

State of Nebraska

NG9-1-1 GIS Ready?

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Introduction

GeoComm is responding to the opinion and findings docket issued by the Nebraska Public Service Commission (NPSC) on July 7, 2009. We understand the overall intent of the document is to identify a permanent funding mechanism for:

- each PSAP in the state and,
- Wireless carrier costs.

GeoComm has no opinion on how the State of Nebraska distributes and authorizes funding for 9-1-1. We do think it is important at this juncture that the State take into account the future GIS data standards required by the evolution of Next Generation 9-1-1 (NG9-1-1). It is important for the State of Nebraska to understand how close it is to having a complete statewide GIS data set that is accurate and relevant for NG9-1-1. GeoComm would be remiss if we did not point out that the State of Nebraska is currently positioned to be a model for their “nearly ready” NG9-1-1 statewide GIS data set.

The State of Nebraska’s program as it is today has created a standardized, sound GIS data maintenance program that promises to provide the GIS foundation necessary to carry the State forward into NG9-1-1. If the State moves the funding to the individual counties GeoComm is of the strong opinion that the State of Nebraska should ensure that this foundation is, first of all, maintained, and secondly, further standardized to meet the future requirements of NG9-1-1. As such the ensuing comments are designed to address the following item outlined in the document from page 4, II. Eligibility Requirements, A. Prerequisites for PSAP Funding, number 4.

NG9-1-1, as defined by NENA:

NG9-1-1 is the next evolutionary step in the development of the 9-1-1 emergency communications system known as E9-1-1 since the 1970s. NG9-1-1 is a system comprised of managed IP-based networks and elements that augment present-day E9-1-1 features and functions and add new capabilities. NG9-1-1 will eventually replace the present E9-1-1 system. NG9-1-1 is designed to provide access to emergency services from all sources, and to provide multimedia data capabilities for PSAPs and other emergency service organizations.

4. Whether the PSAP must have contracts or personnel in place to ensure that all GIS data is up to date and accurate;



Today, GeoComm provides map and database services to 50 of the 93 counties in the State.. This means that over half of the counties in the State of Nebraska are effectively moving towards having the requisite process in place for NG9-1-1. Further, of the 93 Nebraska counties, 58 counties are using the GeoLynx family of products for 9-1-1 dispatch mapping.

Next Generation 9-1-1 GIS Data

Next Generation 9-1-1 was a new term introduced to the public safety industry shortly after the State went through this 2004 competitive process. It is a term that for several years was ill-defined, but today is becoming better understood with many quantifiable standards and processes for NG9-1-1 now emerging as the National Emergency Number Association (NENA) and the Associated Public Communications Officers Inc. (APCO) work to standardize implementation of NG9-1-1.

What is most critical to the State of Nebraska in response to docket application no. 911-019/PI-118 is the role GIS data plays in a NG9-1-1 system.



In a NG9-1-1 system, GIS data replaces the current E9-1-1 Master Street Address Guide (MSAG) and Emergency Service Number (ESN) tabular databases. Fundamentally, the GIS data is used as the primary routing mechanism for all 9-1-1 calls based on location.

Currently, GIS data for 9-1-1 is used to locate and display the position of a 9-1-1 caller, after the call has been received at a PSAP. With NG9-1-1, caller location is embedded in the Session Initiation Protocol (SIP) call signaling itself before the call enters the 9-1-1 network. With location embedded in the call signaling, NG9-1-1 call routing functions then leverage GIS data to determine where the 9-1-1 call should be routed to next. In other words, identifying which PSAP will receive the call based on geographic location embedded in the call signaling and comparing this location to a GIS map of PSAP service area boundaries.

There are a number of ways the role of the GIS data changes for integration into a NG9-1-1 system. Below we will outline the main role redefinitions of GIS data for NG9-1-1. Each of these changes requires planning and standardization of public safety GIS data.

By 2009, NG9-1-1 includes a new list of acronyms, terms, concepts, and standards for the public safety industry to understand. Additional information on NG9-1-1 can be found at www.nena.org. Specifically the NENA i3 “functional and Interface Standards for NG9-1-1” document (NENA 08-002) provides insight into the direction for the industry.



One: Location Based 9-1-1 Call Routing

Within the NG9-1-1 framework, GIS data will be critical because all calls will be geographically routed through NG9-1-1 networks to PSAPs based on comparing a caller's location (which may be coordinate based (xy) or a civic address) to polygon maps of service area boundaries. The new call routing standards are based on changing network rules using GIS to ensure calls are routed to the appropriate PSAP.

Another purpose of the GIS data is to provide a Uniform Resource Identifier (URI) to route an emergency call to the correct PSAP for the specified caller's location. Currently, while GIS data is helpful in locating the caller once the call is processed and answered by the telecommunicator, in a NG9-1-1 system, it will also route the 9-1-1 call to the correct PSAP - making it one of the most critical elements required to ensure that an accurate, proper emergency response is achieved.

Location-based 9-1-1 call routing depends on two main things: Quality, accurate, NG9-1-1 GIS data created and maintained on a regional or statewide level and appropriate PSAP and other services area boundary layers.

Quality and Accuracy



Clearly, the overall quality and value of GIS data declines as soon as GIS data is no longer maintained. Any lapse in maintenance will result in 9-1-1 accuracy issues today and with NG9-1-1 tomorrow. For the purpose of this document, criteria for continuing GIS data maintenance are critical. We recommend measures be in place to ensure there is no lapse in GIS data maintenance as a means of maintaining quality and accuracy.

In today's E-9-1-1 systems it is not acceptable to have inaccurate ALI telephone records or MSAG databases because they are the primary method of locating 9-1-1 callers. The same standards apply to GIS data in an NG9-1-1 system where the GIS data is used to route the 9-1-1 call to a PSAP based on geography.

Next Generation 9-1-1 increases the need for accurate, locally relevant GIS data. This type of data is not obtainable through commercial nationwide digital data sets available from Tele Atlas, NAVTEQ, and other similar vendors. This data is most typically built

Importance of GIS

1. Calls are routed to the correct PSAP using GIS data
2. GIS data PSAP service boundary layers needed
3. Data accuracy critical to correct and timely call routing and response
4. Additional service area boundaries layers needed
5. GIS provides a URI to route call to correct PSAP
6. GIS data replaces the MSAG



and managed locally by GIS and IT departments within a city or county. Frequently, as in the case in the State of Nebraska, a city or county hires an outside firm such as GeoComm to initially create a GIS and build local level detail base maps including parcels, sub-parcels, building footprints, address points, address ranged street centerlines, emergency service zones, and other types of locally relevant GIS data. After initial data delivery, the city or county may take over data management or may choose to outsource ongoing GIS data management.

Service Area Boundaries

Clearly, GIS data is critical for NG9-1-1 call routing, as it effectively replaces the 9-1-1 MSAG. In addition, the concept of Emergency Service Zones (ESZs) changes greatly in NG9-1-1. In the State of Nebraska, ESZs today are map polygons denoting the footprint of primary law, fire, and medical responder districts. An ESZ is identified by an ESN. However, in NG9-1-1 there are many more service areas possible beyond just law, fire, and medical such as Poison Control, Game and Parks, Railroads, etc.

Today most counties use PSAP boundaries obtained from PSAPs, or commercial data products, for “spatial call routing.” However, NG9-1-1 requires greater levels of GIS data management for operating the overall system. For national, statewide, and regional NG9-1-1 Emergency Services IP Networks (ESInets) – there must first be a seamless map of PSAP boundaries.

Next Generation 9-1-1 roles and responsibilities defined by NENA hold the individual 9-1-1 authorities responsible for GIS data utilized by a NG9-1-1 system. This data will be used for primary call routing and transferring calls to other PSAPs. Similar to how most 9-1-1 authorities today assume the responsibility of ensuring the MSAG and ALI database are accurate, NG9-1-1 establishes the same responsibility for the GIS data. The PSAP service area boundary coverage must be seamless with no overlaps and no unintended gaps. This is often difficult to obtain if individual GIS departments are building their own PSAP service area boundaries, as they may be using different software, coordinate systems, and precisions.

From GeoComm’s experience, problems typically arise today when multiple 9-1-1 authorities submit their GIS service area boundaries to a managed network or telephone service provider. Some of these problems are:

- Boundary overlaps and gaps occur
- Boundaries themselves may be unclear (such as counties bordered by a river)



- Topological completeness may be impossible due to different GIS platforms, coordinate systems, datums, and precisions used by different county and city GIS departments
- Some counties are unable to provide digital data and may only be able to provide paper maps
- Disputes over topological problems are likely (which county must move vertices) and who is responsible for resolving gaps and overlaps

Adding to the complexity, NG9-1-1 requires more than PSAP service area boundaries. Location-to-Services Translation (LoST) servers and Emergency Call Routing Functions (ECRFs) need service areas for responders as well as additional service types such as poison control. These agencies are also unlikely to be able to do this on their own, let alone to create a seamless, gapless statewide coverage map. This creates more problems:

- Services such as law, fire, and medical are authoritative for their service area polygons, but lack capabilities to build this data on their own, so logically it falls back to the 9-1-1 authority acting on their behalf.
- This leads to the same gap/overlap responsibility and resolution problem as described for PSAP boundaries.
- And NG9-1-1 requires more service types than defined by ESN today – potentially including services like Poison Control and Mountain Rescue and many more.

According to the NENA i3 document, “The GIS data that is normally considered local to a specific PSAP must be made available to the diversion PSAP.”

Recommended Action

- Implement a process to ensure that maintenance contracts are in place at the PSAPs and no lapse in maintenance occurs.
- PSAPs maintaining or contracting the maintenance of their 9-1-1 GIS data should be required to provide weekly reports on data accuracy and synchronization to the MSAG and ALI Database.
- Establish criteria for funding that addresses the level of accuracy required and a defined mechanism for meeting that accuracy level.
- Define criteria for resolving PSAP service area boundaries region and statewide and defining other service area boundaries

Two: Data Sharing

After September 11, 2001 various organizations called for interoperable data sharing across jurisdictions and across states. Even with funding made available for this effort, eight years later,



very few, if any, multiple jurisdiction efforts have resulted in a single map that is geographically aligned, follows one data standard, and is truly current.

With the introduction of NG9-1-1, there are new efforts underway to create better data sharing methods explicitly for 9-1-1 call routing. The future will allow PSAPs more options for back up PSAPs than just the closest in proximity. It will be possible to implement Policy-based Routing Functions (PRF) to set up criteria in which calls will be routed to a specified PSAP or even within a PSAP to specific call takers. Some examples are special language requirements, number of calls in queue, general PSAP availability (disaster situation), or based on a preplanned event such as a large festival or event.

Most states have not started the process of creating a statewide 9-1-1 map data set. When they do, and NG9-1-1 will require them to do so, they will spend significant public dollars on the creation of a statewide GIS data set. In addition to the expenses there is the issue of time. NG9-1-1 requires the establishment of uniform GIS data standards to include how this GIS data will be shared, created, owned, maintained, etc. These are all items the State of Nebraska has been actively engaged in for five years since the 2004 RFQ even if that was not the primary objective.



This is where the State of Nebraska is unique. Starting in 2004, when the NPSC went out for RFQ to identify a limited number of vendors and created one data standard for GIS specific for 9-1-1, the state indirectly started creating a statewide GIS data set for NG9-1-1. This is monumental. Not only was the GIS data for State of Nebraska counties created with 9-1-1 standards, it is maintained to those 9-1-1 standards.

Data Sharing and Integration

Another item of consideration is the method, timeliness, and geographic compliancy for integrating the data sets. At some point in the future, this data will be required for primary 9-1-1 call routing. This will require integration into one large statewide data set. It will be necessary for the counties GIS data to align geographically for accurate call routing. One county's boundaries will be required to align appropriately to the next county's boundaries with no gaps or overlaps.

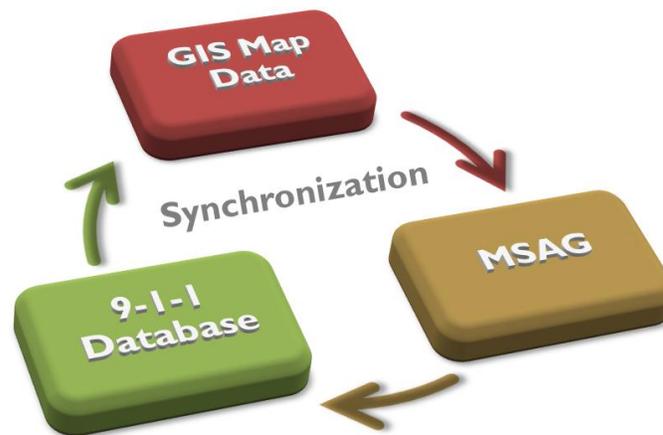
Recommended Action

- Establish statewide standards for the process, timeliness, and geographic compliancy as a means of integrating GIS data sets across jurisdictional boundaries.
- Consider using a GIS services bureau for aggregating and distributing up-to-date, accurate, NG9-1-1 ready GIS data.



Three: MSAG Eliminated

As defined by the emerging NENA NG9-1-1 standards, the classic MSAG will be replaced by a combination of the ECRF and the LVF (Location Validation Function).” What today we know as the MSAG will, in the future, be made up of GIS data. The MSAG will no longer be a simple tabular database. The GIS data will become the MSAG as a geographical representation of the street and address information. Each map data feature will have data associated with it that will aid in the routing and response of a call. Similarly, ESN\ESZ is no longer used, and service area boundaries are disaggregated from the currently combined law\fire\medical zones, to individual service area boundaries.



In 2000, GeoComm foresaw the eventual evolution of GIS data to replace the MSAG while working on a project for St. Clair County, Illinois. Subsequently, GeoComm has been developing and maintaining GIS data for the State of Nebraska that is synchronized to the 9-1-1 ALI database and MSAG. The GIS data should be a geographical representation of the MSAG. This was a quality control standard that GeoComm implemented well before NG9-1-1 existed. It made sense to simulate a 9-1-1 call during the GIS data development process, well in advance of an emergency, to ensure the highest level of accuracy possible. This process results in GIS data sets that are built to spatially represent the MSAG.

Recommended Action

- PSAPs maintaining or contracting the maintenance of their 9-1-1 GIS data should be required to provide weekly reports on data accuracy and synchronization to the MSAG and ALI Database.

Four: Civic Addresses Need Coordinates for Routing

The location information with some calls will be civic address and not coordinate (xy) based. For these calls to route in a NG9-1-1 system, they must be resolved into a geometry that can be intersected with service area boundaries for the requested service. Common mechanisms to do this address geometry resolution include utilizing a GPS point address layer, parcel\sub parcels layers, or address ranged street centerline GIS layers. It is anticipated that the most commonly



used GIS data set to perform this work initially will be the Road Centerline Layer (RCL). This will require the creation of a statewide road centerline layer that is seamless and gapless for facilitating NG9-1-1 call routing for calls presented with civic address locations.

In many cases the location contained in the NG9-1-1 system will still be the civic address (for example, “23123 400TH ST, Albany, NY”). Civic addresses are most common for wireline telephones as well as self reported addresses for VoIP telephone service subscribers. In these cases, the GIS system must be capable of converting civic addresses into geographic coordinates that can be intersected with service area polygons to determine proper routing. Several types of GIS data are required to perform such conversions:

- Address point data – a map layer of points (such as collected GPS points) attributed with address information for all locatable structures in a jurisdiction may be used to convert civic addresses into XY coordinates that can be used for point-in-polygon query against service area polygons to determine call routing.
- Parcel / sub-parcel polygons – a map layer of polygons such as parcels from a jurisdiction’s cadastral GIS, attributed with address information, may be used to convert civic addresses into polygon geometries that a LoST server can intersect with service area polygons to determine call routing.
- Road Centerline Layers (RCL) – a map layer of road centerlines containing street segments attributed with low and high address ranges and street names may be used to “geocode” civic addresses into coordinates that can be used for point-in-polygon query against service area polygons to determine call routing.
- Community Boundaries – the GIS data must also contain community boundary data in order to refine civic-to-geometry conversions, because addresses such as “100 MAIN ST” may occur in many different locations within a single jurisdiction. Community boundary information may be embedded in the above GIS data types, or may exist as a separate GIS layer itself.

It is critical to have a statewide standard for NG9-1-1 purposes. It would be detrimental to effective public safety to allow the GIS data in each jurisdiction to vary from a mutual standard. GIS has many purposes in state and local government, i.e. assessor department, highway department, environmental purposes, public works, election departments, etc. While all these are important, they all require various data needs. Because of the importance of the GIS data in NG9-1-1, it is no longer acceptable to use data that is not specific to 9-1-1 or is not 100 percent accurate. The State of Nebraska is well on the path to achieving a statewide GIS data set that is specific to 9-1-1 and is 100 percent accurate.

Statewide GIS Data Standards Continuously Monitored and Modified



We recommend the state implement procedures or criteria to ensure that GIS state standards are met and the standards are current with the changing GIS technology and NG9-1-1 requirements. Everyone needs to understand



these are continually-changing targets and the standards must continually match. Today, the State's 9-1-1 GIS data standards need to be analyzed, formalized, and should continue to be evaluated on a regular basis indefinitely.

Recommended Action

- Evaluate current State 9-1-1 GIS Data Standards documentation for GIS technology and 9-1-1 industry changes specifically with Next Generation 9-1-1 GIS data requirements.
- Statewide accuracy standards must be defined.

Summary

Implementing and maintaining a regional or statewide GIS data fabric for NG9-1-1 presents new challenges, requirements, and opportunities for local, regional, and statewide GIS data planning and management. The impending critical role played by accurate GIS data in the proper routing of 9-1-1 calls to the correct PSAP is central to the theme outlined in this document. In addition, the same GIS database that is used to route a call to the correct PSAP may also be used to subsequently route the 9-1-1 call to the correct responder agency.

Initial call routing in an NG9-1-1 system requires service area boundary maps for PSAPs. Service area boundaries for other types of services (such as poison control) can also be used by PSAPs for selectively transferring calls after they have been initially answered.

NG9-1-1 call routing is based on standards for geospatial routing mechanisms, so all PSAPs can utilize the same underlying GIS data for initial call routing, as well as selective transfers. This will be best implemented if states have a statewide seamless, gapless, geospatial data fabric encompassing the entire state for PSAP boundaries, law, fire, and medical boundaries, and additional service type boundaries, as well as statewide GIS data for resolving civic addresses to geometry.

The above outlined new or redefined uses for GIS data which illustrates the need for standardized NG9-1-1 GIS data across a geographical area: a region or state. These standards should be put in place to ensure all data requirements are met for implementation across a NG9-1-1 system.



The State of Nebraska needs to ensure that if it moves the funding back to the individual counties it retains the NG9-1-1 GIS maintenance initiative that has already been begun.



It is important to give careful consideration to these issues prior to restructuring the state's funding processes or criteria as they promise to fundamentally affect the future of 9-1-1 services provided in the State of Nebraska. No matter the funding method chosen, we recommend procedures be implemented to ensure the State of Nebraska continues to maintain a standardized, accurate, GIS data set throughout the state to allow for the subsequent evolution into NG9-1-1.

Recommended Actions Summarized

- Evaluate current State 9-1-1 GIS Data Standards as they support the eventual migration to Next Generation 9-1-1 systems.
- Establish statewide GIS data accuracy standards as it relates specifically to NG9-1-1.
- Establish statewide standards for the process, timeliness, and geographic compliancy as a means of integrating GIS data sets across jurisdictional boundaries.
- Establish funding criteria that considers the level of GIS accuracy required by NG9-1-1 and define a mechanism for meeting that accuracy level.
- Implement a process to ensure that GIS data maintenance contracts are in place at the PSAPs and that there is no lapse in data maintenance.
- Define criteria for resolving PSAP service area boundaries on a region and statewide basis and define other service area boundaries as appropriate.
- Require PSAPs maintaining or contracting the maintenance of their 9-1-1 GIS data to provide regular, frequent reports on data accuracy and synchronization of the GIS data to the 9-1-1 MSAG and ALI Database.
- Consider using a GIS services bureau for the aggregation and distribution of up-to-date, accurate, NG9-1-1 ready GIS data

