Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	§	
	§	
FEDERAL COMMUNICATIONS COMMISSION SEEKS TO REFRESH THE RECORD ON LOCATION-BASED ROUTING FOR WIRELESS 911 CALLS	§	**PS Docket No. 18-64**

COMMENTS BY NENA: THE 9-1-1 ASSOCIATION

NENA: The 9-1-1 Association applauds the Commission in engaging on this important proceeding on updating the record for Location-Based Routing (LBR). As the Commission has rightly observed, there have been numerous advances in technology, as well as enhancements in implementation of these technologies, since the Commission last explored this topic in 2018.[1] NENA is pleased to provide these comments as the only standards development organization solely dedicated to 9-1-1 topics on behalf of our over 18,000 members.

I. Cell-Sector Based Misroutes

NENA does not have empirical information on the number of wireless calls that are not routed to the correct PSAP each year but can provide reasonable estimates. We note ATIS' 2019 study, *Analysis of Predetermined Cell Sector Routing Outcomes Compared to Caller's Device Location*.[2] The study shows that the *majority* misroutes would be prevented with LBR with a routing location as uncertain as 300 meters.[3] ATIS also recommends waiting no longer than 5 seconds to determine the location used for

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[1] *See Location-Based Routing for Wireless 911 Calls*, PS Docket No. 18-64, Notice of Inquiry, 33 FCC Rcd 3238 (2018) (Notice of Inquiry).

[2] *See Analysis of Predetermined Cell Sector Routing Outcomes Compared to Caller's Device Location*, ATIS-0500039, July 2019. (ATIS-0500039). Retrieved 1 July 2022 at https://www.techstreet.com/standards/atis-0500039?product_id=2078062.

[3] *See* Id. at 8.3.2.

routing.[4] As reiterated through recent findings in the Test Bed,[5] horizontal location (X/Y) provided by Device-Based-Hybrid (DBH) currently is accurate within 50 meters with call delivery.[6] If used for LBR, this location information should correct for an estimated 85% of misrouted calls from wireless devices.[7] The same study notes that a sample study showed that as of 2019, approximately 12% of all wireless calls using cell-sector based routing were not routed to the correct PSAP.

The Commission reports 152,708,044 wireless 9-1-1 calls placed in 2020, that figure representing 74% of all 9-1-1 calls reported; though the Commission admits this is almost certainly an undercount, as (1) not all states and territories responded to the Commission's inquiry and (2) not all respondents broke out separate service types.[8] NENA independently estimates approximately 240,000,000 9-1-1 calls are placed each year with about 80% of those calls being wireless calls (and growing).[9] It is therefore reasonable to estimate that in the United States up to 192,000,000 wireless 9-1-1 calls are placed annually, and that around to 23,000,000 wireless 9-1-1 calls[10] have been misrouted annually when cell-sector-based routing is the routing mechanism. Assuming location-based routing mechanisms have access to an FCC-compliant 50 meter horizontal uncertainty, **NENA estimates universal location-based routing for wireless 9-1-1 calls can reduce the number of misrouted calls to an estimated maximum of about 3,450,000 per year.**[11]

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[4] *See* Id.

[5] http://www.911locationtestbed.org/

[6] *See* e.g., filings from AT&T, T-Mobile, and Verizon certifying compliance with the Commission's 50m rules. Retrieved, respectively, 8 July 2022 at https://www.fcc.gov/ecfs/search/search-filings/filing/10602589304378, https://www.fcc.gov/ecfs/search/search-filings/filing/10613326816428, https://www.fcc.gov/ecfs/search/search-filings/filing/10613326816428

[7] *See* ATIS-0500059 at table 7.1.

[8] *See THIRTEENTH ANNUAL REPORT TO CONGRESS ON STATE COLLECTION AND DISTRIBUTION OF 911 AND ENHANCED 911 FEES AND CHARGES FOR THE PERIOD JANUARY 1, 2020 TO DECEMBER 31,* 2020. United States Federal Communications Commission. Retrieved 1 July 2022 at https://www.fcc.gov/sites/default/files/13th-annual-911-fee-report-2021.pdf

[9] *See 9-1-1 Statistics*. NENA: The 9-1-1 Association. Retrieved 1 July 2022 at https://www.nena.org/page/911Statistics

[10] 12% of 192,000,000.

[11] Based on ATIS' findings that an estimated 85% of misrouted calls can be prevented with a horizontal location accuracy of 50 meters. 15% of 23,000,000.

There are some caveats with this estimate; it leverages multiple different sources and assumes that these source estimates are accurate. There are also two major wireless carriers that have indicated that they have deployed LBR in their networks *to some extent*,[12] though they have not yet published any information on how or whether this has improved 9-1-1 outcomes. NENA strongly encourages such an analysis be done and will gladly participate to any study conducted to this end. However, it is very rational to conclude from available evidence that universal support for LBR will improve response times for tens of millions of emergency calls per year, and in doing so, will save lives.

NENA does not have independent empirical data on the typical time it takes to transfer a 9-1-1 call. The circumstances depend on many factors. For example, a wireless 9-1-1 caller may not be able to describe their exact location, which ties up the telecommunicator who is handling the call. The telecommunicator will typically have a procedure for assisting the caller in figuring out the caller location, but it takes time. Also for example, a call *is* routed as the system is designed, but the call is about a different individual at a different location. If these two locations are very far away—such as opposite sides of the country—it takes a significant amount of time to find contact information for the destination PSAP. For a third example, such as the Washington D.C. area with a high density of bordering jurisdictions, call transfers are routine as the PSAPs already have a relationship with each other and are accustomed to transferring calls.

NENA notes reports on the estimated average time to handle a call transfer under these circumstances; the Commission has previously cited a study from Snohomish County, WA that reported an average of 40 seconds in their jurisdiction,[13] and E-Comm, who handles 9-1-1 calls for almost all of British Columbia, reports an average of 45 seconds for call transfers.[14] In preparing this filing, NENA

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[12] See press releases by AT&T and T-Mobile; retrieved 1 July 2022 at https://about.att.com/story/2022/nationwide-location-based-routing.html and https://www.t-mobile.com/news/network/tmobile-next-generation-911-location-based-routing, respectively.

[13] *See Determining Routing of Wireless Sectors in a Multi-PSAP 9-1-1 System.* Snohomish County, WA. Retrieved 1 July https://proceedings.esri.com/library/userconf/proc15/papers/19_248.pdf.

[14] *See NEW CALL TRANSFER PROCESS AIMS TO ADDRESS STRAINS ON BRITISH COLUMBIA'S 9-1-1 SYSTEM.* E-Comm Emergency Communications for British Columbia Incorporated. Retrieved 1 July 2022 at

queried a number of 9-1-1 professionals about this topic, and the general anecdotal consensus was that a call transfer typically takes "about a minute". NENA can therefore reasonably conclude that on average call transfers take from 40 seconds to a minute, on average. Sometimes 40 seconds is too long. For example, a patient experiencing cardiac arrest can experience permanent brain damage in as few as 5 minutes.[15] For these patients, 40 seconds can mean the difference between a full recovery versus disability or death.

It is worth noting that the extra time associated with call transfers not only increases the chances of a negative outcome from a 9-1-1 call, but also consumes staff resources. While a call is being transferred, the transfer is typically "attended", meaning that the initial telecommunicator describes the incident to the second telecommunicator, and confirms hand off.[16] Extrapolating the numbers above, **NENA estimates over 200,000 hours per year of excess 9-1-1 professional labor is consumed due to call transfer events**.[17] With universal LBR the vast majority of wireless 9-1-1 call transfers would be unnecessary.

NENA also notes that there are current technical solutions, either proprietary *or* standards-based, which alleviate the time to complete a call transfer. One example is the NENA Enhanced PSAP Registry and Census (EPRC), which is a free tool available to the 9-1-1 community. The EPRC contains service area boundaries and 24x7 transfer telephone numbers for every PSAP in the United States,[18] and soon to expand internationally. A user can search for a PSAP based on street address, latitude and longitude, community name, landmark and map area. In some cases the EPRC is natively integrated into the user's

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https://www.ecomm911.ca/news/new-call-transfer-process-aims-to-address-strains-on-british-columbias-9-1-1-system/.

[15] Per Cleveland Clinic. Retrieved 1 July 2022 at https://my.clevelandclinic.org/health/diseases/21736-cardiac-arrest#:~:text=Cardiac%20arrest%20can%20be%20fatal,re%20not%20in%20the%20hospital.

[16] *See* NENA-STA-020.1-2020, *NENA Standard for 9-1-1 Call Processing*. Retrieved 8 July 2022 at https://cdn.ymaws.com/www.nena.org/resource/resmgr/standards/nena-sta-020.1-2020_911_call.pdf

[17] Based on the assumption above that there are about 23,000,000 wireless calls misrouted annually in the absence of universal LBR, and that the call transfer consumes two telecommunicators for up to 40 seconds during an unattended transfer.

[18] *See* http://eprc.nena.org

mapping service, call-taking software, or computer aided dispatching system. This tool is *not* standards-based and is not an NG9-1-1 product. In the interim, until end-state NG9-1-1 is deployed universally, this tool is an important and helpful free tool for telecommunicators who find themselves in an unusual call transfer situation. An edge case example: a loved one calls 9-1-1 on behalf of a family member who is having a medical emergency in another state. The EPRC allows a telecommunicator to quickly determine the appropriate PSAP's 10-digit telephone number to transfer the call efficiently. Our users report that this occurs approximately 1% of the time; a very small percentage of all calls, enough that millions of 9-1-1 calls every year fall under these conditions. Use of tools such as the EPRC can mitigate call transfer times within the Emergency Communications Center (ECC) itself. NENA also observes that there are private sector companies providing similar services.

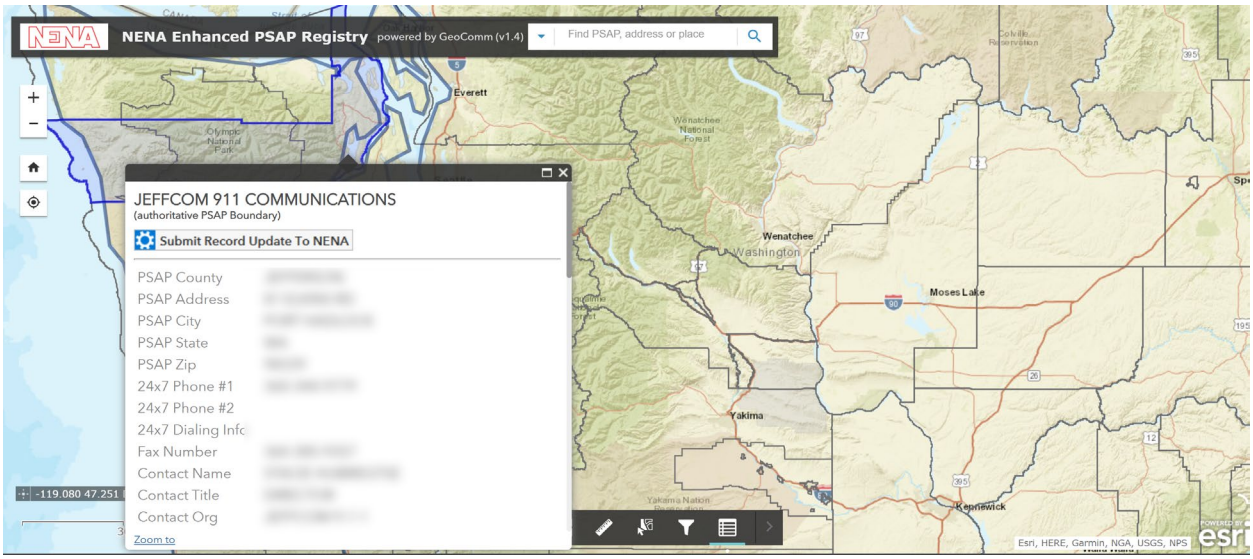

Figure 1: NENA EPRC Viewer

The long-term standards-based solution for LBR to alleviate call transfer times rests in specifications for PIDF-LO,[19] LoST,[20] and the Forest Guide.[21] As the Commission is likely aware, PIDF-

[19] *See* IETF 5491, its precedents and its successors.

[20] *See* LoST: A Location-Service Translation Protocol. Internet Engineering Task Force. Retrieved 1 July 2022 at https://datatracker.ietf.org/doc/html/rfc5222

[21] *See* Location-to-URL Mapping Architecture and Framework. Internet Engineering Task Force. Retrieved 1 July 2022 at https://datatracker.ietf.org/doc/html/rfc5582.

LO and LoST are the consensus standards employed by the entire industry for LBR for NG9-1-1. These specifications are incorporated into global Next Generation emergency calling standards, including NENA i3 in North America,[22] equivalent standards for NG112 in Europe,[23] and in 3GPP 4G/5G global specifications,[24] among others. These specifications are implemented in the services that many states and localities have for transitional NG9-1-1 today, as well as the entire nation of Canada, and initial NG112 deployments in Europe. PIDF-LO conveys the caller location in either civic (an address) or geodetic (coordinates) format; LoST[25] is the server that ingests a PIDF-LO and makes a routing decision; and the Forest Guide is for different LoST servers to coordinate between different NG9-1-1 systems.

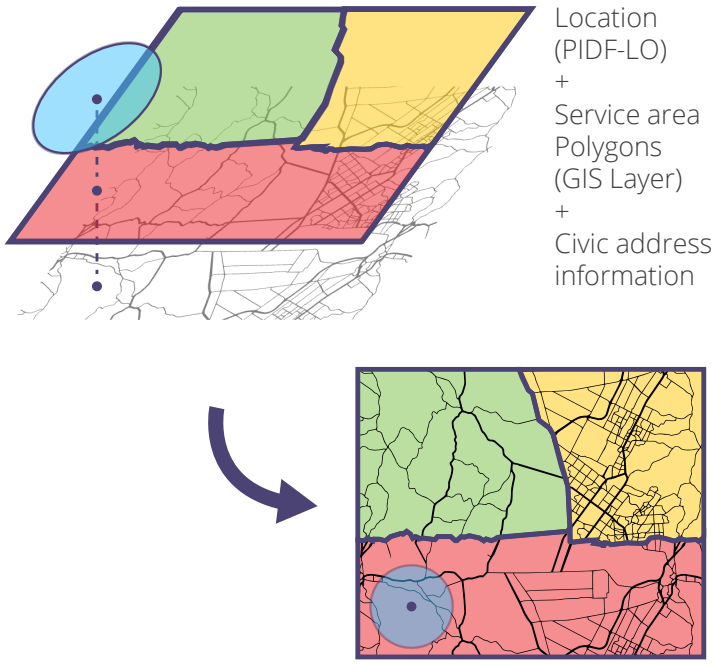

Figure 2: LoST and PIDF-LO Diagram

[22] *See* NENA-STA-010.3b-2021, NENA i3 Standard for Next Generation 9-1-1. NENA: The 9-1-1 Association. Retrieved 1 July 2022 at https://cdn.ymaws.com/www.nena.org/resource/resmgr/standards/nena-sta-010.3b-2021_i3_stan.pdf ("i3")

[23] *See* Protocol Specifications for Emergency Service Caller Location determination and transport. European Telecommunications Standards Institute. Retrieved 1 July 2022 at https://www.etsi.org/deliver/etsi_es/203200_203299/203283/01.01.01_60/es_203283v010101p.pdf.

[24] *See* 3GPP TS 24.141. Retrieved 1 July 2022 at https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=1044.

[25] In i3, this is called the Emergency Call Routing Function (ECRF). This is because i3 adopts the LoST specification but adds additional functions and requirements and has special rules for how it interacts with other NG9-1-1 functions. But its primary function is as a LoST server.

In standards-based NG9-1-1, call transfers are done in one of two ways. Both of these methods are more efficient than the legacy convention of transferring to a 24x7 telephone number.

In NG9-1-1, the first transfer method is to a known jurisdiction where the telecommunicator's system has the transfer-to jurisdiction's information already provisioned. Normally, this is when two neighboring jurisdictions execute a mutual aid agreement to share their GIS data that their LoST servers use.[26] In this case the transfer is straightforward; the telecommunicator can enter an address or coordinates onto their screen, and click "transfer"—and the system takes care of the rest. Speaking operationally, it is still likely the transfer will have to be attended.

The second method in NG9-1-1 is through use of the Forest Guide,[27] which is a standards-based mechanism to help different systems resolve LBR requests. The Forest Guide contains information about each LoST server (the LoST server in NENA i3 is called the ECRF). If one LoST server does not have information for a different LoST server (e.g., a different NG9-1-1 system operated by a different state or jurisdiction), the Forest Guide can help resolve the query. In end-state NG9-1-1 this will be critical during unusual call transfer situations. The telecommunicator will be able to enter a location onto their screen and click "transfer", even if the transfer is to a distant location where there is no mutual aid agreement. The Forest Guide will resolve the query to connect to the transfer-to jurisdiction. These long-distance transfers are the kind that take the most time to handle, and NG9-1-1 can help mitigate that.

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[26] In IETF 5222, there is a standardized mechanism to automate this, called LoST Sync.
[27] *See* IETF 5582.

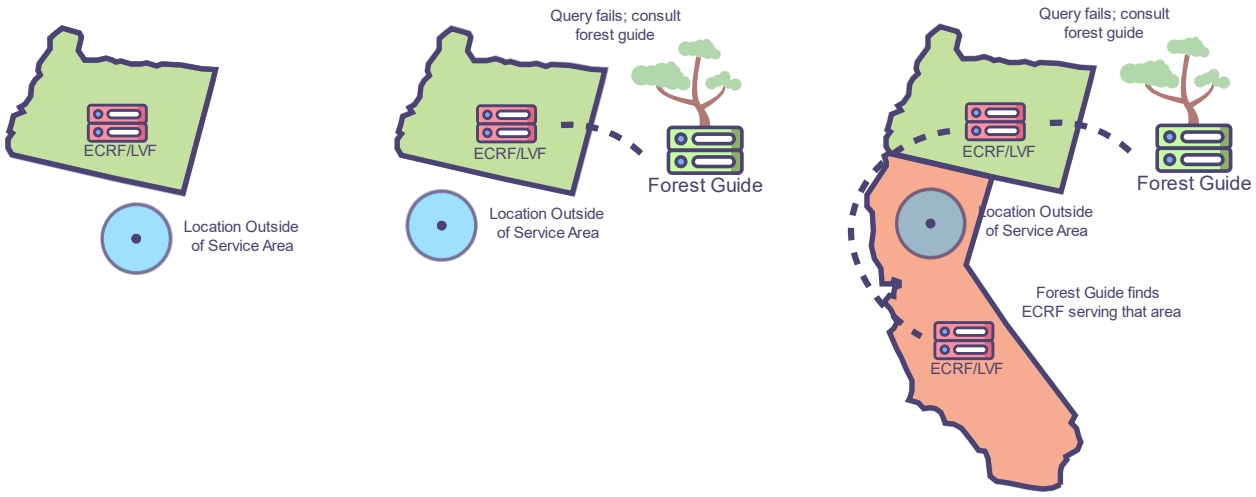

Figure 3: Forest Guide Recursive Query Process

II. Wireless Carrier Implementation of Location-Based Routing

NENA will defer to our colleagues in the wireless industry about the specific degree to which they have employed location-based routing today, aside from observations made prior in this filing. NENA will note, however, significant differences in routing in a legacy E9-1-1 as opposed to an NG9-1-1 environment. Routing in NG9-1-1 is more efficient and requires much less physical hardware. Many NG9-1-1 systems are forced to operate in a transitional environment. The 9-1-1 authority is forced to operate both an ESInet *and* a legacy E9-1-1 system that supports Selective Routers. NG9-1-1 transitional environments are very costly and inefficient. **The Commission must adopt a framework that *no longer forces* 9-1-1 authorities to operate both legacy and NG9-1-1 systems simultaneously**. It is imperative that carriers be required to update their call origination to comply with current standards of technology.

III. Transitions to Next-Generation 9-1-1 and Location-Based Routing

NENA notes that there are 5 domains of responsibility associated with a 9-1-1 call: (1) the originating device, (2) the carrier, (3) the 9-1-1 service itself, (4) the PSAP or ECC, and finally (5) the field responder. All five domains need to upgrade their networks and software to truly support end-state NG9-1-1. The Commission historically claims jurisdiction only over the carrier domain.

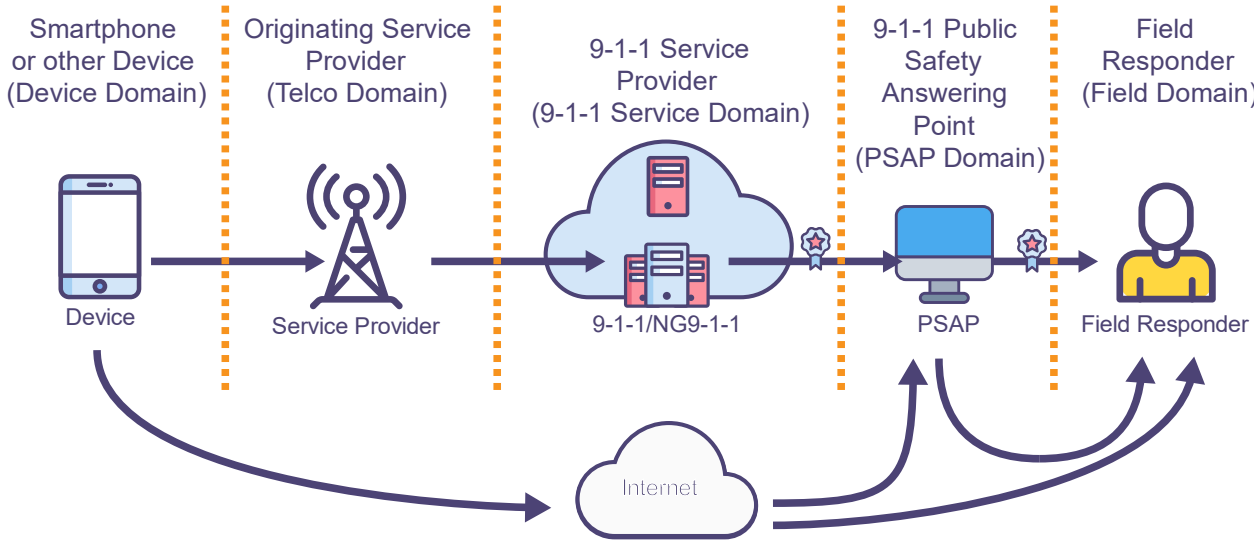

Figure 4: 9-1-1 Domains of Responsibility

NENA urges the Commission to reconsider its scope; NG9-1-1 may be considered by some an "Information Service." In an end-state NG9-1-1 environment, some requests for assistance may use systems that communicate strictly only over the public internet. NG9-1-1 does not require call origination to be done through a telephone company or other covered provider. NENA is concerned that the Commission's historical claim of jurisdiction over 9-1-1 services may not apply to many call scenarios in end-state NG9-1-1.

In compelling carriers to implement NG9-1-1, NENA urges the Commission to implement a mechanism similarly to how it implemented interim SMS-to-9-1-1; i.e. to require telecommunications carriers to fully support standards-based NG9-1-1 within a limited time frame after a 9-1-1 authority affirms that it can support location-based routing and NG9-1-1 standards-compliant call origination. Many NG9-1-1 systems operating today fail to enjoy the features of NG9-1-1 because there is no requirement for carriers to update their systems to support NG9-1-1 call origination. Routing errors aside, callers are also unable to place multimedia calls. Once a SIP session is initiated, it does not matter whether the media is audio, video or RTT; to NG9-1-1 it is all the same call type, even though multiple

multimedia formats are supported.[28] Unless compelled, NENA fears that the telecommunications industry will never fully upgrade their services to provide the public with the modern 9-1-1 service that the public deserves.

IV. Location-Based Routing for Text-to-9-1-1

The Commission inquires about the viability of location-based routing for text-to-9-1-1. In standards-based NG9-1-1 there are two cases where location-based routing may apply to a text-to-9-1-1 call: (1) an interactive RTT 9-1-1 call (2) and a one-way, SMS-style text message call.

In NG9-1-1, for an RTT call, there is no practical difference whatsoever in how the call is handled compared to a voice call. It is just a SIP call. RTT is one of the supported media types for an interactive session in NG9-1-1, so it is handled exactly like a voice or video call.[29] This cannot be understated to the Commission: **standards-compliant NG9-1-1 RTT call origination contains the same features for LBR and policy-based routing supported for voice calls. For all practical purposes the calls are exactly the same.** At the protocol level there is no difference. On most smartphones today, to initiate an RTT session, the caller dials 9-1-1 like they would for a voice call. The user interface then includes a prompt to use RTT. This is because RTT is just one of the several media types supported once an interactive SIP session is established.

For an SMS-style one-way text in NG9-1-1, the call uses the SIP MESSAGE method.[30] With respect to how routing is handled, the only difference is that the call is a one-way text, so it is not an interactive multimedia session. Like a multimedia call, the SIP MESSAGE includes a PIDF-LO location and supports other features available for emergency calls in NG9-1-1. These features include marking for call Resource-Priority,[31] Additional Data, and callback information. Standards compliant NG9-1-1 one-way text calls utilize LBR in exactly the same way as any other call; the distinction is that it is not an

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[28] *See* i3 at 3.1 *SIP Call*.
[29] *See* i3 at 3.1.9, *Media*.
[30] *See* i3 at 3.1.2.6, *MESSAGE*.
[31] *See* i3 at 3.1.7, *Resource Prioritization.*

interactive multimedia session but rather a series of one-way texts sent between the caller and telecommunicator (like SMS).

V. Digital Equity and Inclusion

The implementation of NG9-1-1 is indeed an issue of digital equity and inclusion. While LBR is a headlining feature of NG9-1-1 that indeed gets a lot of attention, and for good reason, an equally **powerful feature—especially with respect to deploying inclusive 9-1-1 service that provides reasonable accommodation—is the Policy Routing Function**. In NG9-1-1, routing decisions after a call enters the ESInet is *not* strictly based on geolocation; the Emergency Services Routing Proxy also evaluates various conditions and *may* make a Policy Routing decision[32] that supplements or overrides an LBR query. Depending on conditions and Policy Routing rules, the routing mechanism may decide not to route based on geolocation.

A SIP session (and by extension an NG9-1-1 call) can contain tags for languages supported and languages preferred, and can assign these tags to each media type (e.g. audio, video or text).[33] [34] [35] For example, the Policy Routing Function could determine that the call only supports American Sign Language over video, and based on this information the system can make an informed routing decision that better accommodates the caller. This could drastically reduce the time involved in handling calls from the deaf and hard of hearing.

Policy Routing decisions could be made based on other factors. Calls can be routed to a telecommunicator who understands the caller's native language; a call may signal that the speaker prefers Spanish, but understands English, and make a routing decision based on that. RTT calls may be routed to

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[32] *See* i3 at 3.3, *Policy*.

[33] *See* IETF RFC 8873, *Negotiating Human Language in Real-Time Communications*. Retrieved 6 July 2022 at https://datatracker.ietf.org/doc/html/rfc8373.

[34] *See also* i3 at 3.3.3.1.16, *SDP Offer Decision*.

[35] *See also* i3 at 3.3.3.3, *PRR Ruleset Examples* for examples and descriptions of this function, and *see also* i3 at Appendix E.1, *Policy Store*, for normative documentation of the standardized Policy Store API.

a call queue dedicated to RTT, reducing call handling time. Handling of language is just one feature that NG9-1-1 supports to provide a more equitable service to *everyone* who calls for help.

There are many other features in NG9-1-1 to support use cases to provide a more equal and inclusive 9-1-1 system; this comment describes only some of them. The consensus standards community has anticipated these use cases a very long time ago. Implementing NG9-1-1 is absolutely a matter of equity and inclusion. **By developing a framework supporting standards-based NG9-1-1, the Commission can help to build a fairer emergency calling service for everyone**.

VI. Actionability of Location Information

The actionability of Location Information, particularly 3D location (i.e., including z-axis information) is an issue the industry has long debated. In lieu of an extended explanation in this filing, NENA has also separately filed a copy of the recently published NENA-REQ-003-2022, *NENA Requirements for 3D Location Data for E9-1-1 and NG9-1-1*.[36] This landmark document reflects the consensus requirements for operationalizing 3D location information in 9-1-1. It includes recommendations for constructing or purchasing 3D maps and other related topics. It is written by nearly 100 experts in 9-1-1, field response, standards development, government, and industry. It also introduces initial work that must be further developed and standardized, such as handling uncertainty with civic addresses to properly convey a Dispatchable Location (DL). Delivery of DL has been a longstanding goal for the Commission and 9-1-1 to achieve. This work is not directly in the scope of the Commission's present inquiry, but NENA believes the recommendations contained therein are very much within scope of recent and anticipated future proceedings regarding geolocation for 9-1-1 calls. NENA wants to bring this work to the Commission's attention.

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[36] *See* NENA-REQ-003-2022, NENA Requirements for 3D Location Data for E9 1 1 and NG9 1 1. Retrieved 8 July 2022 at https://nena.org/standards

VII. Conclusion

NENA again applauds the Commission for opening this very timely and important proceeding. We are honored to have the opportunity to participate.

Respectfully submitted,

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