



ATIS-0500033

ATIS Standard on -

**Overview and Operational Considerations for an IMS-  
based Next Generation 9-1-1 (NG9-1-1) Service  
Architecture based on ATIS-0500032**



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 and major U.S. contributor to 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.

---

*Published by*

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

Copyright © 2017 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> >.

# **Overview and Operational Considerations for an IMS-based Next Generation 9-1-1 (NG9-1-1) Service Architecture based on ATIS-0500032**

**Alliance for Telecommunications Industry Solutions**

Approved February 21, 2017

## **Abstract**

This document provides an overview and operational consideration for an IMS-based Next Generation 9-1-1 (NG9-1-1) Service Architecture based upon ATIS-0500032, *ATIS Standard for Implementation of an IMS-based NG9-1-1 Service Architecture*. This document includes considerations related to IMS Emergency Service Networks that are considered terminating networks.

## Foreword

---

The Alliance for Telecommunication Industry Solutions (ATIS) serves the public through improved understanding between carriers, customers, and manufacturers.

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 ESIF Next Generation Emergency Services (NGES) Subcommittee coordinates emergency services needs and issues with and among SDOs and industry forums/committees, within and outside ATIS, and develops emergency services (such as E9-1-1) standards, and other documentation related to advanced (i.e., Next Generation) emergency services architectures, functions, and interfaces for communications networks.

The mandatory requirements are designated by the word *shall* and recommendations by the word *should*. Where both a mandatory requirement and a recommendation are specified for the same criterion, the recommendation represents a goal currently identifiable as having distinct compatibility or performance advantages. The word *may* denotes a optional capability that could augment the standard. The standard is fully functional without the incorporation of this optional capability.

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

At the time of consensus on this document, the committees responsible for its development, had the following leadership:

- S. Sherwood, ESIF Chair (Verizon Wireless)
- R. Hixson, ESIF First Vice-Chair (NENA)
- R. Marshall, ESIF Second Vice-Chair (Comtech)
- C. Militeau, ESIF NGES Co-Chair (West Safety Services)
- T. Reese, ESIF NGES Co-Chair (Ericsson)

Table of Contents

<b>PREFACE</b> .....	<b>1</b>
<b>1 SCOPE, PURPOSE, &amp; APPLICATION</b> .....	<b>1</b>
1.1 SCOPE.....	1
1.2 PURPOSE.....	2
1.3 APPLICATION.....	2
<b>2 NORMATIVE REFERENCES</b> .....	<b>2</b>
<b>3 INFORMATIVE REFERENCES</b> .....	<b>3</b>
<b>4 DEFINITIONS, ACRONYMS, &amp; ABBREVIATIONS</b> .....	<b>3</b>
4.1 DEFINITIONS.....	3
4.2 ACRONYMS & ABBREVIATIONS .....	5
<b>5 OVERVIEW</b> .....	<b>7</b>
5.1 ARCHITECTURE .....	7
5.2 IMS-BASED NG9-1-1 SERVICE ARCHITECTURE FUNCTIONAL ELEMENTS.....	7
5.2.1 <i>Emergency Call Session Control Function (E-CSCF)</i> .....	7
5.2.2 <i>Interrogating Call Session Control Function (I-CSCF)</i> .....	8
5.2.3 <i>Location Retrieval Function (LRF)</i> .....	8
5.2.4 <i>Routing Determination Function (RDF)</i> .....	8
5.2.5 <i>Location Server (LS)</i> .....	8
5.2.6 <i>Interconnecting Border Control Function (IBCF)</i> .....	8
5.2.7 <i>Legacy Network Gateway (LNG)</i> .....	8
5.2.8 <i>Emergency Call Routing Function (ECRF)</i> .....	9
5.2.9 <i>Legacy PSAP Gateway (LPG)</i> .....	9
5.2.10 <i>Application Server (AS)</i> .....	9
5.2.11 <i>Multimedia Resource Function Controller (MRFC)</i> .....	9
5.2.12 <i>Multimedia Resource Function Processor (MRFP)</i> .....	9
5.2.13 <i>Transit Function (TRF)</i> .....	9
5.3 INTERFACES.....	10
<b>6 EXAMPLE CALL FLOWS</b> .....	<b>12</b>
6.1 EMERGENCY CALLS FROM A LEGACY OSP TO A LEGACY PSAP .....	13
6.2 EMERGENCY CALLS FROM A LEGACY OSP TO A NENA I3 PSAP.....	13
6.3 EMERGENCY CALLS WITH LBYV FROM AN IP CAPABLE OSP TO A LEGACY PSAP .....	14
6.4 EMERGENCY CALLS WITH LBYV FROM A IP CAPABLE OSP TO A NENA I3 PSAP .....	15
6.5 EMERGENCY CALLS WITH LBYR FROM A IP CAPABLE OSP TO A LEGACY PSAP .....	16
6.6 EMERGENCY CALLS WITH LBYR FROM A IP CAPABLE OSP TO A NENA I3 PSAP .....	16
6.7 TRANSFER OF CALLS FROM A NENA I3 PSAP TO A NENA I3 PSAP .....	17
6.8 TRANSFER OF CALLS FROM A NENA I3 PSAP TO A LEGACY PSAP .....	18
6.9 TRANSFER OF CALLS FROM A LEGACY PSAP TO A NENA I3 PSAP .....	19
6.10 TRANSFER OF CALLS FROM A LEGACY PSAP TO A LEGACY PSAP.....	19
<b>7 COMPARE AND CONTRAST NENA I3 WITH ATIS-0500032</b> .....	<b>20</b>
7.1 OVERVIEW OF NENA I3.....	21
7.1.1 <i>ECRF</i> .....	22
7.1.2 <i>ESRP</i> .....	22
7.1.3 <i>Legacy Network Gateway (LNG)</i> .....	22
7.1.4 <i>Legacy PSAP Gateway (LPG)</i> .....	22
7.2 USE OF GATEWAYS .....	22
7.3 DEREFERENCING CAPABILITIES .....	23
7.4 ROUTE DETERMINATION .....	23
7.5 CALL ROUTING .....	23
<b>8 OPERATIONAL CONSIDERATIONS</b> .....	<b>24</b>
8.1 ORIGINATING NETWORKS.....	24

8.2 IMS-BASED NG9-1-1 SERVICE ARCHITECTURE PROVIDERS ..... 24  
8.3 LEGACY PSAPs ..... 25  
8.4 NENA I3 PSAPs ..... 25

**Table of Figures**

---

FIGURE 5.1: IMS-BASED NG9-1-1 SERVICE ARCHITECTURE ..... 7  
FIGURE 6.1: EMERGENCY CALLS FROM A LEGACY OSP TO A LEGACY PSAP ..... 13  
FIGURE 6.2: EMERGENCY CALLS FROM A LEGACY OSP TO A NENA I3 PSAP ..... 14  
FIGURE 6.3: EMERGENCY CALLS WITH LBYV FROM A IP CAPABLE OSP TO A LEGACY PSAP ..... 15  
FIGURE 6.4: EMERGENCY CALLS WITH LBYV FROM A IP CAPABLE OSP TO A NENA I3 PSAP ..... 15  
FIGURE 6.5: EMERGENCY CALLS WITH LBYR FROM A IP CAPABLE OSP TO A LEGACY PSAP ..... 16  
FIGURE 6.6: EMERGENCY CALLS WITH LBYR FROM A IP CAPABLE OSP TO A NENA I3 PSAP ..... 17  
FIGURE 6.7: CALL TRANSFER FROM A NENA I3 PSAP TO A NENA I3 PSAP ..... 17  
FIGURE 6.8: CALL TRANSFER FROM A NENA I3 PSAP TO A LEGACY PSAP ..... 18  
FIGURE 6.9: TRANSFER OF CALLS FROM A LEGACY PSAP TO A NENA I3 PSAP ..... 19  
FIGURE 6.10: TRANSFER OF CALLS FROM A LEGACY PSAP TO A LEGACY PSAP ..... 20  
FIGURE 7.1: NENA I3 CALL ROUTING ARCHITECTURE ..... 21

ATIS Standard on –

## Overview and Operational Considerations for an IMS-based Next Generation 9-1-1 (NG9-1-1) Service Architecture based on ATIS-0500032

### Preface

ATIS has developed a Next Generation 9-1-1 (NG9-1-1) network and emergency call processing architecture based on contributions received since 2011 and requirements by a number of wireless carriers to have an IP Multimedia Subsystem (IMS)-compatible NG9-1-1 design<sup>1</sup>. Additionally, the NENA i3 Architecture Working Group<sup>2</sup> deferred the IMS-based Emergency Services IP network (ESInet) development to ATIS. ATIS' goal in developing this standard has been transparent interoperability between the two network designs.

ATIS' intent in this development work was to produce a standard method for IMS-based carriers to offer NG9-1-1 services wholly within their IMS platforms, while maintaining consistency and interoperability with the NENA i3 ESInet/NGCS (Next Generation Core Services) design goals. This kind of standards approach allows IMS-based carriers to take advantage of complete IMS interoperability and features found in their existing IMS ecosystems, while still remaining interoperable with downstream i3 Public Safety Answering Points (PSAPs) that implement NENA i3 standards and interfaces.

It is also ATIS' goal to assure that terminating NG9-1-1 entities, such as i3 PSAPs, find the upstream networks that are built on the ATIS IMS-based NG9-1-1 Service Architecture to be as completely interoperable with their systems and networks as that of a NENA i3 NG9-1-1 standard SIP-based architecture. This goal of transparency – both upstream and downstream between architectures – ensures that an i3 PSAP should find no difference whether the i3 PSAP interconnects to a NENA i3 ESInet with NGCS, or interconnects to an ATIS IMS-based NG9-1-1 Service Architecture. This consistent interoperability principle has guided all of ATIS' development work since the beginning, as documented within the original Issue Statement underlying this work.

The ATIS IMS-based NG9-1-1 Service Architecture provides compatibility for IMS-based carriers acting as an NG9-1-1 System Service Provider (911SSP) to seamlessly interoperate with NENA i3 ESInet architectures.

For entities early in the process of selecting ESInet solutions, the expectation within this ATIS development work was that the ATIS IMS-based NG9-1-1 Service Architecture would offer a choice for carriers that already had an IMS ecosystem, but not be considered a viable architecture choice for 9-1-1 service entities that had no plans for an IMS infrastructure.

Public Safety entities should naturally understand the applicability of an IMS-based NG9-1-1 Service Architecture network approach to processing emergency calls, yet in this case, they can remain confidently focused on NENA i3-based NG9-1-1 architectures (because IMS may be of interest to carriers, not to jurisdictions), which means that Public Safety's progress and momentum to adopt NG9-1-1 will not be impeded by the introduction of this ATIS NG9-1-1 Service Architecture standard.

## 1 Scope, Purpose, & Application

### 1.1 Scope

The telecommunication industry is assessing the sunset of the Public Switched Telephone Network (PSTN) as the carriers plan to transition their networks to IP core networks, specifically those utilizing IP Multimedia Subsystem (IMS) architectures. This has implications on legacy emergency services that are based upon Time Division Multiplexing (TDM) technologies. As carriers migrate to IMS, there is value in considering how emergency services can be supported in that environment. This ATIS Standard provides an overview and

<sup>1</sup> IMS is a set of standards based on the IETF RFC 3261 [Ref 18] family of standards that also introduces additional requirements, specific for carrier operators not differentiated in the more general SIP RFCs.

<sup>2</sup> The NENA i3 Architecture Working Group developed NENA-STA-010.2 [Ref 27].

## ATIS-0500033

operational considerations for ATIS-0500032. That standard applies Common IMS architecture concepts to NG9-1-1 Service Architectures to encompass:

- Definition of an IMS-based NG9-1-1 Service Architecture that includes an IMS-based NG9-1-1 Emergency Services Network architecture, and a set of additional gateway functional elements adopted from the existing NENA i3 architecture to support the delivery of emergency calls to legacy and NG9-1-1/i3 PSAPs.
- NG9-1-1 network deployment scenarios showing an IMS-based Next NG9-1-1 Service Architecture interconnecting with a variety of originating network and PSAP types and associated Stage 2/3 call flows.

### 1.2 Purpose

The purpose of this standard is to provide an overview of, and discuss operational and deployment topics related to, ATIS-0500032.

### 1.3 Application

This standard applies to the following entities:

- NG9-1-1 System Service Providers that support IMS-based emergency services network architectures.
- Originating network providers that interconnect to IMS-based emergency services networks.
- PSAPs (legacy or NG9-1-1) that receive calls from IMS-based emergency services networks.

## 2 Normative References

---

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

[Ref 1] ATIS-0500032, *ATIS Standard for Implementation of an IMS-based NG9-1-1 Service Architecture*.<sup>3</sup>

[Ref 2] ATIS-0500023, *Applying Common IMS to NG9-1-1 Networks*.<sup>3</sup>

[Ref 3] NENA-STA-010.2, *Detailed Functional and Interface Standards for the NENA i3 Solution*, September 10, 2016.<sup>4</sup>

[Ref 4] J-STD-036-C, *Enhanced Wireless 9-1-1 Phase II*, June 2011 including the addendum in J-STD-036-C-1, *Addendum to J-STD-036-C, Enhanced Wireless 9-1-1 Phase II*.<sup>3</sup>

[Ref 5] 3GPP TS 29.333, *Technical Specification Group Core Network and Terminals; Multimedia Resource Function Controller (MRFC) - Multimedia Resource Function Processor (MRFP) Mp interface: Procedures Descriptions*.<sup>5</sup>

[Ref 6] NENA 04-001, *Recommended Generic Standards for E9-1-1 PSAP Equipment*.<sup>4</sup>

[Ref 7] NENA 04-005, *NENA ALI Query Service Standard*.<sup>4</sup>

[Ref 8] RFC 5222, *LoST: A Location-to-Service Translation Protocol*.<sup>6</sup>

[Ref 9] RFC 6753, *A Location Dereference Protocol Using HTTP-Enabled Location Delivery (HELD)*.<sup>6</sup>

---

<sup>3</sup> This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005 at: < <https://www.atis.org/docstore/default.aspx> >.

<sup>4</sup> This document is available from the National Emergency Number Association (NENA) at: < <http://www.nena.org/standards/informational> >.

<sup>5</sup> This document is available from the Third Generation Partnership Project (3GPP): < <http://www.3gpp.org/specs/specs.htm> >.

<sup>6</sup> RFC text is available at < <http://www.freesoft.org/CIE/RFC/index.htm> >.