SOLACOM

LOCATING CALLERS FASTER

OPTIMIZING GIS DATA AND MAPPING TO PINPOINT CALLER LOCATION

A Solacom White Paper

PSAPs Need More Precise Location Information

Instant access to accurate caller location information is crucial during all 9-1-1 calls. Call handling systems must provide call takers with the ability to pinpoint the location of a caller more accurately, whether the call is placed from a landline or wireless phone. Today, most public safety answering points (PSAPs) still rely on an Automatic Location Information (ALI) database that uses telephone company subscriber service records and a Master Street Address Guide (MSAG) database to determine the caller location.

While traditional databases and Enhanced 9-1-1 (E9-1-1) technology are currently used to find people calling from a landline at a known street address, they do not provide the most accurate location information for people using mobile phones and text messages to contact 9-1-1. Unfortunately, despite continuing advances in mapping capabilities, media attention has focused on the technology lag. An in-depth USA Today article called it "9-1-1's deadly flaw[1]." And in January 2018, NBC News highlighted the dangers associated with the ongoing inaccuracy of 9-1-1 caller location information by noting that the free apps people routinely install on their mobile phones provide far more accurate location information than that available to PSAPs from traditional sources[2].

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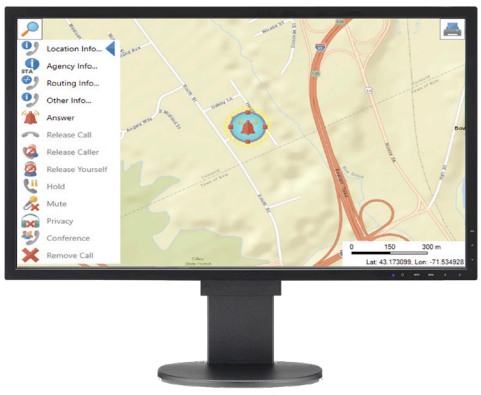

NG9-1-1 Standards Address the Location Issue

The good news is that the move to Next Generation 9-1-1 (NG9-1-1) systems will bring PSAPs far more precise location capabilities. NG9-1-1 call handling and management systems leverage location information from a geographic information system (GIS) database that includes numerous location details that are not available from today's MSAG, Emergency Service Number (ESN), and ALI databases.

The most sophisticated NG9-1-1 systems also offer advanced mapping capabilities that enable call takers to manipulate and display all the available data, and handle calls directly from the mapping application. And they allow PSAP systems to query third-party databases, such as the RapidSOS NG911 Clearinghouse, to access the Advanced Mobile Location (AML) data a smartphone transmits when a 9-1-1 call is made[3].

While NG9-1-1 systems bring critical new location capabilities, PSAPs must determine how to best evolve their systems and their operations to get there from here. Taking the right approach to provisioning GIS data and selecting the right mapping solution to display and manipulate the GIS data will make all the difference.

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Provisioning GIS Data Requires Time and Expertise

In an NG9-1-1 system, PSAPs transition from a tabular MSAG database and ESNs to a Location Validation Function (LVF) and Emergency Call Routing Function (ECRF) that use the information stored in the new GIS database.

To help PSAPs develop complete, accurate, and consistent GIS data, the draft NENA standard for the NG9-1-1 GIS data model provides extremely precise requirements for how location information must be structured and formatted. GIS data layers, field names, and the associated attribute data are all defined in detail. While some data layers are mandatory, others are recommended or strongly recommended (Table 1).

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Table 1: Mandatory and Recommended Data Layers for an NG9-1-1 GIS Database[4]

GIS Data Layer	Requirement
Road centerlines	Mandatory
PSAP boundary	Mandatory
Site/Structure address points	Mandatory
Emergency service boundary	Mandatory
Provisioning boundary	Mandatory
Street name alias table	Strongly recommended
Landmark name part table	Strongly recommended
Complete landmark name alias table	Strongly recommended
States or equivalents	Strongly recommended
Counties or equivalents	Strongly recommended
Incorporated municipal boundary	Strongly recommended
Unincorporated municipal boundary	Strongly recommended
Neighborhood community boundary	Strongly recommended
Railroad centerlines	Recommended
Hydrology line	Recommended
Hydrology polygon	Recommended
Cell sector location	Recommended
Mile marker location	Recommended

To further increase the precision of location information, PSAPs can go beyond the NENA GIS specification to include details that help first responders when they are acting on calls from tall buildings, sprawling shopping complexes, and large entertainment venues. That detail can include:

- Building floor plans, floor heights, seating plans, and entrance locations
- Building systems, such as heating, ventilation, and air condition (HVAC) systems, elevators, and security systems
- Building inspection history and previous citations
- The geographic layout of large venues with indoor and outdoor spaces

PSAPs Must Acquire, Audit, and Adapt GIS Data

The information needed to populate NG9-1-1 GIS databases already exists in various databases and formats. The challenge for PSAPs is to find it, analyze it, and rework it to meet the NENA standard.

ACQUISITION: GIS DATA COMES FROM A VARIETY OF SOURCES

Figuring out who or what organization can provide the required GIS data can be a time-consuming task. In many jurisdictions, the assessor's office is responsible for developing and maintaining GIS data. In some cases, the data is available online. In other cases, the data may be contained in a tattered paper map that's been taped to a wall so many times, it's barely readable.

Because the GIS data generated by the assessor's office was not developed for 9-1-1 purposes, it does not include mandatory NENA details, such as emergency services boundaries and address points. It also does not include information such as street aliases and landmark names that are strongly recommended by NENA and extremely helpful to call takers. For example, callers might say they're on the Main Street rather than use the county highway number. Or they might use a landmark as reference, saying they're at a football field, beside a fairground, or in a shopping mall parking lot.

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To acquire the data needed to accurately locate people, PSAPs will likely need to contact other municipal departments or other levels of government. In some cases, they may need to acquire the information directly from railway companies, cellular providers, surveyors, architects, construction companies, and building owners.

AUDITING: EXISTING DATA RARELY MEETS THE NENA STANDARD

Once PSAPs acquire the GIS data, it must be thoroughly audited to determine the enhancements and corrections required to comply with the NENA GIS data model standard. Depending on the volume and accuracy of the data, this task can take days or weeks.

For example, to comply with the NENA GIS data model standard, each road must end at an intersection and start again at the other side of the intersection. If one road is positioned on top of another, it is not clear whether there is an overpass or an underpass at that location. As a result, elevations must be precisely identified to ensure the system knows where a left or a right turn is possible and where it is not. Each road must also be split at city, county, and state boundaries.

Thorough auditing of GIS data identifies:

- Duplicate features and records
- Invalid geometry
- Road name inconsistencies
- Missing metadata based on the Federal Geographic Data Committee (FGDC) standard
- Domain validation
- Discrepancies between address point information and road centerline information
- Projection inconsistencies
- Road splits at intersections and boundaries
- Boundary misalignments
- Multi-address structure formats

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ADAPTATION: A 9-1-1 GIS EXPERT IS NEEDED

The NENA GIS data requirements are complex. So is the software used to input the GIS information and develop the GIS database. As a result, the data adaptation task must be completed by someone with specific experience in and knowledge about GIS data requirements for NG9-1-1 services.

Synchronizing the GIS data with the existing MSAG database is one of the most challenging tasks. There can be thousands of errors in out-of-date telephony information. Additional data adaptation tasks include:

- Standardizing data content
- Correcting attribute and geometry errors
- Creating the missing GIS data layers required for compliance
- Adding mandatory data to existing map layers

Once the GIS database complies with current standards, PSAPs must ensure that it remains compliant. Depending on the population of the jurisdiction, updates may be required quarterly, monthly, weekly, or daily.

Due to the time and expertise that is required to keep GIS databases accurate and up to date, many PSAPs engage a qualified third party to manage ongoing additions, changes, and deletions to the GIS database. This approach enables PSAPs to maintain their focus on daily operations rather than database maintenance.

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Sophisticated Mapping Puts GIS Details a Click Away

To make the best possible use of GIS data and information from other sources, PSAPs need a sophisticated mapping application that allows call takers to view location data in different ways and to manage 9-1-1 calls through the map.

Most mapping applications allow call takers to isolate and view GIS information in layers and to easily zoom in and out and pan around the map view. With these capabilities, call takers can change the map view to show only the elements that are relevant to the current call.

For example, call takers may want to show only specific types of buildings, such as schools, shopping centers, or banks. Or, they may want to zoom in from the view of a building footprint to a detailed view of its floor plans so they can accurately guide first responders to the most convenient entrance and the fastest path to the caller.

The ability to manage and prioritize calls from within the mapping application is also an extremely important capability for PSAPs. When call takers can see the status of all calls on the map at a glance — ringing, answered, muted, on-hold, abandoned — then simply click the icon for the call, they can quickly deal with calls in the order that makes the most sense for the call location and status.

For example, if there is a cluster of calls originating from the same location, they are all very likely about the same major event. In this case, it may make more sense to answer a new call coming in from a different location rather than a second, third, or subsequent call from the location of the major event.

The ability to instantly see call location on a map can also accelerate response times. In one case, call takers were able to accurately predict which bank would be targeted next in a sequence of robberies because they could see the geographic pattern of the 9-1-1 calls about the previous robberies on the map. With this insight, call takers were able to quickly dispatch police to the next-targeted bank. In another case, a call taker was able to send police a photo of the caller's location on the map that was so precise, police were able to locate and apprehend the suspect in less than 15 minutes.

PSAPs need a sophisticated mapping application that allows call takers to view location data in different ways and to manage 9-1-1 calls through the map.

Not All Mapping Applications Are Created Equal

While many vendors of NG9-1-1 systems offer some form of visual mapping capabilities, most cannot offer the ability to manage and prioritize calls through the map as described above. When call takers have access to the most sophisticated mapping capabilities available, important new capabilities become possible. For example, call takers can:

- View call status, name, address, and location on the map as soon as the call comes in
- Automatically see more precise caller location information over time as the confidence radius provided by the network improves
- Automatically zoom to the active call location when the call is answered
- Visually track caller location on the map as the caller moves
- Filter calls on the map to hide calls with particular statuses and simplify the map view
- Visually identify which call taker is handling each in-progress call on the map

To ensure that the NG9-1-1 call handling and management system provides the required level of GIS data support and location mapping capabilities, PSAPs should look for a system that supports:

- A synchronization server that allows GIS data updates to be propagated automatically to all workstations from a single location
- Customized GIS data layers and base maps, such as aerial photos and address points
- Multiple base maps that can be toggled by call takers
- Location information from third parties, such as RapidSOS
- ArcGIS© Server data so the mapping application can use base maps, network datasets, published locators, and additional GIS layers directly from the ArcGIS Server published services
- ArcGIS Server/Enterprise geocoding services so they can build customized geocoding services and ensure call takers have the most up-to-date information possible

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Solacom Combines GIS and Mapping Leadership

GIS data is so critical to PSAP operations that it has been called "the hero of 9-1-1[5]." To help PSAPs take full advantage of GIS data, Solacom has made significant investments in advancing both sides of the location equation.

On the GIS data side, we offer database development, standardization, and maintenance services that simplify the transition to new data standards and ensure that location-based information meets industry benchmarks for uniformity, accuracy, and timeliness.

Solacom's complete GIS services optimize emergency call data for use by the mapping application. With these services, PSAPs can ensure that critical geospatial data is collected, stored, and delivered in a consistent manner to Solacom's Guardian 9-1-1 Call Handling solution.

On the mapping side, we offer Guardian Map, an advanced mapping application that integrates seamlessly with our Guardian 9-1-1 Call Handling solution. Guardian Map delivers complete GIS mapping capabilities to the desktop based on:

- Locally hosted maps created from client-supplied data
- Custom GIS base maps
- Free Esri ArcGIS Online base maps
- StreetMap™ Premium

Guardian Map is one of the only NG9-1-1 call handling and management solutions available today that supports call handling from within the mapping application.

We also believe very strongly in the value of incorporating third-party location information to help call takers more precisely pinpoint caller location. As a result, we have integrated the RapidSOS capability as part of a free software upgrade to our Guardian 9-1-1 Call Handling solution.

With Solacom as their partner, PSAPs have the GIS data, advanced mapping capabilities, and third-party location data needed to make significant improvements to the accuracy of caller location information. Together, we can help first responders find people faster to save lives.

Guardian Map Pinpoints Location of School Shooting Hoax 9-1-1 Caller

Just two weeks after installing the Solacom Guardian Map solution, a call taker in Marion County, Arkansas, used the sophisticated mapping capability to help police quickly locate a caller who said someone armed with a shotgun was going to "shoot up" a school nearby Baxter County.

The quick-thinking call taker sent police a photo of the map that identified the location of the suspect within 30 feet of his actual location, and the caller was apprehended in 13 minutes.

Read the full story.

Acronyms

ALI	Automatic Location Identification
AML	Advanced Mobile Location
E9-1-1	Enhanced 9-1-1
ECRF	Emergency Call Routing Function
ESN	Emergency Service Number
FGDC	Federal Geographic Data Committee
GIS	Geographic Information System
HVAC	Heating, Ventilation, and Air Conditioning
LVF	Location Validation Function
MSAG	Master Street Address Guide
NG9-1-1	Next Generation 9-1-1
PSAP	Public Safety Answering Point

References

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[2] https://www.nbcnews.com/nightly-news/video/911-can-t-always-get-accurate-locations-from-cell-phones-1135073347526

[3] https://www.solacom.com/latest-news/solacom-rapidsos-enable-kentucky-psap-better-respond-9-1-1-calls-smartphones/

[4] Draft NENA Standard for NG9-1-1 GIS Data Model, March 2018

[5] http://urgentcomm.com/ng-911/gis-will-become-hero-911-says-apco-panelist

Additional Information

Click here for more information about how Solacom can help you make the move to fully integrated mapping based on GIS data as part of a complete NG9-1-1 call handling and management solution for your PSAP.

Contact Us

Solacom 9-1-1 call handling and management solutions are built on more than 30 years of research and innovation in the application of advanced hardware and software technologies for public safety. Today, Solacom Guardian 9-1-1 solutions support thousands of agencies affecting millions of lives annually — from dense urban environments to statewide deployments.

Contact us today to discover how our Guardian solutions can help your PSAP streamline 9-1-1 call handling and management processes and enable more efficient collection of critical information in emergency situations.

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