The local GIS stakeholder needs to get their data ready to support NG9-1-1…but what does that mean?

MSGIC Quarterly Meeting
October 21, 2015
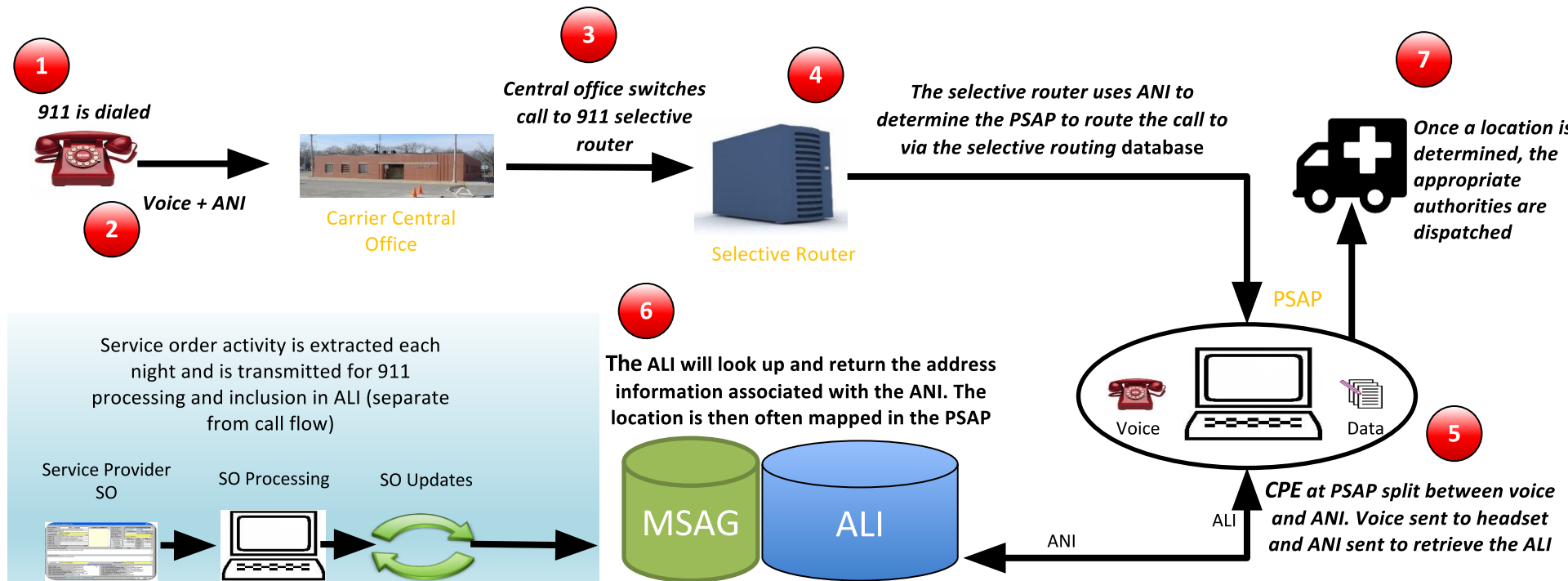**Russell Provost**

- 911 History
- NG911 Overview
- GIS Implications
  - GIS' role in NG911
  - New NENA requirements
- Preparation
  - Education
  - Data evaluation & Gap Analysis
  - GIS Data & Maintenance Enhancements
  - QA Audit
  - Data Aggregation & Conflation
- Conclusion
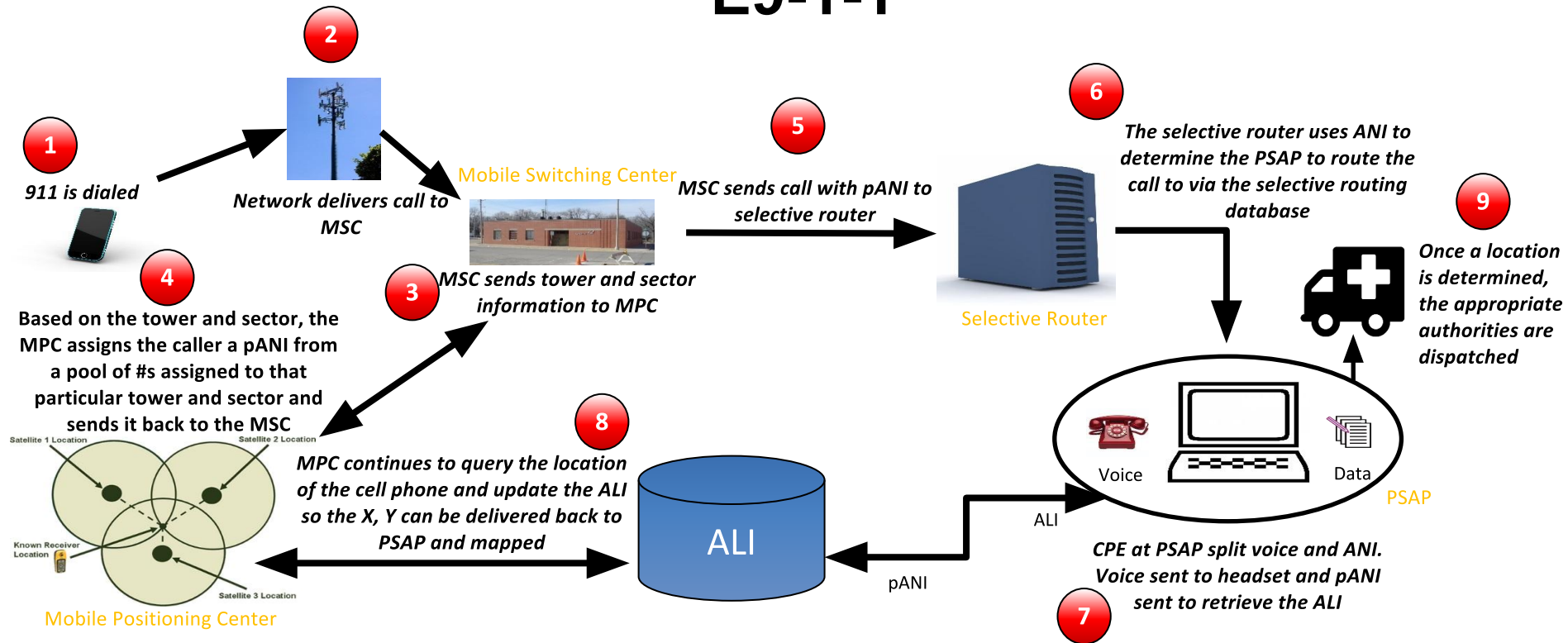
Next Generation 9-1-1 for the GIS Stakeholder

911 BACKGROUND

- Basic 911 Service
  - You dial 911….it reaches a PSAP
  - First 911 call placed in 1968 (Alabama)
- Enhanced 911
  - The location (either civic address for wireline callers or tower location and/or X,Y for wireless callers) is provided/able to be looked up by PSAP
  - **1976: Chicago claims the first enhanced 911 system of any major city**

Emergency Landline Call Routing Workflow: E9-1-1

1 911 is dialed

Voice + ANI

2

Carrier Central Office

3 *Central office switches call to 911 selective router*

Selective Router

4 *The selective router uses ANI to determine the PSAP to route the call to via the selective routing database*

7 *Once a location is determined, the appropriate authorities are dispatched*

PSAP

Voice   Data

5 *CPE at PSAP split between voice and ANI. Voice sent to headset and ANI sent to retrieve the ALI*

ALI

ANI

6 **The ALI will look up and return the address information associated with the ANI. The location is then often mapped in the PSAP**

MSAG   ALI

Service order activity is extracted each night and is transmitted for 911 processing and inclusion in ALI (separate from call flow)

Service Provider SO   SO Processing   SO Updates

We Make a Difference

Emergency Wireless Call Routing Workflow: E9-1-1

1 *911 is dialed*

2 *Network delivers call to MSC*

Mobile Switching Center

3 *MSC sends tower and sector information to MPC*

4 *Based on the tower and sector, the MPC assigns the caller a pANI from a pool of #s assigned to that particular tower and sector and sends it back to the MSC*

Mobile Positioning Center

5 *MSC sends call with pANI to selective router*

6 *The selective router uses ANI to determine the PSAP to route the call to via the selective routing database*

Selective Router

7 *CPE at PSAP split voice and ANI. Voice sent to headset and pANI sent to retrieve the ALI*

8 *MPC continues to query the location of the cell phone and update the ALI so the X, Y can be delivered back to PSAP and mapped*

9 *Once a location is determined, the appropriate authorities are dispatched*

ALI

pANI

ALI

Voice

Data

PSAP

Next Generation 9-1-1 for the GIS Stakeholder

NG911 OVERVIEW

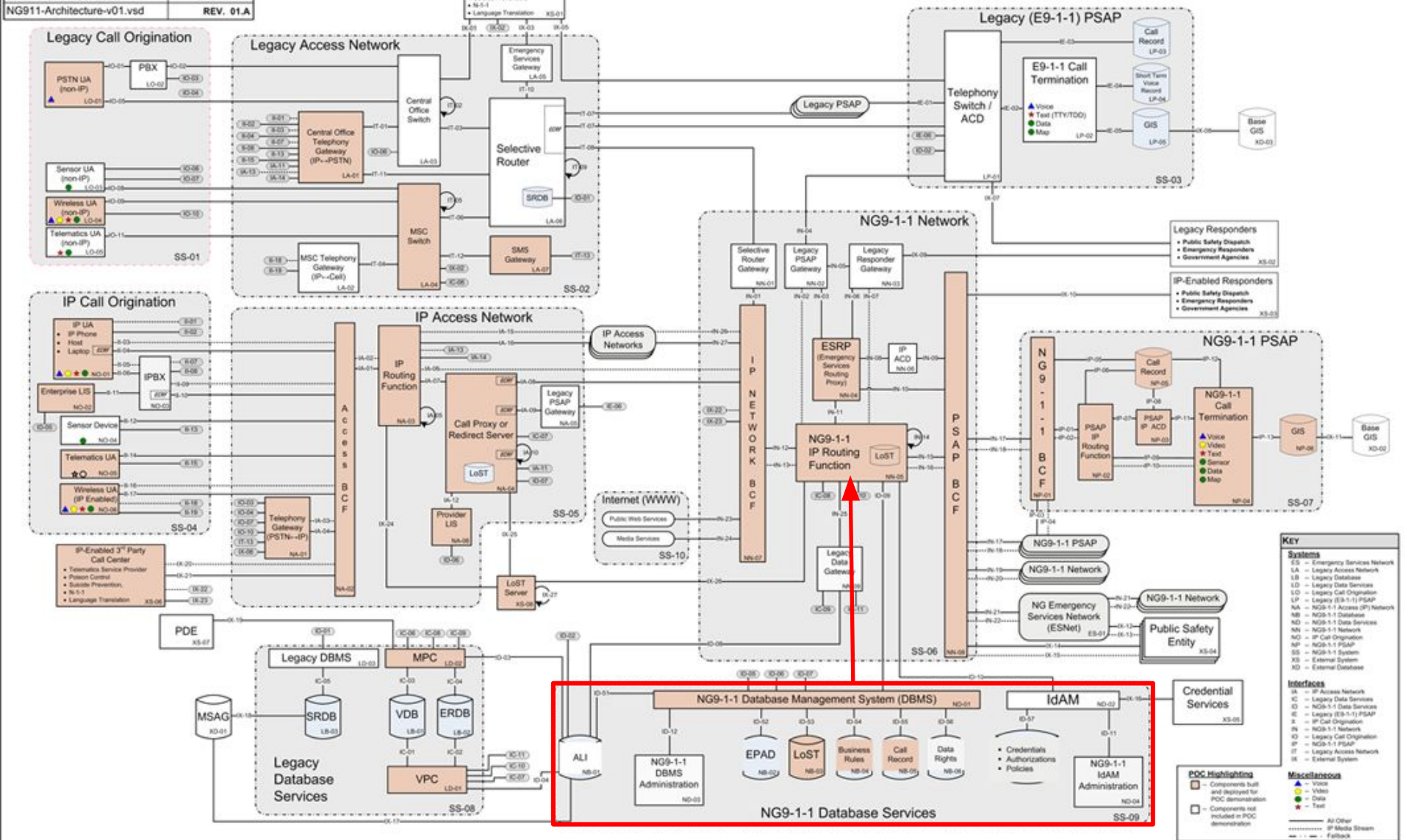|	
ESInet	Emergency Services IP Network
ECRF	Emergency Call Routing Function
ESRP	Emergency Services Routing Proxy
LIS	Location Information Server
PSAP	Public Safety Answering Point
LVF	Location Validation Function
NENA	National Emergency Number Association
SI	Spatial Interface

- "Put simply, NG911 is an Internet Protocol (IP)-based system that allows digital information (e.g., voice, photos, videos, text messages) to flow seamlessly from the public, through the 911 network, and on to emergency responders". US DOT
- NENA's goal is to ensure that everyone has access to emergency services anytime, anywhere, from any device.
  - NENA identified this need in 2000, published the Future Path Plan in 2001, and began development activities toward this end in 2003 culminating in the i3 standard
- Network of networks that is envisioned to integrate PSAPs across the country
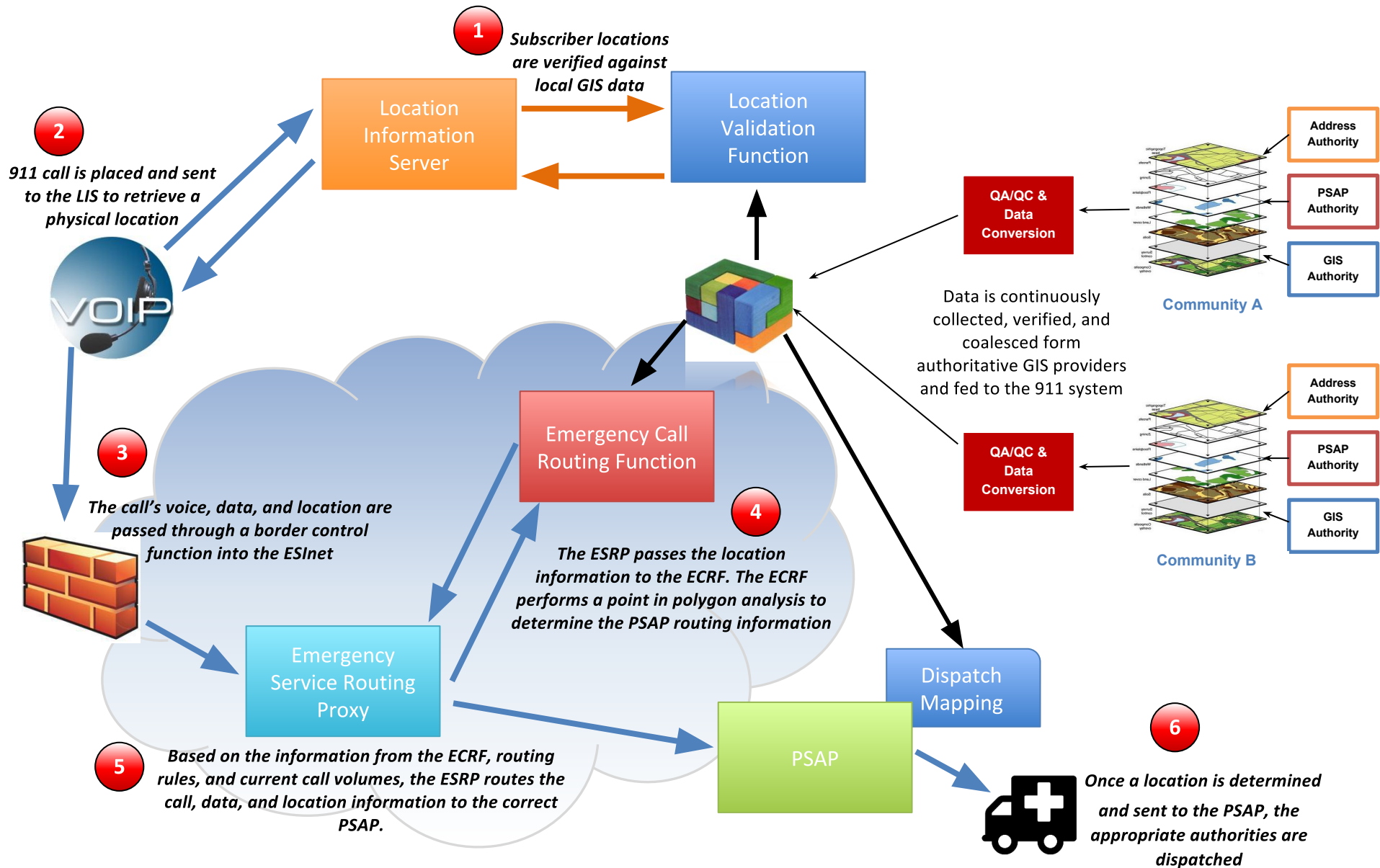
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Major carriers looking to phase out their support of legacy analog 911 systems

Why Next Gen?

Existing system is over 40 years old

Changing landscape of communication devices & public expectations

Interoperability

Analog systems becoming under utilized & expensive to manage
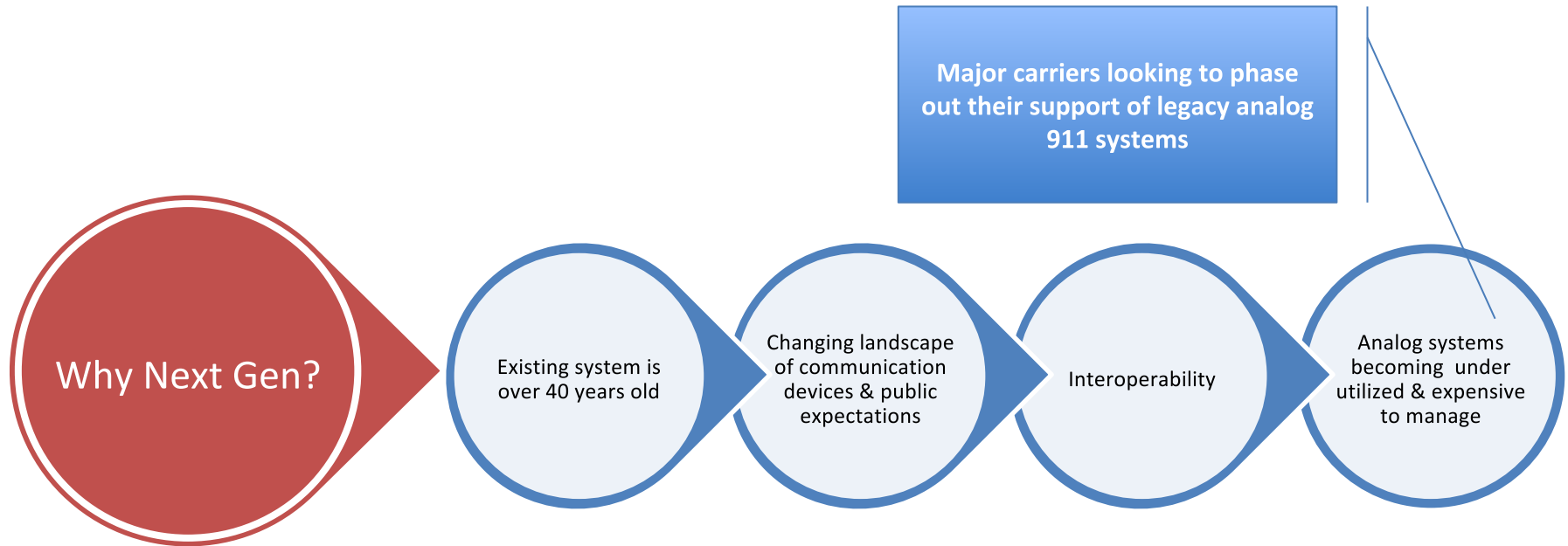
- FCC reports that in 2013 a total of $2,404,510, 784.64 was collected (4 states did not reply) at the state level to administer local 911 operations
  - 46 respondents reported that their 911 funding mechanism allows for distribution of 911 funds for the implementation of NG 9-1-1
  - 32 states and DC reported that they used funds for NG 9-1-1 totaling

1 *Subscriber locations are verified against local GIS data*

2 *911 call is placed and sent to the LIS to retrieve a physical location*

Location Information Server

Location Validation Function

VOIP

3 *The call's voice, data, and location are passed through a border control function into the ESInet*

Emergency Call Routing Function

4 *The ESRP passes the location information to the ECRF. The ECRF performs a point in polygon analysis to determine the PSAP routing information*

Emergency Service Routing Proxy

5 *Based on the information from the ECRF, routing rules, and current call volumes, the ESRP routes the call, data, and location information to the correct PSAP.*

PSAP

Dispatch Mapping

6 *Once a location is determined and sent to the PSAP, the appropriate authorities are dispatched*

QA/QC & Data Conversion

QA/QC & Data Conversion

Data is continuously collected, verified, and coalesced form authoritative GIS providers and fed to the 911 system

Address Authority

PSAP Authority

GIS Authority

Community A

Address Authority

PSAP Authority

GIS Authority

Community B

Next Generation 9-1-1 for the GIS Stakeholder

GIS IMPLICATIONS

- NG 911 has many components, each with its own set of considerations

• Emergency Services IP Network (ESInet)
  • People
  • IP-Enabled PSAP

Garbage in

Garbage out
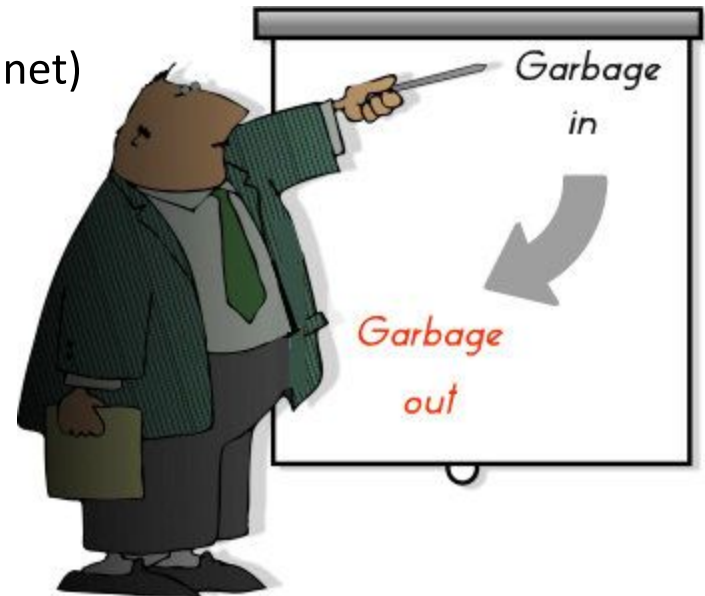
This **document describes** the "**end state**" that has been reached after a **migration** from **legacy** TDM circuit-switched telephony, and the legacy E9-1-1 system built to support it, to an all IP-based telephony system with a corresponding **IP-based Emergency Services IP network (ESInet)**. **To get to this "end state" it is critical to understand the following underlying assumptions**:

#5 9-1-1 authorities have accurate and complete GIS systems, which are used to provision the LVF and ECRF. A change to the 9-1-1Authority's GIS system automatically propagates to the ECRF and LVF and immediately affects routing."

(NENA 08-003, p. 16)

- GIS is elevated to a mission critical level in NG911

- GIS comes into play *BEFORE* a 911 call even reaches the PSAP

  - Complete & seamless for the system's geographical scope

  - Consistent

    - Common set of data layers, data model, and quality

  - Current and regularly maintained

  - Authoritative

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Minimum Data Required to Support ECRF/LVF in i3 NG9-1-1 Architecture*

Source: data supplied to the SI should come from each jurisdiction as defined by the extents of the Authoritative Boundary polygon.

Footprint: each PSAP needs access to a seamless, normalized and highly accurate footprint of data from any jurisdiction it shares a boundary with.

Update: new data and data err͏ be updated in the GIS within a 1-͏ day cycle.

Accuracy: Each source entity responsible for the accuracy (bot͏͏ and attribution) of each dataset. This results in the need for coordination amongst neighboring jurisdictions as there are no allowable gaps, overlaps or redundancies in any of the datasets.

•Road Centerlines

•PSAP Boundaries

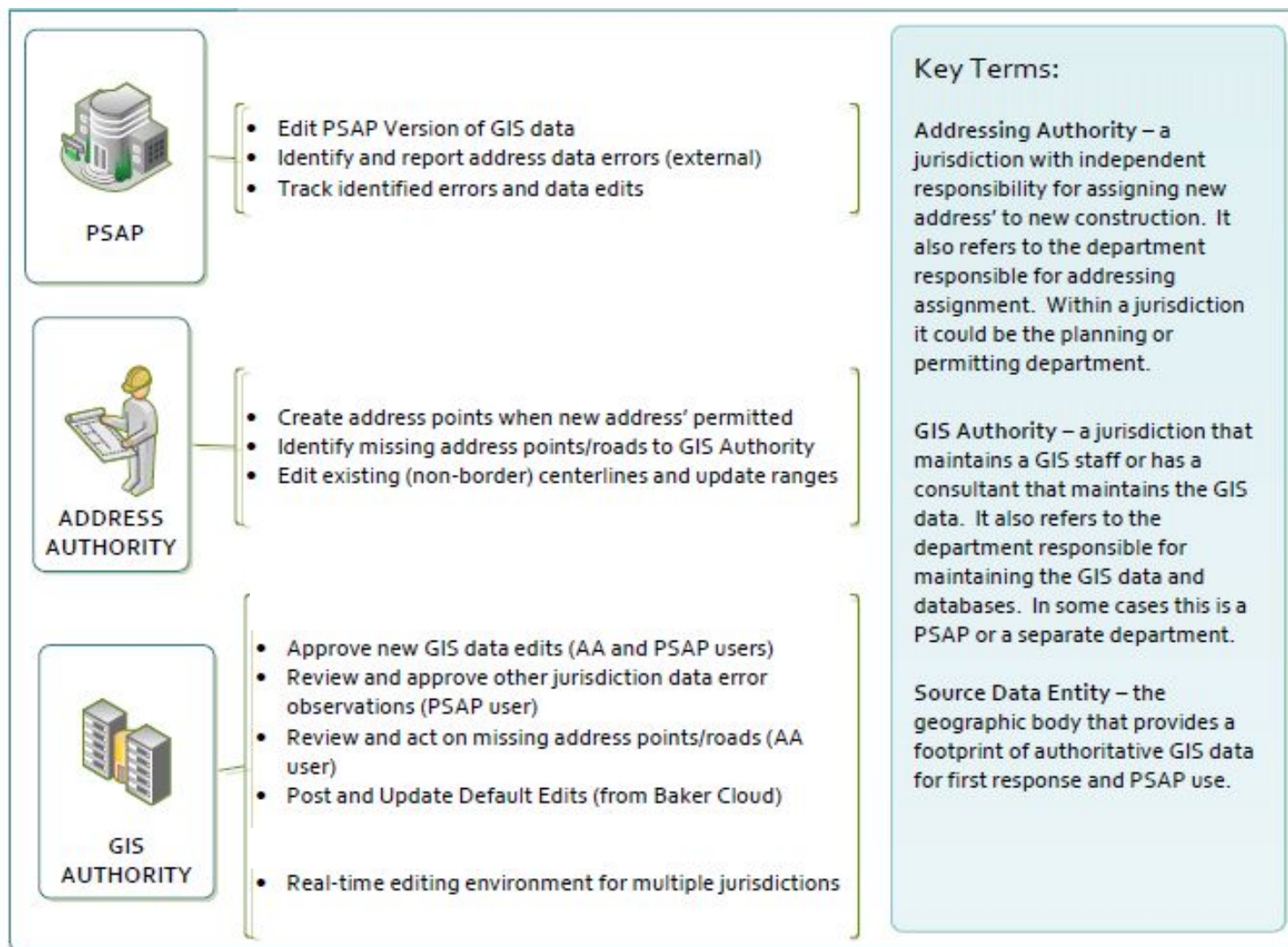| Attribute	Mandatory/Optional	Field Type	Field Length
Source of Data	M	A	75
Date Updated	M	D	26
Effective Date	M	D	26
Expiration Date	O	D	26
RCL_Unique_ID	M	A	100

Boundaries

aries

Address Point data is not required per the NENA NG9-1-1 GIS Data Model but will likely be deemed so by the majority of end-users.

Next Generation 9-1-1 for the GIS Stakeholder

GIS PREPARATION

- Every NG 911 deployment across the country will be unique but there are considerations and workflows that should be consistent with regards to preparing GIS data
  - Educate stakeholders
  - GIS Gap Analysis
    - Assess missing layers and attributes
    - MSAG/ALI to GIS
    - Evaluate Address Completeness
    - Other Validation Checks
  - GIS Data & Maintenance Enhancements
    - Make a Plan & Develop Standards!
    - Internal Data Enhancements
    - External data Enhancements
  - QA Audit
  - Data Aggregation and Conflation

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PSAP
- Edit PSAP Version of GIS data
- Identify and report address data errors (external)
- Track identified errors and data edits

ADDRESS AUTHORITY
- Create address points when new address' permitted
- Identify missing address points/roads to GIS Authority
- Edit existing (non-border) centerlines and update ranges

GIS AUTHORITY
- Approve new GIS data edits (AA and PSAP users)
- Review and approve other jurisdiction data error observations (PSAP user)
- Review and act on missing address points/roads (AA user)
- Post and Update Default Edits (from Baker Cloud)

- Real-time editing environment for multiple jurisdictions

Key Terms:

Addressing Authority – a jurisdiction with independent responsibility for assigning new address' to new construction. It also refers to the department responsible for addressing assignment. Within a jurisdiction it could be the planning or permitting department.

GIS Authority – a jurisdiction that maintains a GIS staff or has a consultant that maintains the GIS data. It also refers to the department responsible for maintaining the GIS data and databases. In some cases this is a PSAP or a separate department.

Source Data Entity – the geographic body that provides a footprint of authoritative GIS data for first response and PSAP use.

Comparing the MSAG and GIS databases will identify inconsistent naming conventions, inaccurate address information, improper ESN assignments to MSAG records, improper community assignments, improper exchange designations, and other discrepancies. The comparison process will also reveal fictitious data, incomplete information, and data that exist in only one database. It is important to note that errors or missing information can exist in both databases and other sources should be consulted as well to improve the overall accuracy and completeness of the data.

It is recommended that a **minimum match rate of 98%** be set prior to using the GIS data in a NG 911 system

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FID	PL_ADD_F	PL_ADD_T	PR_ADD_F	PR_ADD_T	PRE_DIR	STREET_NAM	STREET_TYP	CITY_L	CITY_R	ESN_L	ESN_R
351	2301	2399	2300	2398	N	10th	St	Monroe	Monroe	1	1
484	1701	1799	1700	1798	N	10th	St	Monroe	Monroe	1	1
503	401	899	400	898	N	10th	St	West Monroe	West Monroe	2	2
583	299	299	298	298	N	10th	St	Monroe	Monroe	1	1
1334	1807	1899	1808	1898	N	10th	St	Monroe	Monroe	1	1
1470	1901	1901	1900	1900	N	10th	St	Monroe	Monroe	1	1
1498	2701	2799	2700	2798	N	10th	St	West Monroe	West Monroe	2	2
2672	301	309	300	310	N	10th	St	Monroe	Monroe	1	1
2735	1903	1999	1902	1998	N	10th	St	Monroe	Monroe	1	1
5031	2401	2499	2400	2498	N	10th	St	Monroe	Monroe	1	1
5248	311	399	312	398	N	10th	St	Monroe	Monroe	1	1
5755	401	499	400	498	N	10th	St	Monroe	Monroe	1	1
5851	1001	1099	1000	1098	N	10th	St	West Monroe	West Monroe	2	2
5906	2001	2099	2000	2098	N	10th	St	Monroe	Monroe	1	1
7161	2501	2599	2500	2598	N	10th	St	Monroe	Monroe	1	1
7577	1801	1805	1800	1806	N	10th	St	Monroe	Monroe	1	1
758											2
762											2
766											1
802											2
8086	501	599	500	598	N	10th	St	Monroe	Monroe	1	1
8095	101	199	100	198	N	10th	St	Monroe	Monroe	1	1
8124	2601	2699	2600	2698	N	10th	St	West Monroe	West Monroe	2	2

DI	STREET				LOW	HIGH	COMM	ST	O_E	ESN
N	10TH ST				100	1099	WEST MONROE	LA		002
N	10TH ST				2400	2699	WEST MONROE	LA		002
N	10TH ST				100	2599	MONROE	LA		001

| PL_ADD_F	PL_ADD_T	PR_ADD_F	PR_ADD_T	PRE_DIR	STREET_NAM	STREET_TYP
1201	1217	1202	1214		Frenchmans Ben	Rd

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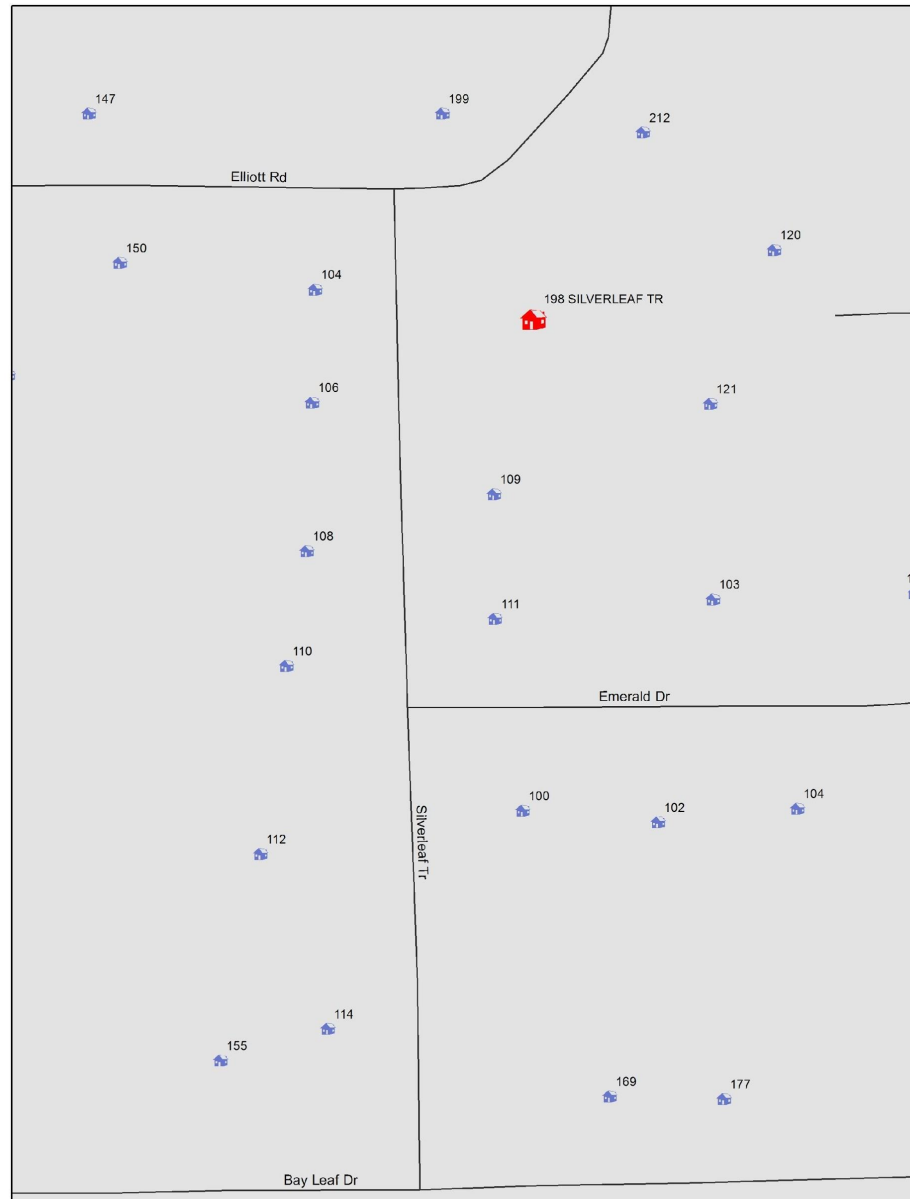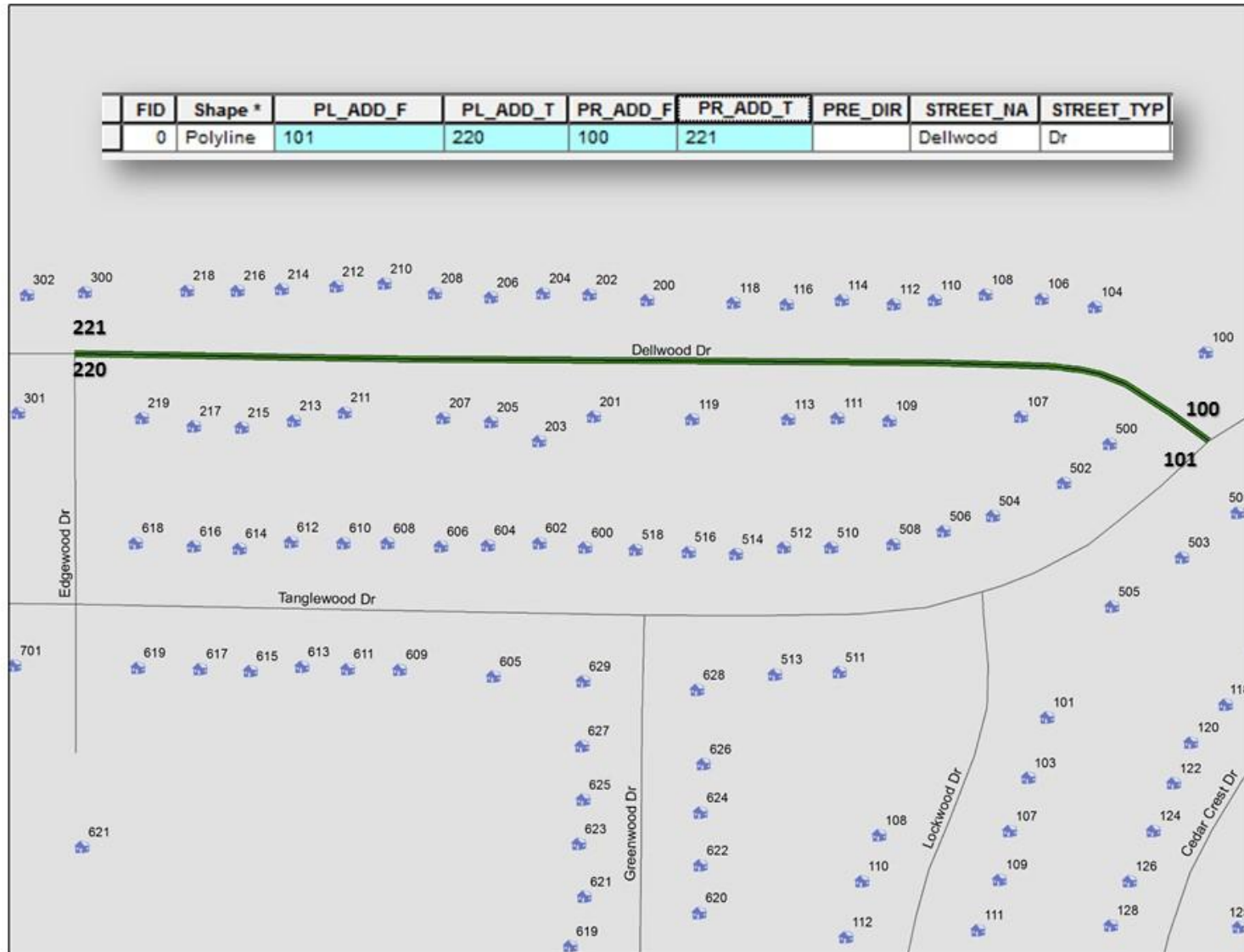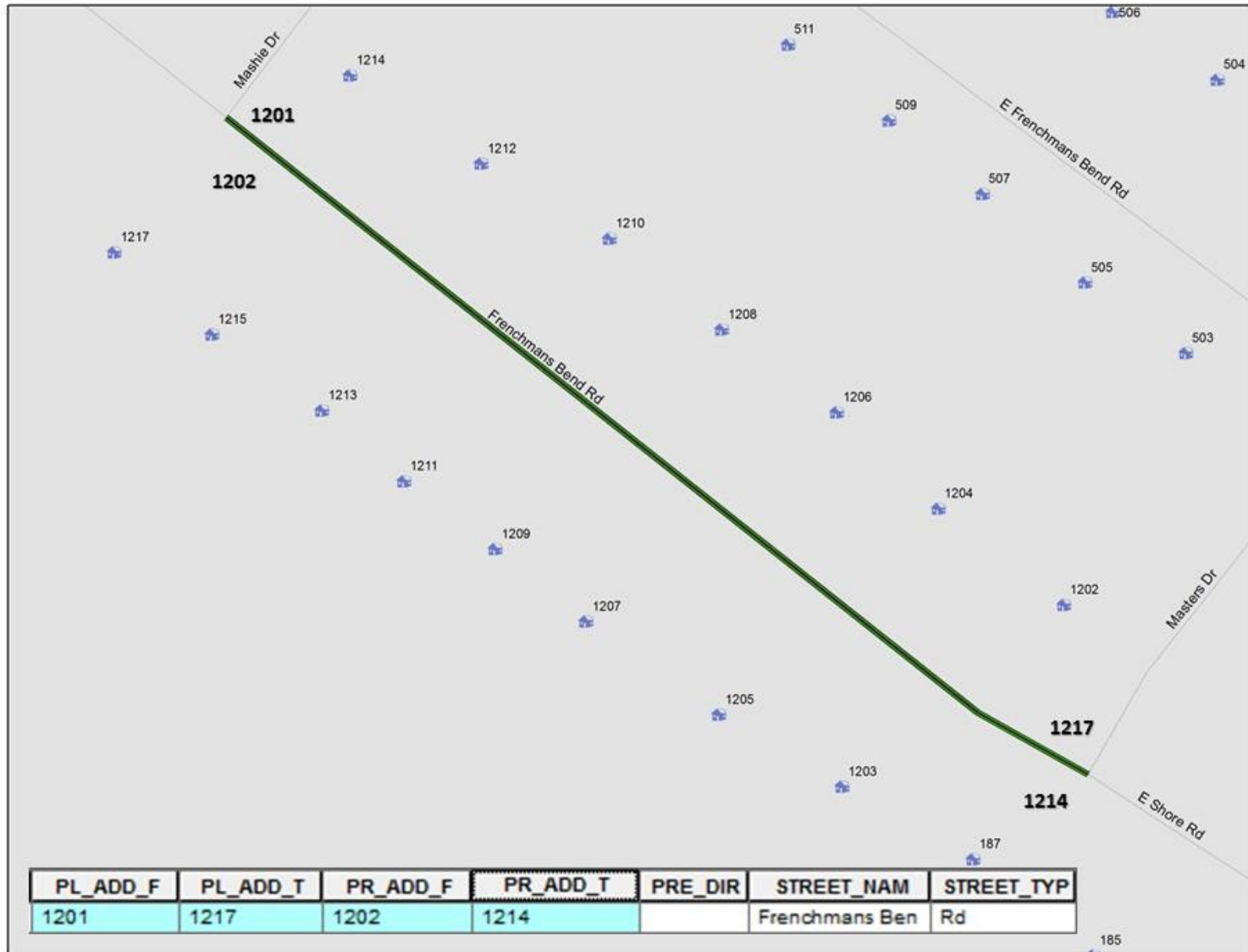
- NENA is developing a data management requirements document that includes recommended turnaround times for error correction in GIS data provided to the system
  - In draft format
  - Between 1 and 3 business days

RECCOMENDATION:

Need an internal GIS data maintenance workflow that enables the emergency communications center to edit the GIS that their system is using in near-real time fashion. Also needs to include workflow for new address' to enter into GIS system in near-real time fashion.

- Planning considerations
  - Resources to accommodate the data clean-up process and create new needed datasets?
  - Maintenance workflows needed to keep data quality at the level for NG911 software and near real-time updates?
  - Integrated GIS support with emergency communications?
  - Collaboration with bordering jurisdictions in creating seamless and disparate regional GIS datasets?
  - Mechanism to accept frequent updates of neighbors data?

PSAP Boundary Creation and Topological Consistency
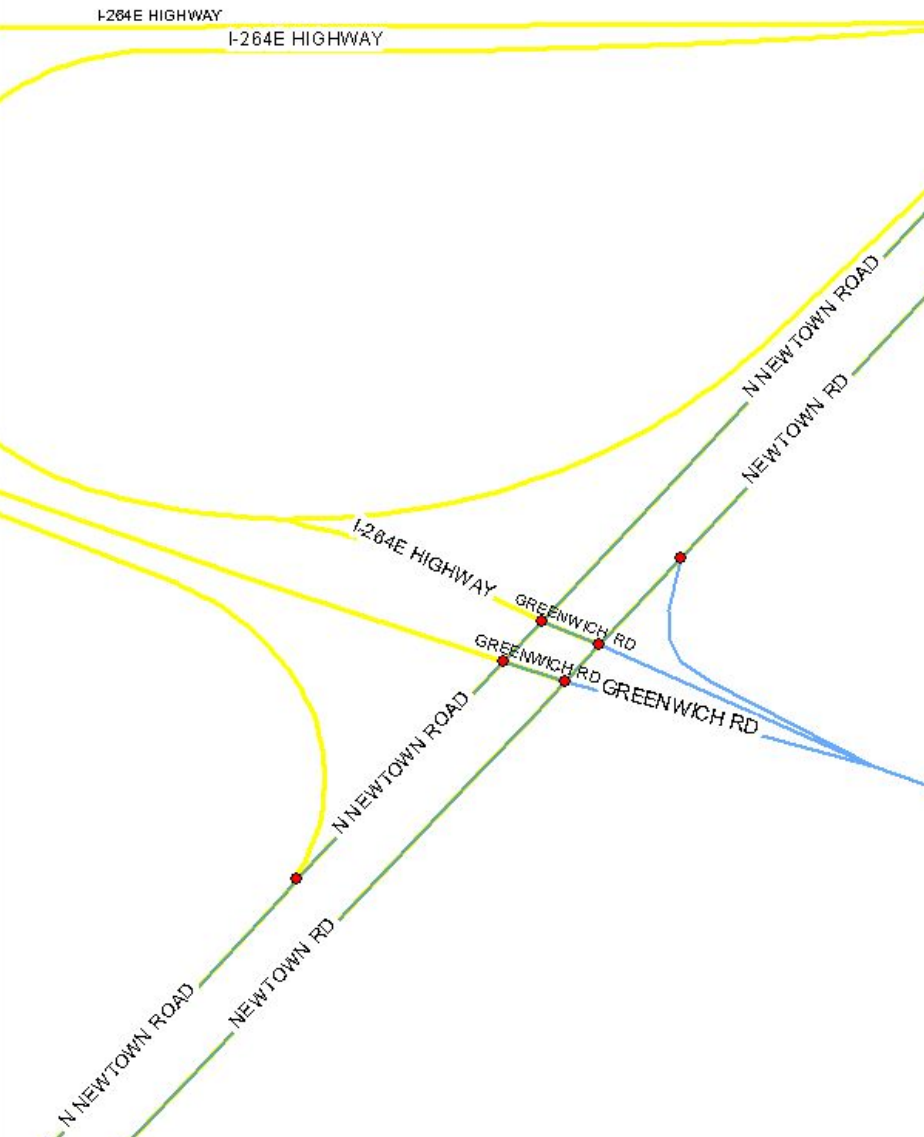
Next Generation 9-1-1 for the GIS Stakeholder

CONCLUSION

Length of time & Task	Task Component	Specific Action(s)	Notes
3 months – GIS Gap Analysis	Assess missing layers and attributes	• Compare with NENA NG 911 Data Model	• NENA NG 911 Data model is in draft format, however, still contains the necessary data components for the efficient delivery of geospatial call routing functionality
	MSAG – Centerline	• Identify where errors exist (GIS or telco) • Update telco	• MSAG defines a tabular extent of PSAP boundary but centerlines will define spatial extent.
	ALI – Centerline ALI – Address Point	• Identify where errors exist (GIS or telco) • Update telco	• Making the centerline corrections first will reduce redundant ALI errors that require analysis.
	Evaluate Address Completeness	• Use additional authoritative and trusted address data sources (USPS, voter registration, parcels, commercial) to evaluate address point completeness	• Comparing address points with multiple sources may identify missing or erroneous address points.

	Conduct Other Validation Checks	• Need to conduct spatial and likely some attribution level quality control validations.
		    • Topology of boundaries
		    • Centerline edge matching
		    • Address point location
		    • Centerline-address point validations	

16 months	GIS Data & Maintenance Enhancements	• Make a plan and develop standards
		• Internal Data Enhancements
		    • PSAP boundary
		    • Address Points
		    • Centerline
		    • Authoritative Boundary
		    • Emergency Services Zones
		• Work with neighboring jurisdictions on boundary data conflation
			• No gaps/overlaps in boundary files
			    • PSAP/Authoritative boundary topology w/ centerlines
			• No centerline feature duplication
			• No address point duplication
			• Road name alias table

18 months	Prepare data for coalesce into database management system	• Database "crosswalk" needed • Implement maintenance schedule	• May need to procure middleware solutions to maintain data integrity, operationalize maintenance plan, and provision data.

NENA

- Published
  - 08-003 *Detailed Functional and Interface Standards for the NENA i3 Solution*
  - 71-501 *Synchronizing GIS with MSAG & ALI*
  - 02-041 *GIS Data Collections and Maintenance Standards*

- Draft
  - **GIS Data Model for NG9-1-1**
    - this document defines the Geographic Information Systems (GIS) database model that will be used to support the NENA Next Generation 9-1-1 (NG9- 1-1) systems, databases, call routing, call handling, and related processes.
  - **Provisioning and Maintenance of GIS data to ECRF/LVF**
  - **Site/Structure Address Points**
    - Is currently developing a document to serve as a guide for those developing site/structure address point data in a GIS for use in 9-1-
  - **Next Generation 9-1-1 Data Management Requirements**
    - The intent of the document is to provide 9-1-1 authorities, vendors, Communication Service Providers (CSP), and other interested parties with guidelines for communicating issues or status of various elements within the system.

Questions?

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