

FY16

PSAP GRANT PROGRAM APPLICATION



**Fairfax County and Northern
Virginia PSAPs
Spatial Information Function (SIF)
Proof of Concept**

VIRGINIA INFORMATION
TECHNOLOGIES AGENCY
Integrated Services Division



Table of Contents

<u>Section</u>	<u>Page</u>
FY16 Application for NoVa SIF Proof of Concept.....	3
Memorandum of Understanding (MOU).....	15
Vendor Proposal in Support of Grant.....	16
White Paper – Role of a SIF in NG9-1-1.....	34



FY16 PSAP GRANT APPLICATION

PROJECT TITLE

**Fairfax County and Northern Virginia PSAPs
Spatial Information Function (SIF) Proof of Concept**

GRANT APPLICANT PROFILE/PROJECT CONTACT

PSAP/HOST PSAP NAME: Fairfax County
CONTACT TITLE: Fairfax County 9-1-1 System Administrator
CONTACT FIRST NAME: Steve
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ADDRESS 1: 4890 Alliance Drive
ADDRESS 2: Fairfax County Department of Public Safety Communications
CITY: Fairfax
ZIP CODE: 20124
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CONTACT PHONE NUMBER: 571-350-1779
CONTACT MOBILE NUMBER: 571-385-6144
CONTACT FAX NUMBER: 571-350-1669
REGIONAL COORDINATOR: Brian Crumpler

HOST PSAP AND PARTICIPATING PSAPS/LOCALITIES

Host – Fairfax County	City of Alexandria
Arlington County	Loudoun County
Prince William County	Stafford County



GRANT TYPE

- Individual PSAP
- Regional Initiative
- Secondary Consolidation
- Shared Services
- Consolidation
-

GRANT PROGRAM TYPE

- Continuity and Consolidation
- Enhancement

TIER

- Out of Service
- Technically Outdated*
- Not Applicable
- Non-Vendor Supported*
- Strengthen

If technically outdated or non-vendor supported, application MUST include age and/or version of hardware/software.

VERSION: _____ # YEARS of HARDWARE/SOFTWARE: _____

n/a

PRIORITY/PROJECT FOCUS GIS: HIGH PRIORITY

If "Other" selected, please specify: [Click here to enter text](#)

FINANCIAL DATA

Amount Requested: \$ 500,000

Total Project Cost: \$ 500,000



STATEMENT OF NEED

This statement should reference the relationship to the current funding priorities established by the Grant Committee and include evidence of any financial need, along with additional information on the impact on operational services; consequences of not receiving funding; inclusion of project in a long-term or a strategic plan; and local sustainability:

Knowing that the existing Verizon Selective Router Network for the legacy 9-1-1 system is nearing obsolescence, and that data preparation is a key element of transitioning to NG9-1-1, the Northern Virginia PSAPs desire to prepare the GIS datasets that are necessary to transition from the tabular MSAG and ALI database to the data that is needed to populate the Emergency Call Routing Function (ECRF) and Location Validation Function (LVF) of the NENA i3 architecture. The goal of this SIF project is to develop a regional GIS dataset for Northern Virginia that is suitable for provisioning into a live NG9-1-1 ECRF/ LVF system residing on the ESInet.

The regional GIS dataset and workflows developed in this project will constitute a useful training model that can easily be replicated by other jurisdictions throughout Virginia as the Commonwealth transitions to NG9-1-1. There is not a budget in place for the data preparation and workflow review tasks each jurisdiction must undertake to prepare and scrub their existing MSAG data for provisioning into an NG9-1-1 system. In fact, the GIS community is only just becoming familiar with the central role GIS data plays in NG9-1-1. Without this project the NOVA PSAPs will face a critical shortfall in funding for the technical assistance in getting GIS data coalesced that is needed to prepare the region for a transition for NG9-1-1.

This vital SIF process is a common task that multiple regions across the State will need to take to populate the most central GIS 9-1-1 application functions (ECRF/LVF) that will reside on the eventual ESInet. This project (and its ability to provide lessons for other state regions) can be seen as an immediate parallel implementation activity for the State in its transition to NG9-1-1 while the ESInet is being implemented and the SIF provides a fully complementary part of an overall short and long term strategy for a unified NG9-1-1 vision. With this project implemented the Northern Virginia PSAPs can begin to make plans to sustain the efforts in their own budgetary processes over the longer term.

A white paper describing the role of a SIF is attached to this application for additional background information.



Describe how the grant will be maintained and supported in the future, if applicable.

The intent of the SIF Proof of Concept grant is to allow the individual jurisdictions to learn what the new requirements are for utilizing GIS data in NG9-1-1 and with assistance from experts in the NG9-1-1 GIS field to identify how to structure new workflows and add to or tailor GIS procedures which will maximize the use of existing GIS datasets for NG9-1-1 activities. The grant provides assistance over a period of one year which should provide sufficient time for each jurisdiction to become familiar with the new processes and also to allow each jurisdiction to plan what their resource requirements will be for these new functions. This will also allow each to request budgetary resources from their individual jurisdictions allowing the new workflows and data manipulation requirements that are a part of the GIS component of NG9-1-1 to be supported at a local level within each jurisdiction's budget.



COMPREHENSIVE PROJECT DESCRIPTION

Provide a thorough, concise, and complete description of the project, including an outline of the goals and objectives, implementation strategy, and a work plan.

This project provides the Fairfax County Department of Public Safety Communications (Fairfax County) and other Northern Virginia (NoVA) Public Safety Answering Points (PSAPs) with a proof of concept project involving software and professional services which together fulfill the National Emergency Number Association (NENA) i3 Spatial Information Function (SIF) element operating on a Next Generation 9-1-1 (NG9-1-1) ESInet. The goal of this pilot project is to assist with the long term planning of a viable Geographic Information Systems (GIS) solution tailored to meet the GIS demands of NG9-1-1. Specific jurisdictions involved in this pilot project include: Stafford County, Arlington County, the City of Alexandria, Fairfax County, Loudoun County, and Prince William County.

This proposed solution (a complete project proposal is attached to this application) includes developing a single GIS dataset for the NoVA region using the locally authoritative GIS datasets from each participating agency. The goal is to prepare a regional 9-1-1 GIS data set that can be used in NG9-1-1 call routing and location validation systems. The solution also includes incorporation of new GIS data changes from the authoritative sources into the regional GIS dataset as part of ongoing NG9-1-1 GIS Managed Services provided by GeoComm for a period of one year. The following products and services will be implemented and executed in order to ensure the region has the most accurate, up-to-date GIS data for use for its future NG9-1-1 system:

1. **Data Management Roles and Responsibilities:** Define new GIS data management roles and responsibilities for GIS staff at the local and regional level. Identify mechanisms and workflows for initial and on-going Extract Transform Load (ETL) routines for acquiring GIS data updates from local sources, incorporating them into the regional GIS dataset, and ultimately provisioning them into the ECRF/LVF.
2. **GIS Data Model Development Services:** An authoritative regional GIS model will be developed dictating the specific GIS layers and attributes required for use within the NG9-1-1 project
3. **QA/QC Plan and Gap Analysis:** A formal Quality Assurance and Quality Control (QA/QC) plan will be developed to document the overall approach to quality control.
4. **Coalesce the various GIS datasets into a combined regional GIS dataset:** Containing the following layers: Road Centerlines, Site/Structure Points, Emergency Services Boundaries (PSAPs, law, fire), Administrative boundaries (city, state, etc.)
5. **Upload the data to a GIS Web Portal:** For the Proof of Concept utilize a subscription based server access to a GeoComm GeoLynx GIS Web Portal to upload jurisdiction GIS data directly through the portal to include into the coalesced dataset. For the balance of the Proof of Concept period (one year) submit ongoing GIS data updates through the portal to the regional GIS dataset to solidify and tailor anticipated workflow processes for NG9-1-1.



FOR CONTINUITY AND CONSOLIDATION OR ENHANCEMENT PROJECTS:

PROJECT TIMELINE – Select each applicable phase of the project and indicate the estimated completion date. Sample activities for each phase can be found in the PSAP Grant Program Guidelines as well as on the addendum to this form.

PROJECT PHASE	ESTIMATED COMPLETION DATE
<input checked="" type="checkbox"/> INITIATION (Project approved by appropriate stakeholders and kick-off meetings conducted during first)	8 / 01 / 15
<input checked="" type="checkbox"/> DESIGN/PLANNING (GIS system design including schema design and field mappings conducted)	11 / 01 / 15
<input checked="" type="checkbox"/> ACQUISITION (System configurations loaded and GIS servers established)	12 / 01 / 15
<input checked="" type="checkbox"/> IMPLEMENTATION (Data acquisition from each jurisdiction and first combined data set completed and first reports delivered)	1 / 31 / 16
<input checked="" type="checkbox"/> TESTING/COMPLETION (Proof of Concept is live with GIS updates and reports made on routine basis through end of July 2016)	7 / 31 / 16



Identify the longevity or sustainability of the project.

This is a very sustainable project as the GIS data analyzed and coalesced during the Proof of Concept project can continue to be maintained as a starting point for loading into whatever system is eventually selected for use as the Emergency Call Routing Function (ECRF) for the Northern Virginia PSAPs. The workflows and data analysis performed will be reusable on a going forward basis to support the instantiation of an ECRF onto a Regional or state-wide ESInet.

Describe how this project supports the Virginia Statewide Comprehensive 9-1-1 Plan.

This project supports the Virginia Statewide Comprehensive 9-1-1 Plan in that the Statewide Plan envisions NG9-1-1 Core Components including regional ESInets and Applications as central pieces of Virginia's NG9-1-1 system vision. The SIF Proof of Concept proposed with this grant is a proven approach for preparing for the implementation of the ECRF which is the central application of a NG9-1-1 system. The approach outlined in this grant application and the attached proposal is an approach that has been successfully used in other PSAPs (such as North Central Texas Council of Governments (NCTCOG)).

Utilizing this project approach will establish a firm and repeatable model for VITA to use throughout the state in other regions as the transition from the legacy Selective Router network moves onto the work the State is doing for the Virginia ESInet solution. This project complements the work the State is doing in laying the foundation for a statewide ESInet as it provides a solid preparatory step for implementing the ECRF on the new ESInet. Implementing this project will help to strengthen the coordination between GIS coordinators within various regions in NOVA and establishes the value of collaborative GIS efforts in support of the Virginia Statewide Comprehensive 9-1-1 plan.



SHARED SERVICES/REGIONAL INITIATIVE (if applicable)

The relationship of the initiative to the participating PSAPs:

Each of the Northern Virginia PSAPs participating in this effort (Fairfax, Arlington, Alexandria, Prince William, Loudoun and Stafford) will eventually be transitioning to a NG9-1-1 i3 call routing solution (a geo-spatial router called the ECRF in NENA terminology) that will likely be a regionally based solution. The regional solution will replace the existing Verizon Selective Router (SR) database and SR network that is based on the Master Street Address Guide (MSAG) data and ALI databases provisioned by Verizon through its subcontracts with 3rd party providers. So each of the participating jurisdictions has a direct interest in this project initiative to make sure that their “new” routing database, the ECRF, has the appropriate GIS boundaries and address points properly identified so that 9-1-1 calls are routed to the correct PSAP in NG9-1-1.

Intended collaborative efforts:

This project initiative is a collaborative GIS effort to build upon existing GIS initiatives previously undertaken in the regions (the Road Centerline project as one example). The intent is to work as a region and to leverage previous regional and state efforts and associated data into a regional GIS dataset that maximizes the existing data schemas in use by the regions and incorporates the essential elements or layers that will be needed to serve as the 9-1-1 Call routing database application. The work effort will require frequent collaboration among all the jurisdictions to discuss GIS related issues as the regional model is developed and refined for NG9-1-1.

Resource sharing:

The proposed effort will share GeoComm provided consultative resources and GeoComm software solutions on a subscription basis to allow the GIS data to be manipulated by each jurisdiction and to allow each jurisdiction to run reports and see the progress of moving the source data into a coalesced GIS data set for NG9-1-1.



How does the initiative impacts the operational or strategic plans of the participating agencies:

This SIF Proof of Concept dovetails with other strategic plans for the involved jurisdictions but does not duplicate any effort the jurisdictions are undertaking in their migration plans to implement NG9-1-1. The effort is seen as a comprehensive way to educate the and involve the GIS departments in each jurisdiction as to their new key role in supporting NG9-1-1 call routing under a geo-spatial routing concept as defined in the NENA i3 architecture.

CONSOLIDATION (Primary or Secondary) - (if applicable)

How would a consolidation take place and provide improved service:

n/a

How should it be organized and staffed:

n/a



What services should it perform:

n/a

How should policies be made and changed:

n/a

How should it be funded:

n/a

What communication changes or improvements should be made in order to better support operations:

n/a



BUDGET AND BUDGET NARRATIVE

List the planned expenditures to be made with grant funds. (**NOTE: In lieu of a line item breakdown, an itemized cost schedule or detailed vendor prepared quote may be submitted as an attachment. However, budgetary quotes received from a particular vendor(s) during the application process do not commit the PSAP to use that vendor(s) once the grant is awarded.**) Briefly explain the reason for each requested budget item and provide the basis for its cost. In addition, if contingency cost has been added, please identify the amount.

Pricing

Description		Price/Unit	Total Price
Upfront Software and Service Fees			\$291,233
Monthly Recurring Software and Service Fees	12	\$17,385	\$208,620
GIS Services Total:			\$499,853



EVALUATION

How will the project be evaluated and measured for achievement and success:

The project will be evaluated as a success when each jurisdiction's source authoritative GIS data has been extracted, had quality control reviews performed against it, and each jurisdiction's datasets are able to be routinely normalized into a common GIS data model and geodetic system used for the Proof of Concept effort. Having accomplished the ability to upload source GIS data into the form that is ready for uploading into the eventual ECRF will validate that the Proof of Concept has been a success and lays the foundation for making the next steps of utilizing the data in whatever ECRF/LVF system and ESInet is deployed in the region.



Fairfax County and Northern Virginia PSAPs Memorandum of Understanding on a VITA Grant submission for FY 2016

The Fairfax County Department of Public Safety Communications and certain of the other Northern Virginia Public Safety Answering Points (PSAPs), to include the PSAPs of Arlington County, City Of Alexandria, Loudoun County, Prince William County, and Stafford County (the NOVA PSAPs) agree that, for the benefit of taking preparatory actions towards Next Generation 9-1-1 (NG9-1-1), the NOVA PSAPs will collaborate in a shared services grant application and, if awarded, subsequent project effort for the implementation of a Spatial Information Function (SIF) Proof of Concept (POC) (the SIF POC) for the Northern Virginia Region. This Memorandum of Understanding (MOU) establishes the agreement for the NOVA PSAPs to jointly submit an FY 2016 grant application to the Virginia Information Technology Agency (VITA) and within that application and associated vendor proposal are outlined the goals, objectives and approaches to guide the SIF POC should the grant be awarded to the NOVA PSAPs by the VITA Board of Directors.

RECITALS

- A. The Fairfax County Department of Public Safety Communications (DPSC) will serve as the Host PSAP for the purposes of the grant, and the grant award, should VITA decide to approve the grant application, will provide the necessary funding for the Proof of Concept project as outlined in the application. The grant application and vendor proposal associated with the grant submission outline the collaborative efforts involving each of the NOVA PSAPs during the period of the grant.

THE PARTIES TO THIS UNDERSTANDING ARE MUTUALLY AGREED TO THE ABOVE AND CONCUR IN THE SUBMISSION OF THE FY 2016 VITA SIF POC GRANT APPLICATION:

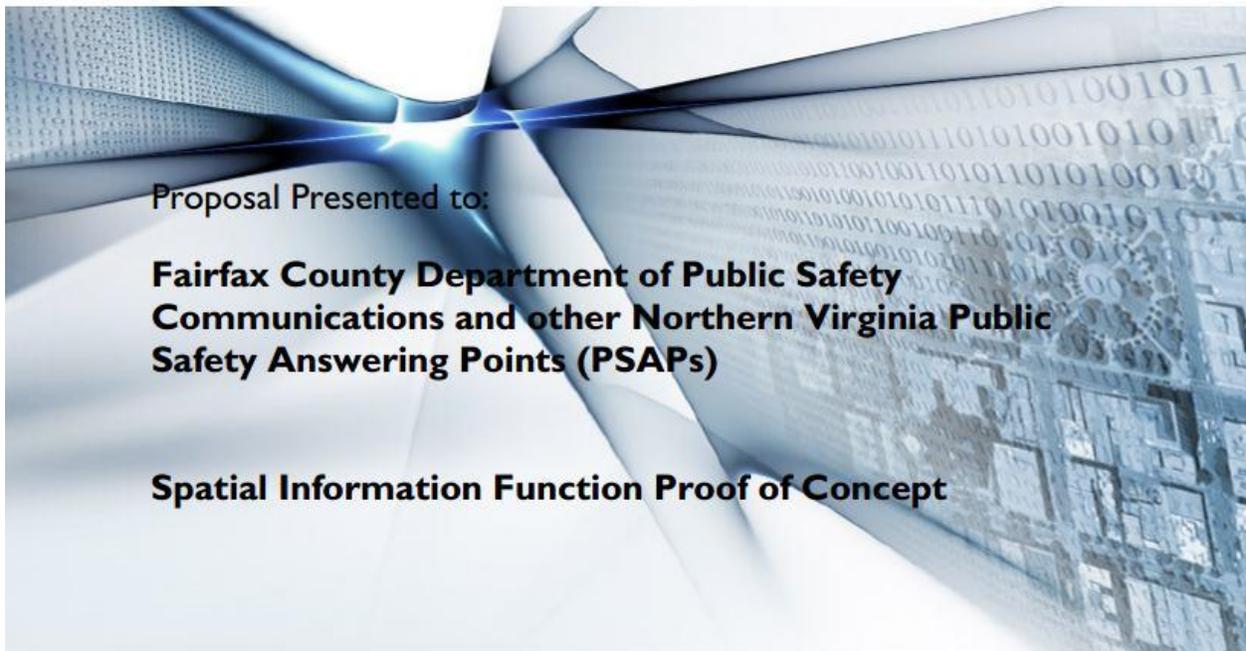
- | | |
|---|--|
| 1. <u>Steve Souder</u> <u>9/29/14</u>
Steve Souder, Director
Fairfax County
Department of Public Safety Communications | 2. <u>[Signature]</u> <u>9/22/14</u>
Adrienne Quigley, Deputy Director
Arlington County
Office of Emergency Management
Emergency Communications Division |
| 3. <u>Jo-Anne Munroe</u> <u>9/23/14</u>
Jo-Anne Munroe, Director
City of Alexandria
Department of Emergency Communications | 4. <u>Wendy Wickens</u> <u>9/22/14</u>
Wendy Wickens, Director
Loudoun County
Department of Information Technology |
| 5. <u>[Signature]</u> <u>9/22/14</u>
W. Keith Brower, Chief
Loudoun County
Loudoun County Fire and Rescue | 6. <u>[Signature]</u> <u>9/22/14</u>
Captain Heidi Braun, Director
Prince William County
Public Safety Communications Center |
| 7. <u>Carol W. Adams</u> <u>9/29/2014</u>
Carol Adams, Director
Stafford County
Division of Emergency Communications | |

This Memorandum shall take effect upon its signing by the authorized representative of each party.



GeoComm

"When seconds matter, we help save lives and protect property by providing essential, innovative location-based solutions to public safety professionals."



Proposal Presented to:

**Fairfax County Department of Public Safety
Communications and other Northern Virginia Public
Safety Answering Points (PSAPs)**

Spatial Information Function Proof of Concept

August 29, 2014

Uniting Public Safety GIS and Communications
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Fairfax County, Virginia and the NoVA PSAPs
Spatial Information Function Proof of Concept

Contents

Section 1:	Executive Summary	1
Section 2:	Scope of Work	3
	Phase One: On-Site Project Initiation Meeting.....	3
	Phase Two: GIS Consulting Services.....	3
	Phase Three: GIS Data Gap Analysis	6
	Phase Four: NG9-1-1 GIS Data Aggregation and Initial GIS Data Load.....	6
	Phase Five: Ongoing NG9-1-1 GIS Managed Services	8
	Phase Six: Pilot Project Summary Report.....	12
Section 3:	Responsibilities and Deliverables	14
	Customer Involvement and Responsibilities	14
	GeoComm Deliverables	15
Section 4:	Pricing	16



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www.geo-comm.com

August 29, 2014



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Executive Summary

Geo-Comm, Inc. (GeoComm) proposes to provide Fairfax County Department of Public Safety Communications (Fairfax County) and Northern Virginia (NoVA) Public Safety Answering Points (PSAPs) with a proof of concept project involving software and professional services which together fulfill the National Emergency Number Association (NENA) i3 Spatial Information Function (SIF) element for a Next Generation 9-1-1 (NG9-1-1) ESInet. The goal of this pilot project is to assist with the long term planning of a viable Geographic Information Systems (GIS) solution tailored to meet the GIS demands of NG9-1-1. Specific jurisdictions involved in this pilot project include: Stafford County, Arlington County, the City of Alexandria, Fairfax County, Loudoun County, and Prince William County.

GeoComm's proposed solution includes developing a single GIS dataset for the NoVA region using the locally authoritative datasets from each participating agency. The goal is to prepare a regional 9-1-1 GIS data set that can be used in NG9-1-1 call routing and location validation systems. The solution also includes incorporation of new GIS data changes from the authoritative sources into the regional GIS dataset as part of ongoing NG9-1-1 GIS Managed Services provided by GeoComm for a period of one year. The following products and services will be implemented and executed in order to ensure the region has the most accurate, up-to-date GIS data for use for its future NG9-1-1 system:

- GIS Consulting Services:** GeoComm's GIS Consultants will work with NoVA to develop a strategy for ensuring timely and accurate local input of GIS data updates into the NG9-1-1 system. As part of this process, GIS Consultants will identify new GIS data management roles and responsibilities for GIS staff at the local and regional level. Consultants will also identify mechanisms and workflows for initial and on-going Extract Transform Load (ETL) routines for acquiring GIS data updates from local sources, incorporating them into the regional GIS dataset, and ultimately provisioning them into the Emergency Call Routing Function/Location Validation Function (ECRF/LVF) system.
- GIS Data Model Development Services:** An authoritative regional GIS model will be developed dictating the specific GIS layers and attributes required for use within the NG9-1-1 project, based on anticipated ECRF/LVF system requirements, current NENA standards, and other relevant requirements.
- QA/QC Plan Development Services:** A formal Quality Assurance and Quality Control (QA/QC) plan will be developed to document the overall approach to quality control, including regular communication of QC results to local GIS entities. Details for specific GeoComm quality control processes will also be developed.
- GIS Data Gap Analysis:** Locally-maintained GIS data will be analyzed to assess its suitability for use within a future NG9-1-1 system. Missing, incomplete, and inaccurate data will be identified and reported to source 9-1-1 entities for remediation.
- GIS Data Aggregation:** GeoComm will implement automated procedures to assimilate the various diverse GIS datasets provided by participating agencies into a combined regional GIS dataset containing the following layers:
 - Road Centerlines



- Site/Structure Points
- Emergency Services Boundaries such as PSAP, law, fire, medical, etc.
- Administrative Boundaries including municipal, county, and state boundaries
- GeoLynx Server GIS Web Portal:** GeoComm will provide subscription based access to the GeoLynx Server GIS Web Portal, which serves multiple purposes:
 - Prior to the regional GIS dataset being aggregated, source 9-1-1 entities may upload their GIS data directly through the portal to include in the dataset
 - A means for submitting ongoing GIS data updates to be made to the regional GIS dataset after the dataset has been created
 - An error reporting mechanism which provides error reports to source 9-1-1 entities in PDF files and GIS data files which can be opened in any GIS system
- GeoLynx DMS Discrepancy Viewer:** GeoComm offers a viewer tool which gives local entities using Esri ArcGIS for Desktop software a means for interacting with GIS error reports directly inside the desktop GIS system commonly used by local authorities.
- Ongoing NG9-1-1 GIS Managed Services:** Based on the agreed upon workflows, GeoComm's 9-1-1 GIS Services Bureau will complete on-going GIS data normalization and QA/QC services. These services will be provided on a weekly basis, for a period of one year, and shall include:
 - Processing updates submitted via Esri geodatabase replication or the GeoLynx Server Web Portal
 - Performing extensive quality control and assurance
 - Coalescing GIS map data from participating local authorities into the regional GIS dataset
 - Sending GIS error reports back to local authorities (as needed) and following up to ensure errors and discrepancies are being corrected in a timely manner.

The goal of the project would include having a regional GIS dataset developed and maintained throughout this project that will eventually be suitable for provisioning into live NG9-1-1 ECRF/ LVF systems. The regional GIS dataset and workflows developed will constitute a model that can easily be replicated by other jurisdictions throughout Virginia as the Commonwealth transitions to NG9-1-1. GeoComm's GIS services are aligned to the most current industry and NENA standards. As standards and recommendations are published by NENA, GeoComm will work with the NoVA region to implement these standards and provide recommendations.



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Scope of Work

GeoComm will implement and manage a proof of concept SIF solution for Fairfax County and the NoVA PSAPs designed to meet the rigorous demands of NG9-1-1. The proposed pilot SIF project will be completed in the following phases to ensure timely results:

- Phase One: On-Site Project Initiation Meeting
- Phase Two: GIS Consulting Services
- Phase Three: GIS Data Gap Analysis
- Phase Four: NG9-1-1 GIS Data Aggregation and Initial GIS Data Load
- Phase Five: Ongoing NG9-1-1 GIS Managed Services
- Phase Six: Pilot Project Summary Report

Phase One: On-Site Project Initiation Meeting

GeoComm will schedule a project initiation meeting with Fairfax County and the NoVA PSAPs to present our specific approach to the project and the anticipated project schedule. GeoComm expects Fairfax County would involve all key project stakeholders. The initiation meeting will be held onsite and will include:

- Introductions: participating stakeholders and GeoComm staff
- Reviewing project objectives and goals
- Defining mutual expectations
- Establishing communication processes
- Reviewing the project timeline, including frequency of periodic progress reporting

GeoComm assumes these on-site meetings will be held at a centrally located meeting space for all stakeholders.

Phase Two: GIS Consulting Services

Maintenance Workflow Development and Presentation

GeoComm's GIS Consultants will work with Fairfax County and the NoVA PSAPs to develop a strategy for ensuring timely and accurate local input of address information and other changes into the authoritative regional GIS dataset. As part of this process, GIS Consultants will assist with identifying new NG9-1-1 GIS data management roles and responsibilities for GIS staff within the region. Consultants will also identify mechanisms and workflows for initial and on-going ETL of GIS data updates from local sources into the authoritative regional GIS dataset.



Immediately following the on-site project initiation meeting, GeoComm will hold an on-site ETL and GIS data management collaboration meeting. During this meeting, our GIS Consultants will work with project stakeholders to identify all GIS data sources for the system, as well as to identify key roles in the NG9-1-1 GIS data workflow process. Discussions will also take place centered around:

- Existing workflows for moving GIS data out of local GIS systems into the authoritative regional GIS dataset
- GIS data quality expectations and data remediation requirements
- Developing mechanisms for working toward a true seamless, gapless regional dataset through guidelines and standard operating procedures for local jurisdictions maintaining the source GIS data

Based on the information collected during the on-site ETL and GIS Data Management Collaboration meeting, GeoComm will conduct an initial GIS workflow analysis. For this analysis, our GIS Consultants will document local GIS data sources as well as specific roles and responsibilities in the GIS data exchange process. Existing workflows will be reviewed and workflow modifications will be identified in order to incorporate the software and services included with GeoComm's solution.

After the review, GeoComm will develop and provide a preliminary copy of the enhanced and new maintenance workflow diagrams. The recommended NG9-1-1 GIS workflows will cover roles, responsibilities, and activities including:

- Local authoritative GIS data update incorporation, including reviewing, tracking, and management by source 9-1-1 entities
- Review, editing, and management of addressing information from other authoritative sources by source 9-1-1 entities
- Provisioning GIS updates into the regional GIS dataset
- Workflow for handling QA/QC error reports, and resulting re-provisioning
- Identify potential mechanisms for propagating GIS changes to the future ECRF/LVF servers

After project stakeholders have had sufficient time to review the preliminary documentation, GeoComm's GIS Consultant will travel on-site for a working session. The on-site meeting will be scheduled to occur during a consecutive two-day period. This will be followed by up to two additional conference calls which may be working web sessions as needed to discuss and adjust the preliminary maintenance workflow diagrams. The final maintenance workflows will be distributed and discussed during an on-site meeting with stakeholders involved in the overall GIS data editing data management and submission.

During this same on-site meeting, the GIS Consultants will also provide a train-the-trainer session focusing on how to incorporate GeoComm's GIS Web Portal tools into the newly developed maintenance workflows. Training curriculum includes:

- Core GeoLynx Server tool functionality



- GIS data request management
- Uploading GIS data for incorporation into the regional dataset
- Downloading GIS data from the GIS Portal
- GeoLynx DMS Discrepancy Viewer functionality
- Accessing QA/QC Reports via GIS Portal or GeoLynx DMS Discrepancy Viewer
- Managing QA/QC Exceptions

As part of the train-the-trainer session, GeoComm will provide training content and materials which will allow trainers at the regional-level to train other system users. During the session, support materials such as agendas, training formats, and scheduling will be reviewed. Training will occur during a consecutive two-day period in conjunction with the workflow presentation.

QA/QC Plan Development

Before GIS data can be used for routing 9-1-1 calls and validating civic locations in the region's future NG9-1-1 system, its accuracy and integrity must be validated through a series of data-specific, thorough QA/QC procedures. Without proper QA/QC, GIS data issues could interfere with NG9-1-1 emergency response operations. Issues could potentially include: valid 9-1-1 addresses not matching the GIS data, calls not plotting in your tactical dispatch mapping system, and emergency calls routing to the incorrect PSAP.

GeoComm's GIS Consultants will collaborate with Fairfax County and the NoVA PSAPs to develop a formal QA/QC plan. The overall approach to quality control, including regular communication of QA/QC results to local GIS entities, will be documented. The plan will also detail initial and on-going quality control processes which will be performed on local GIS data submitted to GeoComm.

The final QA/QC Plan will be submitted to Fairfax County and the NoVA PSAPs for review and approval prior to initiating any managed GIS services.

GIS Data Model Development

GeoComm's GIS Consultants will also work with Fairfax County and the NoVA PSAPs to define an authoritative GIS data model which will serve as the foundation for the regional GIS dataset. The data model will clearly outline the feature datasets, feature classes, and domains specific to the needs of the NG9-1-1 project. GeoComm will work closely with project stakeholders to review resources which will influence the final design of the data model.

Resources and workflows to consider include:

- NENA and industry standard ECRF/LVF system requirements
- Current NENA standards

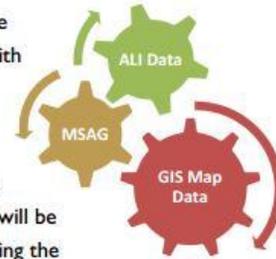


- Federal Geographic Data Committee (FGDC) standards
- Other end-user software data requirements
- Unique ID's for change tracking and management of exceptions

The final agreed upon GIS Data Model will be documented in Excel format with a template Geodatabase and provided to project stakeholders to aid in overall project understanding and future system maintenance. These documents will outline specific attribute information for each GIS data layer in the regional GIS dataset, including field names, descriptions, field types, etc.

Phase Three: GIS Data Gap Analysis

GeoComm will perform a gap analysis on each local GIS dataset provided for use within the pilot SIF system. The analysis will provide each source 9-1-1 entity with an overview of issues related to the accuracy and synchronization of their GIS map data, Master Street Address Guide (MSAG), and Automatic Location Identification (ALI) database. Various quality control checks, as defined within the QA/QC Plan, will be completed to identify issues that could adversely affect emergency response and provisioning to NG9-1-1 systems. Potential problems will be identified by first reviewing each provided GIS layer individually and then evaluating the synchronization of the GIS data with the MSAG and/or ALI. Provided GIS data layers will also be compared to the region's authoritative GIS Data Model to identify missing or incomplete GIS data layers requiring further development by source 9-1-1 entities.



Results Reporting

All geospatial data issues detected during the GIS Data Gap Analysis will be referred back to source 9-1-1 entities for remediation. After the reviews are complete, results and error lists will be compiled into a report and delivered digitally. GIS layers depicting error locations will also be provided for issues related to feature topology. The reports will provide each local agency with actionable items requiring resolution prior to provisioning the GIS data into a live NG9-1-1 system.

At each agency's discretion, after the report is delivered, GeoComm can answer questions regarding the report. GeoComm will be available for up to two hours per entity to review the analysis results, answer questions, and discuss the next steps in the data remediation process.

Phase Four: NG9-1-1 GIS Data Aggregation and Initial GIS Data Load

GeoComm will combine individual GIS data layers from participating 9-1-1 source entities into a single, regional GIS dataset that will be loaded into the GeoLynx Server Web GIS Portal. The following tasks will be completed by GeoComm's GIS Services Bureau as part of the initial load process:

- Acquire GIS data from source 9-1-1 entities. Source 9-1-1 entities may choose to submit their data via one of the following methods:



- Upload GIS data to GeoComm using the GeoLynx Server GIS Portal or FTP
- Send GIS Data to GeoComm on a CD or DVD
- Esri geodatabase replication may be configured during the initial load stage for source entities capable of using Esri replication
- Perform initial quality control checks
- Coalesce regional GIS datasets into a seamless, gapless regional GIS data fabric
- Check for gaps and overlaps in the coalesced GIS database, refer issues back to source 9-1-1 entities
- Load GIS data into GeoLynx Server for Web Portal viewing
- Create, configuring, and load Esri address locators for simple address lookups
- Design Esri ArcGIS map documents (.mxd) for GeoLynx Server (layers, layer order, layer visibility, scale dependent display, symbology, labeling, etc.) based on customer preferences
- Develop, configure, test, and publish ArcGIS Server map services

GeoComm understands the GIS data will come from disparate sources and may contain differences in data format, structure, and projection/coordinate system from one source to the next. To facilitate the creation of a uniform, regional GIS base map, GeoComm will implement automated schema and geodetic transformation procedures to assimilate the various diverse GIS data layers into an authoritative regional GIS data model. The individual GIS data layers will then be merged into a regional dataset. Ongoing QA/QC processes and reporting will include topology results the local GIS data authorities need to use to create and maintain a seamless, gapless regional dataset

Automated GIS data transformation and GIS data normalization procedures will be implemented as part of an overarching ETL process. The process will define how GIS data will be obtained from source 9-1-1 entities and modified by GeoComm for use within the NG9-1-1 system. As part of GeoComm's Maintenance Workflow Development, our GIS Consultant will work closely with Fairfax County and the NoVA PSAPs to define this procedure from start to finish.

The following regional GIS data layers will be aggregated during this phase:

- Road Centerlines
- Site Structure Points
- Administrative Boundaries
 - State
 - Counties
 - Municipalities
- Emergency Services Boundaries
 - PSAP Service Areas



- Law Enforcement Zones
- Fire District Jurisdictions
- Emergency Medical Services (EMS) Service Areas

Note: GeoComm understands source 9-1-1 entities may maintain emergency service boundary data as a single Emergency Service Zone (ESZ) layer or as individual layers. Layers will represent PSAP service areas, Law Enforcement Zones, Fire District Jurisdictions, and EMS Service Areas.

Phase Five: Ongoing NG9-1-1 GIS Managed Services

GeoComm will provide Fairfax County and the NoVA PSAPs with an ongoing NG9-1-1 Managed Services solution to ensure timely and accurate input of address information and other key GIS changes into the authoritative regional GIS dataset. The solution contains a variety of core components for acquiring GIS data updates, performing GIS data transformation and GIS data normalization, executing automated QA/QC, and reporting GIS discrepancies back to source GIS entities.

GeoComm's ongoing NG9-1-1 Managed Services solution includes the following specific elements:

- Access to GeoComm enterprise GIS data management tools:
 - GeoLynx Server GIS Portal for easily transferring GIS data and viewing GIS update status
 - GeoLynx DMS Discrepancy Viewer to efficiently communicate GIS data errors to source GIS agencies for resolution
- Weekly GIS data normalization, QA/QC, and error reporting services

Notes: The GeoLynx Server GIS Portal will be hosted in GeoComm's secure datacenter and provided to Fairfax County and the NoVA PSAPs as a service.
NG9-1-1 Managed GIS Services will commence following initial load of the GIS data into GeoLynx Server and will continue for one year.

Enterprise GIS Data Management Tools

GeoComm's enterprise GIS data management tools allow users to view the regional GIS dataset, upload and download GIS datasets, and view QC discrepancy reports. Authorized entities interact with these tools across the Internet using the secure GeoLynx Server web portal. Traffic to and from GeoLynx Server is encrypted using SSL over HTTPS. GeoLynx Server uses a role-based user management system, which controls features and data access based on user role memberships. The web portal includes a log-on screen. GeoComm GIS Specialists will configure the web-based map and enterprise GIS data management solution to meet the region's preferred system configuration and operational workflows.

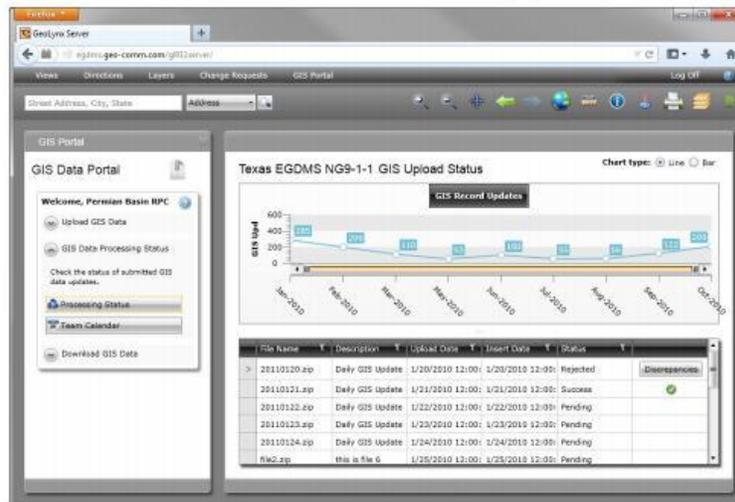
GeoLynx Server GIS Portal

With the GeoLynx Server GIS Portal, authorized providers and consumers of NG9-1-1 GIS data can easily transfer and share GIS data with others. The portal is capable of:

- Uploading updated GIS data for inclusion in a dataset
- Browsing and downloading GIS datasets
- Providing links to published ArcGIS for Server map services which open the map in applications such as ArcGIS for Desktop, ArcGIS Explorer, Google Earth, ArcGIS.com, and National Capital Region (NCR) Geospatial Data Exchange (GDx)
- Project status update tracking and collaboration
- Searching for GIS data layers hosted on the site using keyword searches
- Charting the volume of monthly data changes
- Maintaining a calendar of GIS updates activities and upcoming events

In addition, the GeoLynx Server GIS Portal provides agencies with easy access to error reports produced by GIS data normalization systems, QA/QC processes, and master GIS dataset coalescing operations. Local 9-1-1 entities can download GIS error reports directly from the GIS portal in PDF format or a generic, universally supported shapefile containing error report locations and descriptions which can be opened in any GIS system.

GIS Portal displays a chart depicting GIS update events and counts



GeoLynx DMS Discrepancy Viewer

GeoComm will provide a tool as part of the system, GeoLynx DMS Discrepancy Viewer, which will enable local entities using Esri ArcGIS for Desktop software to interact with GIS error reports right inside their native GIS editing environment. This also enables authorities to quickly zoom to the location of a GIS error, read a description of the issue, and to correct it.

GeoLynx DMS Discrepancy Viewer can also be used by source 9-1-1 entities to mark specific GIS features as exceptions for single or multiple QA/QC audits.

GeoLynx DMS Discrepancy Viewer depicting an address point error report:



NG9-1-1 GIS Managed Services

Based on the workflows established in Phase Two, GeoComm's GIS Services Bureau will perform on-going GIS data normalization and QA/QC services on a weekly basis for a period of one year. After the initial load, multiple mechanisms exist for submitting GIS data updates into the system. Entities may choose the best mechanism based on their individual capabilities and internal systems. Available options supported by GeoComm include:

- GIS datasets uploaded to the GeoLynx Server GIS Portal, or FTP server
- Esri change-only geodatabase replication (if available)
- CD, DVD, or other external storage media shipped to GeoComm

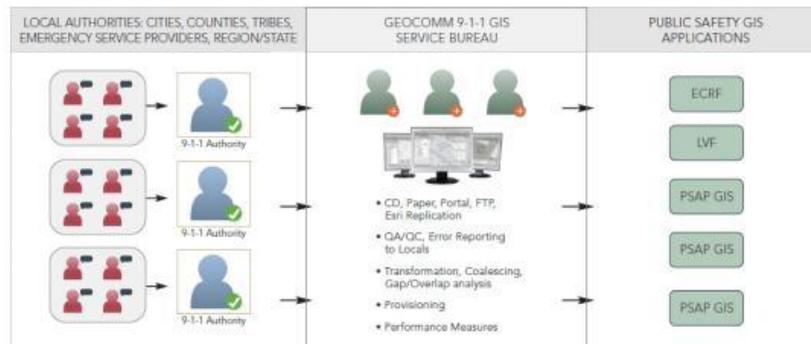
When a 9-1-1 source entity submits a GIS update to GeoComm, multiple automatic validation checks are performed to ensure the dataset meets the minimum expected requirements for further processing. Following successful validation, the datasets are normalized to a common GIS data model and geodetic system. Built-in conversion processing enables 9-1-1 source entities to continue utilizing existing local GIS



data schemas. Once updates have been normalized, GeoComm performs multiple automated and manual quality control processes prior to coalescing the updates into the regional GIS dataset. At this stage, additional quality checks are run on the regional data set, including edge matching and gap/overlap checks to identify mismatches which may occur along jurisdictional boundaries.

GIS error reports will be generated for updates that do not pass quality control. These reports will then be transmitted to the sending agency, to GeoComm, and optionally to stakeholders at the regional level for performance monitoring.

High level diagram of GeoComm’s NG9-1-1 Managed Services:



Note: For the SIF Pilot Project, GeoComm’s GIS Services Bureau will provision GIS data to the GeoLynx Server GIS Portal. Future project phases may include provisioning into live ECRF, LVF, and PSAP GIS systems.

Technical Support

GeoComm’s NG9-1-1 GIS Managed Service offering is fully supported by a professional service bureau comprised of software support technicians, GIS specialists, and project management professionals. Together this team will work to ensure the NG9-1-1 system is functioning as designed and continually meeting end user needs.

GeoComm’s services bureau provides on-going technical assistance to support the NG9-1-1 Managed Services solution. Hotline support consists of technical assistance and product coaching by trained and experienced specialists in an advisory capacity via a toll-free telephone number, fax, or e-mail, relating to the operation of any portion of the solution.

All calls for service are logged in our Microsoft Dynamics Customer Relationship Management (CRM) software. Upon receiving the telephone call, fax, or e-mail regarding a software issue, the Technical Support Analyst will assign a case number in CRM and work with you to resolve it. If all analysts are busy assisting other customers, a return telephone call will be made within four hours.





GeoComm's response time commitment is depicted in the following table:

Priority	Description	Response Time
Critical Impact – Service Not Available	Service is unavailable or halted Data is unavailable or nonfunctional Service productivity or functionality is severely compromised There is a complete loss of service for all End Users and there is no ability to avoid or reduce the incident via a workaround	Less than two clock hours 24 x 7
Major Impact – Severely Impaired	Service performance/functionality for all End users is seriously impaired or degraded Data accuracy is seriously impaired There is no ability to avoid or reduce the effect of the incident via a workaround	Less than four clock hours 24 x 7
Minor Impact – Minimal Degraded Performance or Functionality; Single User Issues	Service has encountered a non-critical issue with minimal loss of performance/functionality Data accuracy is minimally degraded May be identified as a functional defect Complete stoppage of a single End User A partial loss of service for an End User and there is a way to reduce the effect or completely avoid the impact of the incident via a workaround at a reasonable cost	Less than 16 business hours Monday through Friday 8 a.m. to 5 p.m. Central Standard Time
Low Impact – Single User Application Issue	Service is unavailable or degraded (not a complete work stoppage) for a Single End User There is a way to reduce the effect or completely avoid the impact of the incident via a workaround at a reasonable cost	Less than 24 business hours Monday through Friday 8 a.m. to 5 p.m. Central Standard Time
No Impact	Password resets Requests for access rights File restores Issues of similar importance	Less than 48 business Hours Monday through Friday 8 a.m. to 5 p.m. Central Standard Time

System users will also have access to GeoComm's eService Customer Portal, our online customer support website, where you can enter a new technical support case, view existing cases, specify contact information, preferences, and more.

Phase Six: Pilot Project Summary Report

Prior to the end of the project, GeoComm will prepare a final report detailing the results of the SIF Pilot Project. The report will recap tasks completed, summarize findings, and offer guidance for future tasks on the road towards developing a sustainable, regional GIS dataset for NG9-I-I. At minimum, the report will include:

- Executive Summary
- NG9-I-I GIS Data Model Standards
- GIS Data Assessment Results
- Lessons Learned During Pilot Project
- Continuing on the critical path to NG9-I-I - what are the next steps?



GeoComm will present the final report to key project stakeholders from Fairfax County and the NoVA PSAPs. During this meeting, GeoComm will initiate discussions regarding future considerations which may include:

- NG9-1-1 GIS Standards Enforcement* – to maintain ongoing compliancy with NG9-1-1 requirements
- NG9-1-1 GIS Data Provisioning* – to ensure quality, current data is provisioned in a timely manner from the SIF into your live ECRF/LVF system

Many variables must be considered in developing a viable regional GIS dataset for NG9-1-1. Without the proper groundwork, it can be a formidable task. The pilot project outlined in this proposal will provide a solid foundation for a future NG9-1-1 GIS dataset for the NoVA region and potentially other areas of the commonwealth as well. With GeoComm's knowledge of emerging NG9-1-1 standards and proven regional and state-wide GIS dataset development experience, we look forward to assisting the Fairfax County and the NoVA PSAPs with this important public safety project.



3 Responsibilities and Deliverables

Customer Involvement and Responsibilities

We believe our clients play a critical role in the overall project success. While GeoComm will lead the project efforts, we will partner with you to ensure you have in-depth project knowledge and are informed regarding the status of meeting the project goals.

It is requested that Fairfax County and the NoVA PSAPs provide the following support:

- Assist in coordinating and attend periodic conference calls
- Provide pertinent project information and documentation
- Assign appropriate staff to attend the training courses provided
- Provide connection to the Internet for all training participants
- Assist in the ongoing quality assurance
- Provide a single point of contact who will be available for communication throughout the project and system implementation
- Provide the following GIS map data layers, if available, in Esri format with corresponding projection information:
 - ◇ Road centerline layer (line features) containing road name and address range attributes
 - ◇ Emergency services boundaries layer (polygon features) representing a unique combination of emergency service number (ESN), PSAP, fire, law, and medical responders and containing ESN and responder attributes
 - ◇ MSAG community boundaries layer (polygon features) containing community name attributes
 - ◇ Municipal and county boundaries layers (polygon features)
 - ◇ Site/structure layer (point or polygon features) containing house number and street name attributes
- Provide a copy of the MSAG and ALI database in Microsoft Excel format
- Provide access to login for the NCR GDx online application
- Work cooperatively with GeoComm to correctly configure users, roles, and jurisdictions during GeoLynx Server implementation and configuration
- Participate in regular status calls
- Post feedback and questions to project portal hosted by GeoComm



GeoComm Deliverables

Project deliverables to Fairfax County and the NoVA PSAPs include:

- On-site project initiation and planning meetings
- Project schedule
- Regular status reports and conference calls
- Maintenance workflow diagrams
- QA/QC plan
- Regional GIS Data Model documentation
- A digital 9-1-1 data analysis report for each entity including digital lists of errors identified and outlined in the analysis report
- Subscription based access to the GeoLynx Server GIS Portal for 12 months
- Eleven licenses of the GeoLynx DMS Discrepancy Viewer (one per participating agency)
- On-site maintenance workflow presentation/discussion and software training
- Weekly GIS data normalization, QA/QC, and error reporting services for 12 months
- On-site project close-out meeting and pilot project summary report
- A copy of the regional GIS dataset maintained throughout the project (a snapshot obtained at the close of the proof-of-concept)



4

Pricing

Description	Qty	Price/Unit	Total Price
Upfront Software and Service Fees			\$291,233
Monthly Recurring Software and Service Fees	12	\$17,385	\$208,620
GIS Services Total:			\$499,853
<p>Notes: Prices are valid for a period of 90 days. Fairfax County is responsible for paying all applicable sales tax. GeoComm is proposing a separate GIS project for the NCR which includes GIS Data Gap Analysis Services for Arlington County, the City of Alexandria, Fairfax County, Loudoun County, and Prince William County. If the NCR decides to proceed with this project, the above total would be reduced to reflect work already completed.</p>			



What You Need to Know about the Spatial Information Function

Role of a SIF in NG9-1-1





Table of Contents

Preface 2

Introduction..... 3

What is GIS?..... 4

What is the Role of GIS in 9-1-1 and NG9-1-1? 5

 Tactical Mapping..... 5

 NG9-1-1 Call Routing..... 5

 Location Validation..... 6

 9-1-1 GIS Data Maintenance..... 6

What is a SIF?..... 7

What are Some Expected SIF Deployment Approaches and Industry Trends?..... 8

 Multiple SIF Approach 8

 Single Shared SIF Approach..... 8

What Does an End-to-End SIF System Look Like?..... 10

Conclusions..... 10

About Geo-Comm, Inc...... 12



Preface

Next Generation 9-1-1 (NG9-1-1) is a modernization of the nation’s 9-1-1 system and is being carried out across the country today. While the existing 9-1-1 system has been a success story for more than 30 years, NG9-1-1 provides a more advanced system for accessing emergency care. The system leverages and supports new communications tools and technologies which have evolved into common use over the last 15 years, including text and multi-media messaging and Internet Protocol (IP) communications platforms.

The new standards for NG9-1-1 introduce fundamental architectural changes such as using Geographic Information Systems (GIS) data for 9-1-1 call routing and location validation. To integrate GIS into the core 9-1-1 functional elements of call routing and location validation, the new system includes a Spatial Information Function (SIF). This white paper specifically seeks to clarify the role of a National Emergency Number Association (NENA) i3 SIF while also presenting some practical considerations to make during procurement and implementation of a new 9-1-1 system.



Introduction

Advancements in modern communications technology have created the need for a more advanced system to access emergency services. The current 9-1-1 system has been effective for the past three decades but its limits have been stretched as technology has advanced.

Smartphone and tablet devices are being adopted at a rapid rate by the population and offer capabilities such as text and video messaging. Unfortunately, the existing 9-1-1 system was never intended to receive calls and data from these technologies. As a result, through cumbersome adaptations, Enhanced 9-1-1 (E9-1-1) is being asked to perform functions it was not designed to handle. In 2000, NENA identified the need for 9-1-1 system upgrades and subsequently published the *Future Path Plan*. In 2011, NENA issued Version 1.0 of NENA Technical Standard 08-003, *Detailed Functional and Interface Specification for the NENA i3 Solution – Stage 3* (herein referred to as NENA 08-003 v.1).

Many 9-1-1 authorities across the United States are already beginning to implement NG9-1-1 systems based on this design and similar NG9-1-1 transitional architectures. Architectural overhaul of the nation's three-digit emergency calling system is not without risk. Beyond the technology, functional elements, interfaces, redundancy, diversity, capacity, and security issues, there is a need for new databases and human process and workflow procedures. These must all be developed, modeled, and tested as well.

One important component of an NG9-1-1 system is SIF. SIF is defined in NENA 08-003 v.1 as follows:

The SIF is a specialized form of a Geographic Information System, and may be implemented on a conventional GIS with the appropriate interfaces. The SIF itself is not standardized in i3. What is standardized is a method of replicating layers from the master SIF to external databases. The ECRF/LVF provisioning interfaces use this mechanism.

NENA 08-003 v.1 standardizes the SIF interface for provisioning GIS data from a SIF to an Emergency Call Routing Function (ECRF)/Location Validation Function (LVF) system but does not standardize the entire SIF itself. As a result, there is industry uncertainty over what a SIF is and does. Many questions are likely to emerge as 9-1-1 authorities begin to implement NG9-1-1 systems and services, but some commonly asked questions include:

- What is GIS?
- What is the role of GIS in 9-1-1 and NG9-1-1?
- What is a SIF?
- What are some expected SIF deployment approaches and industry trends?
- What does an end-to-end SIF system look like?

What is GIS?

As NENA defines a SIF as “a specialized form of a Geographic Information System” it is worthwhile to first consider the definition of GIS. A GIS is commonly defined as follows:

GIS is a system of hardware and software used for storage, retrieval, mapping, and analysis of geographic data.

Geographic data includes digital map layers representing the real world using points, lines, and polygons, as well as aerial and satellite imagery. Digital maps provide fast and reliable computer-based display and analysis and support enhanced decision making business functions. GIS data is experienced through many free consumer services such as Google™ and Microsoft Bing™ maps.

A GIS is a system of hardware and software used for storage, retrieval, mapping, and analysis of geographic data. As a result, it is not a single software application displaying a map on a computer screen. Rather, a GIS typically:

- Comprises many different applications, as well as human processes and workflows, federated within a single common system
- Provides applications and methods for authoring and maintaining geographic data over time, for performing spatial analysis and decision making calculations
- Displays maps to end users in desktop, mobile, or web based computing environments

Human processes and workflows required to operate a GIS include division of roles and responsibilities for various users of the system, identification and agreements around authority of data loaded into the system, and processes for editing and maintaining GIS data. They are required to ensure GIS provides an accurate generalization of the real world.

What is the Role of GIS in 9-1-1 and NG9-1-1?

Tactical Mapping

GIS plays many roles in 9-1-1. Since the late 1990s, GIS is most commonly used to provide tactical mapping for 9-1-1 telecommunicators, Computer Aided Dispatch (CAD) dispatchers, and emergency responders. Tactical mapping systems reduce emergency response time by identifying the location of emergency calls on a map, and compute best routes to the scene for emergency responders. Valuable supplemental "on the ground" information, not limited to fire hydrant locations and valve specifications, network camera locations, and premise information including contacts, physical structure information, and owner and tenant data, is also provided by GIS.



NG9-1-1 Call Routing

GIS plays an even more critical role in NG9-1-1 by determining which public safety answering point (PSAP) to route a 9-1-1 call to, based on the location of the calling device, and also for location validation prior to a caller making an emergency call (replacing an E9-1-1 MSAG). Geospatial call routing enables more accurate call routing than traditional E9-1-1 systems and can reduce the number of 9-1-1 call transfers due to misrouted 9-1-1 calls. This in turn can help reduce emergency response times and save more lives and property; a primary goal of emergency responders and public safety management and stakeholders.

When an NG9-1-1 call is being routed, an Emergency Services Routing Proxy (ESRP) queries an ECRF to determine which PSAP to route the call. The ECRF query contains the location of the device calling 9-1-1. This location may be a civic location (house number / street name style address) or a geodetic location (a latitude / longitude coordinate, circle, ellipse, polygon, or arc-band). Civic locations may be used for fixed location devices such as wireline or VoIP phone



services. Geodetic locations may be used for mobile devices such as cell phones. In either case, when routing a 9-1-1 call, an ESRP will query an ECRF with the location of the device and the type of service being requested (such as 9-1-1 or a selective transfer from the 9-1-1 center to a responding agency). The ECRF will intersect the location provided in the query against a map of the PSAP service area boundaries to determine the PSAP which should receive the call.

To route 9-1-1 calls based on location, an ECRF must be provisioned with GIS data depicting the PSAP service area boundaries. If the location provided in the query is a civic location, this must be converted into map coordinates to be intersected with the PSAP boundary polygon map. This conversion can be accomplished using an address point layer in the GIS, a site/structure polygon layer where each polygon is tagged with civic address location attributes, or an address ranged road centerline layer. Minimally, an ECRF needs to be provisioned with PSAP service area boundaries and one form of civic location GIS data such as address point data.

Location Validation

In addition to being used when routing 9-1-1 calls, NG9-1-1 systems use GIS data before a 9-1-1 call is placed. As Communications Service Providers (CSPs) prepare subscriber records for 9-1-1, they must confirm subscriber records have addresses usable for 9-1-1. This process is similar to checking an E9-1-1 ALI record for MSAG validation. In this case, a Location Information Server (LIS) queries an LVF with the location in question. The LVF examines its GIS database to see if the address is valid for 9-1-1. The GIS data provisioned to the LVF is identical to the GIS database provisioned to the ECRF.

9-1-1 GIS Data Maintenance

GIS data provisioned to an ECRF/LVF or PSAP mapping system must first be created, and must also be maintained over time. GIS data can be authored and maintained using a variety of different GIS software applications. The dominant provider of GIS software in state and local government is Esri (Environmental Systems Research Institute, www.esri.com). Other vendors, such as Pitney Bowes and Manifold, provide GIS software to state and local government as well. In addition, there are some open source GIS applications such as QGIS, MapServer, MapGuide, and others.

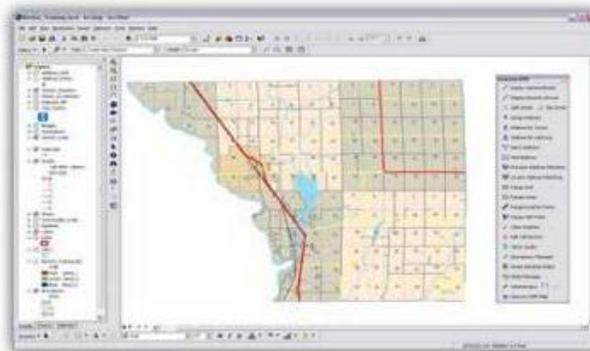
A number of 9-1-1 GIS vendors, such as Geo-Comm Inc. (GeoComm), provide 9-1-1 GIS data management applications and services on top of existing broadly horizontal GIS platforms. These platforms are used in a variety of different industries ranging from utilities, to defense, to natural resources mapping, to business analytics, and beyond. NENA has not standardized any particular end-user GIS application or platform. 9-1-1 authorities are free to pick and choose the best GIS platform, software, and vendor services for editing and maintaining GIS data for 9-1-1, based upon their own particular needs and individual enterprise requirements.

What is a SIF?

Based on the definitions of SIF and GIS described earlier, a SIF encompasses the traditional business functions of a GIS, in addition to the NG9-1-1 system-specific interfaces for provisioning GIS data to the ECRF and LVF. NENA describes a SIF as a specialized form of a GIS which may be implemented on top of a conventional GIS, so long as the appropriate NG9-1-1 interfaces are available. As a practical matter, this means 9-1-1 authorities building and maintaining GIS data systems for 9-1-1 should consider GIS data management components to be part of the SIF. In addition, they need to add interfaces to their GIS systems for provisioning GIS data and updates into NG9-1-1 ECRF/LVF i3 functional elements.

While not required in NENA standards, GeoComm recommends SIFs include quality assurance and quality control (QA/QC) mechanisms tuned for 9-1-1 GIS data, such as MSAG to GIS synchronization during NG9-1-1 transitional periods, service area boundary gap/overlap checking, and various address point and road centerline checks.

The importance of GIS data quality control mechanisms and processes cannot be overstated as routing 9-1-1 calls to the closest responding agency depends on accurate, complete, and timely high quality GIS data.



The interface for provisioning GIS data from the SIF to ECRF/LVF is standardized in section 4.7 of NENA 08-003 v.1. While the standards are continuing to evolve and subsequent versions of 08-003 are planned and in process, the current standardized mechanism in NENA 08-003 v.1 can be difficult to implement as a practical matter. The Open Geospatial Consortium (OGC) geo-synchronization standard referenced in NENA 08-003 v.1 is a public engineering report and not



a standard. GeoComm has implemented a NENA-compliant ECRF/LVF provisioning mechanism based on the documents but has found several ambiguities in the specifications. As a result, assumptions are required to proceed with the interface development. This limits the possibility of interoperable provisioning systems emerging across different vendor platforms. At the same time, existing proprietary geodatabase replication mechanisms exist from common GIS platform vendors, such as Esri. The platforms are robust, performant, and already widely in use in enterprise GIS systems across state and local government.

What are Some Expected SIF Deployment Approaches and Industry Trends?

SIFs may be deployed in different manners, and NENA does not standardize or require a single particular approach. There are two general approaches for SIF utilization by 9-1-1 authorities:

Multiple SIF Approach: In this envisioned approach, each 9-1-1 authority participating in a common Emergency Services IP Network (ESInet) operates their own SIF for building and maintaining their jurisdiction's 9-1-1 GIS data. In this scenario, individual 9-1-1 authorities provision GIS data directly to the same ECRF/LVF system using their own SIF. NENA standards around the SIF to ECRF/LVF provisioning mechanism are intended to support interoperability – each 9-1-1 authority may utilize a different SIF make and model to provision locally authoritative GIS updates to a single common ECRF/LVF system, by adhering to a common provisioning interface standard. To date, this approach has not been commonly utilized in any live NG9-1-1 systems.

Single Shared SIF Approach: In a more commonly used approach, a regional or statewide 9-1-1 authority may have GIS staff operate a SIF for NG9-1-1. Local 9-1-1 authorities typically provide GIS updates to the regional authority via a variety of modalities including file transfer, CD/DVD, or Esri geodatabase replication. The statewide or regional authority applies a data normalization service to load locally authoritative GIS data into a common regional GIS data model for NG9-1-1, as well as QA/QC services to ensure the GIS data is suitable for use in core NG9-1-1 functions of ECRF and LVF. Errors and discrepancies are transmitted back to locally authoritative sources for resolution. The regional or statewide 9-1-1 authority manages the provisioning of GIS data updates into the ECRF/LVF system. To date, this approach is used by many live NG9-1-1 implementations.

Either approach described above may utilize on premise or hosted implementations. On premise implementations are better suited for 9-1-1 authorities with strong GIS capabilities and an existing enterprise GIS system. In some cases, it may be possible to layer SIF interface software on top of the existing GIS enterprise. The existing investment in GIS staff and



technology may be leveraged for 9-1-1, decreasing the costs and time required to implement a fully functioning SIF.

In contrast, hosted SIF systems (commonly referred to as managed services) are emerging in the market and provide all elements and functions of a SIF as a professional managed service. In this case, 9-1-1 authorities provide locally authoritative GIS updates to the service bureau using a modality best suited to them. The professionally managed service bureau then performs GIS data normalization, QA/QC, error reporting and feedback, and safe and secure provisioning into NG9-1-1 ECRF/LVF systems and other third party PSAP mapping systems. NG9-1-1 Managed SIF services provide some benefits over on premises self-operated SIF systems such as:

- 24x7x365 operation (many GIS offices limit operations to normal business hours)
- NG9-1-1 GIS domain expertise (some local GIS offices specialize in tax and cadastral mapping rather than GIS for 9-1-1 purposes)
- Automated QA/QC, closed loop error reporting, and performance measurements
- Service Level Agreements guaranteeing availability and system performance
- Off-site data backups
- Often a managed SIF service can be turned on faster, and for less cost, than an on-premises system
- Management by a single GIS service provider, when there is no regional or state authority that can take on the work of managing all GIS data for all participating local 9-1-1 authorities

Regardless of which scenario is in play, stakeholders of regional and statewide SIF systems must also consider data model and geodetic system transformation considerations. Often times, locally authoritative sources of GIS data have developed their own GIS data models, and use geodetic systems (coordinate systems and projections) which conform to local GIS application requirements. These may differ from the common GIS data model and geodetic system used by the regional or state-wide NG9-1-1 system. In these cases, SIFs should have a conversion function to transform GIS data from local data models and geodetic systems into the common model for the coalesced NG9-1-1 GIS database. To avoid unintended gaps and overlaps in PSAP and other service area boundaries, and street centerlines not connecting at the edges of GIS dataset, additional care must be taken when GIS data from multiple authorities is coalesced into a single GIS database for NG9-1-1.

GeoComm recommends all SIF systems include QA/QC to ensure the quality of GIS data and meet GIS requirements for NG9-1-1. QA/QC checks should include a closed loop error reporting feedback mechanism. Locally authoritative sources of GIS data should receive QC check error reports after submitting GIS updates into the system, and the SIF system should track resolution of error reports. Performance measurements are necessary in order to ensure

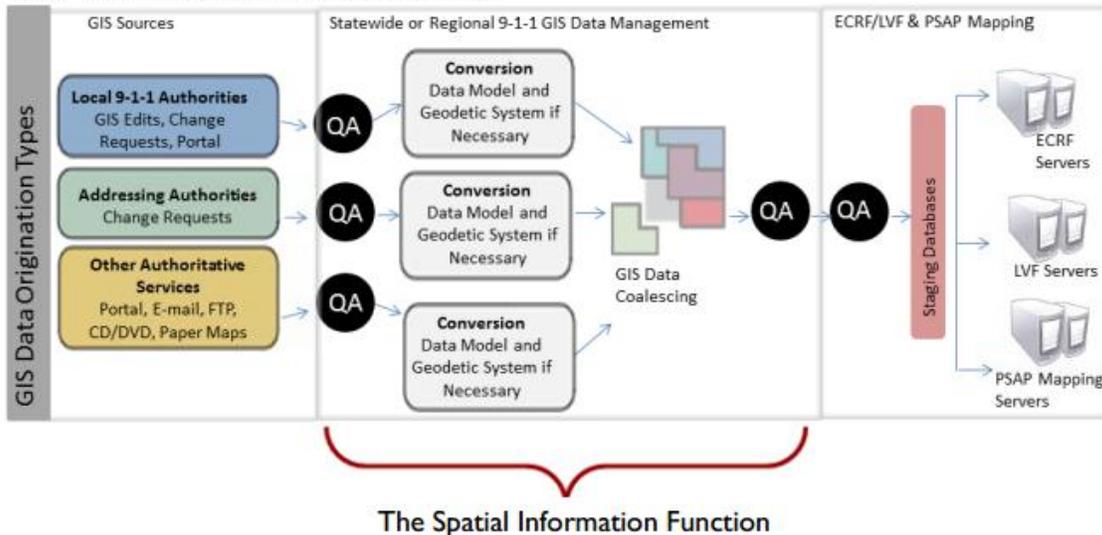


all components of the SIF are operating as required for NG9-1-1, including human workflows and processes.

What Does an End-to-End SIF System Look Like?

Below is an end-to-end NG9-1-1 GIS data management workflow diagram depicting the commonly used shared SIF approach. The middle component labeled “Statewide or Regional 9-1-1 GIS Data Management,” as well as the input and output interfaces, comprise the SIF. The arrows moving GIS data from the coalesced GIS dataset and into ECRF/LVF and PSAP mapping servers is provided by the SIF provisioning interfaces. Thus the diagram below depicts a **conventional GIS** with multiple authoritative inputs, GIS data QA/QC, transformation, coalescing, gap/overlap checking, and finally provisioning to ECRF/VLF **with the appropriate interfaces**:

NG9-1-1 GIS Provisioning System Overview



Conclusions

GIS data plays a critical role in NG9-1-1 for mapping the location of 9-1-1 calls in PSAP and responder mapping applications, pre-validating locations (replacing 9-1-1 MSAG validation), and for determining 9-1-1 call routes in real time. As a result, NENA has created a SIF element for managing GIS data for NG9-1-1. NENA’s definition of a SIF is broader than only the provisioning interface between an authoritative GIS system and an ECRF/LVF system. 9-1-1 authorities should take into account the following considerations when designing, specifying, and procuring NG9-1-1 SIF systems and services:



Sending GIS updates into the NG9-1-1 system is a continual process, not a one-time event. SIF systems must support on-going daily updates similar to E9-1-1 ALI/MSAG maintenance.

- Normalizing NG9-1-1 GIS data from local authoritative sources to a common data model and geodetic system. Service boundaries and road centerlines must edge match.
- Providing 24x7x365 support for SIF processing is recommended. 9-1-1 GIS data used for 9-1-1 call routing is mission critical and must be supported outside of normal business hours.
- Leveraging existing investments and reduce SIF costs to ensure the planned procurement of an NG9-1-1 SIF can interoperate with your existing enterprise GIS.
- Planning how you will manage GIS data from multiple locally authoritative sources, including transformation and coalescing into a single SIF database.
- Implementing performance measures and GIS error reporting feedback loops within the SIF to ensure GIS errors detected in the SIF are corrected in a timely fashion.
- Identifying legacy QA/QC SIF requirements during NG9-1-1 transitions, such as MSAG to GIS on-going continual synchronization.
- Considering the necessary human factors such as processes, workflows, roles and responsibilities, and data sharing agreements for managing a SIF for multiple 9-1-1 authorities.

By considering the requirements for daily 9-1-1 GIS data management, and the holistic nature of a SIF beyond the physical ECRF/LVF provisioning interface, 9-1-1 authorities can implement rich and robust NG9-1-1 systems leveraging GIS data. These NG9-1-1 systems will route 9-1-1 calls faster and more accurately, ultimately reducing response times, saving more lives, and protecting more property.

While advancements in technology continue, public safety agencies must adapt their systems and processes to meet the need of their citizens and responders. The procurement of SIFs will be a consideration for public safety during NG9-1-1 implementation and needs to be carefully planned and executed. Overall, enabling 9-1-1 systems to receive other methods of communication via smartphones and tablet devices, while also being aware of the requirements for each NG9-1-1 component, is one step towards managing the latest in voice and data technological advancements for your agency.



A GeoComm White Paper

About Geo-Comm, Inc.

GeoComm (www.geo-comm.com) was founded in 1995 to provide county governments with turnkey emergency 9-1-1 development services. Over the subsequent 19 years, the company has grown to serve more than 12,000 dispatchers in 800 emergency 9-1-1 call centers in the United States, helping to keep more than 84 million people safe. Today, GeoComm has a national reputation as a leading provider of geographic information and communication systems for local, regional, and state government agencies. The company's systems route emergency calls to the appropriate call center, map the caller's location on a dispatchers map, and guide emergency responders to the accident on mobile displays within police, fire, and ambulance vehicles.

GeoComm's mission is: When seconds matter, we help save lives and protect property by providing essential, innovative, location-based solutions to public safety professionals.

Contact us today to learn more about the Spatial Information Function and other NG9-1-1 related topics.

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12 | Page