact on the 911 Network in the Mid-Atlantic States.

Late in the evening of Friday, June 29, 2012, a severe storm hit the Mid-Atlantic region with unusually intense straight-line winds. This "Derecho" caused widespread commercial power outages in the Washington, D.C., Virginia and Maryland area, and widespread damage to Verizon's networks. Indeed, the Derecho downed more poles and generated more commercial trouble tickets for Verizon than even Hurricane Irene did in August 2011. As a result of the Derecho, Verizon lost commercial power in more than 100 locations.

At each of these locations, Verizon's emergency back-up power systems kicked in, with batteries and nearly all the back-up generators working as designed, allowing us to continue service. However, one of two back-up generators failed to start at each of the Fairfax and Arlington facilities, disabling hundreds of network transport systems, and causing Verizon to lose much of its visibility into – or ability to monitor – the network in the impacted area.

While Verizon was able to maintain 911 service to the vast majority of the more than 200 PSAPs it serves across the storm's path, these two generator failures caused a loss of 911 service to four PSAPs in northern Virginia. Three of these PSAPs (Fairfax County, Prince William County, and Manassas) did not receive 911 calls for several hours Saturday, June 30, and the

other (Manassas Park) did not receive 911 calls for much of that weekend. In addition, a number of area PSAPs (including those four) faced other 911-related problems, consisting primarily of a lack of delivery of location information on 911 calls and the loss of administrative and back-up phone lines.[1]

Verizon Immediately Investigated and Identified the Cause of the Temporary 911 Outages.

Immediately following the temporary loss of 911 service to these four PSAPs, Verizon launched an investigation to determine the cause of the outages. Our investigation determined that the 911 disruptions were caused when, following the loss of commercial power, one of two back-up generators at each of our Arlington and Fairfax central office locations failed to start. Multiple failures cascading from these specific generator problems and damage to Verizon's transport network combined to cause the outages for the four PSAPs. Included among those failures were systems that enable us to monitor the condition of our network facilities in northern Virginia, and that loss of visibility over our network hindered our initial efforts to assess and repair damages.

Arlington Facility. The Arlington facility has two generators that must operate in tandem to support all of the equipment at the site. At 10:55 PM on June 29, 2012, the Arlington facility lost commercial power. One of the two generators started, but the other did not. The single running generator could not support the entire site load, became overloaded, and shut down as designed. Back-up batteries served the office's equipment into the morning of June 30. A power technician arrived at 12:28 AM on June 30, but despite best efforts throughout the night, could

[1] Location information, referred to as Automatic Location Identifier ("ALI") information, automatically provides the PSAP with the address of 911 callers using landlines. Callers can dial 911 and reach the PSAP even if the ALI systems are not operating, and the PSAP can dispatch the appropriate public safety response. In these cases, however, a 911 call-taker must obtain location information from the caller rather than the information appearing automatically. In addition, the Arlington County PSAP's regular business lines (which could also be used during emergencies) were not working because of the problems at the Arlington central office, explained in more detail below.

not get the second generator started. At approximately 5:00 AM on June 30, the batteries drained completely and network equipment failed.[2] Verizon deployed additional resources, working in parallel both to start the second generator and prepare a replacement mobile generator. Commercial power was restored at 12:45 PM, before those efforts were completed.

Verizon since has conducted extensive testing using third-party experts to determine why the second generator in the Arlington facility did not start. We determined that air had entered the fuel system, resulting in a lack of fuel in the lines. We have since replaced the fuel lines for both of the back-up generators at the Arlington facility (even though no leaks were found in the generator that started).

Significantly, during the period while power was out in Arlington, Verizon lost use of its telemetry systems located at that facility, which ordinarily allow Verizon to monitor its network and other facilities in northern Virginia. When Verizon lost its Arlington telemetry systems, it lost its ability to monitor and identify problems at other Northern Virginia locations, including the Fairfax facility. Once power was restored in the Arlington office, we began to regain our visibility into the network at large.

Fairfax Facility. The Fairfax facility has two generators that each support specific components of network equipment in the location when commercial power is lost. At approximately 10:35 PM on June 29, the Fairfax facility lost its commercial power. One of the generators started and supported its equipment as designed. The other generator did not start, so back-up batteries served the corresponding equipment into the morning of June 30. At approximately 6:15 AM, the batteries completely drained and the network equipment in the specific section of the facility served by the inoperable generator failed. Throughout this period, the other generator supported its network equipment in the rest of the building.

[2] Some network equipment is more sensitive to low voltage and failed before the batteries were completely exhausted.

That morning, because we had lost visibility to the network in the area, the decision was made to send technicians to various facilities, including Fairfax. A central office technician arrived at the site at 7:30 AM, but did not immediately recognize that one section of the facility was not on generator power. At approximately 9:45 AM, the central office technician realized there was an issue in one section of the building and called for a power technician. The power technician arrived at the Fairfax facility at approximately 11:30 AM, investigated the power plant, determined that the second generator had failed to start, initiated the starting procedures, and brought the generator back on manually by 12:15 PM. Verizon immediately started restoring the equipment in the office and bringing services back on line.

Verizon conducted extensive testing using third-party experts to determine why the second generator did not start at this location, ultimately concluding that the Fairfax generator did not start because the auto-start mechanisms failed. Those mechanisms are designed to automatically start the generator once commercial power is lost, but they did not operate correctly and since have been replaced.

As Result of the Derecho Outages, Verizon Is Making Several Proactive Improvements to Ensure that 911 Services Remain Available in the Event of Commercial Power Loss.

In addition to implementing the specific fixes identified above, Verizon is committed to making the following additional improvements that will minimize the risk of 911 service disruptions in the event of commercial power loss in the future.

Changes to Address Generator System Failures. As described above, we suffered key generator system failures that were different in each of the two locations. The specific failures that occurred at those two locations have been repaired, but we are extending our review to other critical locations to address any other potential issues. In particular, Verizon is conducting back-up power system audits in the mission-critical Verizon facilities supporting 911 in Virginia,

Maryland and Washington, D.C., and will institute any corrective measures identified in those power audits. For example, we have already completed the Arlington audit and are instituting an automated controls process to prioritize system load shedding (e.g., to support telemetry over other, less critical functions) in case one of the two generators fails.

Instituting New Emergency Practices and Procedures. Our investigation determined we could have improved our restoration of service had we (i) recognized more quickly the partial power outage in Fairfax and (ii) been able to power some network equipment (e.g., telemetry systems) on the one generator in Arlington that was working. Accordingly, Verizon has developed and posted at each location a set of site-specific back-up power system assessment procedures that can be used by any employee to determine if there is a loss of power to an area of a building. Verizon also is developing and will post at each location a site-specific set of procedures on how to manually start a generator that does not start automatically and how to transfer certain functions from a non-working generator to be powered by a working unit, including instructions on how to serve system loads on a prioritized basis (i.e., with available power to be used for more critical functions first). And, to help ensure that back-up power will work when needed, Verizon is enhancing our "Black Out" testing at critical facilities. Under the new approach, we will continue to test our back-up power systems regularly (as we have been doing), but will enhance this existing testing by including tests for "failed automated controls" and "prioritized system load transfer" scenarios.

Improvements to Communication and Mobilization. Verizon has maintained a standard practice of internal mobilization to address service disruptions or outages based on their actual or potential service impacts. This process is triggered by alarms in the system, but – in the case of the northern Virginia outages – the loss of visibility prevented us from receiving these alarms and, therefore, delayed our response. To avoid this issue going forward, Verizon will create two

new event criteria for notification and mobilization purposes. We have enhanced our notification and mobilization procedures to trigger activity more quickly when back-up batteries are activated or when telemetry is lost. These events now will trigger a response that will lead to quicker escalation with greater resources.

Redesign the Telemetry Systems to Avoid Loss of Visibility to Multiple Sites. As noted above, Verizon's ability to identify and address outages was impeded by the loss of telemetry functions at the Arlington office. To avoid a similar problem in the future, Verizon will redesign its telemetry network to include more diverse connections and failover (alternative) locations, so that – if telemetry is unavailable at one location – those critical functions can be carried on at other facilities.

In Addition to Internal Improvements to Address the Generator-Starting Problems, Verizon Is Working with PSAPs to Address PSAP-Specific Routing Issues.

As noted above, Verizon's 911 design provides multiple diversities or redundancies "inside the network." There are multiple tandem offices providing routing so that, if one fails, the calls to the failed office are routed through the other(s). Also, Verizon's ALI databases and links to each ALI database are redundant, as are Verizon's signaling systems, which route calls to their destinations. However, Verizon's analysis of the network impacts following the Derecho has identified areas for improvement – especially with ALI diversity – for certain, specific PSAP configurations. Since those specific PSAP configurations are highly sensitive and confidential to those PSAPs, and present security issues, they cannot be publicly disclosed. However, Verizon is committed to working directly with the specific PSAP partners to decide on improvements for their particular configurations to minimize the risk of 911 service disruptions in the future.

Verizon Is Working with the PSAPs to Improve Communications during an Emergency or System Failure.

Over the past few years, Verizon has established robust processes to communicate with PSAPs during an emergency or system failure, particularly during high-volume (also known as "mass calling" or "focused overload") situations. In fact, Verizon has a large team entirely dedicated to communicating with PSAPs. These processes generally worked well during the Derecho, as Verizon stayed in frequent communication with PSAPs during the 911 outages, including sending automatic notifications to PSAPs when certain alarms were triggered. But, once Verizon lost its telemetry, we did not have the specific information needed by the PSAPs to understand the impact of the event and plan for alternatives. Likewise, certain automatic notifications that go to PSAPs stopped when the alarms stopped.

As discussed above, Verizon is redesigning its telemetry systems so it can retain its visibility into its network even when telemetry is lost at one location, and that will improve the utility of the communications with PSAPs in the face of catastrophic failures. But there are other ways in which Verizon can improve its communications with PSAPs during a crisis.

The 911 Directors of the City of Alexandria, and the Counties of Arlington, Fairfax, Loudoun, Prince William and Stafford have recommended that Verizon adopt five steps in response to the storm, primarily focused on communications. These recommendations include: (1) adopting and utilizing the National Incident Management System (NIMS) model to address and mitigate any and all significant events/incidents impacting providing 911 service; (2) utilizing a system to notify the PSAPs, via voice and text, as soon it is known or suspected by Verizon that there is or may be an interruption of 911 service; (3) developing a method to conduct a semi-annual drill/exercise on actions to be taken in the event of a potential or actual 911 outage; (4) providing a current contact list during the first week of each month for the Verizon account manager assigned to each PSAP jurisdiction and the four immediately

escalating Verizon personnel up to a Vice President level; and (5) having a Verizon representative be present at the jurisdictions' Emergency Operations Center (EOC), to provide current, accurate information concerning 911 service and outages, other telephone service, etc. and liaison with other parties staffing the EOC, when the EOC is activated.

Verizon believes these recommendations are constructive, and we have already taken steps toward working with the 911 Directors to most effectively implement these concepts.

Verizon Is Committed to Better Communication with the Public during an Emergency.

Verizon also is committed to improving communications with the public during outages. In the future, when we face significant network-related issues like those caused by the Derecho, Verizon will share additional information about our restoration efforts more quickly to provide greater insight regarding the extent of the impact to our subscribers and the expected duration of the restoral efforts. We are mobilizing a more robust emergency response communications process to ensure that media outlets and other channels are provided relevant information on a timely basis.

Verizon Also Is Committed to Looking at the Next Generation of 911 Services.

In addition to looking at issues directly related to the Derecho, Verizon has commented extensively on the appropriate way to develop Next Generation 911 services ("NG911") at the Federal Communications Commission, which has a rulemaking proceeding pending on the subject. NG911 takes into consideration the evolution of network technologies, and contemplates the move to an IP-enabled 911 system. Verizon strongly supports a standards-based and efficient transition to NG911, which must involve more than just PSAPs and their 911 networks if it is to be deployed successfully. Wireline, wireless and VoIP service providers, device and network equipment manufacturers, app providers, state and local governments, and consumers themselves must be involved if we are to realize the public safety benefits of an end-

to-end IP-enabled NG911 system. Verizon is committed to doing its part and is engaged in the development of NG911 standards and products across its business units.

With the right funding mechanisms, PSAPs could make the necessary investments in NG911 architecture and provide an overall increase in 911 system reliability. The architecture contemplates that all critical components would be deployed with no single point of failure, and that services are provided in a manner to survive disaster, deliberate attack and massive failure – which would require a redundant and geographically diverse design. And full NG911 is dependent upon end-to-end IP communications, which has the capability to dynamically reroute traffic and improve redundancy, and to dynamically re-route 911 calls to established back-up PSAPs or even virtual PSAPs that can efficiently serve multiple jurisdictions. Still, no network can be fully immunized from natural and manmade disasters, so PSAPs will still need to incorporate recommendations for reliability and security into migration plans as appropriate. Verizon looks forward to working with the PSAPs as part of its continued participation in NG911 development.

Verizon Has Developed Text-to-911 Capabilities.

In further recognition of consumers' changing communications demands, Verizon Wireless has voluntarily developed an interim SMS-to-911 solution to supplement the existing 911 networks, and we are committed to deploying this solution to capable PSAPs beginning in late 2012 or early 2013. This would allow the public to contact 911 through text messaging, providing another means to contact PSAPs during an emergency, in addition to voice 911 calls.

As a general rule, however, Verizon expects that SMS-to-911 communications can be affected by outages in much the same way (and to largely the same degree) as voice 911 calls. That is because the interim SMS-to-911 solutions currently under development all rely on existing radio, SMS and PSAP architecture. Thus, cell site outages would affect SMS-to-911

communications just as they would voice. And, within a PSAP's facilities, an outage of the PSAP's network would also necessarily affect SMS-to-911 traffic flowing over that network. By the same token, PSAPs also may have limited SMS-to-911 "call-taking" capabilities. Accordingly, while Verizon has been working on a text-to-911 option, there is a broad consensus that – as the first option – users can and should be instructed to make a voice call to 911, if possible. Or stated differently, I would caution that we should *not* rely heavily on alternate legacy technologies, such as SMS-to-911, as a substantial alternate mechanism of reaching 911 in emergencies. Instead, policymakers at all levels should remain focused on the transition to end-to-end IP-enabled NG911 services.

Conclusion.

Verizon understands the critical role of 911 services to the community, and is committed to making improvements to avoid the issues that occurred during the Derecho and otherwise to ensure that the next generation of 911 services are available to the public. Verizon will improve its internal processes and procedures and work directly with the PSAPs, as described above, to implement the lessons learned. And we will look to apply improvements and lessons learned from the Washington metropolitan area to other areas in our service territory as well, so that 911 services are available whenever needed.