Location Matters for NG9-1-1 Systems

WHITE PAPER

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One of the main principles of Next Generation 9-1-1 (NG9-1-1) is that an emergency call can be quickly routed to the most appropriate Public Safety Answering Point (PSAP) based on the caller's location with a high degree of accuracy and low latency. To accomplish this, many aspects of location are involved that fit within the NG9-1-1 architecture, including the caller's current location, databases, interfaces and the Geographic Information System (GIS) data that forms the basis of NG9-1-1 call routing.

This new system of information and interfaces for NG9-1-1 will eventually make infrastructure such as Automatic Location Information (ALI) databases obsolete. However, for a short period of time, the NG9-1-1 system must remain backwards compatible. In order to realize full NG9-1-1 potential and reduce overall costs, it is important to keep this transitional period to a minimum. Using a National Emergency Number Association (NENA) i3 standards-based approach, the NG9-1-1 system can be deployed with interoperability at the local, regional or state level that provide a framework for transitioning to NG9-1-1 in the shortest time possible.

This white paper provides a brief overview of how location data is accounted for within a NG9-1-1 architecture, a solution framework that jurisdictions can use in a transition to end-state NG9-1-1, key elements of the solution and key points of why location matters for NG9-1-1.

Solution Overview

Location matters for NG9-1-1 in several ways; identifying the caller's location in the real time call flow, location in the geospatial routing of emergency calls, integration with Originating Service Providers (OSPs) and sharing location information with applications and other PSAPs.

Elements involved in location for a NG9-1-1 system include:

- Caller's location in real time call flow
- Geospatial routing of emergency calls
- Integration with Originating Service Providers (OSPs)
- Sharing location information with applications and other PSAPs

The NENA i3 Standard requires that the caller's location be defined as a civic address or geodetic information in the Session Initiation Protocol (SIP) call signaling, or retrievable by reference from an external Location Information Server (LIS) using Presence Information Data Format – Location Object (PIDF-LO) formatted data based on the United States Civic Location Data Exchange Format (CLDXF) standard. The Location Database (LDB) uses the HTTP Enabled Location Delivery (HELD) protocol to respond to location queries, which replaces ALI and provides a transition to a LIS. The NG9-1-1 solution uses the Wireless Emergency Service E2 protocol to access caller's location data provided by Mobile Positioning Center (MPC) and Voice over IP (VoIP) Positioning Center (VPC) services. The NG9-1-1 system Interfaces to Text Control Center (TCC) services using SIP, Message Session Relay Protocol (MSRP) and HELD.

Solution Framework

When an emergency call is received by an NG9-1-1 system, the real time location of the caller is identified at the start and maintained throughout the duration of a call, even as a caller's location may change, regardless of call type. Using the caller's location, the NG9-1-1 solution performs a geospatial lookup for the most appropriate PSAP to which the emergency call must be routed. The geospatial lookup must be fast and highly accurate, based on jurisdiction-provided GIS data that is normalized to the NG9-1-1 CLDXF standard. Integration with OSPs is required to obtain a snapshot of the ALI database, and then to receive Service Order Input (SOI) civic records on a regular basis to keep the LDB up to date. The ability to share location information between PSAPs on the same or different Emergency Service Internet Protocol Networks (ESInets) is enabled by the end-to-end IP architecture and standards-based approach.

Key points for identifying the caller's location include:

- NG9-1-1 location can be found in SIP call signaling – In contrast, there is no location data in legacy 9-1-1 call signaling
- Location by value (civic or geodetic) or by reference
- Location value defined by Presence Information Data Format – Location Object (PIDF-LO)
- Location can be sent in SIP packet and contained in Emergency Incident Data Document (EIDD)

Figure 1 illustrates the points where location is used within a NG9-1-1 emergency services call flow.

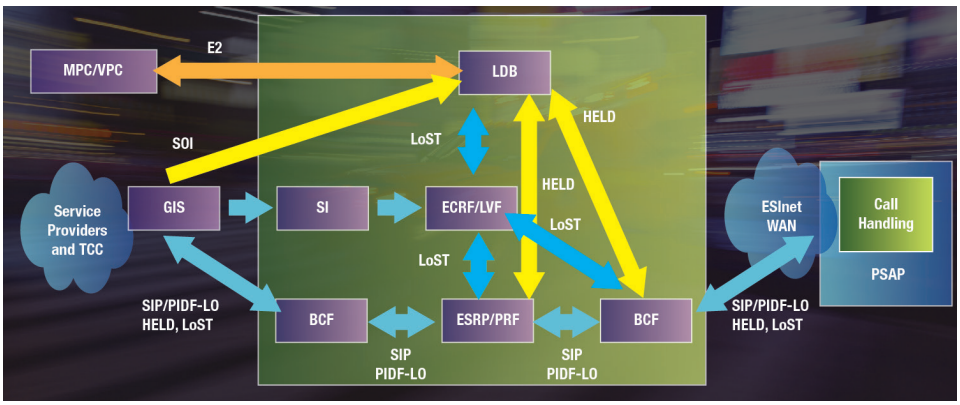

Figure 1. NG9-1-1 Location Interfaces

The ability to geospatially route an emergency call, which is routing based on location, helps to improve routing accuracy. Emergency Call Routing Function (ECRF) determines the appropriate PSAP in real time and responds to routing requests using Location to Service Translation (LoST) protocol. The Location Validation Function (LVF) performs high-accuracy validation of civic addresses for LDB and ECRF using NENA NG9-1-1 US CLDXF. The Spatial Interface (SI) provides GIS data import and GIS data normalization for ECRF/LVF.

Integration with OSPs is an important part of providing location, due to their position in the network between the caller and the emergency services network. The NG9-1-1 system imports Service Order Input (SOI) records which are used by service providers to add, change, or delete subscriber and location data, keeping the LDB up to date. The NG9-1-1 system enables jurisdictions to remove legacy elements using a transitional approach using Master Street Address Guide (MSAG) and ALI conversion services.

The ability to share information with other PSAPs or coordination centers is a key benefit of NG9-1-1, by taking a standards based approach with Internet Engineering Task Force (IETF) protocols including SIP, HELD, LoST, PIDF-LO and future EIDD interfaces.

When the caller's location is not available in the incoming call signaling, the NG9-1-1 solution receiving the emergency call is able to identify caller location data with low latency for all call types, including wireline, wireless and VoIP. An NG9-1-1 solution uses a transitional element called a Location Database (LDB) which replaces the legacy ALI database, and provides a transition to a LIS using a HELD interface. The LDB provides interfaces to MPC or VPC services for real time caller location of wireless (Phase 1 and Phase 2) or nomadic VoIP call types using an E2 interface. The LDB records are validated against the GIS data and kept in synchronization with the back-end databases that enable geospatial routing of emergency calls.

Key Elements of the Solution

The geospatial routing of emergency calls is based on the integration of functional elements that import, normalize, validate, translate and maintain GIS-based data (roads and addresses) with Emergency Service Boundaries (ESBs) defined as one of the GIS layers. Location-based NG9-1-1 functional elements include the Location Database (LDB), Emergency Call Routing Function (ECRF), Location Validation Function (LVF) and Spatial Interface (SI).

Figure 2 illustrates key elements of building an NG9-1-1 routing data set.

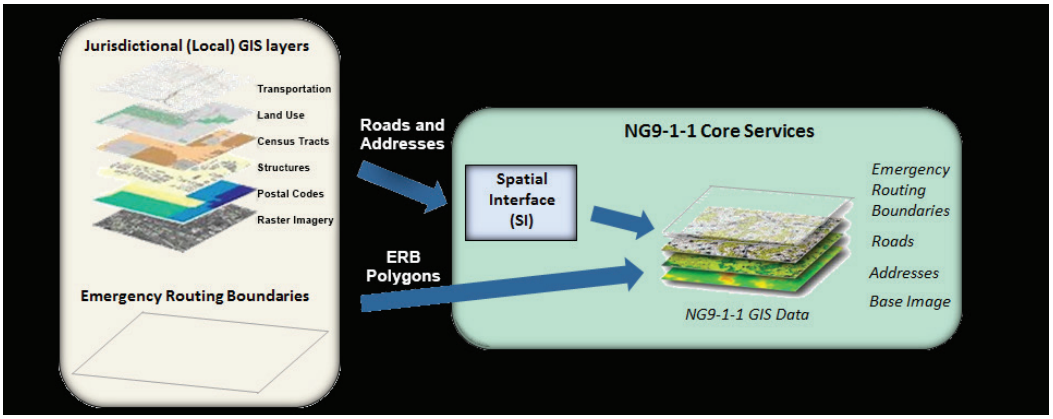

Figure 2. Key Elements of Building NG9-1-1 Routing Data Set

The Emergency Call Routing Function (ECRF) performs real time geospatial routing lookups based on LoST queries from an internal Emergency Services Routing Proxy (ESRP) or from external NG9-1-1 Core Services (NGCS) systems. The LoST query to the ECRF contains the caller's location by value or reference using PIDF-LO. The ECRF can determine a route based on an address point, address range or centerline. The ECRF looks up the caller's location against its ECRF database and, if a match is found, the ECRF returns a SIP Uniform Resource Identifier (URI) and its confidence level in the response to the LoST query originator. If a match is not found, the ECRF can use different rules to determine routing such as highest confidence level, alternate or default routes.

The Location Validation Function (LVF) performs the same function as the ECRF, except its sole purpose is the validation of civic addresses before the data is used for ECRF routing decisions. The LVF can be considered an Application Programming Interface (API) to the ECRF, providing external non-real-time access to the ECRF NG9-1-1 GIS data set used for emergency call routing. The LVF ensures that a civic address will have a PSAP route when used by the ECRF.

The Spatial Interface (SI) is a NENA i3 construct that in the GDIT NG9-1-1 system imports GIS data, performs a set of quality assurance and quality control checks, exports into the NG9-1-1 GIS database, pushes changes to the ECRF/LVF data sets and provides discrepancy reporting.

Different data models are used in local jurisdictions throughout the country, which drives the need to normalize the local jurisdictional GIS data into a NG9-1-1 construct that can be used by any ECRF to perform geospatial routing. GIS data normalization services can bring multiple jurisdictions together to gather and build the GIS data to create the ECRF/LVF data sets used for NG-1-1 routing.

About the Author

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