

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

In the Matter of	)	
	)	
Location-Based Routing	)	PS Docket No. 18-64
For Wireless 911 Calls	)	

**NOTICE OF INQUIRY**

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By the Commission: Chairman Pai and Commissioners Clyburn, O’Rielly, Carr, and Rosenworcel issuing separate statements.

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**I. INTRODUCTION**

1. This *Notice of Inquiry* (NOI) seeks to determine the best way to avoid delay in the response to some wireless 911 calls that results from the manner in which such calls are routed in the current 911 system. When someone seeking aid initiates a wireless 911 call, the expectation is that the call will be directed to and answered by the public safety answering point (PSAP) that has the ability to promptly dispatch aid to the caller’s location. However, this may not always happen, because the current 911 system is configured to route wireless 911 calls to PSAPs based on the location of the cell tower that handles the call, which may be some distance (varying from a few hundred feet to several miles) from the caller’s location. In such circumstances, particularly in the case of wireless 911 calls made near jurisdictional borders, the call may be answered by a different PSAP from the one that serves the caller’s location. For example, a wireless 911 call originating in Washington, D.C. may be received by a cell tower in nearby Northern Virginia, causing the call to be routed to a Virginia PSAP. In such situations, the PSAP to which the call is initially routed must transfer the call to the PSAP that is responsible for call-handling and dispatch of emergency response to the caller’s location.

2. Each time a wireless 911 call is “misrouted”<sup>1</sup> and transferred in this manner, the call transfer process consumes time and resources in both the PSAP that initially receives the call and the PSAP to which the call is transferred, and the process ultimately delays dispatch and the ability of first responders to render aid.<sup>2</sup> We have reason to believe that 911 misroutes are not occasional or isolated and in fact occur frequently,<sup>3</sup> on occasion with deadly consequences.<sup>4</sup> The importance of addressing this issue is escalating as the public is increasingly dependent on wireless networks and devices for access to 911.<sup>5</sup>

3. This *Notice of Inquiry* explores how the delays that arise from misrouting of wireless 911 calls can be avoided, possibly resulting in faster response times, via the implementation of location-based

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<sup>1</sup> 911 calls that are received by one PSAP and then transferred to another are commonly referred to as “misrouted” calls or “misroutes.” However, it is important to note that the “misroutes” that are the subject of this inquiry mostly result from current 911 call routing mechanisms that rely on cell tower location working as designed, not from technical failure of those mechanisms.

<sup>2</sup> For example, a study in Snohomish County, Washington found that in 2014, there were approximately 94,600 transferred 911 calls between PSAPs, each adding an average of 40 seconds to the call time, for a total of 1,051 hours of call delays. See Robert Thurston, GIS Technician, Snohomish County, Determining Routing of Wireless Sectors in a Multi PSAP 9-1-1 System (2018), [http://proceedings.esri.com/library/userconf/proc15/papers/19\\_248.pdf](http://proceedings.esri.com/library/userconf/proc15/papers/19_248.pdf).

<sup>3</sup> For example, according to the California Office of Emergency Services, a total of 3,758,748 calls to 911 were transferred from one PSAP to another in California in 2017 (out of a total 911 call volume of 28,129,927 calls). See California Office of Emergency Services, State of California Official E9-1-1 Call Statistics (2018), <http://www.caloes.ca.gov/PublicSafetyCommunicationsSite/Documents/2017OfficialCallTotalBreakdownSpreadsheet.pdf>. It has also been reported that an estimated 5000 mobile calls per year are misrouted in the Tri-Cities area of Washington State, requiring dispatchers to “reroute them by landline to the proper dispatch center, leading to dropped calls and misinformation.” Wendy Culverwell, Pasco Franklin County Ask to Join 911 Dispatch, Tri-city Herald (Feb. 24, 2016), <http://www.tri-cityherald.com/news/local/crime/article62350952.html>. See also Summit County, Utah Sheriff’s Office, Summit County / Park City Dispatch Center Consolidation (Aug. 24, 2017), <http://www.summitcounty.org/DocumentCenter/View/6671> (over 1,100 of Park City’s total of approximately 20,000 911 calls were transferred from another jurisdiction).

<sup>4</sup> Such tragic occurrences have been widely reported in the news. For example, in December 2014, dispatchers were unable to locate Shanell Anderson, who drowned after accidentally driving off the road and into a pond in Cherokee County, Georgia. She was able to call 911, but the call was picked up by a cell tower in an adjoining county and routed to that county’s PSAP, where critical minutes were lost while dispatchers sought to determine the county in which she was located. Brendan Keefe and Phillip Kish, Lost on the Line: Why 911 is Broken, USA Today, (Jan. 2015), <https://www.usatoday.com/story/news/local/investigations/2015/01/31/911-location-problems-/22645139/>. In another case in 2008, Olidia Kerr Day made a wireless 911 call before she was fatally shot in a murder-suicide in front of the Plantation, Florida police department. Although she placed the call in Plantation, it was routed to the 911 center in Sunrise, Florida, and had to be transferred to Plantation. Sofia Santana, Cell Phone 911 Calls are Often Routed to the Wrong Call Centers, The Sun Sentinel (June 21, 2008), <http://www.sun-sentinel.com/sfl-flbsafe911calls0621sbjun21-story.html>.

<sup>5</sup> The Commission’s Ninth Annual Report on 911 Fees reported data showing that approximately 70 percent of total 911 calls in 2016 came from wireless phones. The report notes that this likely understates the percentage of wireless 911 calls because some states reported total 911 calls but did not break out service categories separately. FCC, Ninth Annual Report to Congress on State Collection and Distribution of 911 and Enhanced 911 Fees and Charges for the Period January 1, 2016 to December 31, 2016 at 10 (2017), <https://www.fcc.gov/files/9thannual911feereportpdf>. The 2017 National 911 Progress Report finds that in 2016, approximately 80 percent of consumers used cellular phones to make 911 calls, while about 16 percent used wireline phones. National Highway Traffic Safety Administration (NHTSA), 2017 National 911 Progress Report at 2 (2017), <https://www.911.gov/pdf/National-911-Program-Profile-Database-Progress-Report-2017.pdf>. The California Office of Emergency Services reports that in California, the percentage of 911 calls from wireless devices increased from 75 percent in 2014 to 79 percent in 2017. California Office of Emergency Services, State of California Official E9-1-1 Call Statistics (2018), <http://www.caloes.ca.gov/PublicSafetyCommunicationsSite/Documents/2017OfficialCallTotalBreakdownSpreadsheet.pdf>.

routing solutions. Historically, legacy approaches to wireless 911 call routing have relied on the location of the cell tower that handles the call rather than on information pinpointing the caller's location because technology used by wireless carriers to generate caller location information took too long to be useful for initial call routing. However, as discussed in greater detail below, recent advances in location technology suggest that in many situations it is now feasible to pinpoint the 911 caller's location quickly and accurately enough to support the initial call routing determination.

4. We believe transitioning from tower-based routing to location-based routing would significantly reduce the number of wireless 911 calls that must be transferred from one PSAP to another and, therefore, have determined that location based routing would be in the public interest and should be encouraged and actively facilitated. Moreover, adoption of location-based routing could provide an incentive for PSAPs and wireless providers to transition to Next Generation 911 (NG911) because NG911 systems are designed to route calls using caller location information obtained in real time. However, while many location-based routing methods are promising, uncertainty remains regarding their reliability, the time required to develop necessary standards, and the potential transition costs of implementing location-based routing on current wireless 911 systems.

5. We believe this *Notice of Inquiry* is the most appropriate initial step in evaluating this transition. This will allow for the development of a more complete record regarding the technical and operational implications, limitations, deployments, and best common practices of location-based routing and the costs and benefits of different location-based routing methods.

## II. BACKGROUND

### A. Legacy E911 Routing

6. Since AT&T's announcement in 1965 that the digits "9-1-1" would be made available nationally as an emergency telephone number, the Commission has periodically reviewed technology to find ways to improve the ability of citizens to call for help and receive fast response to emergency situations. Initially, 911 service was provided to the public over wireline telephone networks, which meant that 911 calls could be routed to the nearest PSAP based on the fixed location of the telephone from which the call originated. As the first generation of cellular service was deployed, however, wireless carriers had to develop mechanisms for routing mobile 911 calls that could originate from any location served by the wireless network.

7. The solution implemented by the carriers was to program their networks to route wireless 911 calls to PSAPs based on the location of the cell tower receiving the call. Because the cell tower receiving the call could be some distance from the caller's location, using tower location information was necessarily imprecise, but it was the most practical means available at the time of generating immediate real-time information about the caller's approximate location to identify the nearest PSAP for purposes of routing the call.

8. To minimize routing delays, most jurisdictions coordinate on how to re-route misdirected calls.<sup>6</sup> Since the initial deployment of cellular networks, wireless technology and location technology have made significant advances.<sup>7</sup> Nevertheless, wireless carriers continue to rely primarily on cell tower (or cell sector) location information for 911 call routing purposes, and the clear majority of wireless 911 calls are currently routed to PSAPs on this basis. Calls routed to a neighboring jurisdiction that cannot dispatch assistance must be transferred. Our wireless location accuracy rules are designed to ensure that the PSAP is able to determine more precisely where the caller is located. But these rules do not ensure that the call is routed to the PSAP that is actually closest to that caller location. When this does not occur, the PSAP that initially receives the call must determine the caller's location, assess the jurisdiction to

<sup>6</sup> LaaSser, NG9-1-1 Institute Technology Showcase at 8 (February 2018), <http://www.ng911institute.org/wp-content/uploads/2018/03/2018-NG911-Technology-Showcase-LaaSser.pdf>.

<sup>7</sup> See generally LaaSser, NG9-1-1 Institute Technology Showcase (February 2018), <http://www.ng911institute.org/wp-content/uploads/2018/03/2018-NG911-Technology-Showcase-LaaSser.pdf>.

which the call should go, and forward the call to the appropriate jurisdiction's PSAP. While PSAPs have developed standards and best practices to transfer calls as efficiently as possible, the transfer process inevitably increases the delay between the time the 911 call is initiated and the time that emergency responders are dispatched to the caller's location.<sup>8</sup>

#### **B. Prior Commission Proceedings Related to E911 Routing and Location**

9. The Commission first began to address wireless 911 routing and location issues when it initiated the Enhanced 911 (E911) proceeding in 1994.<sup>9</sup> In 1996, the Commission promulgated E911 rules requiring wireless carriers to provide automatic location information to PSAPs as part of the 911 call process.<sup>10</sup> The rules gave carriers one year to develop the capability to provide the location of the base station (cell site) receiving a 911 call (referred to as Phase I location information) to the designated PSAP.<sup>11</sup> The rules further established a five-year period for carriers to be capable of providing geo-coordinates (latitude and longitude) for the mobile unit making a 911 call (referred to as Phase II location information).<sup>12</sup> The Commission's E911 rules did not, however, address the use of location information to support routing of wireless 911 calls.

10. In 1999, Congress enacted the Wireless Communications and Public Safety Act of 1999, which codified 911 as the national emergency number and sought to promote public safety through the deployment of a seamless, nationwide emergency communications infrastructure that included wireless

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<sup>8</sup> We note that even where a caller has made a privacy request by selecting Caller ID blocking that the Commission has concluded that to the extent Caller ID services are used to deliver emergency services, privacy requirements should not preclude delivery of the Calling Party Number (CPN) to a public agency's emergency lines or in conjunction with 911 emergency services. In these instances, the Commission has concluded that Caller ID blocking mechanisms could jeopardize emergency services and therefore pose a serious threat to safety. See 47 CFR § 64.1601(d). The Commission recently extended the availability of blocked Caller ID to private emergency services. See *Rules and Policies Regarding Calling Number Identification Service – Caller ID*, CC Docket No. 91-281, Report and Order, FCC 17-132, paras. 24-29 (rel. Oct. 25, 2017).

<sup>9</sup> *Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems*, Notice of Proposed Rulemaking, 9 FCC Rcd 6170 (1994).

<sup>10</sup> *Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems*, Report and Order and Further Notice of Proposed Rulemaking, 11 FCC Rcd 18676 (1996) (*E911 R&O and FNPRM*). The E911 rules applied to "covered carriers," which it defined to include all cellular licensees, broadband Personal Communications Service (PCS) licensees, and certain Specialized Mobile Radio (SMR) licensees. *Id.* at 18682, para. 10. The Commission applied the rules to cellular and broadband PCS carriers because customers of these public telephone services clearly expected access to 911, while the rules were applied to certain SMR licensees because the Commission concluded that these carriers had significant potential to offer near-term direct competition to cellular and broadband PCS carriers. *Id.* at 18716-17, paras. 80-81.

<sup>11</sup> *Id.* at 18683-64, para. 10. The Commission's wireless E911 rules require wireless carriers to provide the originating telephone number of a 911 call (Automatic Numbering Information (ANI)) and information regarding the caller's location (i.e., Automatic Location Identification (ALI)) to any PSAP that has requested that such information be delivered with 911 calls. See, e.g., 47 CFR § 20.18(d)-(h). Wireless carriers have developed various techniques to provision ANI and ALI that involve enhancements to the existing wireline E911 network. Some of these techniques involve the use of a "pseudo-ANI" or "p-ANI," which is a number containing the same number of digits as the ANI but that is not a North American Numbering Plan telephone directory number. The p-ANI is used to route wireless 911 calls to a geographically appropriate PSAP by identifying the cell sector in which the caller is located, even if the caller has a wireless telephone number not associated with his or her location. PSAPs that are equipped to handle p-ANI can distinguish wireless from wireline calls, and can use the p-ANI to query the ALI Database for non-traditional location information. Forms of p-ANI known as "Emergency Services Routing Key" (ESRK), "Emergency Services Query Key" (ESQK), and "Emergency Services Routing Digits" (ESRD) currently are used to cause the Wireline E911 Network to properly handle and process E911 calls placed by CMRS subscribers.

<sup>12</sup> *Id.*

communications services.<sup>13</sup> In response, the Commission adopted rules in 2001 requiring all telecommunications carriers to “transmit all 911 calls to a PSAP, to a designated statewide default answering point, or to an appropriate local emergency authority.”<sup>14</sup> Aside from establishing this general requirement to transmit 911 calls, the Commission’s rules did not specify or mandate technical requirements on carriers for routing 911 calls to the appropriate PSAP, default answering point, or appropriate local emergency authority.

11. Since 2001, the Commission has continued to update and enhance its E911 location rules to respond to advances in technology, but has not modified or amended its rules that relate to call routing. In the 2005 *VoIP 911 Order*, the Commission required interconnected voice over Internet Protocol (VoIP) service providers to supply E911 capabilities to their customers.<sup>15</sup> With respect to routing, the Commission required that interconnected VoIP providers route 911 calls through the dedicated wireline network based on fixed location data.<sup>16</sup> To support this routing function, VoIP providers are required to obtain from their customers the registered location at which the VoIP service will be used.<sup>17</sup> The Commission has also sought comment on the potential for VoIP 911 calling to be supported by automatic location solutions,<sup>18</sup> but to date it has not required VoIP providers to implement any such solution.

12. In 2014, the Commission adopted text-to-911 rules that provided for cell tower-based routing on the same basis as routing of wireless 911 voice calls. The Commission required text providers to “obtain location information sufficient to route text messages to the same PSAP to which a 911 voice call would be routed.”<sup>19</sup> The Commission stated that text providers could route texts to 911 using coarse location (cell ID and cell sector) or other equivalent means that allow the covered text provider to route a text to the appropriate PSAP.<sup>20</sup> The applicable standard defines coarse location information as “typically the initial location estimate of the mobile device,” consisting of “the Latitude/Longitude (X/Y) coordinates representing the geographic center (centroid) of the cell site/cell site sector area currently associated with the mobile device where the emergency communication dialogue was initiated.”<sup>21</sup>

13. In 2015, the Commission revised its wireless E911 location rules to improve accuracy of

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<sup>13</sup> Wireless Communications and Public Safety Act of 1999, Pub. L. No. 106-81, enacted Oct. 26, 1999, 113 Stat. 1286, amending the Communications Act of 1934, §§ 222, 251 (*Wireless 911 Act*)).

<sup>14</sup> 47 CFR § 64.3001. See *Implementation of 911 Act*, Fifth Report and Order, Memorandum Opinion and Order on Reconsideration, 16 FCC Rcd 22264, 22265, para. 1 (2001). The Commission also required wireless carriers to transmit 911 calls in accordance with Section 64.3001. See 47 CFR § 20.18(b).

<sup>15</sup> *IP-Enabled Services; E911 Requirements for IP-Enabled Service Providers*, WC Docket Nos. 04-36, 05-196, First Report and Order and Notice of Proposed Rulemaking, 20 FCC Rcd 10245 (2005) (*VoIP 911 Order*), *aff’d sub nom. Nuvio Corp. v. FCC*, 473 F.3d 302 (D.C. Cir. 2006); see also 47 CFR part 9.

<sup>16</sup> See 47 CFR § 9.5(b)(3)-(4).

<sup>17</sup> *VoIP 911 Order*, 20 FCC Rcd at 10271, para. 46; see also 47 CFR § 9.5(d). The “registered location” is the most recent information obtained by an interconnected VoIP service provider that identifies the physical location of an end user. 47 CFR § 9.3.

<sup>18</sup> *VoIP 911 Order*, 20 FCC Rcd at 10276, para. 56; *Wireless E911 Location Accuracy Requirements; E911 Requirements for IP-Enabled, Service Providers*, PS Docket No. 07-114, Further Notice of Proposed Rulemaking and Notice of Inquiry, 25 FCC Rcd 18957, 18968-69, paras. 27-30 (2010); *Amending the Definition of Interconnected VoIP Service in Section 9.3 of the Commission’s Rules; Wireless E911 Location Accuracy Requirements; E911 Requirements for IP-Enabled Service Providers*, GN Docket No. 11-117, Notice of Proposed Rulemaking, Third Report and Order and Second Further Notice of Proposed Rulemaking, 26 FCC Rcd 10074, 10094-10101, paras. 59-77 (2011).

<sup>19</sup> 47 CFR § 20.18(q)(9).

<sup>20</sup> *Facilitating the Deployment of Text-To-911 And Other Next Generation 911 Applications*, Second Report and Order and Third Further Notice of Proposed Rulemaking, 29 FCC Rcd 9846, 9874, para. 59 (2014).

<sup>21</sup> *Id.*

location information for wireless calls made indoors.<sup>22</sup> Specifically, in support of providing horizontal location information,<sup>23</sup> all Commercial Mobile Radio Service (CMRS) providers must provide (1) dispatchable location,<sup>24</sup> or (2) X/Y location within 50 meters for an increasing percentage of total 911 calls over a six year period.<sup>25</sup> Similarly, all CMRS providers must meet specific vertical location information<sup>26</sup> requirements over a six year period.<sup>27</sup> With respect to carriers that seek to rely on dispatchable location to meet the benchmarks, the location information must come from the under-development National Emergency Address Database (NEAD), a database that will enable wireless providers to use Wi-Fi media access control (MAC) addresses and Bluetooth Public Device Addresses (BT-PDA) (i.e., information from fixed indoor access points, to locate wireless devices being used to call 911).<sup>28</sup> The Commission's 2015 order did not address call routing issues.

### C. CSRIC V Location-Based Routing Report

14. In March 2015, the Commission tasked the Communications Security, Reliability and Interoperability Council V (CSRIC V)<sup>29</sup> with “develop[ing] and recommend[ing] best practices and actions the FCC can take that promote reliable communications services, including 911, E911, and NG911 service.”<sup>30</sup> As part of this tasking, the Commission directed CSRIC V to examine the routing of wireless 911 calls in two stages. In the first stage, the Commission tasked CSRIC with reviewing best

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<sup>22</sup> *Wireless E911 Location Accuracy Requirements*, PS Docket No. 07-114, Fourth Report and Order, 30 FCC Rcd 1259 (2015) (*Indoor Location Fourth Report and Order*).

<sup>23</sup> Horizontal (X/Y) information refers to the location on the surface of the earth as described by, e.g., geographical coordinates or street addresses.

<sup>24</sup> A dispatchable location is a location delivered to the PSAP by the CMRS provider with a 911 call that consists of the street address of the calling party, plus additional information such as suite, apartment or similar information necessary to adequately identify the location of the calling party. 47 CFR § 20.18(i)(1)(i).

<sup>25</sup> CMRS providers must provide X/Y location within 50 meters as follows: within two years for 40 percent of all wireless 911 calls; within three years for 50 percent of all wireless 911 calls; within five years for 70 percent of all wireless 911 calls; and within six years for 80 percent of all wireless 911 calls. *Indoor Location Fourth Report and Order*, 30 FCC Rcd at 1261, para. 6; 47 CFR 20.18(i)(2)(i).

<sup>26</sup> Vertical, or Z-axis, information refers to the height above the surface of the earth, e.g., 150 feet, or the 15th story of a building.

<sup>27</sup> Under the Commission's vertical location requirements, within three years, all CMRS providers must make uncompensated barometric sensor data (i.e. measured absolute barometric pressure not tied to the barometric pressure of a known altitude reference, such as sea level) available to PSAPs from any handset that has the capability to deliver barometric sensor data. Also within three years, nationwide CMRS providers must use an independently administered and transparent test bed process to develop a proposed z-axis accuracy metric, and must submit the proposed metric to the Commission for approval. Further, within six years, nationwide CMRS providers must deploy either (1) dispatchable location, or (2) z-axis technology that achieves the Commission-approved z-axis metric, in each of the top 25 Cellular Market Areas (CMAs). Where CMRS providers use dispatchable location, the National Emergency Address Database (NEAD) must be populated with a total number of dispatchable location reference points in the CMA equal to 25 percent of the CMA population. Where CMRS providers use z-axis technology, CMRS providers must deploy z-axis technology to cover 80 percent of the CMA population. Lastly, within eight years, nationwide CMRS providers must deploy dispatchable location or z-axis technology in accordance with the above benchmarks in each of the top 50 CMAs. 47 CFR 20.18(i)(2)(ii).

<sup>28</sup> 47 CFR 20.18(i)(1)(iii). See *infra* para. 21.

<sup>29</sup> The Communications Security, Reliability and Interoperability Council (CSRIC) is a federal advisory committee, subject to the requirements of the Federal Advisory Committee Act (FACA), see 5 U.S.C. § 10, charged with providing recommendations to the FCC to ensure, among other things, the security and reliability of communications systems.

<sup>30</sup> Charter of the FCC's Communications Security, Reliability and Interoperability Council at 1 (Mar. 19, 2015), [https://transition.fcc.gov/bureaus/pshs/advisory/csric5/CSRIC\\_Charter\\_Renewal\\_2014.pdf](https://transition.fcc.gov/bureaus/pshs/advisory/csric5/CSRIC_Charter_Renewal_2014.pdf).

practices and standard operating procedures, identifying gaps, and making recommendations to mitigate the need to reroute 911 calls between PSAPs when cell sector information is used to route the initial call.<sup>31</sup> In the second stage, the Commission directed CSRIC V to examine location based routing, and specifically to make recommendations on the “architectural, technical, operational standards, and cybersecurity requirements of location-based routing that uses longitude and latitude information or other location identification methods (when available) to determine and route a 911 call to the nearest appropriate PSAP.”<sup>32</sup> This task included considering different routing delivery options for location-based routing methods; exploring and reporting on the pros and cons of various sources of available location information; examining the potential reliability and accuracy of the sources of information; and analyzing the transition path to location-based routing of 911 calls from legacy to hybrid and then to fully deployed NG911 systems.<sup>33</sup> CSRIC V was also to focus on “identifying the necessary roles and responsibilities of key stakeholders involved in supporting 911 calls and identify existing and future standards to support the transition.”<sup>34</sup>

15. In 2016, CSRIC V adopted two separate reports addressing each of these tasks. In March 2016, CSRIC V adopted its “Task 1” report on optimizing wireless call routing where tower-based location is used. The report reviewed legacy 911 best practices for rerouting 911 calls between PSAPs, made recommendations for modifying those practices to ensure their continued relevance, and recommended new ways to optimize the rerouting process.<sup>35</sup>

16. In September 2016, CSRIC V adopted its “Task 2” report examining 911 location-based routing (*CSRIC V LBR Report*).<sup>36</sup> The *CSRIC V LBR Report* contained an in-depth review of five location-based routing solutions chosen by CSRIC V that could be used for wireless 911 call routing.<sup>37</sup> These solutions were: holding the call until Phase II location information is available;<sup>38</sup> using an interim or quick fix;<sup>39</sup> using geo-code registered or provisioned civic address;<sup>40</sup> relying on device-based hybrid location;<sup>41</sup> and using wireless 911 location accuracy emerging technologies.<sup>42</sup> The *Report* included

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<sup>31</sup> See CSRIC V Working Group Descriptions and Leadership at 1 (Dec. 22, 2016), <https://www.fcc.gov/file/11884/download>.

<sup>32</sup> *Id.*

<sup>33</sup> *Id.*

<sup>34</sup> *Id.* at 1-2.

<sup>35</sup> Communications Security, Reliability and Interoperability Council V, Working Group 1, Evolving 911 Services, Final Report – Task 1: Optimizing PSAP Re-Routes (Mar. 2016), [https://transition.fcc.gov/bureaus/pshs/advisory/csrc5/WG1\\_Task1\\_Final\\_Report\\_0316.docx](https://transition.fcc.gov/bureaus/pshs/advisory/csrc5/WG1_Task1_Final_Report_0316.docx).

<sup>36</sup> Communications Security, Reliability and Interoperability Council V, Working Group 1, Evolving 911 Services, Final Report – Task 2: 911 Location-Based Routing (Sep. 2016), [https://transition.fcc.gov/bureaus/pshs/advisory/csrc5/WG1\\_Task2\\_FinalReport\\_092016.docx](https://transition.fcc.gov/bureaus/pshs/advisory/csrc5/WG1_Task2_FinalReport_092016.docx) (*CSRIC V LBR Report*).

<sup>37</sup> CSRIC V LBR Report at 3.

<sup>38</sup> *Id.* at 10. A Phase II fix is a location provided to a PSAP, in connection with a wireless E911 call, in which location meets the accuracy criteria in the FCC rules at 47 CFR part 20. *Id.* at 8; see generally Indoor Location Fourth Report and Order and rules 47 CFR § 20.18(i) et seq.

<sup>39</sup> CSRIC V LBR Report at 12.

<sup>40</sup> *CSRIC V LBR Report* at 14. The *CSRIC V LBR Report*’s analysis of the geo-code registered/provisioned civic address method considered: (a) static or nomadic consumer home devices for which the customer registered the location of the device; (b) semi-permanent devices or cells installed by the carrier or other commercial entity, the address for which has been provided by the entity; and (c) dynamic geo-code registration, in which a nomadic device can update its registered civic address in real time through reverse geo-coding. *Id.*

<sup>41</sup> *Id.* at 16. According to the *CSRIC V LBR Report*, a device-based hybrid location is “an estimation method that typically utilizes either a selection or a combination of location methods available to the handset in a given

several recommendations about the five reviewed location-based routing solutions, including:

- (1) The delivery of a 911 call should not be delayed to allow time to acquire a Phase II location fix.<sup>43</sup>
- (2) An interim or quick fix method should be used where its use is expected to yield sufficient benefit to justify the cost.<sup>44</sup>
- (3) The Commission should work with device manufacturers and CMRS providers to assess the feasibility of enabling any device used for static and nomadic purposes that uses a registered or provisioned civic address with the ability to validate if it has been moved and alert the network of its status.<sup>45</sup>
- (4) The Commission should further study the suitability of device-based hybrid location for 911 call routing.<sup>46</sup> Additionally, the Commission should encourage the use of assisted satellite navigation systems by CMRS providers in the 911 location algorithm used for device-based hybrid commercial locations and take steps to ensure that location fixes calculated from proprietary databases, considered for routing 911 calls, are accurate.<sup>47</sup>
- (5) The Commission should continue to support the independent testing and analysis of new location technologies that promise significantly increased accuracy and speed.<sup>48</sup>

We seek comment below on these recommendations, including specific questions relating thereto.

### III. NOTICE OF INQUIRY

17. Any solution to the problem of misrouted 911 calls must be preceded by a determination of the dimensions of the problem. Thus, we seek comment on the current frequency of wireless 911 call misrouting and its impact on public safety. How many 911 calls are currently misrouted yearly? What proportion of wireless 911 calls are being delayed due to the need to reroute them to the correct PSAP? Does the time required to locate the correct PSAP and reroute the call typically take at least a minute? Is there a trend that is rising or declining over time? Are there particular geographic areas or situations in

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environment, including crowd-sourced Wi-Fi, A-GNSS, and possible other handset-based sensors. It also includes an associated uncertainty estimate reflective of the quality of the returned location.”

<sup>42</sup> *Id.* at 20. The *CSRIC V LBR Report* explains that wireless carriers are in the process of implementing the *Indoor Location Fourth Report and Order*, and this “includes provisions for an independent Test Bed to assess the indoor location accuracy of carrier-deployed location solutions and new, emerging location technologies, the creation of the NEAD for storing Wi-Fi access points and Bluetooth beacons for determination of dispatchable location, and the establishment of a z-axis metric through the Test Bed process.”

<sup>43</sup> *Id.* at 12.

<sup>44</sup> *Id.* at 14.

<sup>45</sup> *Id.* at 16.

<sup>46</sup> *Id.* at 19-20.

<sup>47</sup> *Id.* at 23. In its report, CSRIC referenced the potential use of Assisted Global Positioning Systems (A-GPS) and Assisted Global Navigation Satellite Systems (A-GNSS). These systems use a combination of satellite location data and data from the cellular network to enable faster position determination. A-GPS refers to a system that uses data from the GPS satellite constellation. A-GNSS refers to a system that uses data from multiple satellite constellations, but A-GPS is sometimes used informally to refer to any assisted satellite technology. For purposes of this Notice, we use the term A-GPS in this manner. However, we note that the use of non-U.S. GNSS requires prior regulatory approval, and that potential use of GNSS systems that have not yet been authorized for use in the U.S. is beyond the scope of this Notice.

<sup>48</sup> *Id.*



which 911 calls are more likely to be misrouted? We seek comment on what expectations consumers may have when calling 911 from a wireless device. How quickly do consumers expect that 911 calls from a wireless device will be routed to the correct PSAP and that help will be promptly dispatched to the caller's location? Are consumers aware that wireless 911 call routing is based on the location of the cell tower that handles the call rather than the caller's actual location? Are there unique issues that persons with disabilities may encounter when a wireless 911 call is misrouted? We also note that not all calls for emergency service are directed to 911. There are some non-public emergency service providers that can be contacted directly by the public.<sup>49</sup> Although these situations do not present issues regarding the routing of calls, we seek comment on whether recent advances in location technology might also facilitate the ability of these entities to respond to requests for emergency service.

**A. State of Location-Based Routing Technologies**

18. The *CSRIC V LBR Report* explains that, because the Mobile Switching Center (MSC) routes the voice portion of a wireless 911 call within six seconds from when the caller presses "send," effective routing by location requires that the location be available to the MSC in five seconds or less.<sup>50</sup> However, the *Report* also finds that most currently deployed wireless 911 location technologies take an average of 15 to 23 seconds to calculate a Phase II fix.<sup>51</sup> We seek comment on these findings. Is the *Report's* estimate of 15 to 23 seconds for these technologies to calculate a Phase II fix accurate? Do certain wireless 911 location technologies fall more consistently on the high end or the low end of this range? Can any currently deployed wireless 911 location technologies calculate a Phase II fix in five seconds or less? If so, how accurate and reliable is that fix? Do accuracy and reliability improve when one or more additional seconds are allowed for requiring a fix and, if so, by how much?

19. *Call Holding.* Having a 911 caller wait until a Phase II location is available to determine the proper PSAP for routing his or her call is a solution fraught with difficulties, not the least of which is the inclination of callers to terminate their calls if there is not an immediate response from a call taker. Nonetheless, we seek comment on the *CSRIC V LBR Report's* consideration of implementing location-based routing by holding a wireless 911 call at a wireless MSC or the PSAP gateway until Phase II location is available, even if that results in not completing the call to the PSAP within six seconds.<sup>52</sup> We are inclined to agree with the *Report's* recommendation that call holding not be pursued as a location-based routing solution,<sup>53</sup> as this approach may require long wait times until connection and lead to callers hanging up.<sup>54</sup> Nonetheless, we seek comment on any new or additional information that the *Report* may not have considered. For example, despite the additional seconds of pre-routing delay, could improvements in routing accuracy and reliability provided by Phase II location result in any improved outcomes for the caller, such as faster average response times by first responders? What additional benefits would this solution provide to PSAPs? Are there way to mitigate or avoid hang-ups by callers who perceive a lack of connection or delay in connecting to a PSAP?

20. *Interim Fix.* Would 911 callers tolerate a delay of fewer than six seconds between the time they call 911 and the time they reach a call taker? If so, should we consider the *CSRIC V LBR Report's* exploration of an "interim or quick fix" method of location-based routing? Under this method a

<sup>49</sup> See, e.g., *Petition of Chevrah Hatzalah Volunteer Ambulance Corps Inc., for Waiver of § 64.1601(b) Regarding the Transmission of Calling Party Number*, CC Docket No. 91-281 (filed on Sept. 30, 2011). Chevrah Hatzalah is a non-profit corporation that operates a private ambulance service in New York City. Requests for its emergency services are made via a dedicated emergency telephone number. While Chevrah Hatzalah performs many of the same functions of a PSAP, it is a private entity.

<sup>50</sup> *CSRIC V LBR Report* at 8.

<sup>51</sup> *Id.*

<sup>52</sup> *Id.* at 10-12.

<sup>53</sup> *Id.* at 12.

<sup>54</sup> *Id.* at 10-11.

wireless 911 call is held at a wireless MSC or the PSAP gateway for up to six seconds to allow the CMRS provider time to deliver X/Y coordinates that are plotted on a geospatial shape file to determine the appropriate PSAP.<sup>55</sup> Which location technologies are best suited to provide an interim location fix prior to Phase II location being available? What level of accuracy are these technologies capable of providing within six seconds? The *CSRIC V LBR Report* finds that some 2G and 3G devices can return an A-GPS fix within five seconds or less if the wireless 911 caller is in an open sky environment with 4 or more satellites in view.<sup>56</sup> We seek comment on this finding. Is this finding also applicable to current 4G and future 5G networks? If an interim location fix is acquired, will the resulting location be significantly more accurate and reliable than tower location? If so, is that improved accuracy and reliability expected to lead to fewer misrouted wireless 911 calls? If this solution is implemented, are there specific circumstances that would lead to some wireless 911 calls not benefitting from the solution and continuing to be misrouted? If this solution is widely adopted, are there steps that the Commission and other stakeholders could take to further minimize the number of misrouted wireless 911 calls?

21. The *CSRIC V LBR Report* finds that the interim fix solution will not require operational changes at the PSAP if CMRS providers generate the interim location fix and plot the resulting X/Y coordinates to determine the appropriate PSAP.<sup>57</sup> However, it also finds that additional work is needed to ensure that location and emergency call servers can appropriately process and handle an interim location fix and that device chipsets transmit timely measurements.<sup>58</sup> We seek comment on these findings, including the specific type and amount of work needed for emergency call servers and device chipsets to achieve this functionality. The *Report* recommends that an interim location fix be used for wireless 911 call routing “where its implementation is expected to derive sufficient benefit to justify investment.”<sup>59</sup> We seek comment on this recommendation, including the type and magnitude of expected benefits and costs.

22. *Registered or Provisioned Civic Address.* Delay in a 911 caller’s reaching a call taker may be minimized by technologies that do not rely on Phase II location information. Thus, we seek comment on the *CSRIC V LBR Report’s* examination of the potential for a registered or provisioned civic address<sup>60</sup> to be used as the basis for location-based routing of wireless 911 calls.<sup>61</sup> The *Report* describes three different categories of devices that are implicated by this approach: (a) static or nomadic consumer home devices with location registered by the consumer, (b) semi-permanent devices or cells installed with the address provisioned by a carrier or other entity, and (c) nomadic devices that can update their registered civic address in real time through reverse geocoding.<sup>62</sup> Are there any additional categories of devices that utilize a registered or provisioned civic address that we should consider? The *Report* finds that devices with a civic address registered by the consumer or provisioned by a carrier or other entity have potentially high accuracy, but will not provide accurate location if the device is temporarily used

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<sup>55</sup> *Id.* at 12-14.

<sup>56</sup> *Id.* at 12.

<sup>57</sup> *Id.* at 13.

<sup>58</sup> *Id.*

<sup>59</sup> *Id.* at 14.

<sup>60</sup> A civic address is comprised of three parts: a civic number, a full street name and the municipality, e.g., 445 12<sup>th</sup> Street, Southwest, Washington, D.C.

<sup>61</sup> *CSRIC V LBR Report* at 14-16.

<sup>62</sup> *Id.* at 14-15. Reverse geocoding converts geographic coordinates to a description of a location, usually the name of a place or an addressable location. Geocoding relies on a computer representation of address points, the street / road network, and postal and administrative boundaries. For purposes of this *Notice of Inquiry*, we define “nomadic” devices as all wireless devices that connect to a CMRS network, including user equipment. We do not include within this definition computing devices interconnected via the Internet that generally fall within the category of the Internet of Things.

elsewhere or permanently moved without updating the civic address.<sup>63</sup> How frequently does this problem arise? How many wireless 911 calls are estimated to come from devices or services that rely on consumer-registered or carrier-provisioned civic address to determine the caller's location? To what extent, if any, could wireless 911 calls be misrouted by devices for which a registered address is meaningful some but not all the time, such as devices that can serve as both cordless phones and wireless phones? We seek comment on effective ways to incentivize consumers, carriers, and other entities to initially register and regularly update their registered civil address in these devices.

23. What is the state of the industry as to technologies that allow devices, including smart phones, routers, and VoIP customer premises equipment, to validate the registered or provisioned civic address and automatically provide updates as necessary? What sensor technologies are currently available that could make automatic location updates achievable? Are wireless 911 calls that originate from devices that update their registered civic address in real time more likely, less likely, or equally likely to route to an incorrect PSAP, as compared to calls that are routed based on cell tower location? Can legacy devices be updated or modified to acquire this capability? How often is that address typically updated, and how often is it capable of being updated? Does the capability exist for the device to trigger an update of the registered civic address when 911 is dialed? If so, how quickly can a device feasibly update the address? Commenters are encouraged to quantify the length of time it would take to complete each step in the updating process, starting with the initial request to update the registered civic address and ending with the address being available for the routing of a wireless 911 call. What steps can be taken to improve the efficiency of this process and reduce the completion time of each step? The *Report* finds that devices that update their registered civic address in real time through reverse geocoding rely on device-based technology to determine address accuracy and therefore “may communicate a false depiction of accuracy to PSAPs.”<sup>64</sup> We seek comment on this finding.

24. *Device-Based Hybrid Location.* Would the time taken for a 911 caller to reach a PSAP be reduced to acceptable levels if handsets relied on environmental location information, e.g., signals from wireless routers or Bluetooth devices? The *CSRIC V LBR Report* finds promise in solutions that use device-based hybrid location,<sup>65</sup> which it describes as “an estimation method that typically utilizes a selection of location methods available to the handset in a given environment and provide an associated uncertainty estimate that reflects the quality of the returned location.”<sup>66</sup> The *Report* is optimistic about the potential of device-based hybrid location solutions, finding that this method provides a latency of approximately five seconds, high location accuracy in many environments (including indoors), and is available from a wide variety of location providers.<sup>67</sup> We seek comment on the *Report's* findings. Which device-based hybrid location solutions are being used in handsets? How widely available are those location methods? Can those methods be newly provided in handsets that customers already own? Is the *Report's* estimate of latency still valid, or have there been improvements that further reduce this maximum latency to less than five seconds? What is the typical level of uncertainty associated with these solutions? What methods exist for verifying the accuracy and reliability of the location acquired via these solutions? Is this level of uncertainty low enough to allow the obtained location to be used for routing a wireless 911 call?

25. We seek additional information on how quickly 911 calls can potentially be routed when using device-based hybrid location solutions. Commenters are encouraged to quantify the length of time it would take to complete each step in the routing process in both “cold start” and “warm start” scenarios, starting with the dialing of 911 and ending with the routing of a wireless 911 call. In a cold start, the

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<sup>63</sup> *Id.* at 15.

<sup>64</sup> *Id.*

<sup>65</sup> *Id.* at 16-20.

<sup>66</sup> *Id.* at 16.

<sup>67</sup> *Id.* at 17.

CMRS network and mobile device have either no GPS-related data or expired GPS-related data from a previous attempt to determine the device's location. In a warm start the network and mobile device do have access to some initial GPS data from a previous attempt to locate the device.<sup>68</sup> What concerns are raised by the potential use of device-based hybrid location to enable location-based routing? The *Report* finds that device-based hybrid location is generally provided via proprietary closed databases, "providing little to no visibility to details of location determination methodology or database maintenance."<sup>69</sup> We seek comment on this finding. To the extent that this finding is accurate, we seek comment on how the use of proprietary systems would affect the routing of wireless 911 calls and the ability of PSAP personnel to respond to those calls.

26. *Wireless 911 Location Accuracy Emerging Technologies.* Wireless carriers currently are examining emerging technologies that can provide indoor location information within seconds of the call being initiated, including the building civic address and precise information about the caller's location within the building. Can these technologies also provide information that will accelerate the time taken to route a 911 call to the proper PSAP? We seek comment on the *CSRIC V LBR Report*'s analysis of the emerging location technologies that wireless carriers are implementing pursuant to the *Indoor Location Fourth Report and Order* and their potential as a solution for location-based routing of wireless 911 calls.<sup>70</sup> Are these technologies currently capable of generating a location in five seconds or less that can be used for routing wireless 911 calls? If not, is it anticipated, as the *Report* considers, that these technologies will be refined using feedback from live 911 call data and compliance test data to become capable of generating a location in five seconds or less?<sup>71</sup> We seek comment on any additional benefits or limitations that emerging location technologies present that should be considered in the context of location-based 911 call routing.

27. In connection with the 2015 *Indoor Location Fourth Report and Order*, the national wireless carriers have committed to designing and building the NEAD, a national database of Wi-Fi media access control (MAC) addresses and Bluetooth Public Device Addresses (BT-PDA) of fixed indoor access points that will be used to determine the specific indoor location of wireless 911 callers.<sup>72</sup> We seek comment on whether the NEAD will be capable of being leveraged to obtain a wireless 911 caller's location for the purpose of routing a 911 call in five seconds or less, and if not, what additional steps would be necessary to provide it with that capability and with sufficient security.

28. The *Report* recommends that the Commission seek assurances from providers of location fixes that utilize proprietary databases that their databases and algorithms are maintained in a manner that assures consistent and accurate locations required for emergency services.<sup>73</sup> The *Report* additionally recommends that the Commission require these databases to be standards compliant; allow for periodic, standardized accuracy testing conducted by users and recipients of device-based hybrid locations; and provide metrics and other performance verification tools to CMRS providers to ensure location fixes meet accuracy and quality requirements.<sup>74</sup> We seek comment on these recommendations, including the costs involved.

29. *Other Solutions.* We do not regard the *CSRIC V LBR Report* as exhaustive of the methods potentially available for improving the location routing process, as technology in this area

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<sup>68</sup> See ATIS, Feasibility Study for WEA Cell Broadcast Geo-targeting, ATIS-0700027 at 44 (2015) (ATIS WEA Geo-targeting Feasibility Study).

<sup>69</sup> *CSRIC V LBR Report* at 17-18.

<sup>70</sup> *Id.* at 20-23; see also 47 CFR § 20.28(i).

<sup>71</sup> See *CSRIC V LBR Report* at 20.

<sup>72</sup> See *Indoor Location Fourth Report and Order*, 30 FCC Rcd at 1279-87, paras. 54-73.

<sup>73</sup> *CSRIC V LBR Report* at 23.

<sup>74</sup> *Id.*

changes rapidly. We therefore seek comment on any additional solutions that can be leveraged to provide location-based routing for wireless 911 calls that are not discussed above. We encourage commenters to quantify the accuracy and reliability of the location that the solution generates, the amount of time that the solution requires to route the call, and any improvements in the rate at which the solution routes to the appropriate PSAP as compared to routing based on tower location.

**B. Implementation of Location-Based Routing Technologies**

30. In addition to examining the capability of different technologies to provide improved routing information consistent with reasonable response times, it is also important to examine the feasibility of various solutions, including whether and how they could be implemented, and at what cost. Therefore, in this section, we seek comment on the relative merits and viability of each of the location-based routing solutions discussed above. Have there been developments in technology, operations, industry standards, or public expectation that cause commenters to conclude that the wide adoption of location-based routing should be pursued? Do commenters believe that one or more of these location-based routing solutions are currently technically and operationally viable or will become viable as the technology on which they rely further develops or as NG911 adoption accelerates? To what extent have CMRS providers, PSAPs, smartphone operating system providers, device providers, or other 911 stakeholders voluntarily implemented or tested these or other solutions? Commenters should specify how these stakeholders implemented or tested these solutions, the experience of PSAPs in receiving wireless 911 calls via these solutions, the strengths and shortfalls experienced during these implementations or tests, and whether the implementation of these solutions is achievable by stakeholders nationwide. What challenges do 911 stakeholders face when considering the potential adoption of location-based routing solutions? Are there special challenges that PSAPs would face if implementation of location-based routing solutions lacked uniformity, either with respect to the types of solutions adopted or implementation by some, but not all, 911 stakeholders?

31. *Existing Standards.* If a 911 location routing methodology is to be implemented successfully, it is important that it be uniform and interoperable among carriers, *i.e.*, that it be standardized. We therefore seek comment on any existing standards that are implicated by the design and implementation of the location-based routing solutions discussed above. Which existing standards should be taken into consideration when examining the routing of wireless 911 calls? What architectural changes, if any, would be necessary to implement one or more of the solutions discussed above? Are there any existing standards, or standards that are currently being developed, that conflict with the design or implementation of any of these solutions? Are there areas related to these solutions where new standards will be needed that are still in development today or areas where standards development has not been initiated? Are there standard tests or other procedures that CMRS providers, device manufacturers, PSAPs, smartphone operating system providers, device providers, or others use to ensure that wireless 911 calls are routed appropriately? Specifically, we seek comment on the extent to which existing standards that assure consistent and accurate location information apply to proprietary databases that are, or can potentially be used for, routing 911 calls. We seek comment on any related standards that might affect location-based routing for wireless 911 calls, such as standards related to security considerations.

32. *Next Generation 911 Capabilities.* In the legacy 911 environment, wireless service providers route 911 calls using the pre-registered location of the tower and radio antennas through which the call was placed and send the information through service provider controlled mobile switching centers (MSC) and selective routers. In a fully implemented NG911 environment, carriers obtain the location of the calling device from a Location Information Server (LIS), which is a functional element in an IP-capable originating network that maintains the locations of calling devices before a 911 call is initiated.<sup>75</sup> However, unlike the legacy 911 environment, in a NG911 system, PSAPs control the network, databases, and policies that determine how to route a 911 call to the appropriate PSAP. Specifically, wireless

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<sup>75</sup> See GAO, Next Generation 911, National 911 Program Could Strengthen Efforts to Assist States at 16 (2018), <https://www.gao.gov/assets/690/689779.pdf>.

service providers deliver IP-based 911 calls with caller location derived from the LIS embedded in call delivery packets to the public safety IP-network called the Emergency Services IP-network (ESInet). The ESInet supports NG911 Core Services, which are the base set of services needed to route a 911 call, including Geographic Information System (GIS) databases.

33. We seek comment on these capabilities in the context of the transition to NG911. How will the availability, speed, accuracy, or reliability of location-based routing capabilities improve as PSAPs transition from legacy 911 to NG911 operations? The *CSRIC V LBR Report* finds that, while NG911 services are designed to receive a registered or provisioned civic address or a device-based hybrid location in time to route the call to the jurisdictionally appropriate PSAP, these features are dependent on the IP-to-IP interconnection between CMRS providers and NG911 ingress components, which at the time of CSRIC's report had not yet been defined.<sup>76</sup> We seek comment on this finding. Are any of the solutions CSRIC identified currently capable of routing 911 traffic, and associated call-back and location information, to ESInets or NG911-enabled PSAPs? If not, what transitional steps are needed for these solutions to develop that capability, and what is the cost of those transitional steps?

### C. Means to Advance E911 Location-Based Routing

34. In this *Notice of Inquiry*, we seek information on the means available to the Commission to facilitate improvements in 911 routing and reduce the likelihood of misrouted 911 calls. Potential approaches could include promotion of voluntary best practices, implementation of incentive-based mechanisms, or regulatory action.

35. First, we seek comment on any action that we should consider to encourage voluntary implementation of location-based routing for wireless 911 calls. What roles, if any, should voluntary best practices or voluntary technical or operational standards play in promoting the development and implementation of location-based routing solutions? What specific issues should standards resolve? What goals should best practices or standards aim to accomplish? To what extent do best practices and voluntary standards for location-based routing exist today? If best practices or voluntary standards exist, have they proven effective? Should additional voluntary best practices or voluntary technical or operational standards be established to support the development and implementation of location-based routing solutions? For example, should standards be pursued for both E911 and NG911 PSAPs? Should standards be pursued for both Voice over Long Term Evolution (VoLTE) and non-VoLTE callers?<sup>77</sup> Should standards be pursued to clearly define service providers' roles and responsibilities for PSAPs transitioning from legacy 911 systems to NG911 systems to ensure delivery of location information consistent with NG911 standards and architecture? By which entities, and via what processes, should such best practices or standards be established, and who should monitor their implementation? What role, if any, should the Commission play in the creation or implementation of such standards or practices? Should the Commission require, as CSRIC recommended, that proprietary location databases used to route wireless 911 calls be standards compliant and allow for periodic, standardized accuracy testing.<sup>78</sup>

36. Are there any incentives that the Commission could provide to encourage the development and implementation of location-based routing solutions for wireless 911 calls? Would Commission action to encourage location-based routing further incentivize the adoption of NG911, which as discussed above, is designed to receive a registered or provisioned civic address or a device-based hybrid location in time to route a wireless 911 call? Are there ways in which the Commission can support the independent testing of new location technologies? Are there any technical or regulatory barriers to the development and implementation of location-based routing? If so, what action, if any, could the Commission take to address them? For example, we observe that while Commission's rules require that

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<sup>76</sup> *CSRIC V LBR Report* at 24-25.

<sup>77</sup> VoLTE provides voice service delivered over the LTE network rather than voice delivered over legacy networks.

<sup>78</sup> *CSRIC V LBR Report* at 28.

interconnected VoIP providers route 911 calls using the caller's registered location,<sup>79</sup> the registered location provided by the customer may not be up-to-date when the 911 call originates from a mobile device. We seek comment on how our 911 rules for interconnected VoIP service can be modernized to better address the availability of mobile VoIP services and permit the application of location technologies that can update or verify a 911 caller's registered location.

37. We seek comment on whether significant technical or informational gaps currently exist in the 911 system due to the use of tower location as the basis for wireless 911 call routing. If significant gaps exist, what actions should the Commission consider to close these gaps? We seek comment on whether we should consider proposing, updating, or streamlining rules to address existing shortfalls and, if so, what those rules should require.

#### **D. Other Costs and Benefits Relating to Location-Based Routing for E911**

38. *Benefits of Location-based Routing.* Any solution to the problem of misrouted 911 calls, no matter how effective, must withstand the test of feasibility and functionality relative to cost. We therefore seek comment on whether the implementation of location-based routing can improve upon the speeds at which emergency personnel and services relying on a legacy 911 system can currently reach the caller, with a resulting improvement in the health and safety of the caller, and the magnitude of this presumed benefit. Are location-based routing solutions expected to benefit PSAPs, such as allowing PSAP staff to focus more on appropriately routed calls? Are location-based routing solutions expected to benefit public safety? How many (if any) lives are lost due to misrouting? Are there other benefits that have or could be accrued from adoption of location-based routing?

39. *Costs of Implementation.* While the *CSRIC V LBR Report* explored the advantages and disadvantages of various sources of location information available for location-based routing, and included the potential reliability and accuracy of the sources, and transition to location-based routing of voice 911 calls wireless devices, the *Report* did not attach any cost to them. We seek information on the costs, with specific dollar values where available, of the various location-based routing methods identified and reviewed by the *CSRIC V LBR Report* that could be used for wireless 911 call routing, and any other methods that may not have been considered in the *Report*. As an initial matter, we seek to know who is bearing the operational costs under the current practice in which a wireless 911 call is routed to a PSAP based on the originating cell sector that handles the call, and what those costs are. How do the costs differ for legacy systems as opposed to IP-based systems, as well as for hosted as opposed to non-hosted systems? Are costs in some geographic areas greater than others and if so, why and to what extent and why? What are the one-time and ongoing costs associated with implementing each of the location-based routing solutions discussed above, including costs related to updating system architecture, testing, ongoing operation, and satisfying security requirements? In addition to these implementation costs, would a single new standard or, rather, several new standards be required? We seek comment on our previous estimation of the cost of creating a new standard to be \$76,000, as outlined in the *WEA R&O*.<sup>80</sup> The *CSRIC V LBR Report* specifically identified the necessary roles and responsibilities of key stakeholders involved in the routing of wireless 911 calls. We seek comment on which 911 stakeholders would incur the costs discussed above. Would location-based routing improve the efficiency and thereby reduce the cost burdens on PSAPs, first responders, or other 911 stakeholders?

40. Would it be reasonable to expect that developments such as NG911 would reduce or eliminate the problem in the reasonably near future? If so, how much time would be expected to pass before such a remedy would occur? How will the transition to NG911 affect the cost of implementing the location-based routing methods discussed above? Do the implementation of NG911 and the

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<sup>79</sup> See 47 CFR § 9.5(b)(2).

<sup>80</sup> See *Wireless Emergency Alerts; Amendments to Part 11 of the Commission's Rules Regarding the Emergency Alert System*, PS Docket Nos. 15-91, 15-94, Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 11112, 11176-77, para. 98 (2016) (*WEA R&O*).

implementation of location-based routing have costs in common, resulting in a lower cost to implement location-based routing for those entities that are already NG911-capable (or vice versa)?

41. *Costs and Benefits of Options.* If the Commission could speed the resolution of misrouted 911 calls by removing regulatory barriers or providing incentives, we seek comment on the costs and benefits of these options. We also seek comment on the costs and benefits of the Commission playing a role in consumer education about location-based routing. Finally, we seek feasibility, cost, and benefit estimates for the options explored in the *CSRIC V LBR Report*. How much of a speed increase can we reasonably expect when one of the location-based routing solutions discussed above is implemented? Are any of the options both feasible and produce benefits that would be expected to exceed their costs? That is, would any of them enhance routing to a significant extent, resulting in lives saved and emergency response cost reductions? Could any of them be expected to occur without Commission action? If Commission action were considered, would that action present any barriers to innovation or efficiency going forward? If so, how should we value these costs?

42. Comments of parties that encourage or discourage adoption of a given technology option or market solution will be given decisional weight only if they contain actual or estimated cost information on the technology or solution proposed and the benefit to be realized from it.

#### IV. PROCEDURAL MATTERS

43. *Ex Parte Rules.* This proceeding shall be treated as a “permit-but-disclose” proceeding in accordance with the Commission’s *ex parte* rules.<sup>81</sup> Persons making *ex parte* presentations must file a copy of any written presentation or a memorandum summarizing any oral presentation within two business days after the presentation (unless a different deadline applicable to the Sunshine period applies). Persons making oral *ex parte* presentations are reminded that memoranda summarizing the presentation must (1) list all persons attending or otherwise participating in the meeting at which the *ex parte* presentation was made, and (2) summarize all data presented and arguments made during the presentation. If the presentation consisted in whole or in part of the presentation of data or arguments already reflected in the presenter’s written comments, memoranda or other filings in the proceeding, the presenter may provide citations to such data or arguments in his or her prior comments, memoranda, or other filings (specifying the relevant page and/or paragraph numbers where such data or arguments can be found) in lieu of summarizing them in the memorandum. Documents shown or given to Commission staff during *ex parte* meetings are deemed to be written *ex parte* presentations and must be filed consistent with Rule 1.1206(b). In proceedings governed by Rule 1.49(f) or for which the Commission has made available a method of electronic filing, written *ex parte* presentations and memoranda summarizing oral *ex parte* presentations, and all attachments thereto, must be filed through the electronic comment filing system available for that proceeding, and must be filed in their native format (e.g., .doc, .xml, .ppt, searchable .pdf). Participants in this proceeding should familiarize themselves with the Commission’s *ex parte* rules.

44. *Procedures for Comment Filing* Pursuant to Sections 1.415, 1.419 and 1.430 of the Commission’s rules, 47 CFR §§ 1.415, 1.419, 1.430, interested parties may file comments and reply comments on or before the dates indicated on the first page of this document. Comments may be filed using the Commission’s Electronic Comment Filing System (ECFS). See *Electronic Filing of Documents in Rulemaking Proceedings*, 63 FR 24121 (1998).

- ☐ Electronic Filers: Comments may be filed electronically using the Internet by accessing the ECFS: <https://www.fcc.gov/ecfs/>.
- ☐ Paper Filers: Parties who choose to file by paper must file an original and one copy of each filing. If more than one docket or rulemaking number appears in the caption of this proceeding, filers must submit two additional copies for each additional docket or rulemaking number.

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<sup>81</sup> 47 CFR §§ 1.1200 *et seq.*



Filings can be sent by hand or messenger delivery, by commercial overnight courier, or by first-class or overnight U.S. Postal Service mail. All filings must be addressed to the Commission's Secretary, Office of the Secretary, Federal Communications Commission.

- ☐ All hand-delivered or messenger-delivered paper filings for the Commission's Secretary must be delivered to FCC Headquarters at 445 12<sup>th</sup> St., SW, Room TW-A325, Washington, DC 20554. The filing hours are 8:00 a.m. to 7:00 p.m. All hand deliveries must be held together with rubber bands or fasteners. Any envelopes and boxes must be disposed of before entering the building.
- ☐ Commercial overnight mail (other than U.S. Postal Service Express Mail and Priority Mail) must be sent to 9050 Junction Drive, Annapolis Junction, MD 20701.
- ☐ U.S. Postal Service first-class, Express, and Priority mail must be addressed to 445 12<sup>th</sup> Street, SW, Washington DC 20554.
- ☐ People with Disabilities: To request materials in accessible formats for people with disabilities (braille, large print, electronic files, audio format), send an e-mail to [fcc504@fcc.gov](mailto:fcc504@fcc.gov) or call the Consumer & Governmental Affairs Bureau at 202-418-0530 (voice), 202-418-0432 (tty).
- ☐ Availability of documents: Comments, reply comments, and *ex parte* submissions will be publicly available online via ECFS. These documents will also be available for public inspection during regular business hours in the FCC Reference Information Center, which is located in Room CY-A257 at FCC Headquarters, 445 12<sup>th</sup> Street, SW, Washington, DC 20554. The Reference Information Center is open to the public Monday through Thursday from 8:00am to 4:30pm and Friday from 8:00am to 11:30am.

45. *Contact Person* For further information about this proceeding, please contact Austin Randazzo, FCC Public Safety and Homeland Security Bureau, Room 7-B521, 445 12th Street, S.W., Washington, D.C. 20554, (202) 418-1462, [Austin.Randazzo@fcc.gov](mailto:Austin.Randazzo@fcc.gov).

## V. ORDERING CLAUSE

46. Accordingly, IT IS ORDERED that, pursuant to the authority contained in Sections 1, 4(i), 4(j), 4(o), 251(e), 403, and 716 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 154(i), 154(j), 154(o), 251(e), 403, 617, this Notice of Inquiry **IS ADOPTED**.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch  
Secretary

**STATEMENT OF  
CHAIRMAN AJIT PAI**

Re: *Location-Based Routing For Wireless 911 Calls*, PS Docket No. 18-64.

In an emergency, every second counts. But too often, those seconds dribble away because a wireless 911 call is misrouted. Just ask the family of Shanell Anderson.

Shanell was delivering newspapers in suburban Atlanta a few days before Christmas in 2014 when her car took a wrong turn and plunged into a pond. Critically, for purposes of this story, that pond was in Cherokee County, but only one hundred yards from the Fulton County line. Unable to escape her vehicle, which quickly became engulfed by water, Anderson used her cell phone to dial 911.<sup>1</sup> She reached a 911 dispatcher in Fulton County and provided her exact address. But the dispatcher could not locate the address Shanell provided because it was for a location in Cherokee County. Precious minutes passed. By the time authorities in Fulton County figured out that they needed to transfer Shanell's call to Cherokee County, it was too late. Although first responders were able to pull her body from the submerged car and restart her heart, she fell into a coma and died a week later.

This tragedy happened because today's 911 system routes a wireless 911 call to a call center based on the location of the cell tower that's closest to the caller, rather than the caller's location. In Shanell's case, that meant her call was misrouted to Fulton County, because the cell tower nearest to her was located there—rather than Cherokee County, where she was actually calling from. With this *Notice of Inquiry*, we aim to understand just how common this problem is, how we can avoid potentially deadly delays in responding to wireless 911 calls, and which location-based routing technologies could help.

Underscoring the importance of this inquiry is that every 911 call center I visit these days reports that the majority of emergency calls come from wireless phones. Just last month, on the 50<sup>th</sup> anniversary of the first 911 call, I visited with Karima Holmes, Director of the Office of Unified Communications in the District of Columbia. Ms. Holmes told me that the District received approximately 10,000 misrouted 911 calls in 2017 alone; these calls had to be transferred to Maryland authorities. And, conversely, many thousands of calls received in Maryland had to be transferred to the District.<sup>2</sup> These statistics are startling. And it makes you wonder how many more have faced a fate like Shannell's—or could.

I want to thank the staff for all their hard work on this item: Rochelle Cohen, Lisa Fowlkes, David Furth, Roberto Mussenden, Erika Olsen, Linda Pintro, Austin Randazzo, Emily Talaga, and Michael Wilhelm from the Public Safety and Homeland Security Bureau; and David Horowitz and Doug Klein from the Office of General Counsel.

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<sup>1</sup> Brendan Keefe & Phillip Kish, Lost on the Line: Why 911 is Broken, *USA Today*, (Jan. 2015), <https://www.usatoday.com/story/news/local/investigations/2015/01/31/911-location-problems-/22645139/>.

<sup>2</sup>Ajit Pai, FCC Chairman, Winning the Wireless Future, *FCC Blog* (Mar. 1, 2018), <https://www.fcc.gov/news-events/blog/2018/03/01/winning-wireless-future>.

**STATEMENT OF  
COMMISSIONER MIGNON L. CLYBURN**

Re: *Location-Based Routing For Wireless 911 Calls*, PS Docket No. 18-64.

Any delay in 911 call response time can mean the difference between life and death. When seeking the assistance of first responders, no explanation for delay could ever bring comfort to a victim's family or friends. There is little wonder why many ask, "if Uber and Lyft can locate me within seconds, then why is it so difficult for police and other public safety officials?" Of the 80 percent of the 240 million mobile phone calls to 911 each year, it is estimated that as many as 10,000 lives could be saved each year, if the 911 emergency dispatching system were able to reach callers just one minute faster.

One way to speed up response times, is to integrate new location technologies into our emergency communications networks. In order for location-based routing to be effective in delivering the 911 call to the appropriate PSAP, or Public Safety Answering Point, the location needs to be calculated in five seconds or less, with a fairly high degree of accuracy.

Legacy location technologies such as GPS, are not capable of providing a location determination within five seconds. Twenty to 30 seconds is more likely. As a result, wireless 911 calls continue to be routed based on cell tower location, because the tower location is known immediately. That means the call is more likely to be routed to the PSAP nearest the cell tower, instead of the one nearest to the actual location of the emergency.

Fortunately, a report that the Communications Security, Reliability, and Interoperability Council (CSRIC) issued in September 2016, found that new technologies may be able to provide more precise location data, than the tower location within the necessary five-second window. It is my hope that today's Notice of Inquiry (NOI) will incentivize the public safety, commercial communications, and technology communities to work together and help us, to expeditiously develop a solution. Time is of the essence.

My thanks to the Public Safety & Homeland Security Bureau for this truly important work.

**STATEMENT OF  
COMMISSIONER MICHAEL O'RIELLY**

Re: *Location-Based Routing For Wireless 911 Calls*, PS Docket No. 18-64.

Today's item seeks information on the routing – and occasional re-routing – of wireless 9-1-1 calls to the appropriate public safety answering point, or PSAP, when location is based on cell tower location, and whether to consider switching the routing of 9-1-1 calls based on device location. A notice of inquiry seems completely appropriate, at this time, as the Commission would benefit from more information about the scope of the problem, to what extent misrouted calls are causing response delays for first responders, the state of location-based technologies, and whether the implementation of NG9-1-1 would mitigate such delays.

Going forward, it would be helpful to know whether any Commission action should be taken now or after NG9-1-1 upgrades. Generally, PSAP and wireless provider attention should be spent on upgrading the 9-1-1 system to the latest technologies that can solve many systemic problems. This is one of the reasons why I advocate so strongly against 9-1-1 fee diversion. Dollars diverted to other purposes limit available funding for upgrading equipment and staff training for next generation 9-1-1 communications and PSAPs. In fact, earlier this week, I visited the PSAP in Rhode Island, the second largest 9-1-1 fee diverting state, behind only New Jersey. While Rhode Island hopes to have text to 9-1-1 by the end of the year, there was no clear timeline when the PSAP would see real, robust NG9-1-1 capabilities, which is only possible when sufficient funding is available.

Additionally, these rerouting problems, central to today's item, are likely to be more prevalent along the boundaries of PSAPs. Therefore, I once again suggest that the Commission and the public safety community must examine the consolidation of PSAPs. While the exact numbers seem to fluctuate depending on the source, there are more than 5,783 PSAPs in the United States serving approximately 3,135 counties.<sup>1</sup> Not only would consolidation lead to certain efficiencies and reduce overall operational costs, but it would also lower the cost to upgrade to NG9-1-1 and decrease the instances where a call is misrouted to a neighboring PSAP.

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<sup>1</sup> National Emergency Number Association, 911 Statistics, <https://www.nena.org/page/911Statistics> (last visited Mar. 22, 2018).

**STATEMENT OF  
COMMISSIONER BRENDAN CARR**

Re: *Location-Based Routing For Wireless 911 Calls*, PS Docket No. 18-64.

Last month marked the 50th anniversary of the first 911 call. At 2:00 p.m. on February 16, 1968, the speaker of the Alabama House of Representatives, Rankin Fite, dialed 911. He was connected to the Haleyville, Alabama, police station where Congressman Tom Beville answered the call. Much has changed since that ceremonial first call. Today, for instance, over 240 million calls are placed to 911 each year in the U.S. And an estimated 80% of those calls come from a wireless phone. It is our job at the FCC to help ensure that every one of those calls reaches a public safety official who can help. In times of crisis, no one should wonder whether our 911 system is going to fail.

But as today's Notice of Inquiry highlights, the system is not perfect. Right now, when a caller dials 911 from a cellphone, the system will often route the call to a public safety answering point, or PSAP, based on the location of the cell tower that handles the call. In some cases, that tower can be miles away from the caller. And this can result in misrouted 911 calls, particularly where the caller is located near the geographic boundary between two different PSAPs. Unfortunately, these misrouted calls must then be transferred to the correct PSAP, which adds precious seconds of delay that, in an emergency, are seconds too many.

This concern is not merely hypothetical. In 2015, for example, a D.C. resident woke up to a crashing sound and footsteps coming up the stairs. She hid in a closet and called 911, but her call was mistakenly routed to a 911 dispatch center in Prince George's County, Maryland. While she remained huddled in a closet, the dispatch center eventually re-routed the call to 911 operators in D.C. Thankfully she was unharmed, but, by the time the police arrived, the thieves had escaped.

There are many stories like these and others that have had much worse outcomes. That's why I support today's inquiry, which moves forward with ideas for reforming our wireless 911 call routing rules. Location technologies have now advanced to the point where carriers may be able to route wireless 911 calls directly to the correct PSAP in many more cases, though technical challenges remain. So I am glad we are seeking comment on the recommendations in the CSRIC report and thinking creatively about ways to transition away from tower-based routing. I am also pleased that the item asks about implementation of location-based routing as we transition from legacy 911 systems to Next-Generation 911. We need to be mindful that any steps we take in this proceeding are consistent with that transition, and I look forward to reviewing the record that develops on this point.

I thank the staff of the Public Safety and Homeland Security Bureau for their diligent work on this item. I am glad that the Commission is taking up this important public safety matter. It has my support.

**STATEMENT OF  
COMMISSIONER JESSICA ROSENWORCEL**

Re: *Location-Based Routing For Wireless 911 Calls*, PS Docket No. 18-64.

One day when the unthinkable occurs, you might have to pick up the phone and dial 911. Before any police radio crackles, fire engine blares, or ambulance races—you will need to reach a 911 operator. That is one call you want to go through.

I know. Because I have watched our nation's 911 operators in action in more than two dozen call centers all across the country—from Vermont to Virginia and California to Colorado and Alaska to Arkansas. In each and every one I saw operators take calls with steely calm and then help ensure that help is on the way. But what I saw in Little Rock stays with me. The center was small but active. The desks were humming as the calls came in. The pride the public safety officials had for their work was palpable.

But the one thing that was most memorable? I learned that in the city of Little Rock if you call 911 using your wireless phone in the corner of the 911 call center your call will not get routed to Little Rock. Instead, it will be answered by a 911 call center in North Little Rock—which is all the way on the other side of the Arkansas River.

That's unnerving. When you make a 911 call location accuracy matters. That kind of imprecision from calling should leave all of us concerned. Because when emergency strikes—and you call 911 from any phone anywhere—you need first responders to find you fast.

Here's the good news. With this Notice of Inquiry we explore why some 911 calls are routed to the wrong call center. Though we know that this is often the result of the growth of wireless technology and the way our 911 systems have been pieced together over time—we are going to try to do something about it. To this end, we ask questions to quantify how many calls go to incorrect call centers and how often this problem occurs. We also ask about recommendations to remedy this situation that have been made by our Communications Security, Reliability and Interoperability Council. This effort is important—and it has my full support.