



**Verizon, 911 Service
and the June 29, 2012, Derecho**

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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 Hurricane Irene. External power failures affected more than 100 Verizon locations. At each of these locations, batteries and nearly all the back-up generators worked as designed, allowing us to continue service. However, at two of these locations, generators failed to start, disabling hundreds of network transport systems, and causing Verizon to lose much of its visibility into its network in the impacted area.¹

Verizon designs its network to provide 911 services even during disasters. As explained further below, our 911 network designs include multiple levels of diversity and redundancy, as well as back-up power in critical facilities, to optimize resiliency during a crisis. Nevertheless, generator failures caused a temporary loss of 911 service to four of the more than two hundred 911 centers (referred to as Public Safety Answering Points, or PSAPs) that Verizon serves across the storm’s path. As a result, three PSAPs (Fairfax County, Prince William County, and Manassas) did not receive 911 calls for several hours Saturday, June 30, and another (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

¹ Across the impacted area, more than 1,900 network transport systems were damaged and failed. A very significant percentage of those systems were in Arlington and Fairfax, where the two generators failing to start caused the 911 issues. Across the impacted area, nine generators failed to operate properly out of 136 in total.

lines.² This document describes Verizon’s final analysis of what happened and identifies important corrective actions to minimize the risk of future problems.

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Two Generator Starting Failures Caused the 911 Outages

Our investigation has determined that the failure of one of two back-up generators to start at each of our Arlington and Fairfax central offices following the loss of commercial power caused the Northern Virginia 911 disruptions. Multiple failures cascading from these specific generator problems and damage to the 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.

At critical facilities, Verizon deploys a combination of batteries and generators to support critical 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.

At more than 100 locations, Verizon’s back-up batteries and generators worked as designed. However, one of two back-up generators did not start at each of the Fairfax and Arlington facilities, and these failures caused the four PSAPs’ 911 call completion problems.

² 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.

Arlington Facility

The Arlington facility has two generators that must operate in tandem to support 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 not get the second generator started. At approximately 5 AM on June 30, the batteries drained completely and network equipment failed.³ We 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.

Significantly, during the period while power was out in Arlington, we lost our telemetry systems and thus our ability to monitor parts of our network and facilities in Northern Virginia, including the Fairfax facility. Once Arlington was restored, our visibility into the network began to restore.

Fairfax Facility

The Fairfax facility has two generators that each support specific components of the network when commercial power is lost. At approximately 10:35 PM on June 29, the Fairfax facility lost 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

³ Some network equipment is more sensitive to low voltage and failed before the batteries were completely exhausted.

generator failed. Throughout this period, the other generator supported its network equipment in the rest of the building. That morning, because we had lost visibility to the network at large, 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. 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. We immediately started restoring the equipment in the office and bringing services back on line.

We have since 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).

In Fairfax, Verizon's investigation has determined 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 have since been replaced.

Proactive Improvements

While the back-up power systems in place should have withstood the Derecho without the resulting 911 problems, our investigation has identified issues for which we are undertaking corrective action:

Issues	Corrective Actions
<p><u>Generator system failures</u> As described above, we suffered key generator system failures that were different in each location. The specific failures have been repaired but we are extending our review of critical locations to address potential issues.</p>	<ul style="list-style-type: none"> • Conduct backup power system audits in the mission-critical Verizon facilities supporting 911 in Virginia, Maryland and Washington, D.C. • Institute any corrective measures identified in those power audits. • For example, we have already completed the Arlington audit and are instituting automated controls to prioritize system loads (e.g., telemetry) in case one of the two generators fails.
<p><u>Emergency Practices and Procedures</u> 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.</p>	<ul style="list-style-type: none"> • Develop and post site-specific backup power system assessment procedures that can be used by any employee to assess if there is a loss of power to an area of a building. • Develop and post site-specific manual generator start and transfer procedures, including serving system loads on a prioritized basis. • Enhance our critical facility “Black Out” testing. We test our back-up power systems regularly but will enhance this testing to include “failed automated controls” and “prioritized system load transfer” scenarios.
<p><u>Communication and Mobilization</u> We have a standard practice of internal mobilization based on actual or potential service impacts. These are triggered by alarms. The loss of visibility prevented us from receiving these alarms and delayed our response.</p>	<ul style="list-style-type: none"> • Create two new event criteria for notification and mobilization purposes. We have enhanced our notification and mobilization procedures to trigger activity more quickly when batteries are activated or when telemetry is lost.
<p><u>Loss of visibility to multiple sites</u></p>	<ul style="list-style-type: none"> • Redesign the telemetry network. We are redesigning the telemetry network to include more diverse connections and failover (alternative) locations.

PSAP-Specific Routing Issues Compounded the Generator-Starting Problems

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). Verizon's ALI databases and links to each ALI database are redundant, as are Verizon's signaling systems, which route calls to their destinations. Verizon's analysis of the network impacts following the Derecho has identified areas for improvement, especially with ALI diversity, with specific PSAP configurations. Verizon will work directly with the specific PSAP partners to decide on improvements.⁴

Communication Improvements Are Being Addressed

PSAP Communications

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, we have a large team entirely dedicated to communicating with PSAPs. These new processes generally worked well during the Derecho, as Verizon stayed in constant 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. And certain automatic notifications that go to PSAPs stopped when the alarms stopped. As discussed above, Verizon is working to develop a better design to retain its visibility into the network, which will improve the utility of the communications in the face of catastrophic failures.

As an example of how the lack of network visibility hindered communications, certain PSAPs, when they were no longer receiving 911 calls the morning after the storm, activated "network controls" to re-route calls through different paths or to a pre-designated alternate

⁴ Verizon is obliged to maintain the confidentiality of its specific PSAP customers' network arrangements and is not free to share those details publicly; in addition, sharing such network design information would create security vulnerabilities.

location. Verizon has since determined that certain of these PSAPs would have been better off not doing so (i.e., they would have started receiving 911 calls earlier if they had not re-routed calls through different paths), but without the appropriate information, they were unable to make that determination at the time. We will discuss the network control process with the individual PSAPs to determine if improvements can be made (e.g., PSAPs may want to deactivate such controls if they do not improve call completion).

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. The recommendations are constructive suggestions, and we look forward to working with the 911 Directors to most effectively implement these concepts. Specifically:

Recommendation	Assessment
<p>Verizon adopt, embrace, instruct, train and utilize the National Incident Management System (NIMS) model, to address and mitigate any and all significant events/incidents impacting providing 9-1-1 service to the aforementioned jurisdictions.</p>	<p>Positive. Verizon employs an "all hazards approach" to its Business Continuity, Disaster Recovery, Facility Preparedness and Emergency Management programs. These are essential to the protection of its employees, critical business processes and structural facilities located around the globe.</p> <p>Verizon today employs an Incident Management System (IMS) along with the concept of Crisis Management Centers to standardize control of certain emergency situations. When invoked, that process utilizes the National Incident Management System (NIMS) principles as published by the Department of Homeland Security. Verizon offers internal training and orientation courses on its National Emergency Command Center (NECC) Process, and an Introduction to the National Incident Management System. (In this event, Verizon did not activate its Emergency Command Center process; as noted above, thresholds for</p>

	<p>invoking that process have been strengthened to more readily bring those procedures to bear in similar situations.)</p>
<p>Verizon obtain and utilize a Reverse 911® type system to notify, via voice and text, those persons identified by the above jurisdictions, as soon it is known or suspected by Verizon that there is or may be an interruption of 9-1-1 service to any or all of the above jurisdictions. The immediately transmitted voice and text message should contain, in plain language, the nature of the problem, current or potential impact of the problem, what Verizon is doing to address the problem, recommend actions the impacted 9-1-1 center(s) should take and other appropriate information and include the name of the sender and the telephone number (business and mobile) at which the sender can be reached, and their email address.</p>	<p>Positive. Since March 2011, Verizon has employed a broadcast email process to provide specific ticket information to individual PSAPs, and also to provide general information and updates on issues that affect multiple PSAPs. Verizon will expand that process to include texting and will work with 911 Directors to establish the correct contact lists and process details.</p> <p>Based on experience with the email process, it is evident that there is no one common standard vehicle that is universally desired by all PSAPs. Verizon will work with the 911 Directors to accommodate specific needs within a standard process.</p> <p>Verizon will make every effort to share actionable information with PSAPs as soon as we are aware of service interruptions. For events that may impact multiple PSAPs, we will recommend that conference bridges will be established to brief PSAPs on the situation and allow for questions and discussion. Recommended actions would be specific to each PSAP (based on their back-up configuration and event impact) and need to be developed jointly between Verizon and the PSAP.</p>
<p>Verizon work with the jurisdictions to develop, by no later than December 31, 2012, a method to semi-annually conduct a drill/exercise with each jurisdiction on actions to be taken by Verizon and the impacted jurisdiction(s) in the event of a potential or actual 9-1-1 outage.</p>	<p>Positive. Verizon will engage the assistance of its Business Continuity Emergency Management (BCEM) team to work with Verizon’s 911 Customer Care Center organization to develop and exercise procedures for drills that model potential or actual 911 outages with any of the jurisdictions that request such a joint exercise.</p>
<p>Verizon provide the above jurisdictions, during the first week of each month, a current contact list; beginning with the name and contact information (email, business telephone number, business</p>	<p>Positive. A draft will be provided to PSAPs for comment and concurrence by August 17, 2012.</p>

<p>mobile telephone number and any other appropriate information) for the Verizon account manager assigned to the jurisdiction and four immediately escalating Verizon personnel up to a Vice President level.</p>	
<p>Verizon, if/when requested by any of the above jurisdictions, have a Verizon representative with authority to act/react; respond to and to be present at the jurisdictions' Emergency Operations Center (EOC), to provide current accurate information concerning 9-1-1 service and outages, other telephone service, etc. and liaison with other parties staffing the EOC, when the EOC is activated.</p>	<p>Positive. Verizon will work with the 911 Directors to explore ways in which we can accommodate this request. We have discussed options for virtual participation in any EOC via an "instant messaging - like" application with the Virginia Commonwealth emergency management leaders. We have discussed joint training with Fairfax Emergency Management personnel and would welcome the opportunity to participate in that activity. If PSAP discussions regarding a joint regional 911 EOC become the strategy, that would present an excellent vehicle for Verizon to be present with multiple jurisdictions in an emergency situation.</p>

Public Communications

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.

Conclusion

Verizon understands the critical role of 911 services to the community, and is committed to making improvements to avoid the performance of the 911 system during the Derecho. We will work directly with the PSAPs, as well as the various governmental bodies considering these important matters, 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.