ATIS-0500026

ATIS Standard on -

OPERATIONAL IMPACTS ON PUBLIC SAFETY OF ATIS-0700015, IMPLEMENTATION OF 3GPP COMMON IMS EMERGENCY PROCEDURES FOR IMS ORIGINATION AND ESINET/LEGACY SELECTIVE ROUTER TERMINATION

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ATIS-0500026, *Operational Impacts on Public Safety of ATIS-0700015, Implementation of 3GPP Common IMS Emergency Procedures for IMS Origination and ESInet/Legacy Selective Router Termination*

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Operational Impacts on Public Safety of ATIS-0700015, Implementation of 3GPP Common IMS Emergency Procedures for IMS Origination and ESInet/Legacy Selective Router Termination

Alliance for Telecommunications Industry Solutions

Approved September 2014

Abstract

With the publication of the ATIS-0700015, Implementation of 3GPP Common IMS Emergency Procedures for IMS Origination and ESInet/Legacy Selective Router Termination, there is a need for a supplemental document that explains, in plain language, the IP to NG9-1-1 interfaces, without overdependence on technical terms and acronyms, to assist Public Safety in understanding the operational impact of the new standard.

This document explains the operational impacts of the ATIS-0700015 standard compared to existing network functionality in today's non-Internet Protocol Multimedia Subsystem (IMS) originating networks. It provides Public Safety the needed insight and overview of what to expect from future IMS originated emergency calls. This document is not a specification but is intended to be informative only.

Foreword

The Alliance for Telecommunication Industry Solutions (ATIS) serves the public through improved understanding between providers, 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 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 an 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, Emergency Services Interconnection Forum (ESIF), 1200 G Street NW, Suite 500, Washington, DC 20005.

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

M. Moody, ESIF Chair (Metropolitan Emergency Services Board)

T. Reese, ESIF 1st Vice-Chair (Ericsson)

T. Breen, ESIF 2nd Vice-Chair (AT&T)

A. Akundi, ESIF NGES Co-Chair (Ericsson)

C. Militeau, ESIF NGES Co-Chair (Intrado)

T. Breen, Technical Editor (AT&T)

The Next Generation Emergency Services (NGES) Subcommittee was responsible for the development of this document.

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1 Scope, Purpose, & Application

The Alliance for Telecommunications Industry Solutions (ATIS) has a number of activities associated with facilitating the introduction of Next Generation 9-1-1 (NG9-1-1). These efforts are primarily being worked by three committees, with support from additional ATIS committees. The primary committees are the Emergency Services Interconnection Forum (ESIF), the Packet Technologies and Systems Committee (PTSC), and the Wireless Technology and Systems Committee (WTSC). ESIF is the primary driver for an effort that applies Common IMS to Next Generation emergency networks, specifically NG9-1-1. PTSC is the primary driver for the public switched telephone network (PSTN) transition to the IP Multimedia Subsystem (IMS). WTSC is the primary driver for specifying emergency services procedures for IMS originating networks. This document provides an overview of the ATIS standard ATIS-0700015, *Implementation of 3GPP Common IMS Emergency Procedures for IMS Origination and ESInet/Legacy Selective Router Termination,* developed by the ad hoc ATIS subcommittee IMSESINET[1], and its operational impacts on Public Safety.

The scope of ATIS-0700015 is to identify, and adapt as necessary, 3rd Generation Partnership Project (3GPP) Common IMS emergency procedures for applicability in North America. It supports emergency communications originating from an IMS subscriber (fixed, nomadic, or mobile) and delivered to a National Emergency Number Association (NENA) i3 Emergency Services IP network (ESInet) or to a legacy emergency services network. The first version of ATIS-0700015 is limited to voice and Global Text Telephony (GTT[2]) communication. A future version of ATIS-0700015 will include Multimedia Emergency Services (MMES).

2 Normative 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]: ATIS-0700015, *Implementation of 3GPP Common IMS Emergency Procedures for IMS Origination and ESInet/Legacy Selective Router Termination,* 2013[3]

3 Informative References

[Ref 100]: NENA 08-003, *Detailed Functional and Interface Standards for the NENA i3 Solution*, Version 1, June 14, 2011.[4]

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[1] The IMSESINET committee is an ad hoc committee chaired by WTSC and comprised of WTSC, PTSC, and ESIF.

[2] GTT is referred to as Real Time Text (RTT) in North America.

[3] This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005 < https://www.atis.org/docstore/product.aspx?id=28140>.

4 Definitions, Acronyms, & Abbreviations

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

4.1 Definitions

Term	Description
User Equipment	Any device used directly by an end-user to communicate. It can be a hand-held telephone, a laptop computer equipped with a mobile broadband adapter, or any other device.

4.2 Acronyms & Abbreviations

Term	Description
3GPP	3rd Generation Partnership Project
ALI	Automatic Location Identification
ATIS	Alliance for Telecommunications Industry Solutions
BCF	Border Control Function
CS	Circuit Switched
E-CSCF	Emergency-Call Session Control Function
ECRF	Emergency Call Routing Function
ESIF	Emergency Services Interconnection Forum
ESInet	Emergency Services Internet Protocol (based) Network
ESQK	Emergency Services Query Key
ESRD	Emergency Services Routing Digits
ESRK	Emergency Services Routing Key
ESRP	Emergency Services Routing Proxy
GTT	Global Text Telephony
IBCF	Interconnecting Border Control Function
IMS	Internet Protocol Multimedia Subsystem
LbyR	Location by Reference
LbyV	Location by Value
LRF	Location Retrieval Function

[4] This document is available from the National Emergency Number Association (NENA). < http://www.nena.org/ >

Term	Description
LS	Location Server
MGCF	Media Gateway Control Function
MGW	Media Gateway
MMES	Multimedia Emergency Services
MPC/GMLC	Mobile Positioning Center/Gateway Mobile Location Center
NENA	National Emergency Number Association
NGIIF	Next Generation Interconnection Interoperability Forum
P-CSCF	Proxy Call Session Control Function
PSAP	Public Safety Answering Point
PSTN	Public Service Telephone Network
PTSC	Packet Technologies and Systems Committee (an ATIS Committee)
RDF	Routing Determination Function
SR	Selective Router or Selective Routing (depending on context)
RI	Reference Identifier
UE	User Equipment
URI	Uniform Resource Identifier
VPC	Voice (over Internet Protocol) Positioning Center
WTSC	Wireless Technology and Systems Committee (an ATIS Committee)

5 Assumptions

1. The following are assumptions that were used in developing IMS-based carrier to E9-1-1 and NG9-1-1 interfaces in ATIS-0700015, and are relevant to this document:
2. ATIS-0700015 supports fixed, nomadic, and mobile callers.
3. The first version of this standard aligns with 3GPP IMS Release 10 and 11, with any North American extensions/restrictions as noted in the standard.
4. Emergency calls are delivered to either a legacy E9-1-1 emergency services network or an IP-based emergency services network (i.e., NENA i3/NG9-1-1 ESInet).
5. All User Equipment (UE) is assumed to have an IMS client.[5]

6 Conceptual Architecture

Figure 6.1 illustrates the conceptual reference architecture for ATIS-0700015. While legacy Public Safety Answering Points (PSAPs) are supported via a legacy PSAP Gateway in the NENA i3 ESInet, such arrangements are not shown in the figure and the implications to those PSAPs are the same as discussed for PSAPs supported in the legacy emergency services network.

In the North American architecture, the emphasis is on the relationship between the originating IMS network and the interconnected emergency services network, rather than the PSAP. For example, emergency calls destined for legacy PSAPs may be directed from the originating IMS network to a Selective Router (SR) in a legacy E9-1-1 emergency services network or to an ESInet that hosts legacy PSAPs. Other emergency calls destined for NENA i3 PSAPs are directed from the originating IMS network to an ESInet for processing by an NG9-1-1 system. Thus in North America, it is the capabilities of the interconnected emergency services network that influence call handling within the IMS originating network, rather than the specific capabilities of the PSAP to which the call will ultimately be delivered.

Calls to a NENA i3 ESInet may be delivered with the location of the caller (location-by-value [LbyV]) or a location Uniform Resource Identifier (URI) (location-by-reference [LbyR]) that the NG9-1-1 system may use to query the Common IMS Network for the location. For the LbyR method, the NENA i3 ESInet will query for location during call set up and the NENA i3 PSAP will query when it receives the call.

If the Common IMS Network needs to acquire the location, the Location Retrieval Function (LRF) will do so via a Location Server (LS). The characteristics of the LS may differ based upon the class of service; for example for mobile calls, the Common IMS Network may query location determination equipment via the LS.

Once the Common IMS Network has obtained location, it must select the appropriate emergency services network to deliver the call. The LRF may use internal processes to access an integrated Routing Determination Function (RDF) to do this, or it may interrogate an external RDF. Using the routing information provided by the RDF, emergency calls may be delivered to either a NENA i3 ESInet or a legacy emergency services network.

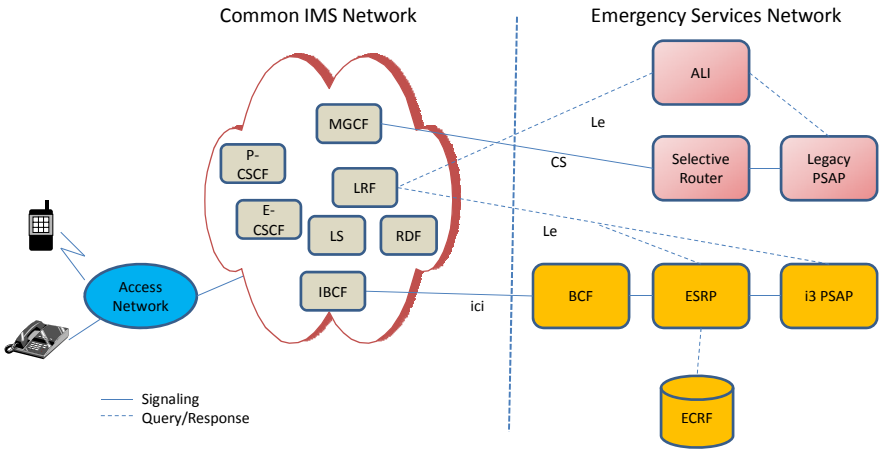

Figure 6. 1 - Conceptual Architecture

6.1 Location Retrieval Function (LRF)

Based upon a request from the Emergency-Call Session Control Function (E-CSCF), the LRF retrieves location information for UEs from the LS (if necessary) and based on the location retrieved, obtains routing information for an emergency session from the RDF. The RDF provides routing information for an emergency session. The LRF returns this routing information to the E-CSCF which may route the call toward a PSAP behind a NENA i3 ESInet or legacy emergency services network.

Once the call is delivered to the appropriate network, the LRF may be queried (via the Le interface in Figure 6.1) for initial location (and updated location if the subscriber is mobile).

6.2 Location Server (LS)

For certain types of emergency calls, the Common IMS Network will have to acquire the location of the UE. The type of call defines how the LS determines location. For example, if the call is from a mobile user, the LS may obtain location via location determination equipment. If the call is from a user with a fixed device, the LS may contain the provisioned location of the UE.

6.3 Routing Determination Function (RDF)

Once the LRF has obtained the UE location (if necessary), it uses that location to query the RDF to get routing instructions. Those routing instructions determine the destination and type of emergency services network that will receive the emergency call. The RDF returns those routing instructions to the LRF, which in turn returns them to the E-CSCF.

6.4 Media Gateway Control Function (MGCF)/Media Gateway (MGW)

The MGCF/MGW converts the native signaling and media within the Common IMS network to that expected by the legacy emergency services network.

6.5 Proxy Call Session Control Function (P-CSCF)

The P-CSCF is a routing proxy within the Common IMS network that routes the call from the access network toward the E-CSCF. The P-CSCF receives the emergency request from the UE, detects that it is an emergency call, and typically forwards it to the E-CSCF.

6.6 Emergency Call Session Control Function (E-CSCF)

The E-CSCF is a routing proxy within the Common IMS network that routes the call from the P-CSCF toward the emergency services network. The E-CSCF receives routing instructions from the LRF which allows it to determine the appropriate emergency service network and route the call to either the MGCF for calls destined to the legacy emergency services network or the Interconnecting Border Control Function (IBCF) for calls destined to a NENA i3 ESInet.

6.7 Interconnecting Border Control Function (IBCF)

The IBCF within the Common IMS network delivers security and control for calls destined to the NENA i3 ESInet.

6.8 Legacy Emergency Services Network

Figure 6.1 shows calls being delivered to legacy E9-1-1 emergency services networks from the MGCF to the SR. The call is then routed to a legacy PSAP. The PSAP will query the regional Automatic Location Identification (ALI) which may subsequently query the LRF to obtain location and (potentially) a callback number.

6.9 NENA i3 ESInet

Figure 6.1 shows calls being delivered to NENA i3 networks from the IBCF to the Border Control Function (BCF) in the ESInet. The NENA i3 elements are defined within NENA 08-003.

7 Simplified Call Flows

To understand the impacts of ATIS-0700015 on Public Safety, it is useful to discuss calls that Public Safety entities may receive. Four call flows are illustrated in this document. The first (Figure 7.1) depicts calls being delivered to a legacy emergency services network and that network having to query the Common IMS Network for location.

The second (Figure 7.2) call flow shows calls being delivered to a legacy emergency services network and the PSAP querying the regional ALI (which contains the subscriber's location). This flow assumes that the subscriber location is provisioned in the regional ALI and not within the Common IMS Network.

The third (Figure 7.3) call flow shows calls being delivered to a NENA i3 ESInet with the location of the subscriber in the call request (LbyV).

The fourth (Figure 7.4) call flow shows calls being delivered to a NENA i3 ESInet with the location of the subscriber referenced by a Reference Identifier (RI). The Emergency Services Routing Proxy (ESRP) must dereference this location for routing and the PSAP must dereference this location for dispatch.

7.1 Calls to Legacy Emergency Services Networks with Location Cached in the LRF

Figure 7.1 illustrates a call to a Legacy emergency service network where the LRF caches the location and the PSAP must query for it via the regional ALI system (which queries the LRF). This example is similar to existing

VoIP emergency calls where the location is contained within the VoIP Position Center (VPC) or a wireless call where the location is provided by a Mobile Positioning Center/Gateway Mobile Location Center (MPC/GMLC).

1. The call is originated and enters the Common IMS Network.
2. The P-CSCF recognizes the call as an emergency call and forwards it to the E-CSCF.
3. The E-CSCF routes the call to the LRF to obtain location and to get routing information.
4. The LRF returns routing instructions to the E-CSCF and the E-CSCF forwards the call to the MGCF.
5. The MGCF routes the call to the PSAP via the SR.
6. The PSAP queries the ALI system for location and callback number.
7. The ALI system forwards the request to the LRF. The LRF returns the location and callback number to the ALI system, which forwards it to the PSAP.

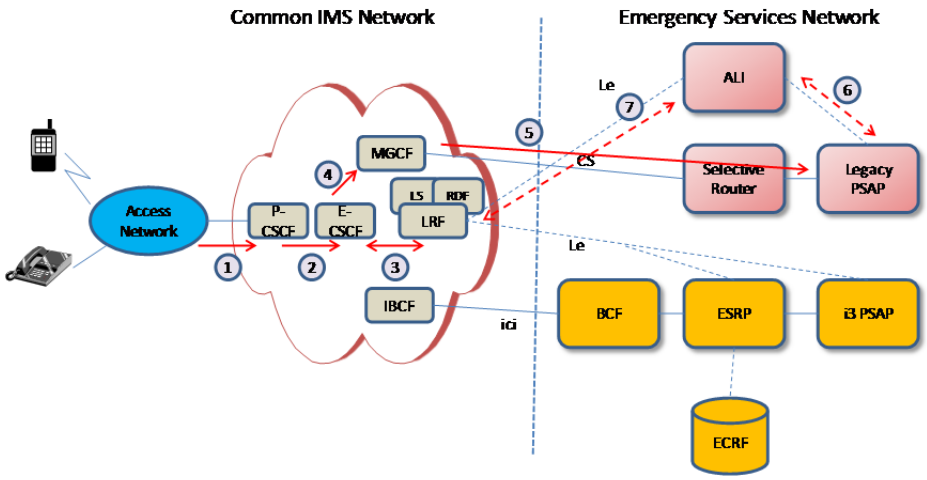

Figure 7. 1 - Calls to Legacy SR with Location Cached in the LRF

7.2 Calls to Legacy Emergency Services Networks with Location Provisioned in the Regional ALI System

Figure 7.2 illustrates a call to a legacy emergency service network where the location is provisioned in the regional ALI system and the PSAP must query the regional ALI system for it. This call is similar to an existing wireline call where the location is provisioned in the ALI. This call flow assumes that the ALI record has been provisioned in the regional ALI system using normal methods.

1. The call is originated and enters the Common IMS Network.
2. The P-CSCF recognizes the call as an emergency call and forwards it to the E-CSCF.
3. The E-CSCF routes the call to the LRF to obtain routing information.
4. The LRF returns routing instructions to the E-CSCF and the E-CSCF forwards the call to the MGCF.
5. The MGCF routes the call to the PSAP via the SR.
6. The PSAP queries the regional ALI system for location, and the regional ALI system returns the location to the PSAP.

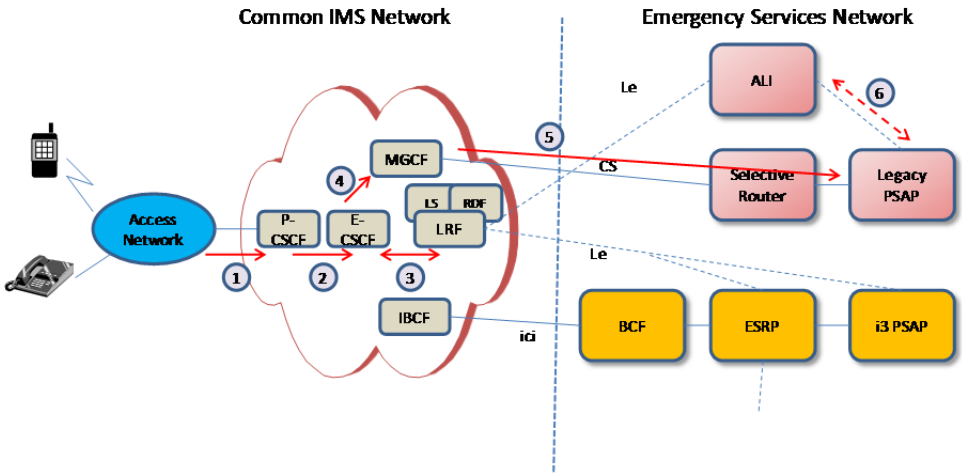

Figure 7. 2 - Calls to Legacy SR with Location Provisioned in the Regional ALI System

7.3 Calls to a NENA i3 ESInet with Subscriber Location

Figure 7.3 shows a call to a NENA i3 ESInet where the subscriber's location (i.e., LbyV) and callback number are delivered with the call request.

1. The call is originated and enters the Common IMS Network.
2. The P-CSCF recognizes the call as an emergency call and forwards it to the E-CSCF.
3. The E-CSCF routes the call to the LRF to obtain location (if needed) and to get routing information.
4. The LRF returns routing instructions to the E-CSCF and the call is routed to the IBCF.
5. The IBCF routes the call to the ESRP in the ESInet via the BCF.
6. The subscriber's location and callback number are passed in the call request. The NENA i3 ESInet uses normal routing techniques to deliver the call, with the subscriber's location and callback number, to the PSAP. The ESRP interrogates the ECRF for routing instructions.
7. The ECRF returns the PSAP URI to the ESRP and the ESRP routes the call to the PSAP.

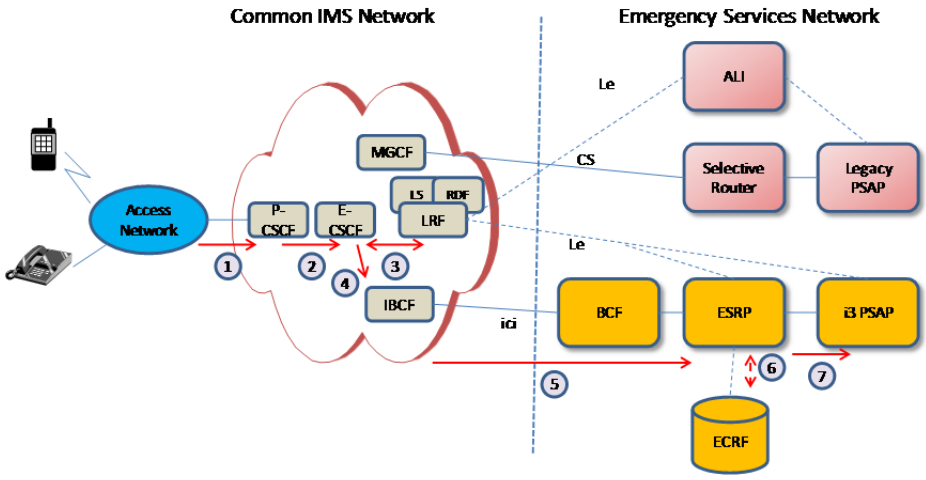

Figure 7. 3 -Calls to a NENA i3 ESInet with Location by Value

7.4 Calls to a NENA i3 ESInet with Location Reference Identifier

Figure 7.4 illustrates a call being delivered to a NENA i3 ESInet with a Location reference identifier (i.e., location-by-reference). The ESInet will have to query the Common IMS Network for a routing location and the PSAP will have to query the Common IMS Network for a dispatch location.

1. The call is originated and enters the Common IMS Network.
2. The P-CSCF recognizes the call as an emergency call and forwards it to the E-CSCF.
3. The E-CSCF routes the call to the LRF to obtain location (if needed) and to get routing information.
4. Since there is a chance to obtain a location update, the LRF creates a Reference Identifier (i.e. a location reference) and returns it to the E-CSCF. The call is routed to the IBCF.
5. The IBCF routes the call to the ESRP in the ESInet via the BCF, passing the RI.
6. The ESRP in the NENA i3 ESInet "dereferences" the routing location by querying the LRF.
7. The ESRP uses that location to obtain routing instructions from the ECRF.
8. The ESRP then routes the call to the PSAP passing the RI.
9. The PSAP "dereferences" the location using the RI to obtain initial location and may request location updates in the same manner.

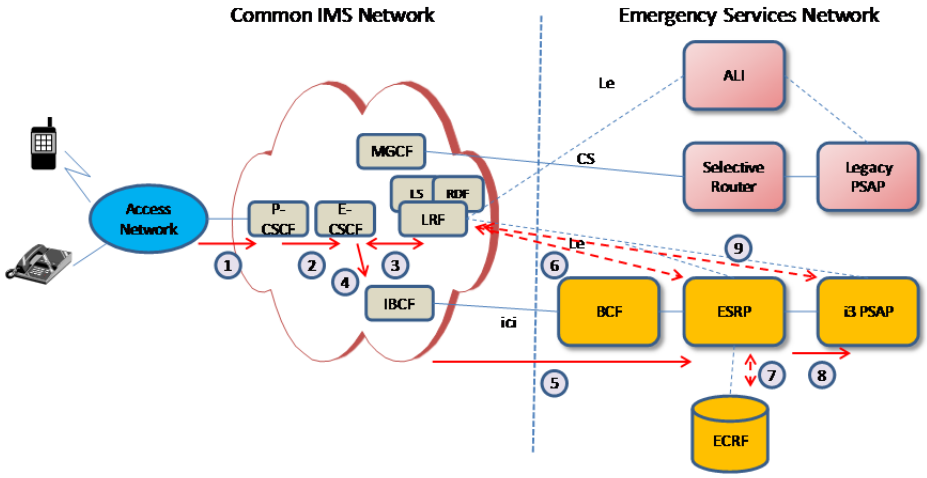

Figure 7. 4 - Calls to a NENA i3 ESInet with Location Reference Identifier

8 Operational Impacts to 9-1-1 Authorities and PSAPs

ATIS-0700015 does not introduce any additional network interfaces to the PSAP over what is specified in existing standards. Legacy PSAPs continue to receive calls via the SR and query for location and callback numbers via the regional ALI. NENA i3 PSAPs continue to receive calls via the ESRP. If the LbyR method is used, the PSAP may have to query ("dereference") the LRF for location. This is the same interface for dereferencing location as defined in the NENA i3 08-003 specification.

8.1 Considerations for Legacy PSAPs

ATIS-0700015 uses the same methodologies to deliver emergency calls from IMS-based originating networks that exist for emergency calls from legacy wireless and (i2/pre-i2) VoIP networks. Therefore, the PSAP or 9-1-1 Authority may have to work with the provider of the originating Common IMS Network so they can allocate and provision the RIs (used in this case as functionally equivalent to Emergency Services Routing Keys (ESRKs), Emergency Services Routing Digits (ESRDs), and Emergency Services Query Keys (ESQKs)) that may be provided by the originating IMS network in their SR databases/ALI systems.

8.2 Considerations for NENA i3 PSAPs

ATIS-0700015 uses the same methodologies to deliver emergency calls from an IMS-based originating network that have been defined for delivering calls from i3-compliant IP-based originating networks to NENA i3 PSAPs. If

a call is delivered to the NENA i3 ESInet with the caller location (LbyV) in the call request, the NENA i3 ESInet will use normal call routing and deliver the call (with location and callback number) to the PSAP. The PSAP will then display the location but will not have the opportunity to request a location update since it is assumed the location is fixed. If there is an opportunity for the originating Common IMS Network to obtain updated location for the caller, the originating IMS Common Network will create a RI (used in this case to represent LbyR). This RI will be passed to the i3 PSAP call handling equipment, which will query for an initial location. If necessary, the call taker will query for an updated location, or in some cases, the i3 call handling equipment may do it automatically for the initial rebid.[6]

8.3 Routing Wireless Calls Based upon Associated Location

Section 8.2.1 in ATIS-0700015 describes the use of an Associated Location for routing wireless calls as follows (modified editorially for clarity here):

> ”An Associated Location is used in some wireless routing scenarios where the cell address or cell centroid cannot be used to route a call to the ESInet. The Associated Location (shown as the Routing Location in Figure 6 of ATIS-0700015) is selected by the LRF, will be used by the RDF and is returned by the LRF to an E-CSCF based upon its request for routing location (an LbyR scenario) and may be subsequently re-used by the ESInet to route the call to the appropriate PSAP. The Associated Location is used for routing only and is not presented to the PSAP.”
>
> How the Associated Location is established is beyond the scope of this standard.

Additionally, Step 6 of Figure 8-3 states:

> “…The LRF maps the cell ID received in the SIP INVITE message to a routing location that is the Associated Location designated for the appropriate PSAP for that cell…”

The IMS-based originating network provider and the 9-1-1 Authority must have a process such that the Associated Location can be agreed upon and related to specific cell site/sectors. The mappings between cell site/sectors and Associated Locations must then be provisioned in the LRF.

The process between the IMS-based originating network provider and the 9-1-1 Authority must have the following steps:

1. The IMS-based originating network provider identifies the cell site/sector coverage for the region.
2. The 9-1-1 Authority provides PSAP boundaries for routing of wireless calls to the IMS-based originating network provider.
3. The IMS-based originating network provider maps cell site/sector to PSAP boundaries and make a recommendation of which cell site/sector calls will go to which PSAP.
4. The IMS-based originating network provider provides this recommendation to the 9-1-1 Authority.
5. The 9-1-1 Authority reviews the mapping information and adds an Associated Location for each PSAP and provides back to the IMS-based originating network provider.
6. The IMS-based originating network provider provisions its LRF with information that maps the cell site/sector identifier to the Associated Location. This relationship will be used during call processing.

Based upon bilateral agreement, the format of the Associated Location may be 1) any valid civic or geodetic (preferred) location within the PSAP boundary/serving area, 2) a polygon that is representative of the PSAP boundary/serving area, or 3) any other mutually agreed upon location information.

[6] Per APCO ANS 3.103.2-2013: *Wireless 9-1-1 Deployment and Management Effective Practices Guide*, Topic Area 4: Rebid/Re-Query: The Agency should not rebid (automatically or manually) less than 30 seconds after the call is first presented to the call taker. Any subsequent rebids should be at 30-second intervals. If automatic rebid is used, only the first rebid should be automatic.

9 Summary

ATIS-0700015, *Implementation of 3GPP Common IMS Emergency Procedures for IMS Origination and ESInet/Legacy Selective Router Termination,* supports emergency communications originating from an IMS subscriber (fixed, nomadic, or mobile) and delivered to a NENA i3 ESInet or to a legacy emergency services network. Version 1 of this standard supports voice and GTT and later versions will support MMES. The standard was based upon 3GPP's IMS standards and adapted to meet the needs of the North American Industry.

For calls destined to Legacy emergency services networks, ATIS-0700015 uses the same methodologies to deliver emergency calls from IMS-based originating networks that exist for emergency calls from legacy originating and (i2/pre-i2) VoIP networks. Therefore, operators of those networks and the PSAPs behind them should expect no changes in their processes.

For calls destined to NENA i3 ESInets, ATIS-0700015 uses the same methodologies to deliver emergency calls from an IMS-based originating network that have been defined for delivering calls from i3 compliant IP-based originating networks to NENA i3 PSAPs. Therefore, operators of ESInets and the PSAPs behind them should anticipate similar processes as with other i3 compliant originating networks.