Reason for Outage

Date: March 25, 2024

Event Tickets: 28898964, 28902181, 28917037, 28906401, 28899302, 28918344, 28899949

Location: San Bernardino, CA

Event Start Time: March 07, 2024, 08:35 GMT

Services Affected: Unprotected Transport Services

Event Clear Time: March 10, 2024, 07:57 GMT

You are receiving this document as a trouble ticket was opened on a circuit that was associated to this network event. This RFO is intended for the client of record associated with this trouble ticket and should not be forwarded to entities outside of the intended audience. Lumen is committed to client satisfaction and understands the significance of a service impact. We sincerely regret any disruption this may have caused.

Cause

A commercial power maintenance and subsequent equipment failures in San Bernardino, CA impacted client services.

Resolution

Commercial power was restored to the site, and failed equipment was successfully replaced, thus restoring services to a stable state.

Summary

The following outlines the details of a service-impacting failure that occurred in San Bernardino, CA between March 07 and March 10, 2024, in its entirety. As multiple devices were received and replaced at various times, affected services did not restore in unison; therefore, the Event Clear time provided in this document reflects that of the last and final alarm observed to clear by Lumen.

On March 07, 2024, at 06:01 GMT, Lumen discovered a service impact in San Bernardino, CA. The Lumen Network Operations Center (NOC) commenced investigations and observed alarms indicating a site power failure. Upon being alerted to the activation of site backup power, Lumen Field Operations was mobilized for immediate dispatch to assist with isolation and restoral efforts. By 06:49 GMT, Field Operations were en route, and the Lumen NOC had obtained confirmation of a commercial power maintenance in progress from the local utility provider. As the local utility provider failed to notify Lumen of the maintenance, Lumen was unable to implement any preemptive auxiliary measures to ensure service stability; however, site backup power did initially engage as designed upon loss of commercial power at the commencement of the activity.

At 07:19 GMT, additional alarms were detected that indicated loss of power to Lumen equipment. Field Operations arrived on site and discovered the site remained running on battery backup. The 11-string battery backup system is designed to hold power for four (4) hours; however, the batteries lost enough voltage by 08:35 GMT, to cause onsite equipment to begin failing, resulting in impact to services. The backup generator was found running, yet no electrical current was being generated due to a tripped ground-fault circuit interrupter (GFCI) breaker that occurred prior to the maintenance. As a result, the site Automated Transfer Switch (ATS) was unable to register the generator as a secondary power source and redirect the power load from the battery string to generator system support as designed.

A generator vendor was engaged for emergency dispatch, arriving on site at 10:00 GMT. The vendor reset the tripped GFCI breaker to restore the generation of electrical current and began to manually transfer power from the battery string. The transition of the site to full generator support was successful, and the Lumen NOC observed service affecting alarms begin to clear at 10:23 GMT; however, some equipment failed to initialize. Lumen Tier III Technical Support and Field Operations commenced troubleshooting which isolated two (2) failed chassis and nine (9) network cards damaged by the

unexpected loss of power. The Lumen NOC proceeded with ordering the necessary replacements for expedited delivery along with additional precautionary units to account for any possible failures.

Throughout March 07 and March 08, 2024, the required spares were delivered at various times and replaced immediately upon receipt to gradually restore affected services. In between replacements, Tier III Technical Support and Field Operations identified and corrected a configuration issue which restored one of the failed chassis and partially restored the second; however, a full replacement was confirmed necessary to restore the remaining services. As stable services would become impacted during the chassis replacement, an emergency maintenance was deemed necessary and efforts to coordinate the replacement would commence once the device was delivered to the site.

On March 09, 2024, at 20:20 GMT, commercial power at the site failed for a second time. At the time of the failure, a portion of the battery string power system had been disconnected and was actively being investigated to determine the cause of premature power depletion that occurred during the initial failure on March 07, 2024. Without the full battery system in place, enough power could not be generated to provide the necessary site support, and previously restored services were once again impacted. After approximately nine (9) minutes, the site ATS successfully transitioned the power load to the backup generator system to restore power, and the battery string system was immediately replaced to provide full backup protection until after the completion of repairs.

As the chassis would take considerable time to recover from the second failure, Lumen personnel determined that utilizing the impact would be the most effective way to expedite overall service restoral and immediately commenced the replacement. Once the new chassis was in place, each shelf was methodically installed and confirmed fully operational before proceeding to the next. By March 10, 2024, at 07:57 GMT, the final equipment replacement was confirmed complete, and the Lumen NOC verified all service affecting alarms clear. Services were monitored for stability, and no further impact was detected.

Corrective Actions

In an effort to establish the exact root cause and circumstances that led to the extended duration of this outage, Lumen leadership spearheaded an extensive post-outage investigation that involved the collaboration of Lumen Engineering, Infrastructure, and Network Operations personnel. Various equipment vendors, specialized surveyors, and certified inspectors were engaged to assist with the execution of a wide range of systematic equipment and systems testing and evaluations.

After analyzing the results, the following provisions and assurances have been implemented to ensure the reliability of Lumen services and assist in preventing future reoccurrences of this nature:

- The local utility provider responsible for not notifying Lumen prior to the maintenance activity is reviewing this incident in collaboration with Lumen to determine if there are any applicable corrective actions that may be put in place. The site remains under heightened scrutiny by Lumen. Any power-related alarms will be escalated for immediate and enhanced review.

- Lumen Infrastructure and Field Operations conducted extensive testing and equipment validations with various vendors which confirmed expected operational output of site power elements.

- The site backup battery string and backup generator systems have both been independently inspected and tested as well as retested by the vendor. A ground survey was completed, and all batteries have been charged, torqued, and confirmed online.

- Technical investigations into the backup battery string system to determine the cause of expedited power depletion continue. Lumen Infrastructure is conducting extensive investigations on the battery distribution bay and will be launching load bank testing on each battery string.

- Lumen has employed an updated policy to validate all batteries immediately upon the stabilization of commercial power to ensure the batteries are fully operational and charging as designed.

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