



**ATIS-0700042**

## **Enhancing Location-Based Routing of Emergency Calls**

**TECHNICAL REPORT**



As a leading technology and solutions development organization, the Alliance for Telecommunications Industry Solutions (ATIS) brings together the top global ICT companies to advance the industry's most pressing business priorities. ATIS' nearly 200 member companies are currently working to address the All-IP transition, 5G, network functions virtualization, big data analytics, cloud services, device solutions, emergency services, M2M, cyber security, network evolution, quality of service, billing support, operations, and much more. These priorities follow a fast-track development lifecycle — from design and innovation through standards, specifications, requirements, business use cases, software toolkits, open source solutions, and interoperability testing.

ATIS is accredited by the American National Standards Institute (ANSI). The organization is the North American Organizational Partner for the 3rd Generation Partnership Project (3GPP), a founding Partner of the oneM2M global initiative, a member of the International Telecommunication Union (ITU), as well as a member of the Inter-American Telecommunication Commission (CITEL). For more information, visit [www.atis.org](http://www.atis.org).

---

### Notice of Disclaimer & Limitation of Liability

The information provided in this document is directed solely to professionals who have the appropriate degree of experience to understand and interpret its contents in accordance with generally accepted engineering or other professional standards and applicable regulations. No recommendation as to products or vendors is made or should be implied.

NO REPRESENTATION OR WARRANTY IS MADE THAT THE INFORMATION IS TECHNICALLY ACCURATE OR SUFFICIENT OR CONFORMS TO ANY STATUTE, GOVERNMENTAL RULE OR REGULATION, AND FURTHER, NO REPRESENTATION OR WARRANTY IS MADE OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE OR AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. ATIS SHALL NOT BE LIABLE, BEYOND THE AMOUNT OF ANY SUM RECEIVED IN PAYMENT BY ATIS FOR THIS DOCUMENT, AND IN NO EVENT SHALL ATIS BE LIABLE FOR LOST PROFITS OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES. ATIS EXPRESSLY ADVISES THAT ANY AND ALL USE OF OR RELIANCE UPON THE INFORMATION PROVIDED IN THIS DOCUMENT IS AT THE RISK OF THE USER.

NOTE - The user's attention is called to the possibility that compliance with this standard may require use of an invention covered by patent rights. By publication of this standard, no position is taken with respect to whether use of an invention covered by patent rights will be required, and if any such use is required no position is taken regarding the validity of this claim or any patent rights in connection therewith. Please refer to [<http://www.atis.org/legal/patentinfo.asp>] to determine if any statement has been filed by a patent holder indicating a willingness to grant a license either without compensation or on reasonable and non-discriminatory terms and conditions to applicants desiring to obtain a license.

---

## ATIS-0700042, *Enhancing Location-Based Routing of Emergency Calls*

*Published by*

**Alliance for Telecommunications Industry Solutions**  
**1200 G Street, NW, Suite 500**  
**Washington, DC 20005**

Copyright © 2019 by Alliance for Telecommunications Industry Solutions  
All rights reserved.

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher. For information contact ATIS at 202.628.6380. ATIS is online at < <http://www.atis.org> >.

## **Enhancing Location-Based Routing of Emergency Calls**

**Alliance for Telecommunications Industry Solutions**

Approved July 12, 2019

### **Abstract**

This Technical Report is a feasibility study that analyzes the Location-Based Routing (LBR) methods, identifies gaps and makes recommendations for potential standards activity.

## Foreword

---

As a leading technology and solutions development organization, the Alliance for Telecommunications Industry Solutions (ATIS) brings together the top global information and communications technology (ICT) companies to advance the industry's most pressing business priorities. ATIS serves the public through improved understanding between carriers, customers, and manufacturers.

This Technical Report was developed jointly between ESIF, PTSC, and WTSC.

The Emergency Services Interconnection Forum (ESIF) provides a forum to facilitate the identification and resolution of technical and/or operational issues related to the interconnection of wireline, wireless, cable, satellites, Internet and emergency services networks.

The Packet Technologies and Systems Committee (PTSC) develops and recommends standards and technical reports related to services, architectures, and signaling, in addition to related subjects under consideration in other North American and international standards bodies. PTSC coordinates and develops standards and technical reports relevant to telecommunications networks in the U.S., reviews and prepares contributions on such matters for submission to U.S. ITU-T and U.S. ITU-R Study Groups or other standards organizations, and reviews for acceptability or per contra the positions of other countries in related standards development and takes or recommends appropriate actions.

The Wireless Technologies and Systems Committee (WTSC) develops and recommends standards and technical reports related to wireless and/or mobile services and systems, including service descriptions and wireless technologies. WTSC develops and recommends positions on related subjects under consideration in other North American, regional, and international standards bodies.

Suggestions for improvement of this document are welcome. They should be sent to the Alliance for Telecommunications Industry Solutions, WTSC, 1200 G Street NW, Suite 500, Washington, DC 20005.

At the time of initiation or issuance of the letter ballot for this document, the committees responsible for its development had the following leadership:

- R. Marshall, ESIF Chair (Comtech)
- J. Green, ESIF First Vice Chair (Sprint)
- R. Hixson, ESIF Second Vice Chair (NENA)
  
- M. Dolly, PTSC Chair (AT&T)
- V. Shaikh, PTSC Vice-Chair (Perspecta Labs)
  
- D. Zelmer, WTSC Chair (AT&T)
- M. Younge, WTSC Vice Chair (T-Mobile)
  
- R. Sherry, Technical Editor (West C)

The WTSC SN, ESIF NGES, and IMSESINET Subcommittees were responsible for the development of this document.

## Table of Contents

1	Scope, Purpose, & Application .....	1
1.1	Scope .....	1
1.2	Purpose .....	1
1.3	Application .....	1
2	References .....	1
3	Definitions, Acronyms, & Abbreviations .....	1
3.1	Definitions .....	1
3.2	Acronyms & Abbreviations .....	2
4	Background .....	3
5	Assumptions .....	5
6	Standards Associated with Location-based Routing .....	6
6.1	ATIS-0700015 .....	6
6.2	3GPP 23.271 Technical Specification Group Services and System Aspects; Functional stage 2 description of Location Services (LCS) .....	7
6.3	3GPP TS 36.355 Technical Specification Group Radio Access Network; Evolved Universal Terrestrial Radio Access (E-UTRA); LTE Positioning Protocol (LPP) .....	7
6.4	OMA LPP Extensions (LPPe) .....	7
6.5	ATIS-0700028 - Location Accuracy Improvements for Emergency Calls .....	8
7	Supplemental Location Acquisition Technology/Offerings .....	8
7.1	Applicability to the CSRIC V LBR Categories .....	10
8	Analysis of Location-Based Routing Methods .....	11
8.1	Conceptual Architecture .....	12
8.1.1	<i>LS interacting with the LOCIWF</i> .....	12
8.1.2	<i>E-SMLC interacting with the LOCIWF</i> .....	14
8.1.3	<i>LRF interacting with the LOCIWF</i> .....	15
8.2	Assessment Criteria .....	16
8.3	Conceptual Call Flow Extensions to Support LBR .....	17
9	Potential Standards Gaps Associated with Location-based Routing Methods .....	21
10	Conclusion .....	22
11	Recommendations .....	22
A	ATIS-0700015 Constructs Supporting Location-based Routing .....	23

## Table of Figures

Figure 1	– Android Emergency Location Services (ELS) .....	9
Figure 2	– Conceptual Location Interworking Function .....	12
Figure 3	– Architecture diagram with LS to Location Interworking Function interface .....	13
Figure 4	– Architecture diagram with E-SMLC to Location Interworking Function interface .....	15
Figure 5	– Architecture diagram with LRF to Location Interworking Function interface .....	16
Figure 6	– Device-Based Hybrid Using the Control Plane Flow Providing Location-based Routing .....	17

Figure 7 Conceptual Flow Using E-SMLC Logic..... 19  
Figure 8 – Conceptual Flow Using GMLC Logic..... 19  
Figure 9 – Conceptual Flow Using LRF Logic ..... 20  
Figure 10 – Conceptual Flow Using an LPP Early Location Fix..... 21  
ATIS-0700015 – Figure 0.1 – UE Location-Routed Call Delivery to NENA i3 ESInet – Location-  
by-Reference ..... 23

**Table of Tables**

---

Table 1 – Definitions for Figure 3 & Figure 4 ..... 13  
Table 2 – Interface Definitions for Figure 3..... 14  
Table 3 – Interface Definitions for Figure 4..... 15  
Table 4 – Interface Definitions for Figure 5..... 16

# Enhancing Location-Based Routing of Emergency Calls

## 1 Scope, Purpose, & Application

### 1.1 Scope

The Scope of this Technical Report is an analysis of improved Location-Based Routing (LBR) methods using the Communications Security, Reliability and Interoperability Council (CSRIC) V Location-Based Routing Report as the basis.

### 1.2 Purpose

This Technical Report is a feasibility study that analyzes the Location-Based Routing methods for Commercial Mobile Radio Service (CMRS) wireless emergency calls as described in the CSRIC V LBR Report and any other methods to enhance LBR that have been identified since the publication of the CSRIC V report. Criteria for the analysis is developed. The Technical Report includes analysis of whether existing standards support a particular LBR method, and if not, what standards gaps exist to support a particular LBR method.

### 1.3 Application

This Technical Report applies to the investigation of the improvement of CMRS wireless routing techniques based upon the location of the caller.

## 2 References

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

[Ref 1]: CSRIC V - Final Report – Task 2: 911 Location-Based Routing, September 2016.

[Ref 2]: Wireless E911 Location Accuracy Requirements, FOURTH REPORT AND ORDER, PS Docket No. 07-114, FCC, February 3, 2015.

[Ref 3]: Notice of Inquiry, Location-Based Routing for Wireless 911 Calls, FCC, March 23, 2018.

[Ref 4]: ATIS-0500001[Revised in 2011], *High Level Requirements for Accuracy Testing Methodologies*.

[Ref 5]: ATIS-0700015, *ATIS Standard for Implementation of 3GPP Common IMS Emergency Procedures for IMS Origination and ESInet/Legacy Selective Router Termination*.

[Ref 6]: NENA-STA-010.3, NENA i3 Standard for NG9-1-1 (to be issued).

## 3 Definitions, Acronyms, & Abbreviations

For a list of common communications terms and definitions, please visit the *ATIS Telecom Glossary*, which is located at < <https://glossary.atis.org/> >.

### 3.1 Definitions

**Cold Start** – In a cold start, the wireless network or handset shall not make use of any location assistance information and positioning knowledge retained from a previous attempt. Such information would not be available to a handset that was originating a 9-1-1 call and that had been turned off for an extended period. See ATIS-0500001[Revised in 2011], *High Level Requirements for Accuracy Testing Methodologies*, for further details.