

**Exh. JDW-39
Docket UT-181051
Witness: James D. Webber**

**BEFORE THE WASHINGTON
UTILITIES AND TRANSPORTATION COMMISSION**

**WASHINGTON UTILITIES AND
TRANSPORTATION COMMISSION,**

Complainant,

v.

**CENTURYLINK
COMMUNICATIONS, LLC.,**

Respondent.

DOCKET UT-181051

EXHIBIT TO TESTIMONY OF

JAMES D. WEBBER

**ON BEHALF OF STAFF OF
WASHINGTON UTILITIES AND
TRANSPORTATION COMMISSION**

CenturyLink Response to Staff DR 56 and Attachment

August 31, 2022

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UTC STAFF DATA REQUEST NO. 56:

Beginning at page 3 of the Response Testimony of Martin D. Valence in this proceeding, Mr. Valence uses the terms “supplier diversity” and/or “network diversity” more than 50 times in his Response Testimony and, in part, suggests “supplier diversity” and/or “network diversity” are requirements of the WUTC and/or the FCC as it relates to the provisioning of 911 calling, routing, signaling and the services related to the provisioning of 911 calling to PSAPs.

- a. Define Supplier Diversity as you understand Mr. Valence to be using that term.
- b. Define Network Diversity as you understand Mr. Valence to be using that term.
- c. Has the WUTC required “supplier diversity” and/or “network diversity” in relation to 911 calls, routing, and/or signaling? If yes, please identify each WUTC Order, rule, statute, or other instance that supports your answer.
- d. Has the FCC required “supplier diversity” and/or “network diversity” in relation to 911 calls, routing, and/or signaling? If yes, please identify each FCC Order, rule, or other instance that supports your answer.
- e. Has NENA required “supplier diversity” and/or “network diversity” in relation to 911 calls, routing, and/or signaling? If yes, please identify each NENA standard or other instance that supports your answer.
- f. Do other applicable industry standards require “supplier diversity” and/or “network diversity” in relation to 911, routing, and/or signaling? If yes, please identify each other standard that supports your answer.

CLC’S RESPONSE:

Without waiving the aforementioned general or specific objections, CLC responds as follows:

- a. Mr. Valence used the term “Supplier Diversity” to mean that separate SS7 signaling links should be obtained from completely different vendors, such that no one network event could negatively impact both SS7 links that were part of the same mated-pair.
- b. Mr. Valence used the term “Network Diversity” to mean that, if separate suppliers were not available to provision alternative circuits, many carriers including Lumen, have multiple networks to ensure that no one network event could negatively impact both SS7 links that were part of the same mated-pair. That is one reason why Lumen has a process to permit customers to request diversity when ordering multiple circuits from it.
- c. CLC objects to this data request on the grounds that it calls for a legal conclusion and seeks information available in the public domain and/or already

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in the Staff's possession. Without waiving its objections, CLC responds as follows.

CLC is unaware of any explicit WUTC order, rule or statute requiring "supplier diversity" or "network diversity." That said, CLC would find it extremely curious if Staff were to take the position that Comtech's conscious failure to ensure supplier diversity, a concept strongly recommended as a best practice, was not of concern or was not directly responsible for 911 calls failing to reach Comtech PSAPs during the December 2018 outage.

d.-f. CLC objects to conducting a comprehensive analysis of all standards, orders, decisions etc. As such, it provides representative examples of the standards, orders, decisions, etc. that support the concept. There are numerous documents/standards that emphasize the criticality of network and/or supplier diversity as defined in CLC's responses to DR 56(a) and (b). It is therefore not surprising that:

- Public Counsel's expert witness, Mr. Rosen, states "In building 9-1-1 systems, I generally advise that supplier diversity be used to guard against the kind of failure that occurred here. In this case, there was no supplier diversity."¹
- Comtech recognizes that it "seeks supplier diversity as a matter of practice"² and that "supplier diversity is a generally good practice, if available, based on the significant expertise of its employees and general industry guidance, such as the National Emergency Number Association ("NENA") i3 materials", which state "multiple circuits from multiple providers is assumed to create greater diversity and Redundancy."³

The need for diversity was emphasized in the FCC's 911 Reliability Order in numerous locations, including, but not limited to:

21. In its January 2013 *Derecho Report*, the Bureau announced the results of its inquiry and provided specific recommendations for Commission action to improve the reliability and resiliency of 911 networks nationwide. The Bureau found that many communications outages during the *derecho*, including 911 outages, could have been prevented

¹ Rosen Direct, at 20-21.

² See Response Testimony of Stacy Hartman, Exhibit SH-12C, Comtech Response to CTL DR 2(a).

³ Id. at Exhibit SH-12C, Comtech Response to DR-CTL7.

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through implementation of best practices developed by entities such as CSRIC and the Alliance for Telecommunications Industry Solutions (ATIS) Network Reliability Steering Committee (NRSC). The Bureau found that, above and beyond any physical destruction by the derecho, 911 communications were disrupted in large part because of avoidable planning and system failures, including inadequate physical diversity of critical 911 circuits and a lack of functional backup power in central offices. Links and aggregation points supplying telemetry data to network operations centers (NOCs) also failed, depriving communications providers of visibility into critical network functions. Among other things, the Bureau recommended that the Commission take action to ensure that 911 service providers (1) routinely audit critical 911 circuits for physical diversity, (2) maintain adequate central-office backup power, (3) deploy physically diverse network monitoring links, and (4) provide PSAPs with timely and actionable notification of communications outages.

25. PSHSB twice issued *Public Notices* reminding 911 service providers to adhere to best practices based on outage reports indicating those practices have not been implemented consistently, particularly with regard to circuit diversity. In 2010, the Bureau noted that “[t]hrough an examination of network outage reports filed through [NORS], the Bureau has observed a significant number of 911/E911 service outages caused by a lack of diversity that could have been avoided at little expense to the service provider.”⁴ In 2012, *less than one month before the derecho*, PSHSB again stated that “[b]ased on submissions in [NORS] and publicly available data, the Bureau has observed a number of major 911/E911 service outages caused by inadequate diversity and/or the failure to maintain diversity.” The Bureau added that “[m]ost of these major outages could have been prevented if existing NRIC best practices had been followed.” Despite the promulgation by industry of these best practices and two formal, public reminders to comply with them more consistently, the derecho revealed multiple instances of insufficient circuit diversity resulting in 911 outages. Likewise, widespread backup power and network monitoring failures during the derecho could have been avoided had affected service providers more consistently

⁴ 2010 Best Practices PN, 25 FCC Rcd at 2806.

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adhered to relevant best practices.

45. To promote reliable 911 service, we adopt a rule that requires all Covered 911 Service Providers to take reasonable measures to ensure 911 circuit diversity, availability of backup power at central offices that directly serve PSAPs, and diversity of network monitoring links (the “reasonable measures” requirement). As commenters point out, reasonable measures may vary to some degree by location, service provider, and technology. The record demonstrates, however, a number of concrete and objective indications of whether a service provider’s practices with respect to 911 reliability are reasonable.

1. CIRCUIT DIVERSITY AUDITS

80. Under the rules we adopt today, Covered 911 Service Providers must certify annually whether they have, within the past year, audited the physical diversity of critical 911 circuits or equivalent data paths to each PSAP they serve, tagged those circuits to minimize the risk that they will be reconfigured at some future date, and eliminated all single points of failure between the selective router, ALI/ANI database, or equivalent NG911 component, and the central office serving each PSAP. In lieu of eliminating single points of failure, they may describe why these single points of failure cannot be eliminated and the specific, reasonably sufficient alternative measures they have taken to mitigate the risks associated with the lack of physical diversity. Alternatively, Covered 911 Service Providers may certify that they believe this element of the certification is not applicable to their network, although they must explain why it is not applicable. Under these rules, all Covered 911 Service Providers must conduct annual audits of the physical diversity of their critical 911 circuits and tag those circuits to prevent rearrangement, but they may take a range of corrective measures most appropriate for their networks and PSAP customers. Covered 911 Service Providers must also retain records of circuit audits for confidential review by the Commission, upon request, for two years.

81. *Critical 911 Circuits.* For purposes of the certification, “critical 911 circuits” include transmission facilities between a

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911 selective router or its functional equivalent and the final point in the local exchange serving the PSAP where these facilities make an appearance (*e.g.*, the main distribution frame) before leaving this exchange on their way to the PSAP. For purposes of this requirement, a selective router is a 911 network component that selects the appropriate destination PSAP for each 911 call based on the location of the caller. Critical 911 circuits also include links from ANI/ALI databases to central offices that serve PSAPs. We emphasize that we do not include in our definition of “critical 911 circuits” the connections between the calling party and the selective router that serves this person. Because IP-based NG911 networks may not employ circuit-switched technologies, we intend the auditing obligation to extend to data transport paths for the core 911 capabilities described above in Section III.B, regardless of whether they are technically “circuits.” Likewise, the selective router function could be hosted by a third party. The facilities connecting the third party’s selective router with the PSAPs to which it is interconnected are “critical 911 circuits.”

82. *Diversity.* The *911 Reliability NPRM* observed that “[i]f providers do not regularly audit the physical routes of 911 circuits and ALI links, they will be ill-equipped to verify diversity and understand, avoid, or address instances where a single failure causes loss of all E911 circuits or all ALI links for a PSAP.” It also noted that a physical diversity audit would likely have revealed vulnerabilities that led to 911 and ALI service failures to multiple PSAPs in northern Virginia during the derecho. A CSRIC best practice advises network operators to “*periodically* audit the physical and logical diversity called for by network design and take appropriate measures as needed.” Given their importance to safety of life and property, few communications circuits could be more worthy of this treatment than the dedicated facilities that Covered 911 Service Providers use to deliver emergency calls to PSAPs. During the derecho, a number of these critical 911 circuits were clearly not provisioned with the diversity called for in the CSRIC best practice. No commenter disputes that increased diversification could help prevent similar failures in the future.

83. Physical diversity, sometimes called route diversity, means that two circuits follow different routes separated by some physical distance so that a single failure such as a power outage, equipment failure, or cable cut will not result in both

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circuits failing. Logical diversity, sometimes called equipment diversity, implies that two circuits are provisioned to use different transmission equipment, but could share the same transmission medium (for example, the same fiber or conduit). For example, two circuits that are modulated onto two wavelengths are logically diverse. If they are then placed onto two physically separate optical fibers whose routes do not meet, they are also physically diverse, provided they do not share other equipment prior to being placed on the fibers. If, instead, they are placed onto the *same* optical fiber, they are no longer physically diverse, but they retain their logical diversity. In the context of critical 911 circuits, we focus on physical diversity as the optimum standard for certification, but we also recognize that logical diversity may be appropriate where a PSAP has not ordered physically diverse service or where physical diversity is not feasible in a particular location. Accordingly, we do not impose a blanket requirement that all critical 911 circuits be physically diverse in all circumstances, but we require Covered 911 Service Providers that do not provision physically diverse 911 circuits to explain why those measures are reasonably sufficient.

See In re Improving 911 Reliability, FCC 13-158 (Re. Dec. 12, 2013) (footnotes omitted).

Other industry bodies make similar recommendations regarding diversity. See Attachment Staff 56 (CLC-007126-007128).

Respondent(s): CenturyLink Legal

Best Practice Number	Best Practice	Reference/Comments	Best Practice History
12-10-0594	Network Operators and Service Providers should follow industry guidelines for validating SS7 link diversity, which should be performed at a minimum of twice a year, and at least one of those validations should include a physical validation of equipment compared to the recorded documentation of diversity.	ATIS-0300018, Next Generation Interconnection Interoperability (NGIIF) Reference Document: Part III, Installation, Testing and Maintenance Responsibilities for SS7 Links and Trunks Attachment G Link Diversity Validation Guidelines, found at http://www.atis.org/docstore . Note: This Best practice could impact 9-1-1 operations.	Developed prior to 2011; Last Edited CSRIC IV WG 7: https://transition.fcc.gov/pshs/advisory/csric4/CSRIC%20IV%20WG7%20Legacy%20Best%20Practices%20Final.pdf
12-10-5250	Network Operators and Service Providers should develop an engineering design for critical network elements and inter-office facilities that addresses diversity, and utilize management systems to provision, track, and maintain and restore that inter-office and intra-office diversity.		Created NRIC VI FG 1A: https://transition.fcc.gov/nric/nric-6/fg1a-report.doc Last Edited CSRIC IV WG 7: https://transition.fcc.gov/pshs/advisory/csric4/CSRIC%20IV%20WG7%20Legacy%20Best%20Practices%20Final.pdf
12-12-0731	Network Operators, Service Providers and Public Safety should provide physical diversity on critical inter-office and wireless backhaul routes when justified by a risk or value analysis.		Developed prior to 2011; Last Edited CSRIC VI WG 1: https://bp.atis.org/best-practice-detail/?bp_id=1918
12-12-3223	Network Operators, Service Providers and Public Safety should	This should be done rather than aggregating traffic	Created NRIC VII, FG 1A: https://transition.fcc.gov/nric/nric-
12-12-3224	Network Operators, Service Providers and Public Safety should use dedicated and diverse Signaling System 7 (SS7) or Multi-Frequency (MF) controlled trunk groups as feasible and commercially reasonable as possible for the normal routing of 9-1-1 calls from originating switching entities to 9-1-1 Selective Routers (SRs) or Legacy network Gateway (for NG9-1-1) rather than using shared Public Switched Telephone Network (PSTN) trunk arrangements and where appropriate and necessary supported by service level agreements. Network Operators, Service Providers, and NG9-1-1 PSAPs should use dedicated, geo-diverse and redundant IP connection points when feasible and commercially available.		Created NRIC VII, FG 1A: https://transition.fcc.gov/nric/nric-7/fg1a-report.pdf Edited CSRIC IV WG 7 https://transition.fcc.gov/bureaus/pshs/advisory/csric5/WG1_Task1_Final_Report_0316.docx Last Edited CSRIC VI WG 1: https://www.fcc.gov/files/csric6wg1finalreport030819pdf
12-12-3276	Network Operators, Service Providers and Public Safety should where feasible, provide both physical and logical diversity of critical facilities links.		Created CSRIC VI, WG1: https://bp.atis.org/best-practice-detail/?bp_id=2021
12-12-3277	Network Operators, Service Providers and Public Safety should identify and manage critical network elements and architecture that are essential for network connectivity and subscriber services considering security, functional redundancy and geographical diversity.		Created CSRIC VI, WG1: https://bp.atis.org/best-practice-detail/?bp_id=2022

Best Practice Number	Best Practice	Reference/Comments	Best Practice History
12-12-8728	Network Operators, Public Safety should consider industry guidelines for logical diversity (e.g. multi-homing), and perform network diversification validation on a scheduled basis (e.g., twice a year). Processes and procedures should exist for tracking discrepancies and maintaining a historical record. This applies to Public Safety only in an NG9-1-1 environment.		2011 Data Dump Says "Developed with WG 2A" in CSRIC II Column (created CSRIC II?) Created before CSRIC III FG 1D: https://transition.fcc.gov/bureaus/pshs/advisory/csric3/CSRICIII_6-6-12_WG8-Final-Report.pdf Edited CSRIC IV WG 7 Last Edited CSRIC VI WG 1: https://www.fcc.gov/files/csric6wg1finalreport030819pdf
12-7-0549	Network Operators should develop an engineering design for critical network elements and inter-office facilities that addresses diversity, and utilize management systems to provision, track and maintain that inter-office and intra- office diversity.		2011 Data Dump has "NE04" in NRIC IV Column (Created NRIC IV?) Created before CSRIC IV WG 7
12-7-5076	Network Operators and Service Providers should ensure and periodically review intra-office diversity of critical resources including power, timing source and signaling leads (e.g., SS7).		Created NRIC VI FG 1A: https://transition.fcc.gov/nric/nric-6/fg1a-report.doc Edited CSRIC IV WG 7?
12-7-5079	Network Operators, Service Providers should where feasible, provide both physical and logical diversity of critical facilities links (e.g., nodal, network element). Particular attention should be paid to telecom hotels and other concentration points.		Created NRIC VI FG 1A: https://transition.fcc.gov/nric/nric-6/fg1a-report.doc Edited CSRIC IV WG 7? Not listed as changed here: https://transition.fcc.gov/pshs/advisory/csric4/CSRIC%20IV%20WG7%20Legacy%20Best%20Practices%20Final.pdf
12-9-0532	Network Operators and Public Safety should periodically audit the physical and logical diversity called for by network design of their network segment(s) and take appropriate measures as needed.		Created NRIC V 2011 Data Dump says "New in NRIC V" Created before CSRIC III, FG 1D: https://transition.fcc.gov/bureaus/pshs/advisory/csric3/CSRICIII_6-6-12_WG8-Final-Report.pdf
12-9-0566	Network Operators, Service Providers, and Public Safety should consider placing and maintaining 9-1-1 TDM or IP based networks over diverse interoffice transport facilities (e.g., geographically diverse facility routes, automatically invoked standby routing, diverse digital cross-connect system services, self-healing fiber ring topologies, or any combination thereof).		2011 Data Dump has "ES01" in NRIC IV Column (Created NRIC IV?) Created before, then Edited NRIC VII, FG 1C: https://transition.fcc.gov/nric/nric-7/fg1c-report.pdf Edited CSRIC IV WG 7?
12-9-0580	Network Operators and Public Safety should apply redundancy and diversity where feasible, to all network links considered vital to a community's ability to respond to emergencies.	Security practices and concepts should be applied to the critical systems supporting Link Redundancy and Diversity.	2011 Data Dump has "ES15" in NRIC IV Column (Created NRIC IV?) Edited NRIC VII, FG 1C: https://transition.fcc.gov/nric/nric-7/fg1c-report.pdf Edited CSRIC IV WG 7?

Best Practice Number	Best Practice	Reference/Comments	Best Practice History
12-9-8727	Network Operators, Service Providers, and Public Safety should implement industry guidelines for validating physical diversity, and consider performing signaling link diversification validation on a scheduled basis (e.g., twice a year).	Processes and procedures should exist for tracking discrepancies and maintaining a historical record. Re: PBX & statewide networks - sonic ring could be influenced by this.	2011 Data Dump Says "Developed with WG 2A" in CSRIC II Column (created CSRIC II?) Created before CSRIC III FG 1D: https://transition.fcc.gov/bureaus/pshs/advisory/csric3/CSRIC_III_6-6-12_WG8-Final-Report.pdf