

# GIS in E9-1-1 & Next Generation 9-1-1

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# Housekeeping



- Emergency Exits
- Restrooms
- Breaks
- Lunch
- Other
- Introductions



**Interaction IS Encouraged**  
**There is no such thing as a Stupid Question**

# Presentation Agenda

- What is GIS
- How 9-1-1 Works Today
- GIS in 9-1-1
- What is Next Generation 9-1-1
- Data Requirements
- Next Generation 9-1-1



**Ask Questions and Have Fun**

# What is GIS?

A **Geographic Information System (GIS)** hardware, software, and data for managing, analyzing, and displaying geographically referenced information

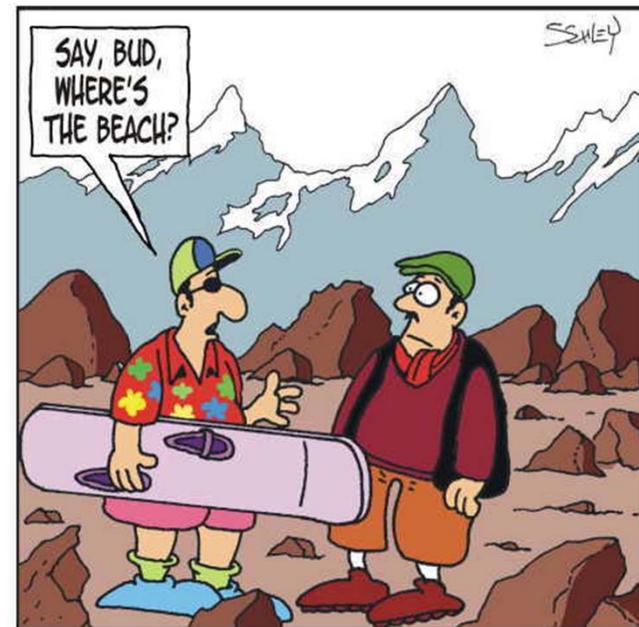


# What is GIS?

GIS uses databases to analyze and visualize real-world problems

GIS databases reference information to a location on the earth (Geographic = Geography)

GIS databases typically have a common theme  
– a layer of information



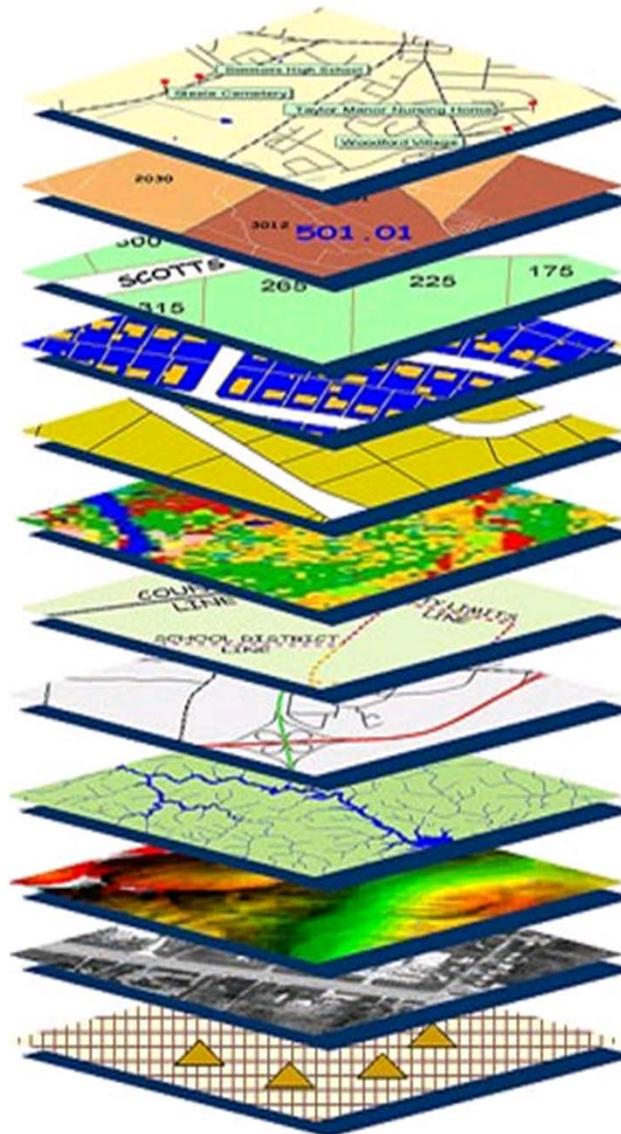
Billy-Joe was great on sport but lousy on geography.

# What is GIS?

Shape	AREA	PERIMETER
Polygon	21367.55	611.1503
Shape	AREA	PERIMETER
Polygon	21367.55	611.1503
Shape	AREA	PERIMETER
Polygon	21367.55	611.1503
Polygon	1.297372E+07	21229
Polygon	26818.36	757.0709
Polygon	29969.94	692.0897
Polygon	41613.2	1048.121
Polygon	1158222	5526.928
Polygon	98096.47	2025.494
Polygon	12364.73	543.3378
Polygon	55936.95	1399.978
Polygon	97471.38	1798.63
Polygon	85175.83	1817.807

A GIS does not contain any maps or graphics

GIS contains relational databases that displays information on a map



Geographic Names \*

Census

Addresses

Structures \*

Parcels

Land Cover \*

Boundaries \*

Transportation \*

Hydrography \*

Elevation \*

Orthoimagery \*

Geodesy

\* The National Map Layer

# What is GIS?

Database “layers / themes” in a GIS

Lakes DB

Attributes of LAKES.SHP		
<i>Shape</i>	<i>Area</i>	<i>Name</i>
Polygon	2359.377	Great Salt Lake
Polygon	320.537	Lake Powell
Polygon	321.384	Salton Sea
Polygon	591.443	Lake Okeechobee
Polygon	398.880	Upper Red Lake
Polygon	317.553	Lake Mead
Polygon	130.366	Clarks Hill Lake
Polygon	1796.353	Lake of the Woods
Polygon	410.084	Fort Peck Lake
Polygon	752.129	Lake Oahe
Polygon	182.629	Mille Lacs Lake
Polygon	22228.328	Lake Michigan

Rivers DB

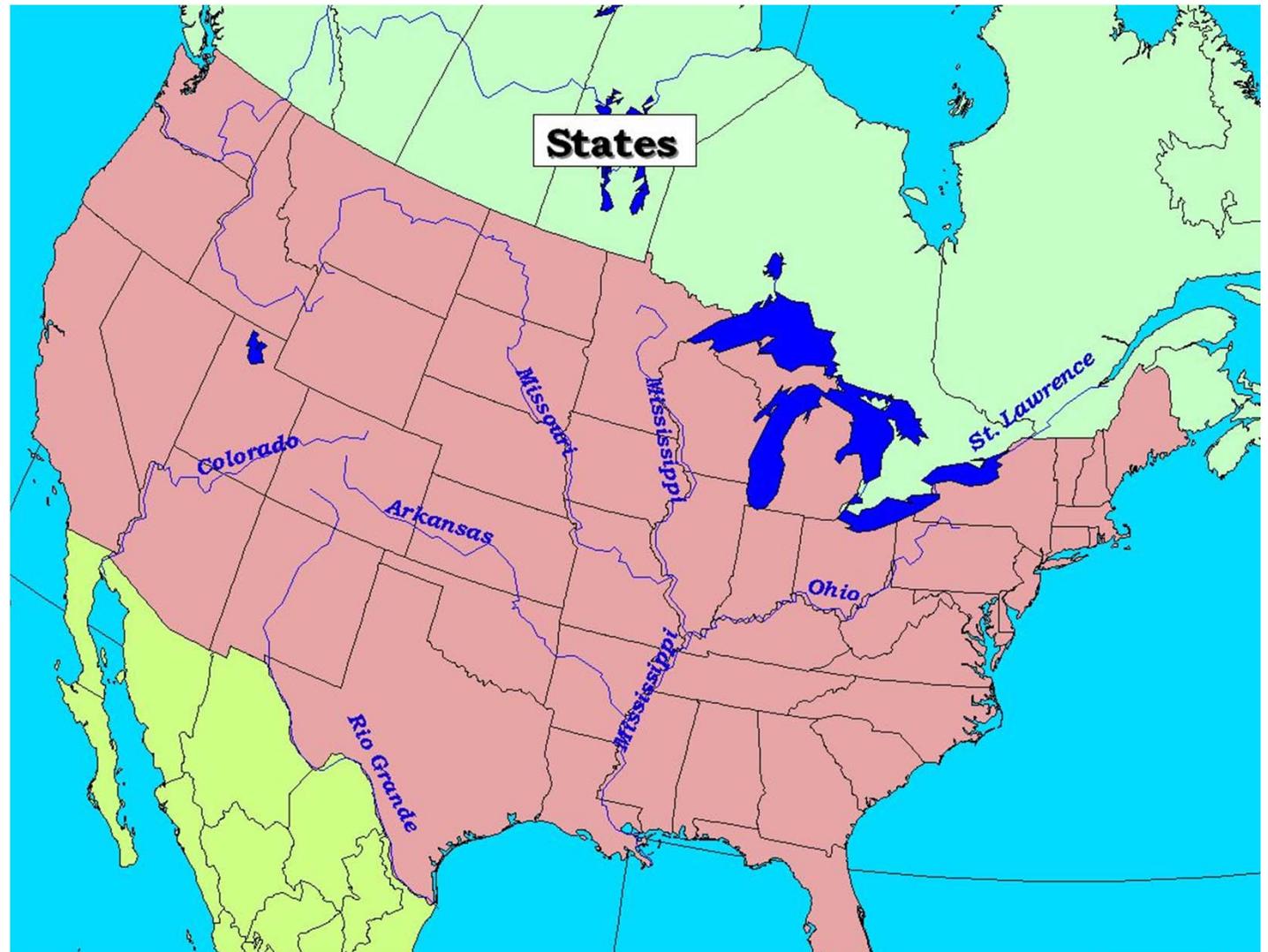
Attributes of RIVERS.SHP		
<i>Shape</i>	<i>Name</i>	<i>System</i>
PolyLine	Missouri	Mississippi
PolyLine	Pecos	Rio Grande
PolyLine	Gila	Colorado
PolyLine	Colorado	Colorado
PolyLine	Snake	Columbia
PolyLine	Columbia	Columbia
PolyLine	Canadian	Mississippi
PolyLine	Arkansas	Mississippi
PolyLine	Illinois	Mississippi
PolyLine	Ohio	Mississippi
PolyLine	Red	Mississippi
PolyLine	North Platte	Mississippi

States DB

Attributes of STATES.SHP			
<i>Shape</i>	<i>Area</i>	<i>State_name</i>	<i>State_abbr</i>
Polygon	67286.878	Washington	WA
Polygon	147236.028	Montana	MT
Polygon	32161.664	Maine	ME
Polygon	70810.153	North Dakota	ND
Polygon	77193.624	South Dakota	SD
Polygon	97799.492	Wyoming	WY
Polygon	56088.066	Wisconsin	WI
Polygon	83340.595	Idaho	ID

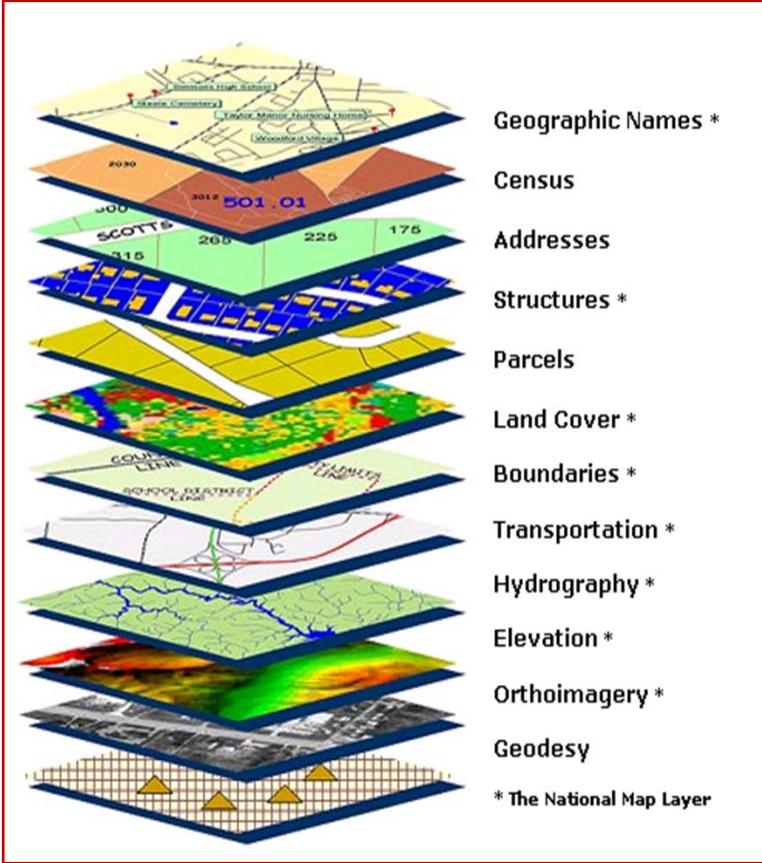
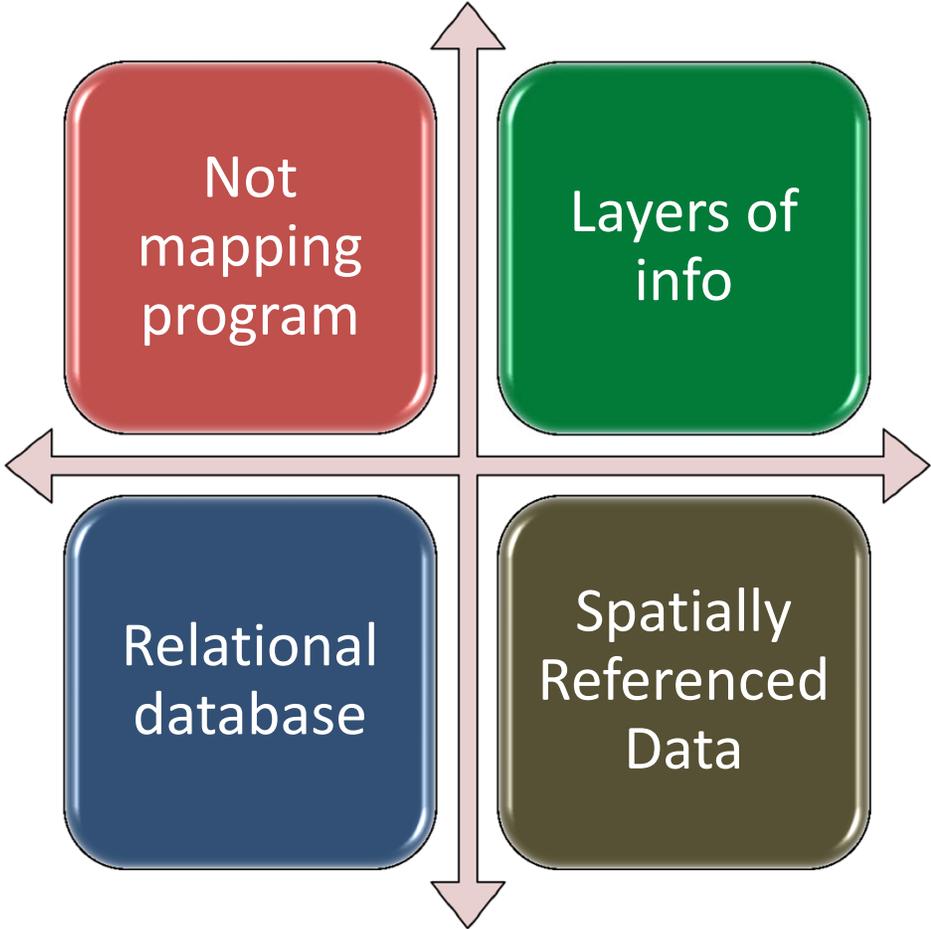
# What is GIS?

Map Display created from data shown on previous slide

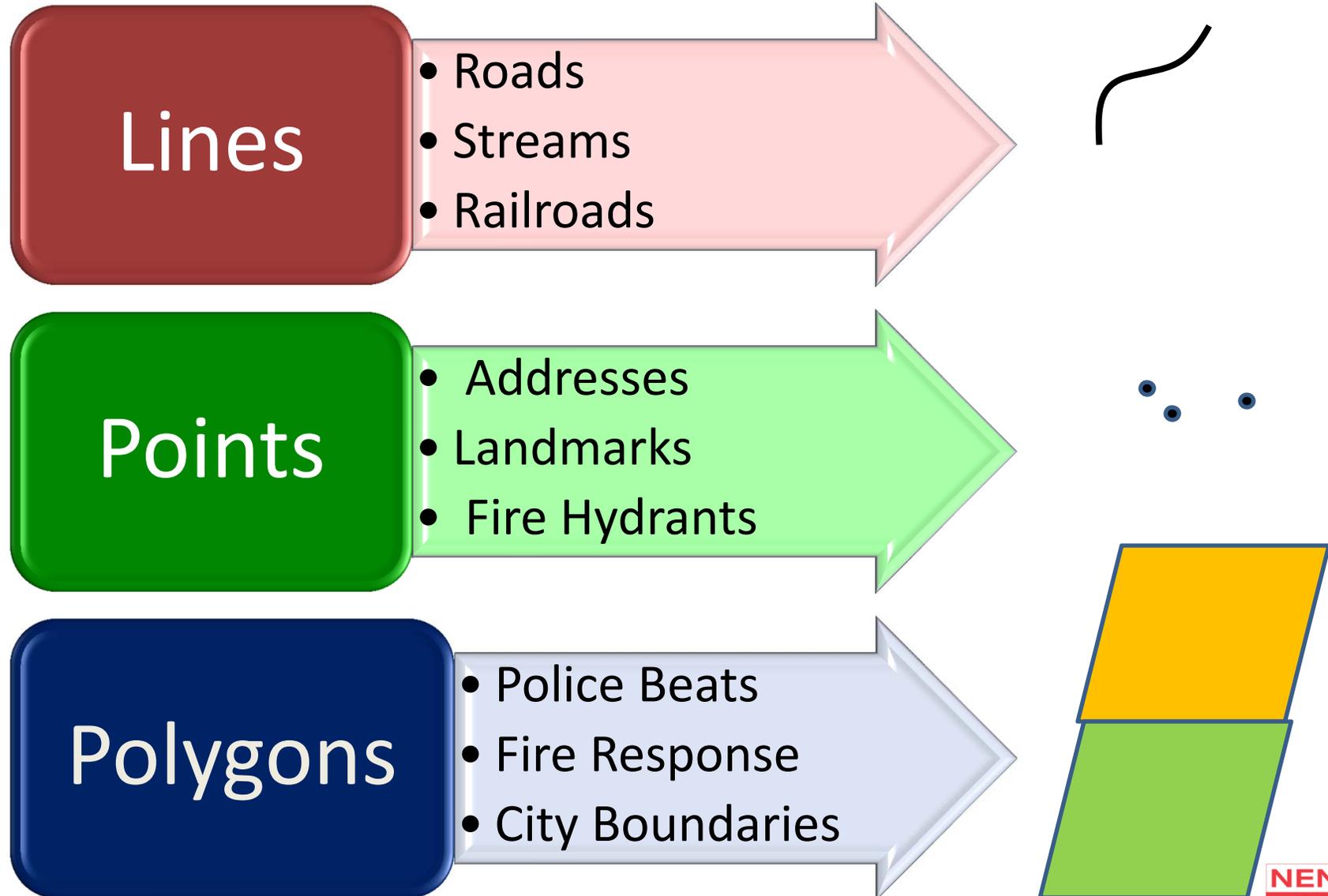


Lakes  
Rivers  
States

# What is GIS?



# What is GIS?



# What is GIS?

The main types of data in a GIS are points, lines, polygons, and imagery

## Feature types

Lines - Roads

Points - Addresses

Polygons

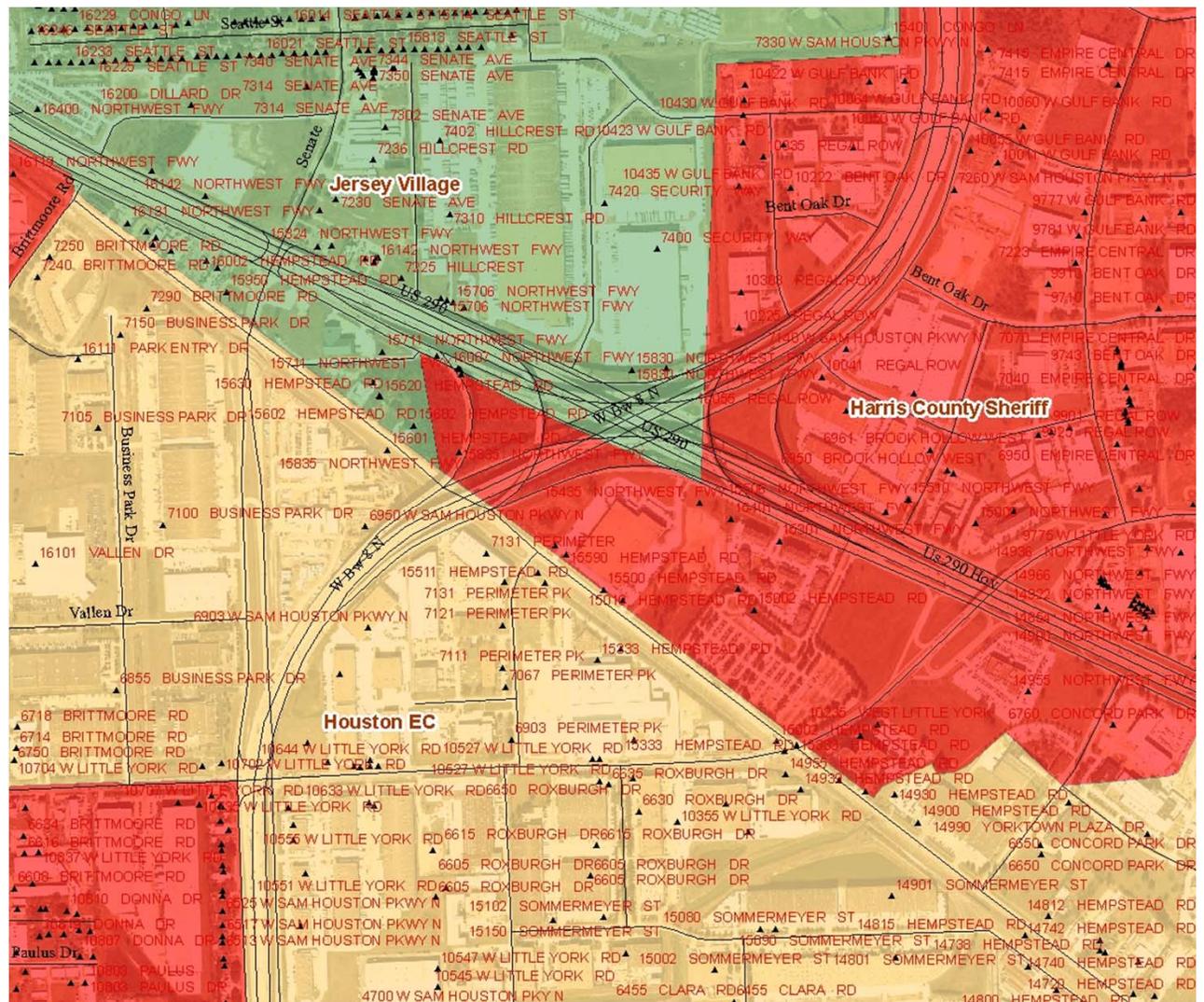
– PSAP's Boundaries

Imagery - Aerial

Combined

Imagery includes graphics, floorplans, and aerial photography

Imagery is not contained in a database



# What is GIS?

Procedures



Personnel



Data



Software

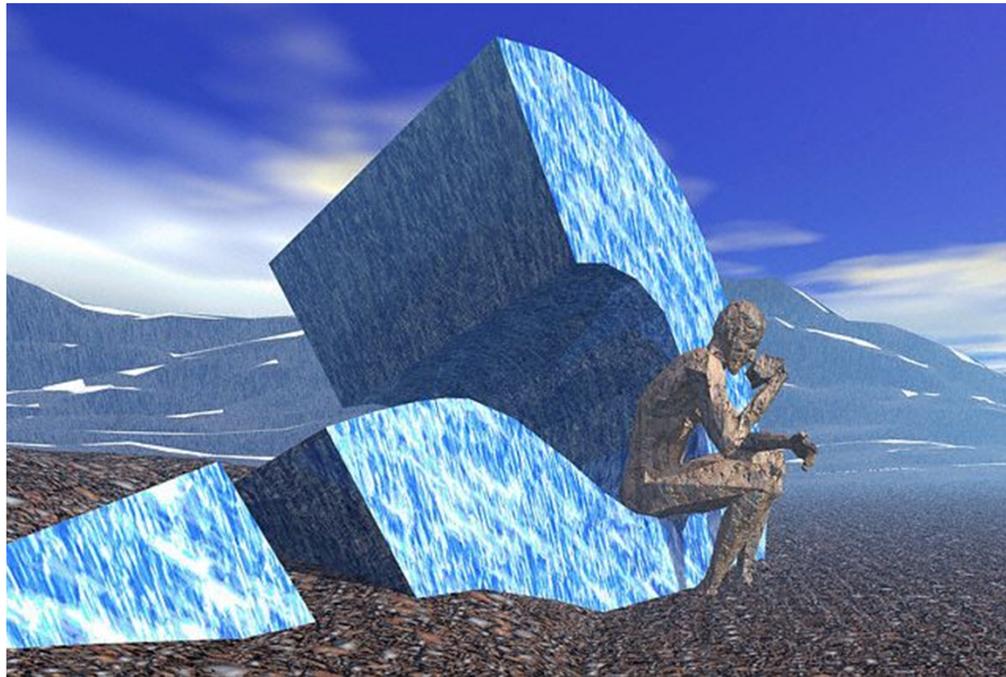


End  
Users

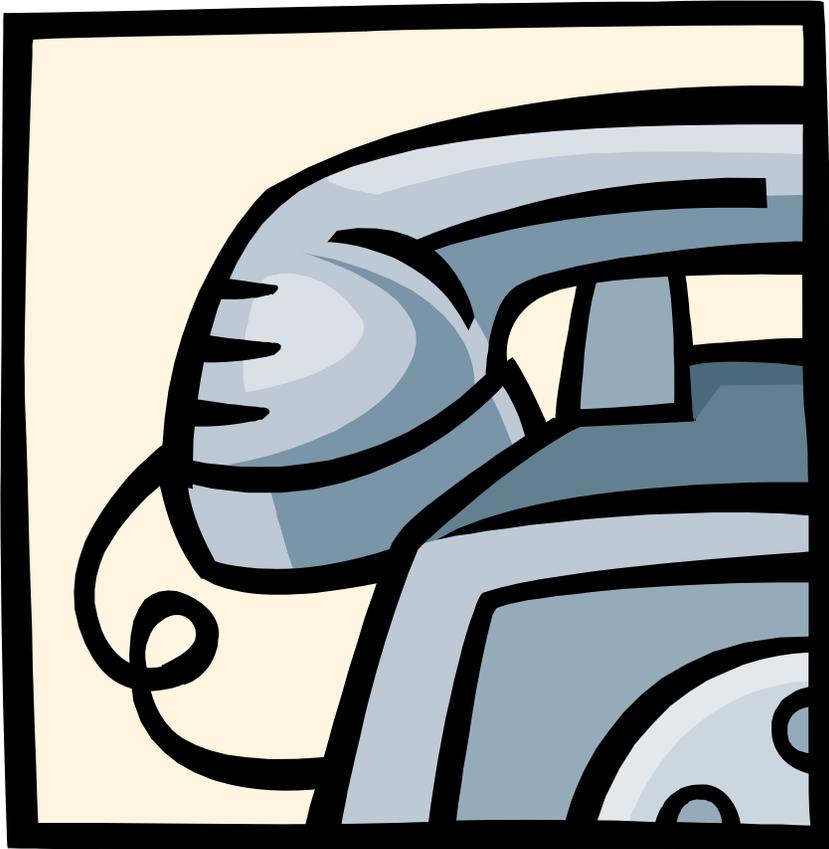


# What is GIS?

- Ask a question of the data
- Data gives you the answer
- Complex questions require complex data

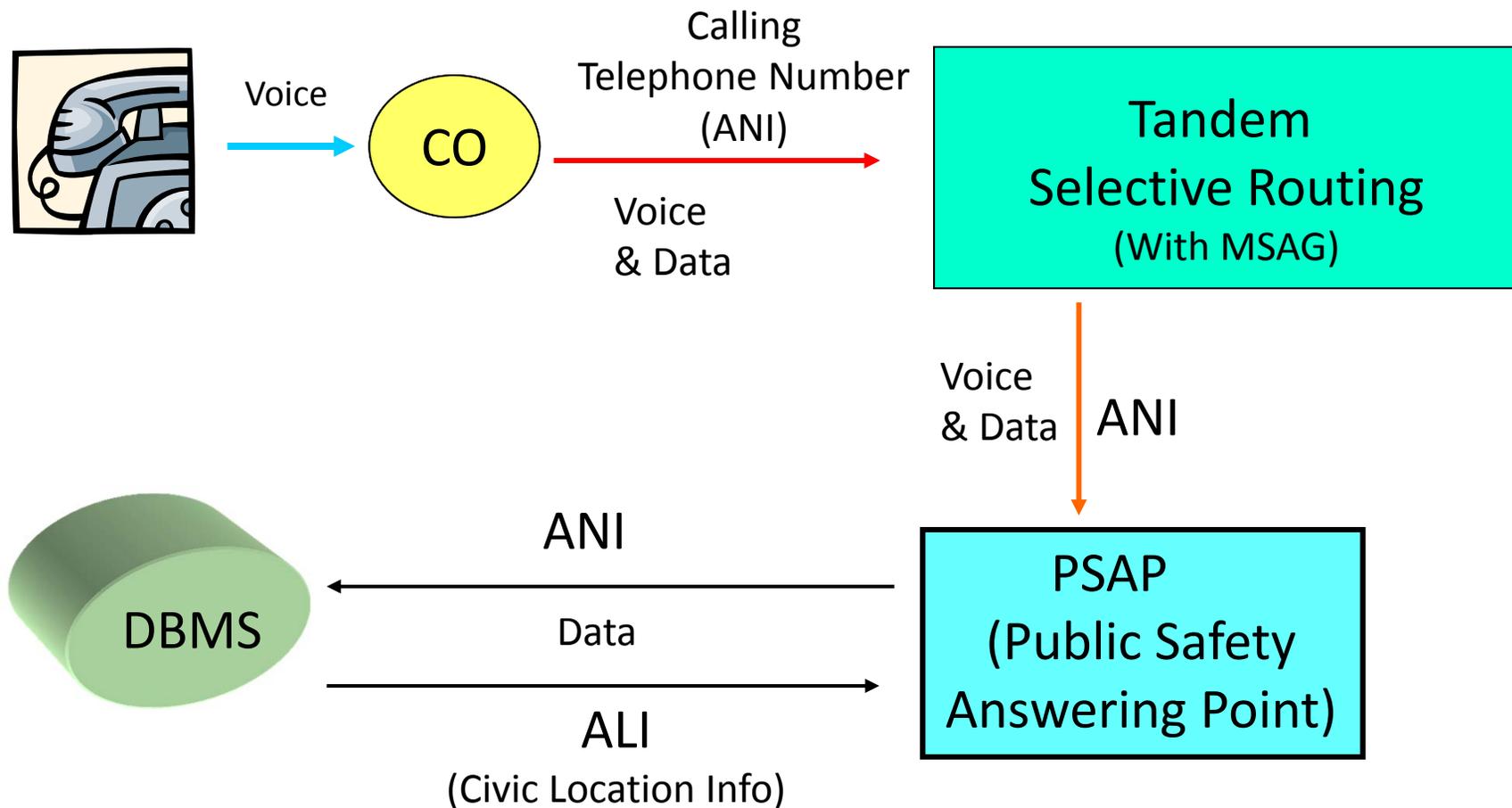


# In the Beginning ... Wireline Enhanced 9-1-1

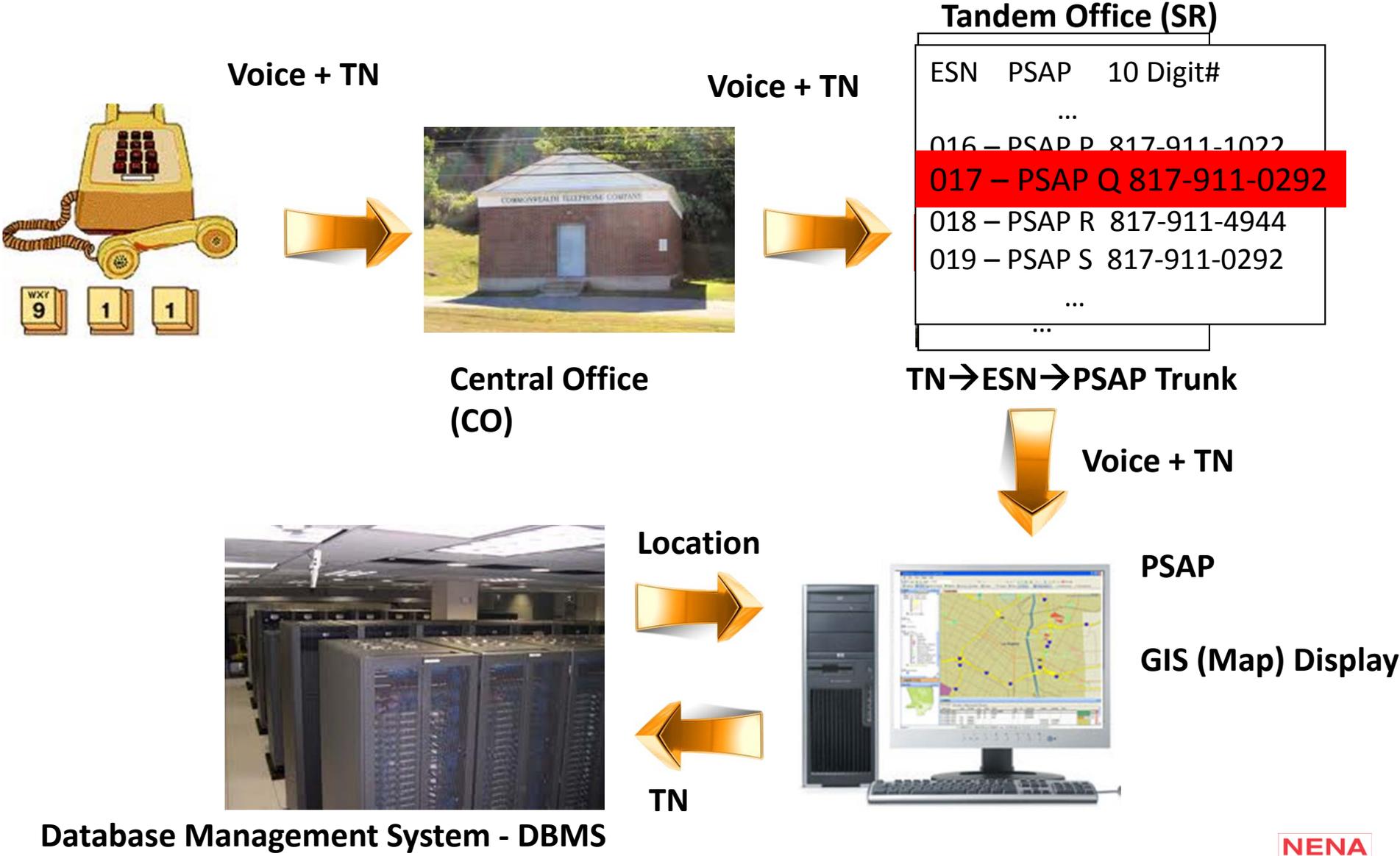


- Enhanced 9-1-1 served only wireline phones so this is what you did...

# Typical Enhanced 911 Wireline Call



# Current Call Flow



# Today's Enhanced 911 (E9-1-1) Data

Today's **ALI** database systems perform three main functions:

- Validation of a subscriber's street address against a **Master Street Address Guide (MSAG)**
- Assignment of an **Emergency Service Number (ESN)** for call routing and selective transfer of 9-1-1 calls to and between PSAPs
- Delivery of the record associated with a telephone number.

These functions have remained largely unchanged over the past 30 years despite significant changes in technology and telephony.



# Automatic Location Information

## ALI Databases

## The Kitchen Sink Field

HOUSE	PREFIX	NAME	TYPE	COMM	ST	LOC
239		ALUM CLIFF RD		NENA TOWN	OZ	LOT D-7 MISTY HARBOR CAMPGROUNDS
2179		ANDERSON STATION RD		NENA TOWN	OZ	APT 142
2441		ANDERSON STATION RD		NENA TOWN	OZ	2-B
1680	N	BRIDGE	ST	NENA TOWN	OZ	NEXT TO LOUNGE - BY POP MACHINES - ENTRANCE
1470	N	BRIDGE ST		NENA TOWN	OZ	IN KMART STORE / NE CORNER
10105		CO RD 550		NENA TOWN	OZ	LOT 13 / WIFE IS HANDICAPPED AND ON BREATHING MACHINE
105		COURTLAND	DR	NENA TOWN	OZ	SECURITY/ELEVATOR
237	R	INDEPENDENCE	DR	NENA TOWN	OZ	HANDICAPPED/USES A STAIR ELEVATOR TO GO UP AND DOWN STAIRS.
144		LAKE RD		STAY	OZ	SCIOTO TRAILS STATE PARK
14	S	PAINT ST		NENA TOWN	OZ	4TH FLOOR SUITE 54
255		PIERCE LA		NENA TOWN	OZ	THIS IS TRAILER - THERE IS OFF PREMISE AT HOUSE
547		PLYLEYS	LA	NENA TOWN	OZ	APT 14
371		PLYLEYS LANE		NENA TOWN	OZ	APT 139
1810		POSSUM HOLLOW RD		AWAKE	OZ	FATHER DEAF-PROPANE TANK BEHIND HOUSE
126	E	SECOND	ST	NENA TOWN	OZ	SUITES E & F
126	E	SECOND ST		NENA TOWN	OZ	A
55		SUNRUSH	BVD	NENA TOWN	OZ	APT 1
167		TURNER	RD	NENA TOWN	OZ	HEART CONDITION - 2ND DOUBLE WIDE ON LEFT - NO SHUTTERS

# Today's ALI – Loc Field

## The Kitchen Sink



In NG9-1-1 the location information is more detailed

LOC
LOT D-7 MISTY HARBOR CAMPGROUNDS
APT 142
2-B
NEXT TO LOUNGE - BY POP MACHINES - ENTRANCE
IN KMART STORE / NE CORNER
LOT 13 / WIFE IS HANDICAPPED AND ON BREATHING MACHINE
SECURITY/ELEVATOR HANDICAPPED/USES A STAIR ELEVATOR TO GO UP AND DOWN STAIRS.
SCIOTO TRAILS STATE PARK
4TH FLOOR SUITE 54
THIS IS TRAILER - THERE IS OFF PREMISE AT HOUSE
APT 14
APT 139
FATHER DEAF-PROPANE TANK BEHIND HOUSE
SUITES E & F
A
APT 1
HEART CONDITION - 2ND DOUBLE WIDE ON LEFT - NO SHUTTERS

# MSAG

A list of street names and house number ranges associated with Communities and Emergency Service Numbers (ESNs) to enable proper routing of 9-1-1 calls

Address Range

PS	ST_NAME	TYPE	SD	LOW	HIGH	MSAG_Community	ST	P	ESN
	BLACK WALNUT	DR		100	162	HOUSTON	TX	B	139
	WALNUT BEND	LN		100	3999	HOUSTON	TX	B	21
N	WALNUT			100	499	TOMBALL	TX	B	95
N	WALNUT	ST		100	699	WEBSTER	TX	B	102
S	WALNUT			100	699	TOMBALL	TX	B	95
S	WALNUT			100	199	MORGANS POINT	TX	B	73
S	WALNUT	ST		100	599	WEBSTER	TX	B	102

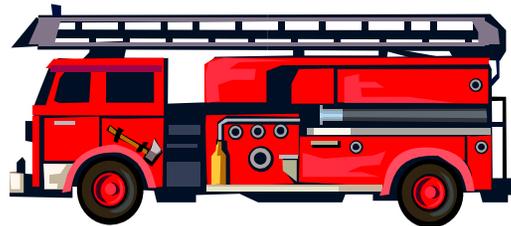
Not all fields are shown

NENA 02-010

NENA 02-011

# Emergency Service Zones

- Unique combination of emergency responders

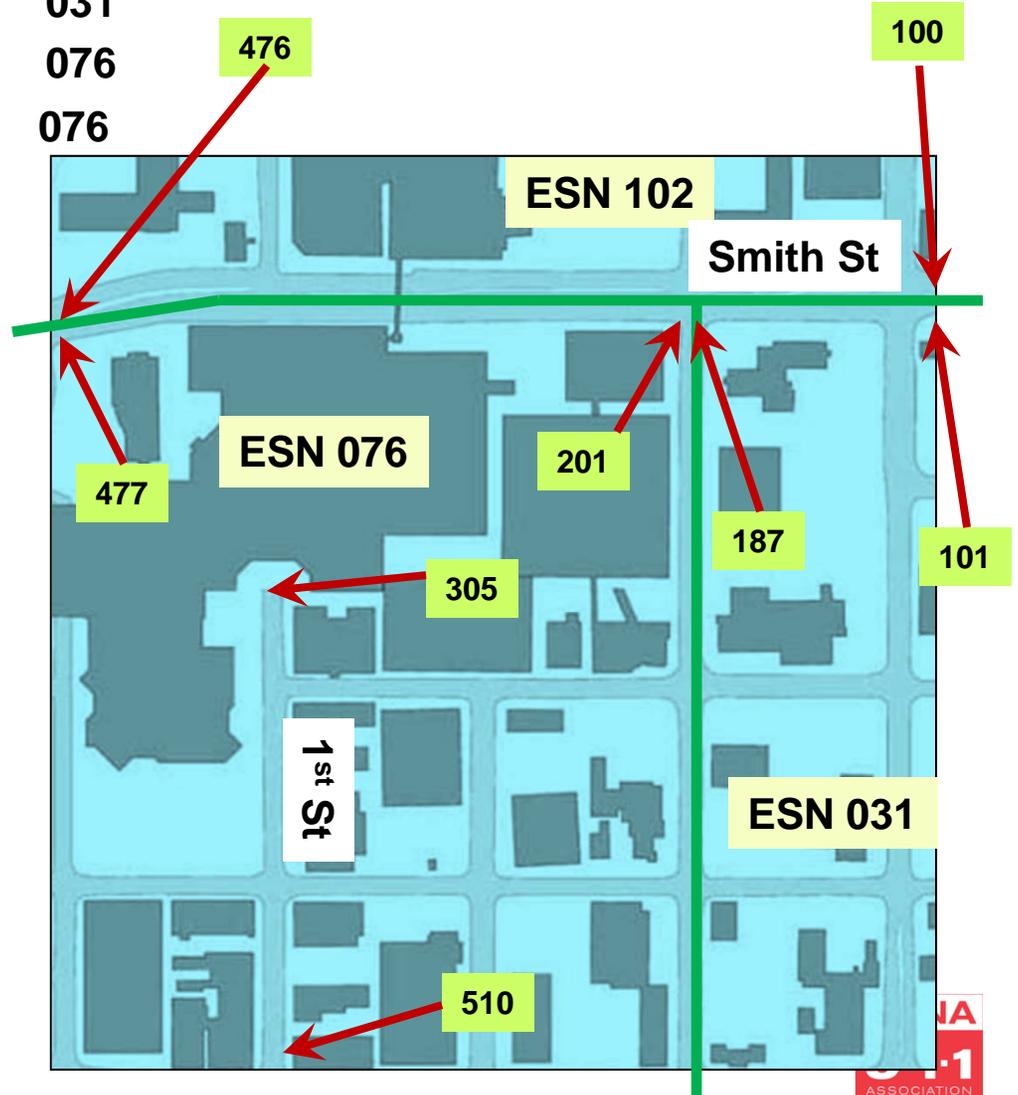


- Clearly defined boundaries
- Identified by road address ranges and address ranges
- Key to PSAP routing and efficient response
- MSAG contains ESN which is the code for the ESZ
- ESZ used for routing to the correct PSAP
- ESN is defined as an area on the map display (*a polygon*)

# ESZ's and ESN's - It all Begins with a Map

## Master Street Address Guide (MSAG)

PD	Street	Type	SD	LOW	HIGH	E/O	ESN
	Smith	St		100	476	E	102
	Smith	St		101	187	O	031
	Smith	St		201	477	O	076
	1ST	St		305	510	B	076

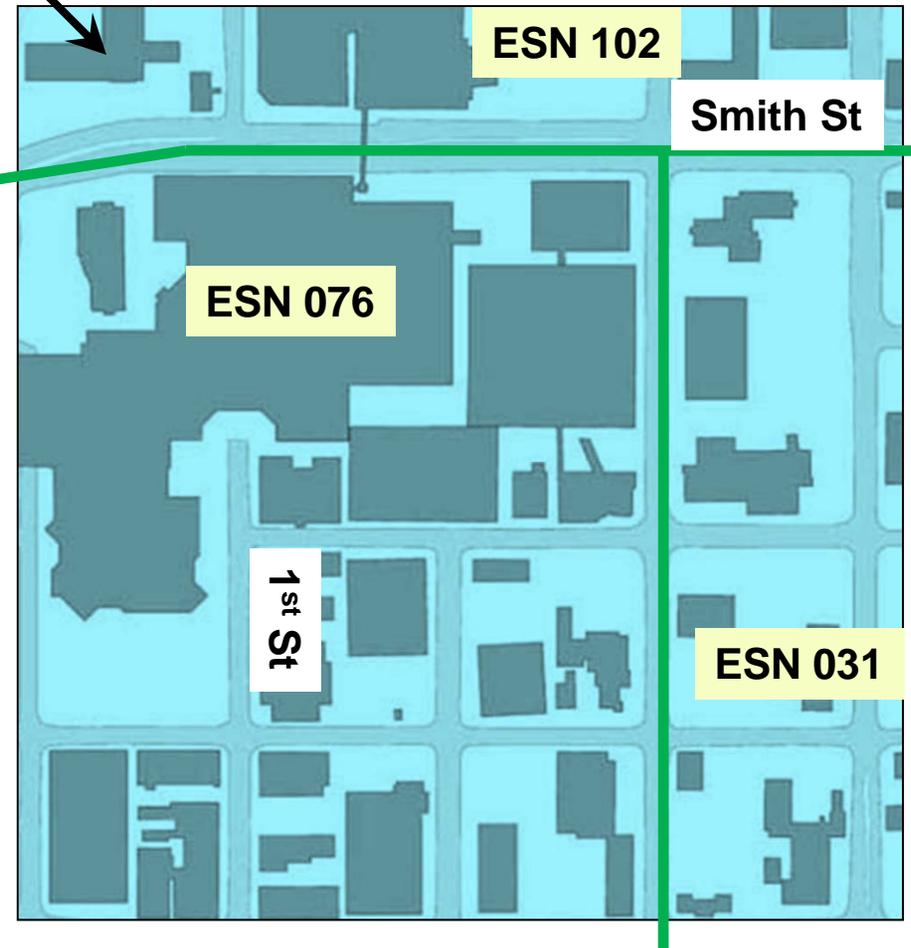


# The Automatic Location Identification - ALI

## NENA Version 3.1 Format

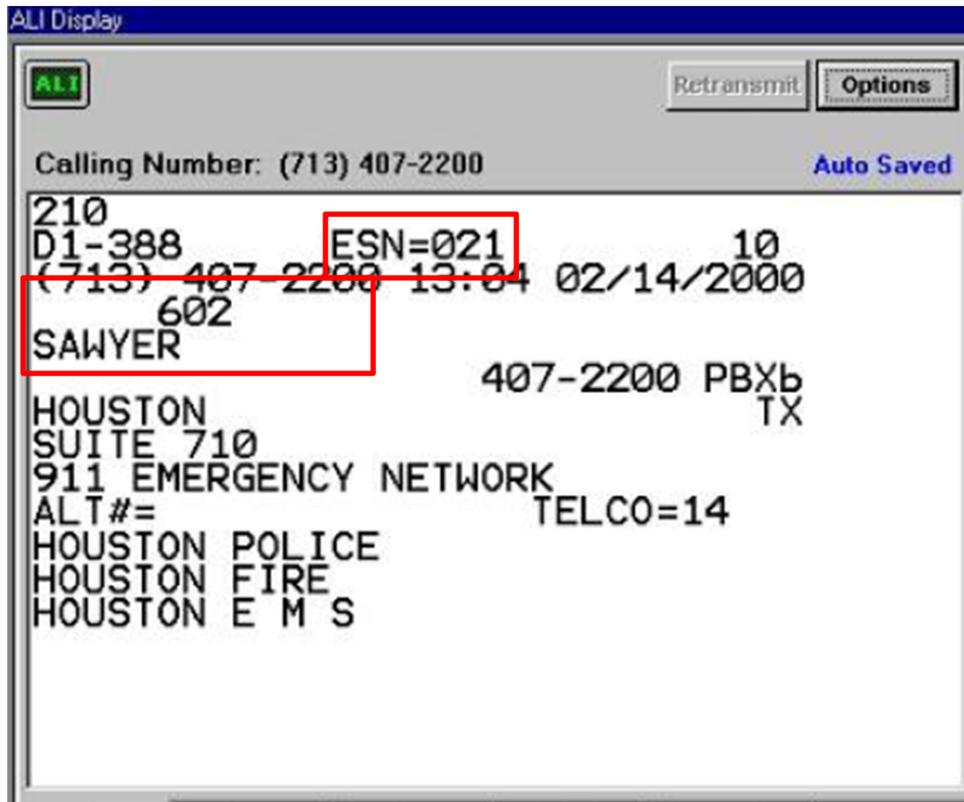
House Number	470
House Number Suffix	
Prefix Directional	
Street Name	SMITH
Street Suffix	ST
Post Directional	
MSAG Community Name	CROOKSBURG
Postal Community Name	SPARTA
State / Province	NC
Location	Suite 103
Landmark	
Customer Name	Kilby's Kookies
Class of Service	2
Type of Service	4
Exchange	
ESN	102
Main Telephone Number	555-555-1010
Call Back Number	
p-ANI	
Zip Code	07542

(Not all fields shown)



# How does GIS work?

When a 9-1-1 comes in there is an ALI with it. A **wireline** ALI contains the address of the caller.



The ALI information is passed to the map display to search the *GIS street centerline* database for all street named Sawyer (in ESN 021).

The GIS then finds the address range on Sawyer that the ALI address (602) is within.

*GIS street centerline database*

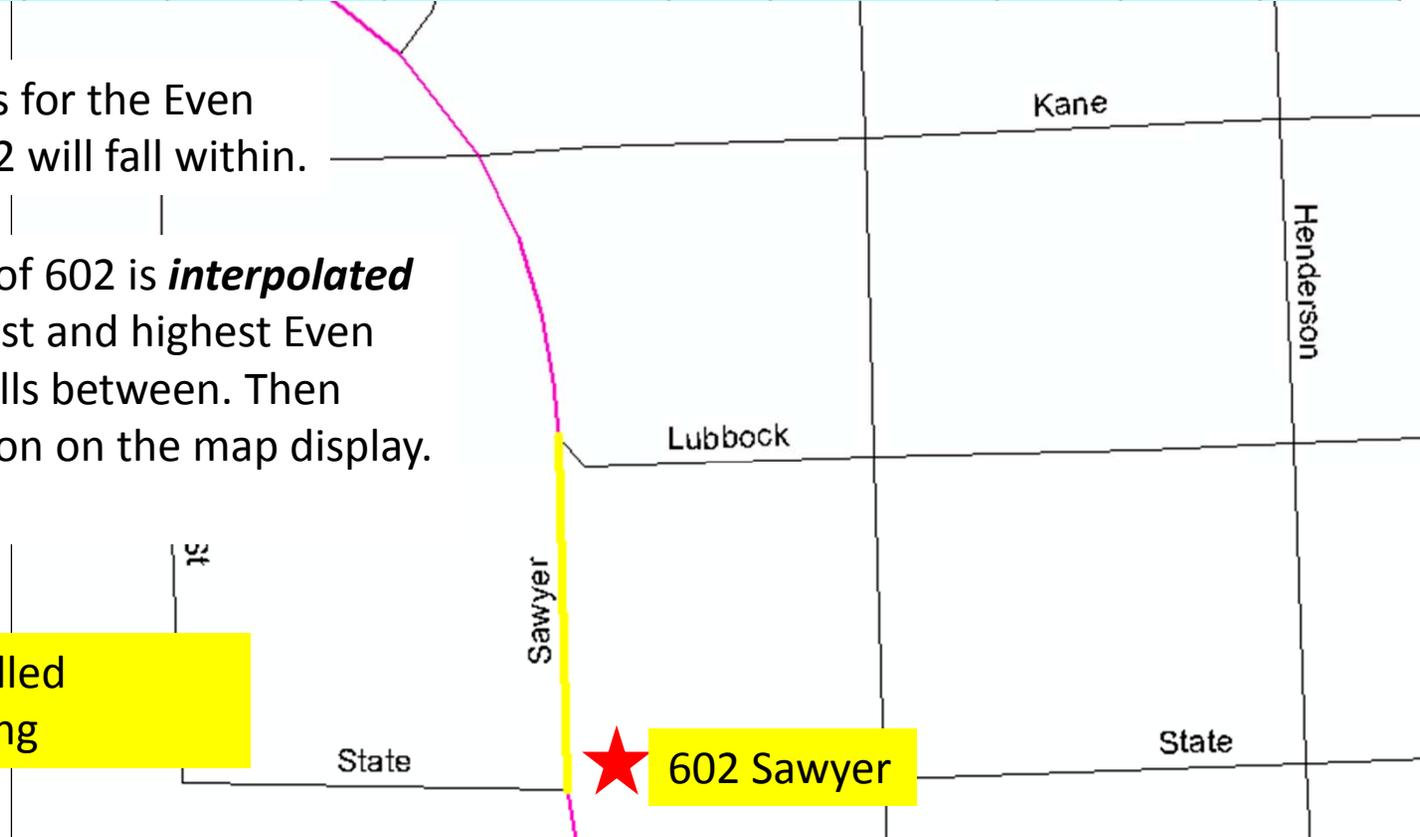
Cu	RF_ADD	LF_ADDR	RT_ADD	LT_ADD	PRE	NAME	ST_T	SUF	ESN_R	ESN_L	ZIP_L	ZIP_R
	400	401	498	499		SAWYER			021	021	77007	77007
	500	501	598	599		SAWYER			021	021	77007	77007
	600	601	698	699		SAWYER			021	021	77007	77007
	700	701	798	799		SAWYER			021	021	77007	77007
	800	801	802	803		SAWYER			021	021	77007	77007
	804	805	898	899		SAWYER			021	021	77007	77007

# How does GIS work?

RF_ADD	LF_ADDR	RT_ADD	LT_ADD	PRE	NAME	ST_T	SUF	ESN_R	ESN_L	ZIP_L	ZIP_R
400	401	498	499		SAWYER			021	021	77007	77007
500	501	598	599		SAWYER			021	021	77007	77007
600	601	698	699		SAWYER			021	021	77007	77007
700	701	798	799		SAWYER			021	021	77007	77007
800	801	802	803		SAWYER			021	021	77007	77007
804	805	898	899		SAWYER			021	021	77007	77007

The GIS then looks for the Even addresses that 602 will fall within.

Next the location of 602 is *interpolated* between the lowest and highest Even ranges that 602 falls between. Then displays the location on the map display.



This process is called Address Geocoding

# Geocoding the Wireline ALI

1498	1500	E County line Rd	1598	1600
1499	1501		1599	1601

**Potential address ranges**  
**vs.**  
**Actual address ranges**

1462	1512	E County line Rd	1558	1608
1463	1511		1559	1607

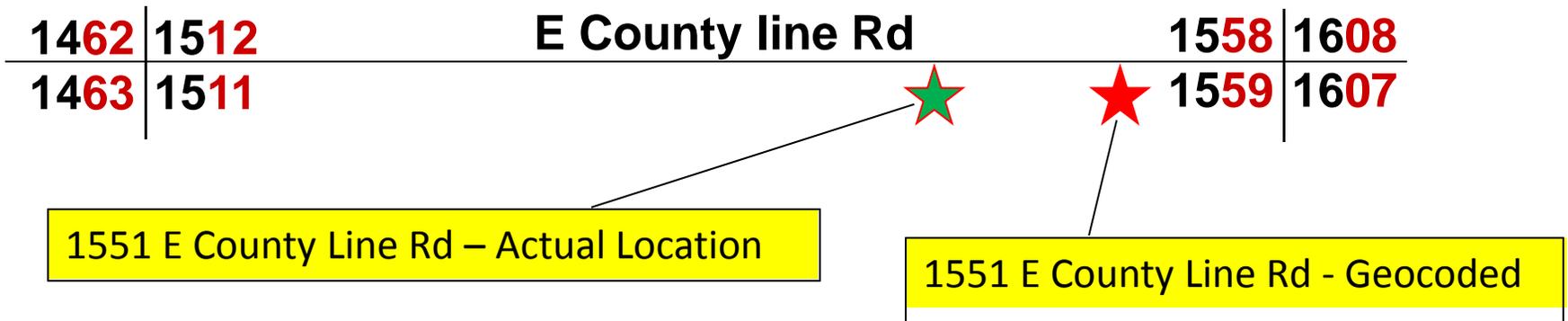
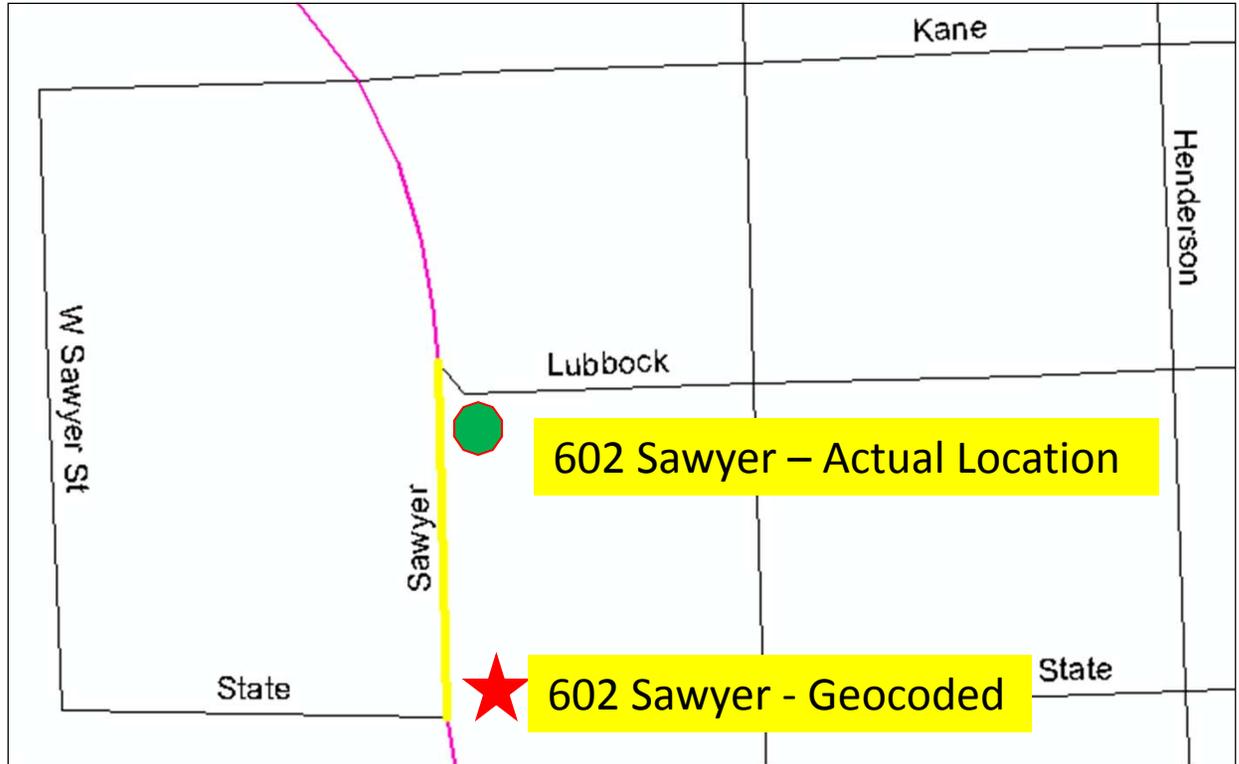
Map 1551 E County Line Rd?

### Street Centerline -

Address Geocoding approximates the location of the address based on ranges

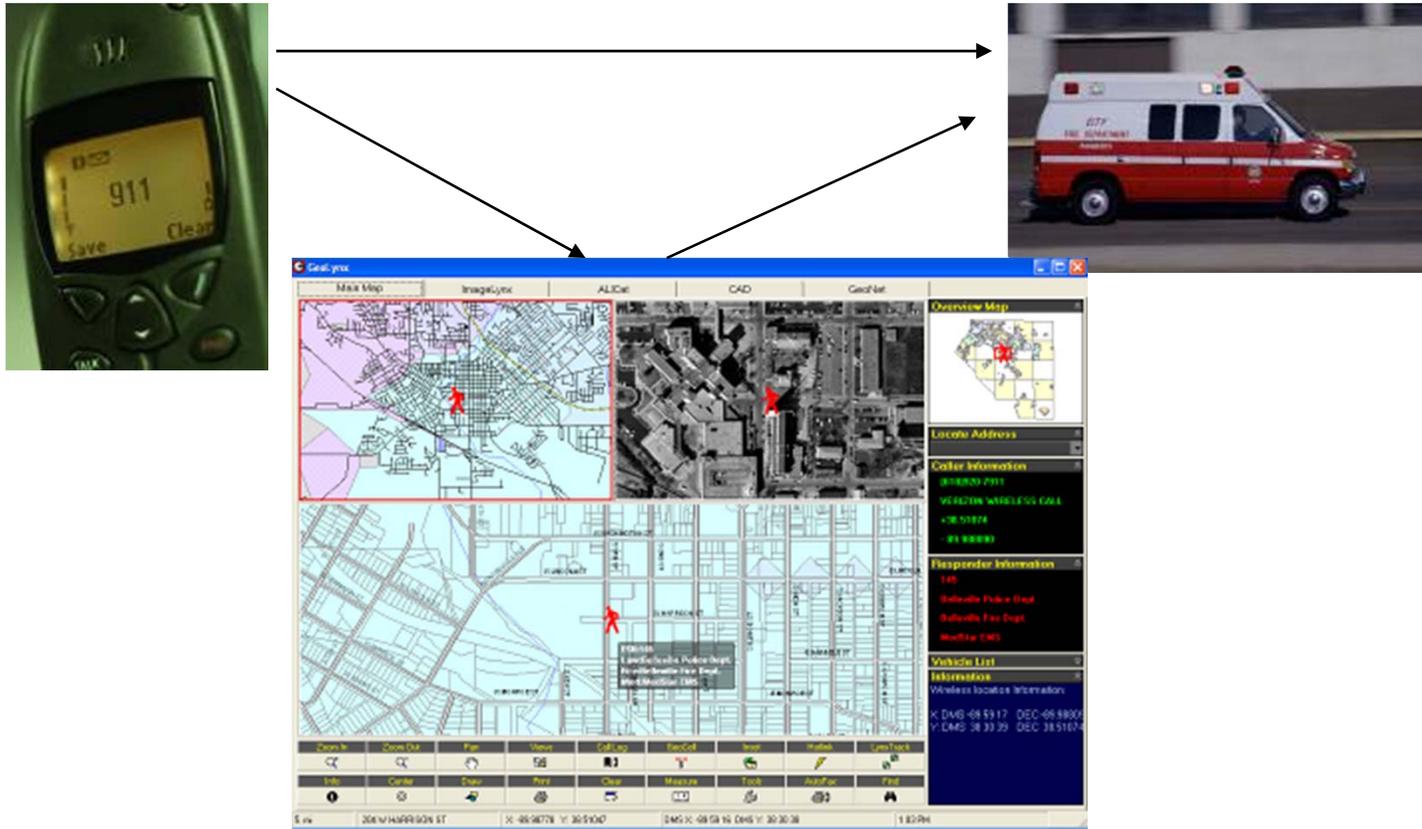
### Address Points

Provides exact address matching to structure location. Location accuracy based on point development



# Why do I need GIS?

Being able to plot the location of a wireless caller benefits emergency operations.

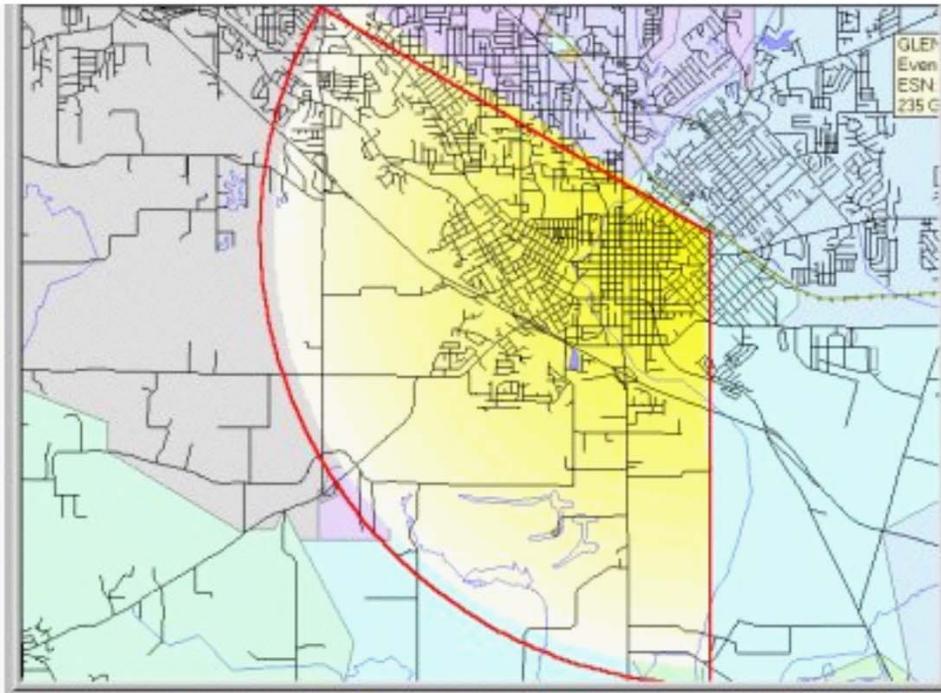


With over 70% of 9-1-1 calls being wireless, you need a map display

# Why do I need GIS?

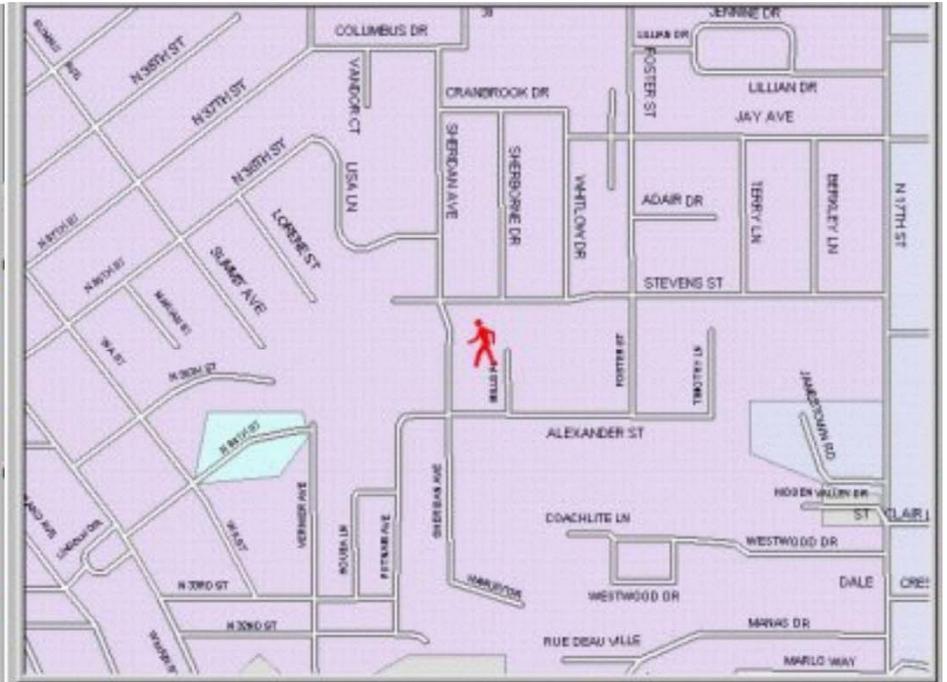
## Display Wireless Calls

Phase I



Phase One Location  
Cell Tower Location and Cell Sector

Phase II



Caller location by longitude – latitude

# 9-1-1: Wireless Calls

## Phase 0

9-1-1 Call Delivery

## Phase 1

9-1-1 Call Delivery

ANI – Call Back Number

ALI (ESRK or ESQK – aka pseudo-ALI

(= Cell Tower Location and Cell Sector)



## Phase 2

9-1-1 Call Delivery

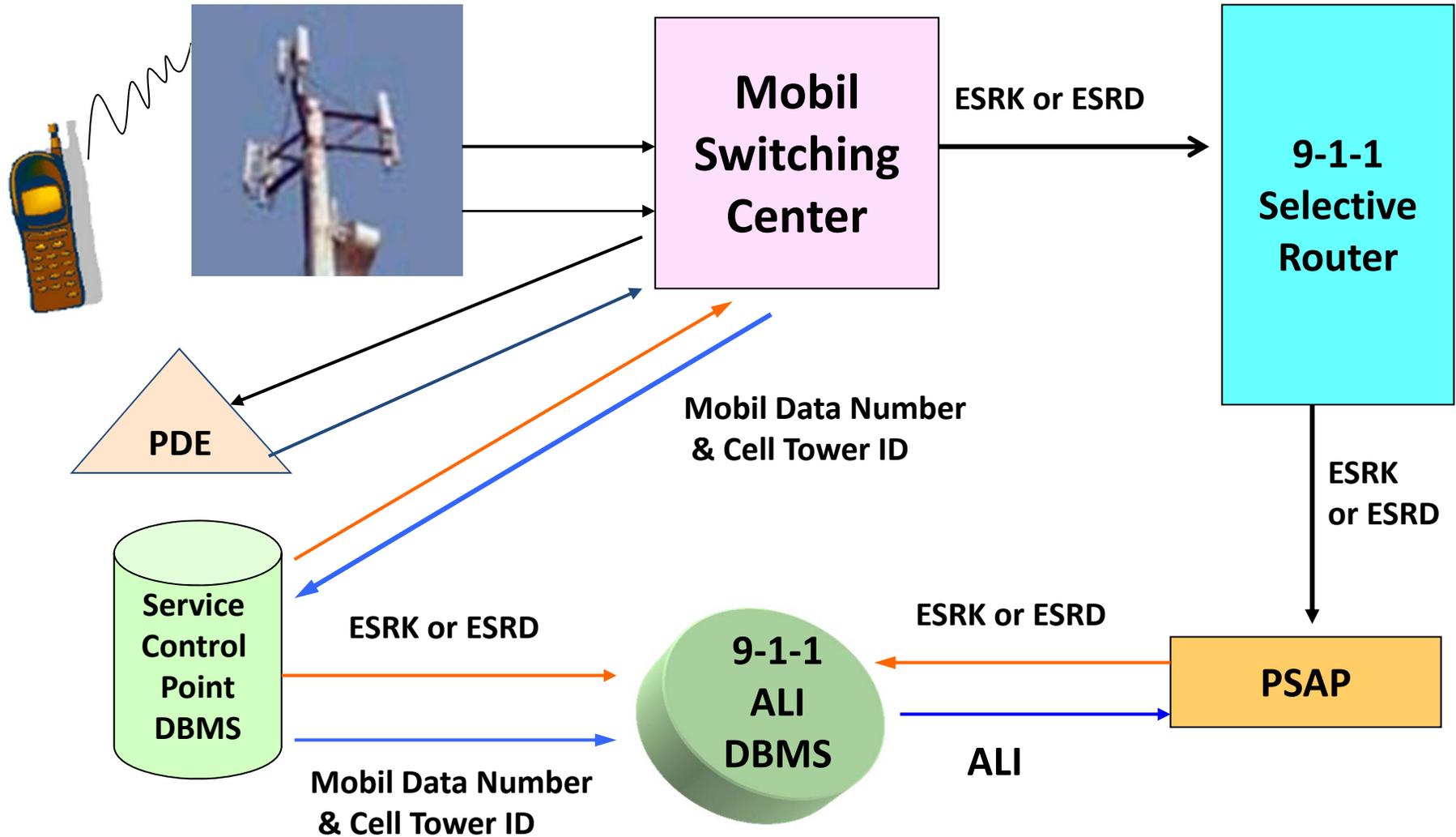
ANI

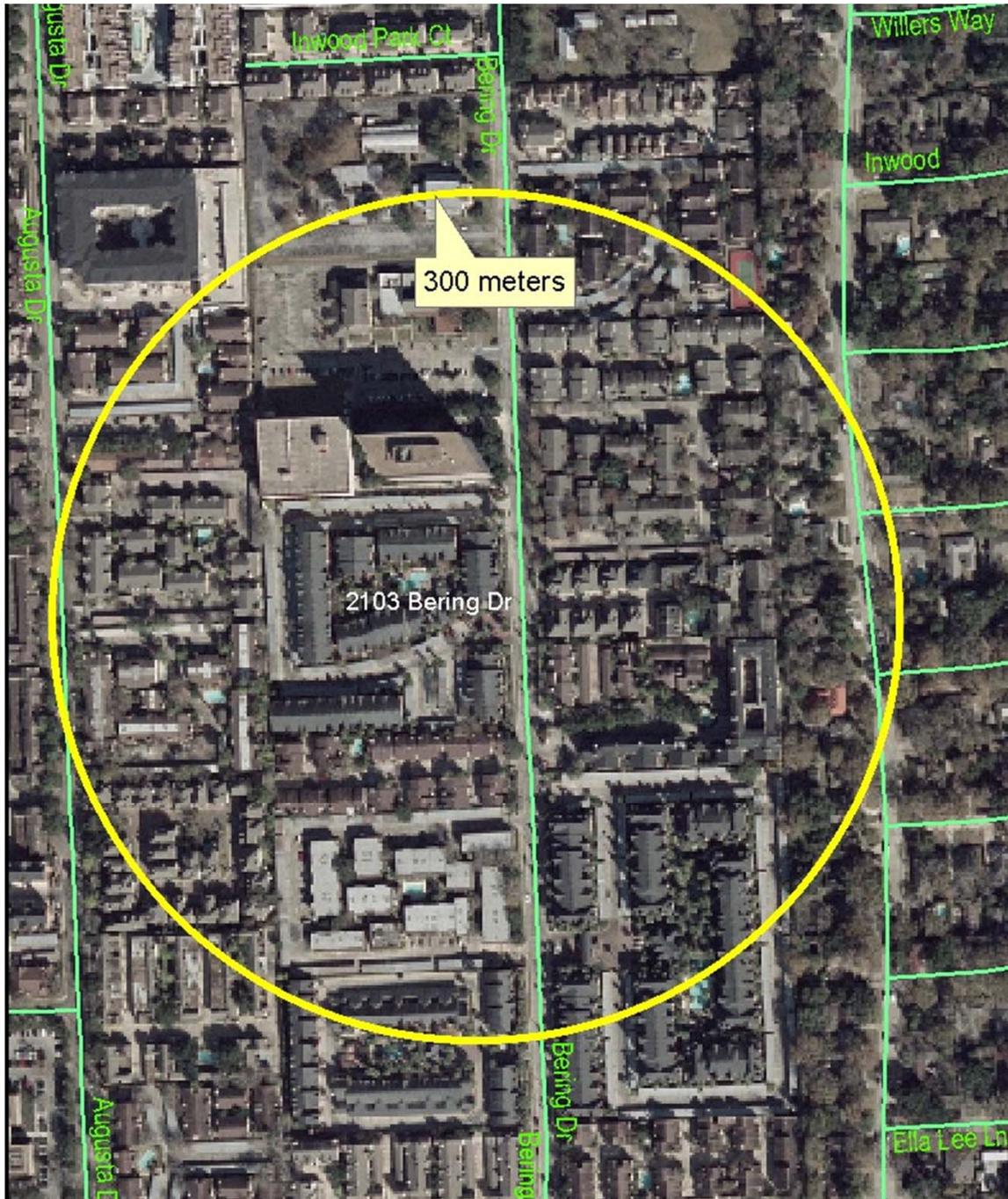
ALI

(Caller location by longitude – latitude  
aka X-Y Coordinates)



# Typical 911 Phase II Wireless Call





Handset-based carriers  
67% within 50 meters  
90% within 150 meters

Network-based  
67% within 100 meters  
90% 300 meters

in 85% of PSAP service  
areas



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areas

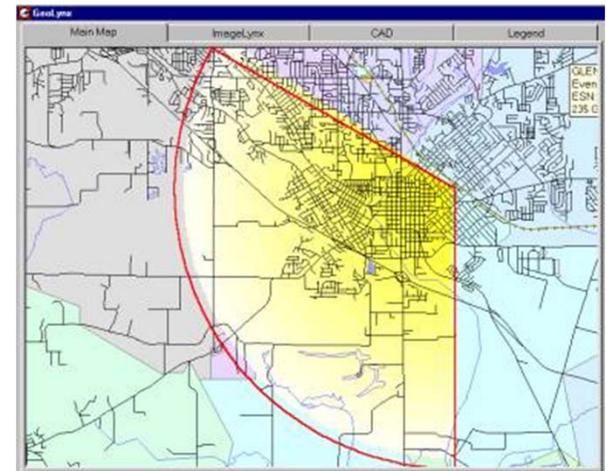
# Wireless Routing

- **Establishing a GIS system** (to verify routing and for PSAP map display)
- Completing the call routing data sheets and addressing database issues
- Establishing an ALI delivery standard
- **Wireless Calls will ALWAYS be routed based on the information on this sheet**
  - (Phase II wireless are routed based on Phase I routing data)

Carrier Cell ID	Carrier Sector ID	Cell Site Identifier	Cell Site Common Name	Cell Site Street Address	Cell Site City	Cell Site State	Cell Site County	Latitude degrees	Longitude degrees	Cell Sector Orientation ( N = 0)	Beam width in degrees	Cell Sector Compass Direction
XYZ1011	1	Anytown2	Green Day	6720 N Post Oak Rd	Anytown	CT	Anycounty	29.77889	-95.45611	60	120	NE
XYZ1011	2	Anytown2	Green Day	6720 N Post Oak Rd	Anytown	CT	Anycounty	29.77889	-95.45611	180	120	S
XYZ1011	3	Anytown2	Green Day	6720 N Post Oak Rd	Anytown	CT	Anycounty	29.77889	-95.45611	300	120	NW
XYZ1018	1	Anytown2	Voss	15757 Woodway	Nenatown	CT	Anycounty	29.76056	-95.49944	60	120	NE
XYZ1018	2	Anytown2	Voss	15757 Woodway	Nenatown	CT	Anycounty	29.76056	-95.49944	180	120	S
XYZ1018	3	Anytown2	Voss	15757 Woodway	Nenatown	CT	Anycounty	29.76056	-95.49944	300	120	NW
XYZ1022	1	Anytown2	IH 110	35 Aldine Westfield	Mytown	CT	Anycounty	29.74500	-95.45833	OMNI		

# Determination of Cell Sector Routing

- GIS used to determine proper routing of wireless calls
- Need GIS Data to determining the proper responding Agency once the caller's location is verified
  - PSAP Boundaries
  - ESN Boundaries
  - Streets and Address Ranges
- **Phase II calls will ALWAYS route on the Phase I sector routing assigned by the PSAP**
  - **NOT by Phase II Coordinates!!**
- Must know location relative to other features  
PSAP's, Population Centers, etc...



NENA 57-001  
NENA 57-002  
NENA 02-014

# Wireless Routing

Road centerlines

**MSAG** = Road name and address ranges

Sites

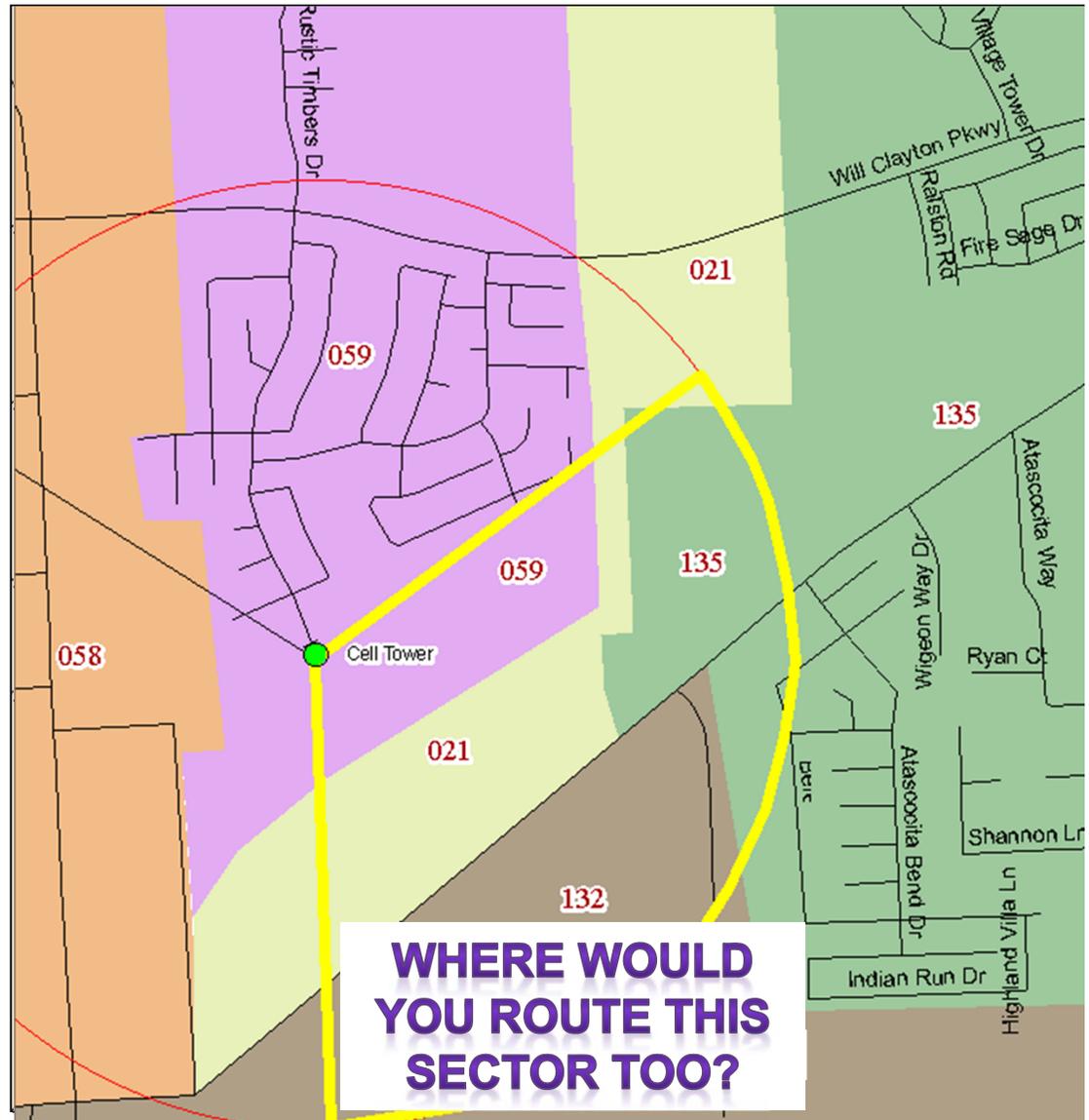
**ALI** = Individual addresses

Emergency Service Zones

ESZ / ESN

Wireless Towers and Sectors

Primary Routing Assignment



# Legacy Style Call Routing

Subscriber  
Calling 9-1-1



3208452738



Find ANI  
in SRDB

3208452738 = PSAP A

3202400040 = PSAP A

2622423577 = PSAP B

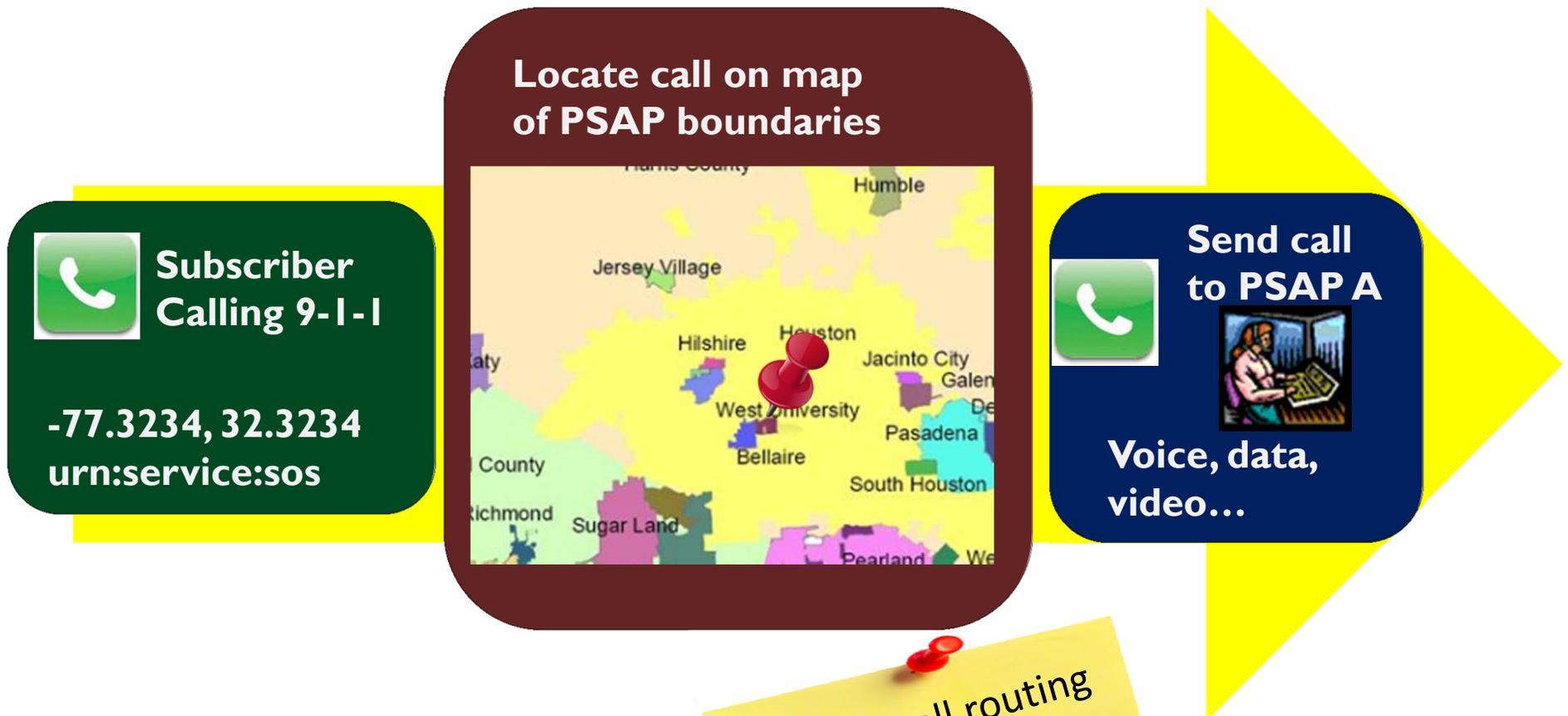
4246280188 = PSAP C

Switch call  
to PSAP A



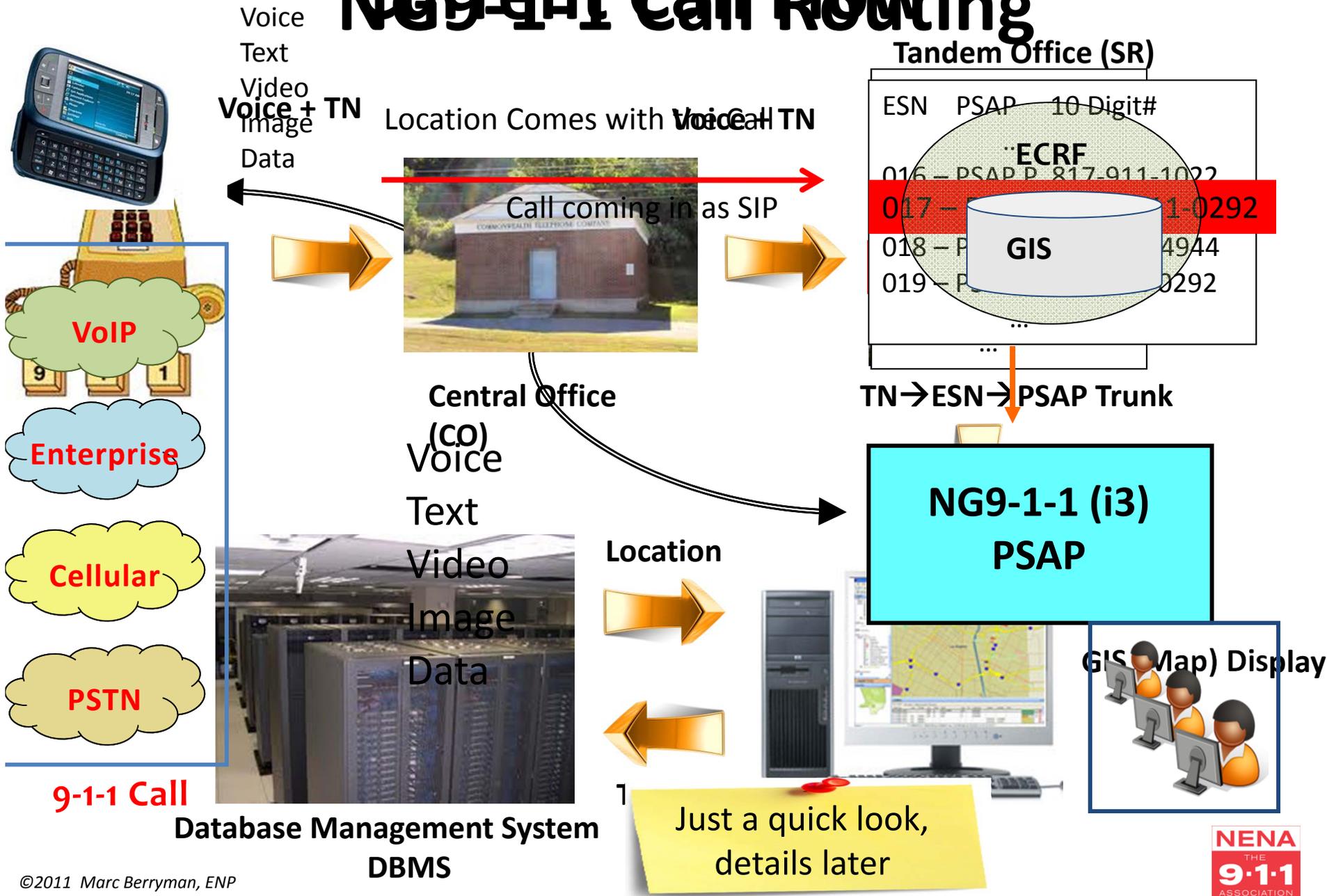
Voice, ANI

# NG9-1-1 Call Routing



NG9-1-1 call routing will be covered in depth later today

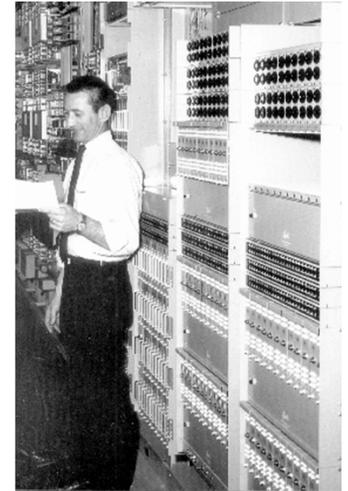
# Next Call Routing



# Evolution of 9-1-1



At 2 p.m. on Friday, Feb. 16, 1968 the first 911 call was placed from the mayor's office in Haleyville (Ala.)



January, 1980, Work began on two full Enhanced 911 systems in **Orange County** (Fla.), and another in **St. Louis** (Mo.).

These systems had the full array of features that we now associate with "Enhanced" 911: ANI, ALI, selective routing and selective transfer.



# Evolution of 9-1-1

Analog

Digital

IP / Packet

Services



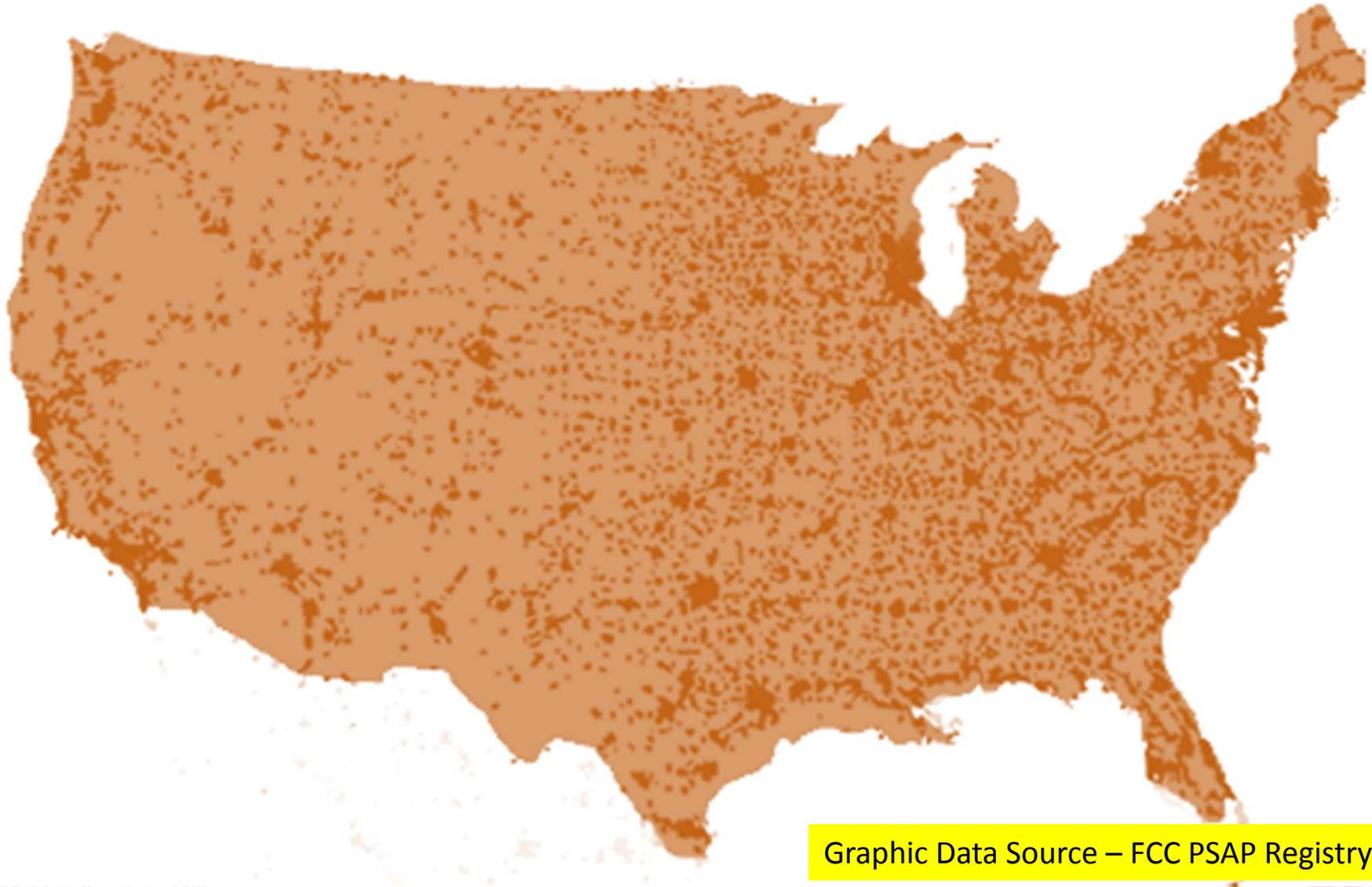
Technology



Standards



# Over 6,100 Primary PSAP's in the US



Graphic Data Source – FCC PSAP Registry

# Evolution of 9-1-1

- Growing Demands on 9-1-1
  - Additional information for other sources
  - More ways to communicate
  - Easier to share information
  - Widespread use of cell phones
  - Video surveillance
  - Sensors
    - Chemical, Biological, Radiation, Gun Shot
    - Intelligent Alarms, vehicle telematics



# Evolution of 9-1-1

*“Today’s 911 system is built on an infrastructure that does not support most of the features that Americans expect are part of an emergency response”*

*Congressional Research Service Report for Congress,  
Emergency Communications: The Future of 911, November 21, 2008*

***“In the past 15 years, advancements in modern communications technology have created the need for a more advanced system to access emergency care. While the existing 9-1-1 system has been a success story for more than 30 years, it has been stretched to its limit as technology advances.”***

***-National Emergency Number Association (NENA)***

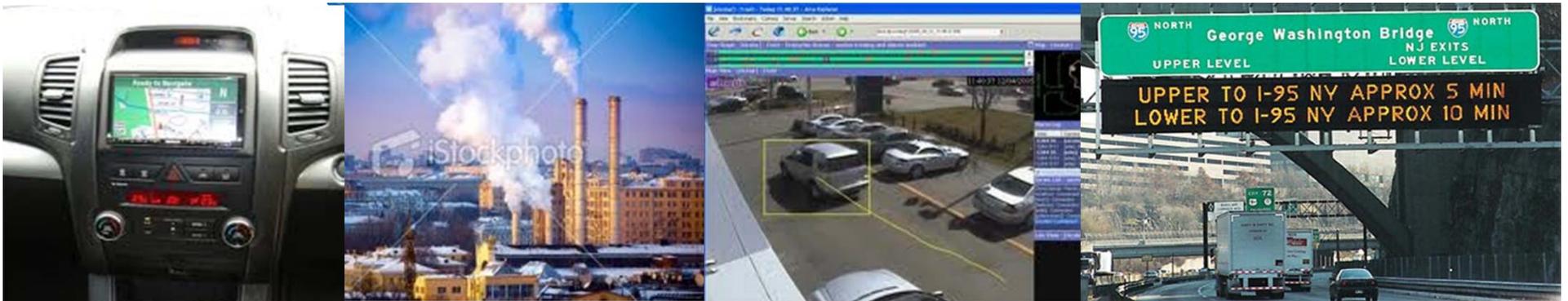
# Evolution of 9-1-1

E9-1-1	NG9-1-1
<b>Complex analog trunking and data network</b>	Engineered, managed IP networks (ESInet)
<b>Translation based control</b>	GIS and database controls
<b>Limited to voice calls or TTY via phones</b>	Voice, text, video
<b>Data limited to 512 characters</b>	Data unlimited
<b>Custom interfaces for each service type</b>	Standard IP interface for all service types
<b>Limited ability to transfer calls</b>	Transfer calls to anywhere
<b>Limited Emergency Notification capability</b>	Location-specific emergency alerts possible
<b>Limited Interoperability</b>	Interoperability unlimited

# Evolution of 9-1-1

## New sources of information

- Vehicle Telematics
- Environmental Sensors
- Intelligent Video surveillances
- Intelligent Transportation Systems

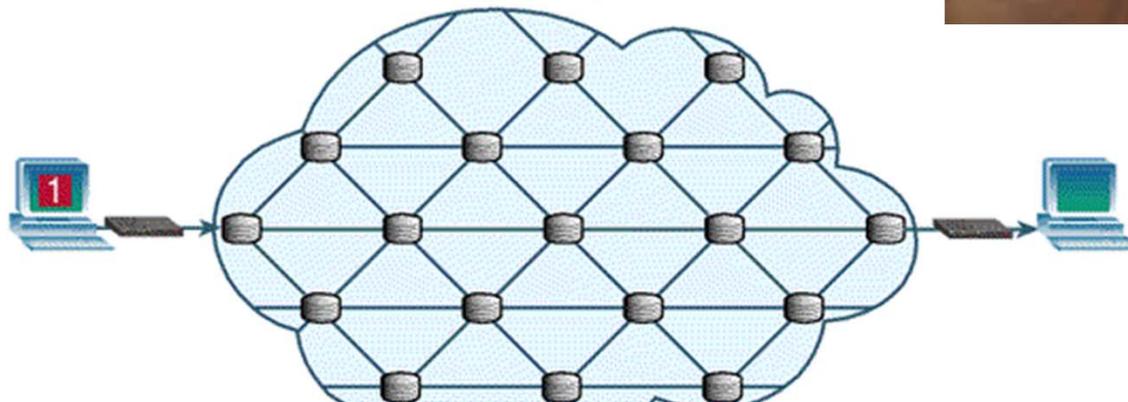


# Evolution of 9-1-1

- Routing
  - Based on GIS
- Media
  - Voice
  - Text
  - Images /Video
  - Sensor Data
- Networked
  - IP based



Packet routing through WAN/Internet



# Evolution of 9-1-1



1968



1996



Soon



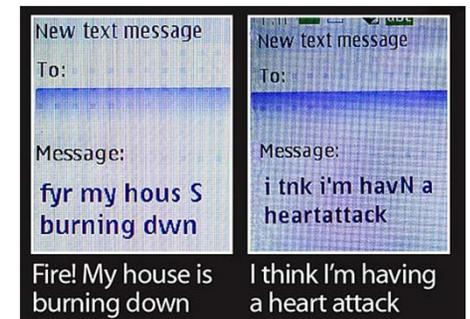
# Public Expectations

- 9-1-1 knows my exact location
- Any Device
- Text, Instant Messages
- Multi-Media (Images, Video)
- Special Response Needs



# Public Expectations

- 73% of today's 9-1-1 calls are wireless
- 92% of all mobile phones have camera
- 9 out of 10 digital images are taken by camera phone
- Over 150 million text users daily
- **85% of calls today are downgraded to analog voice to work with E9-1-1**





# What is NG 9-1-1

Call Routing based on a pre-validated Location (not a 10 digit number)

Allowing dynamic routing of calls with GIS and policy rules

Moving away from 30 year old technology – MSAG, ALI, ANI

Allowing today's communications modes into Public Safety



# What is NG 9-1-1

Collaborative data sharing creating a ***Common Operating Picture (COP)*** among incident commanders

A ***Common Operating Picture*** enables more accurate and timely decision making thereby improving ***Quality of Command (QoC)***

Improved ***Operational Effectiveness*** and thus the safety of field personnel and the public

## Bottom Line...Improved Public Safety!



# What is NG 9-1-1

## Procedures

+ Databases

+ Geospatial Routing

+ i3 Architecture

+ ESInet

---

= NG9-1-1



# What is NG 9-1-1

## Lower Cost through Cooperation, Collaboration, Coordination, and Communication

- Share equipment, resources, and database costs between PSAPs, while retaining local knowledge
- Lowers the costs of Database, GIS, Security, and IT management
- Ability to deal with any kind of 9-1-1 call from any device



# Who Developed NG9-1-1?

## Major Contributors

NENA

APCO

IETF

TIA

8,200+ total contributors

## Major Stakeholders

Citizens

Public Safety

Emergency Services

Federal Agencies

- DOT
- DHS
- DOJ
- FCC

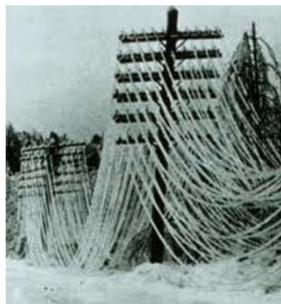
# Why NG9-1-1?

- Support all communication devices
  - Text – IM, SMS, PDAs, other non-voice devices
  - Wireless – WiFi, WiMAX, new wireless devices
  - Sensors – environmental, alarms, biometric
  - Video, Images to 9-1-1 and First Responders



# Why NG9-1-1?

- Overflow
- Outages
- Interoperability
- Officer Safety
- Sharing Information for Better Decisions
- Common Operating Picture
- Situational Awareness



# Why NG9-1-1?

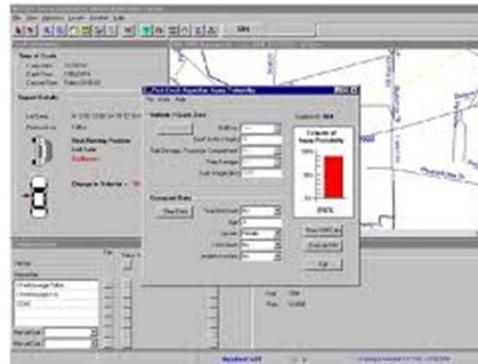
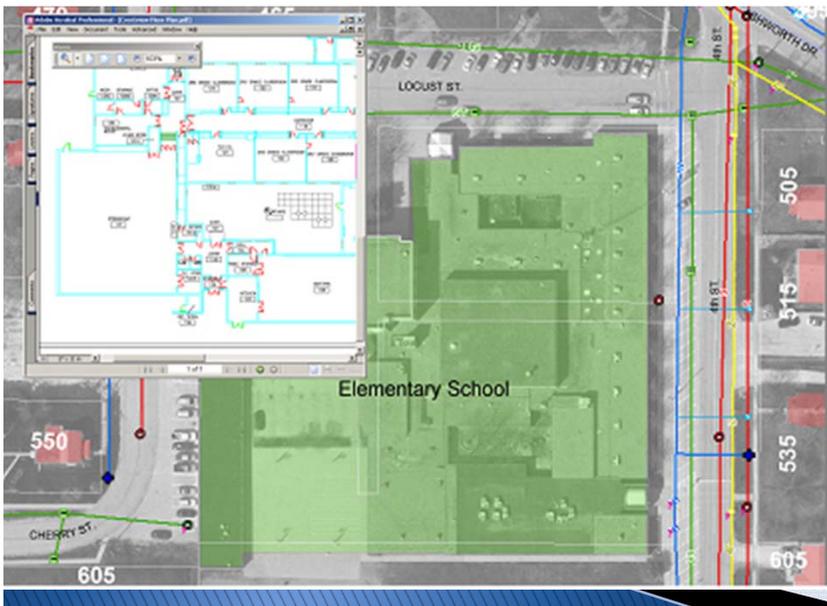
- Accessibility to those with hearing and sight problems is a critical need
- Public Safety must adapt to public's use of wireless communications
- We cannot kludge anything else into the 30+ year old technology we are using today



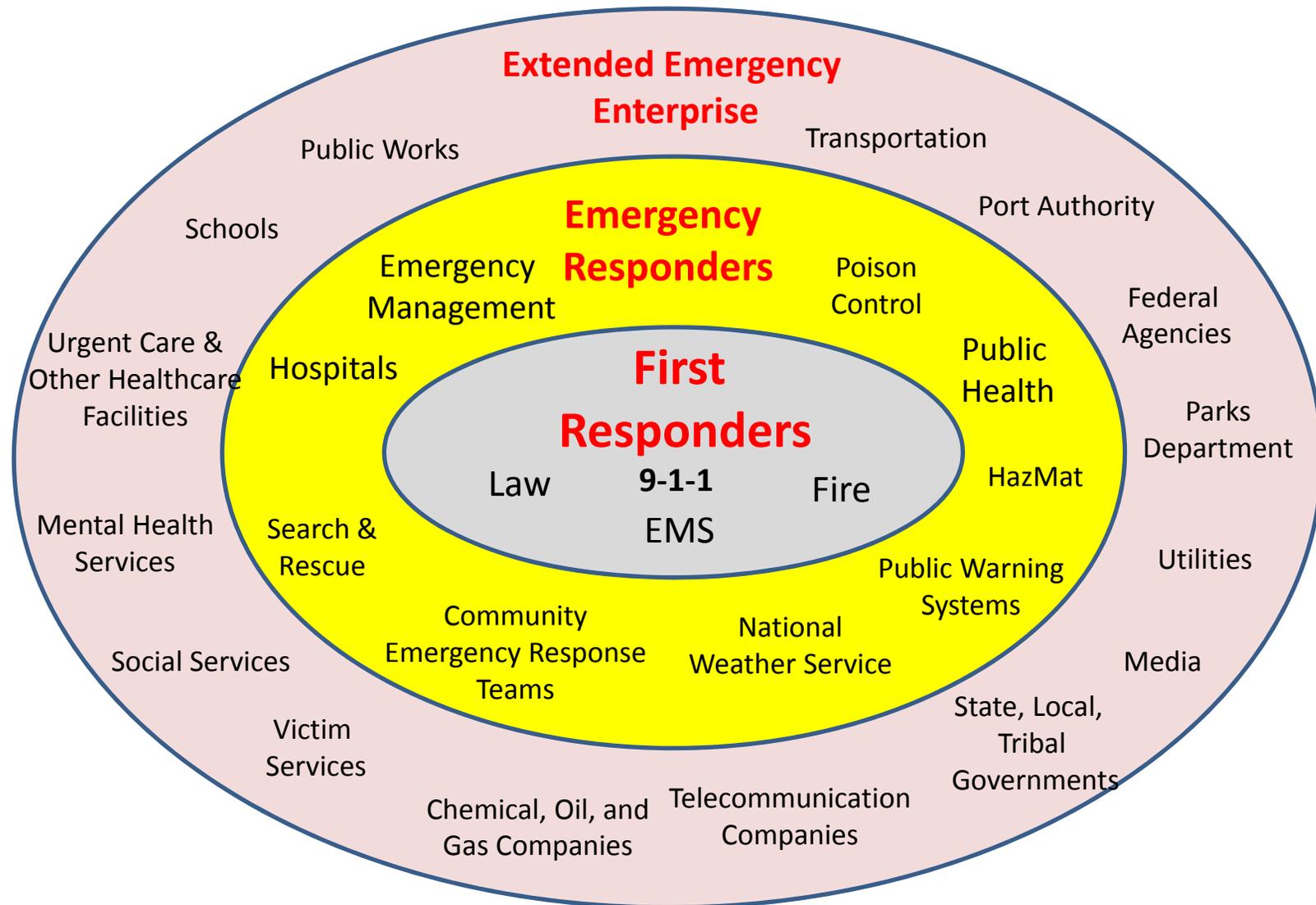
# Why NG9-1-1?

Non-proprietary system of *Standardized* data and formats operating on *Open System* specifications

Providing advanced capabilities for PSAPs and emergency service providers (ESPs\*)



# \*Emergency Service Providers (ESP)



# More Information Available to 9-1-1 and Responders

AccuGlobe E9-1-1 Dispatch [0 of 1 servers connected]

File View Tools Plugins Help

Scale: 1:1500

Addresses Streets Points of Interest MilePosts Lat/Long Routing Incidents Orthos InfoTips Create Incident Edit Restrictions

Incident Map AVL Map

Wireless call [phase II]  
95% confident call is v  
Nearest address: Non

**Incidents**

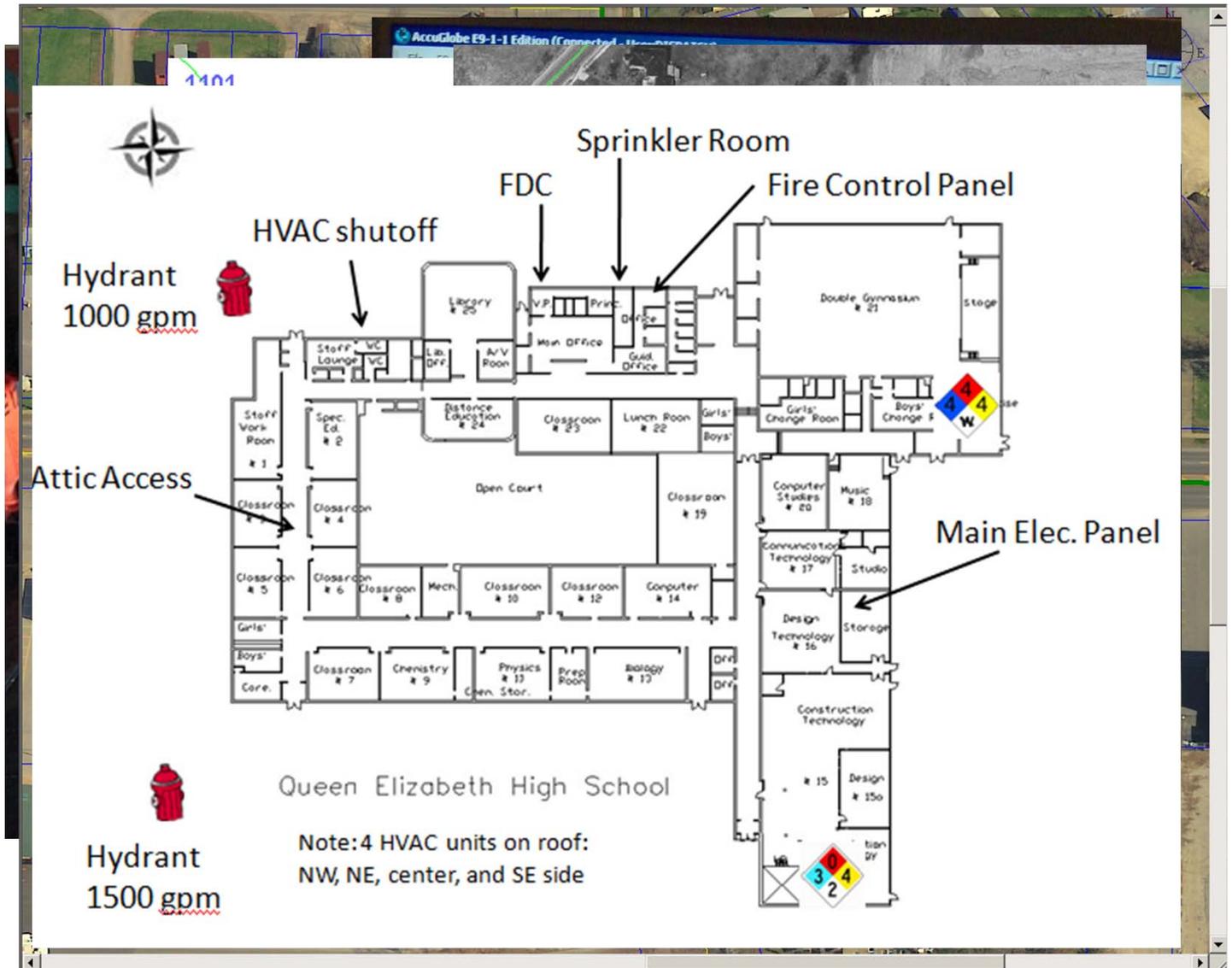
My Incidents All Incidents Additional Incident Information

Date	Area...	Phone#	HouseN...	Unit	Prefix	Name	Type	Suffix	Commu...	LAT	LON	Other
10/15/2...	419	4189890								41.4800842	-82.68163...	

X: 1918163.8972 Y: 660782.0528, Lat: 41.48021853 Long: -82.68370132, N 41° 28' 48.787" W 82° 41' 01.325"

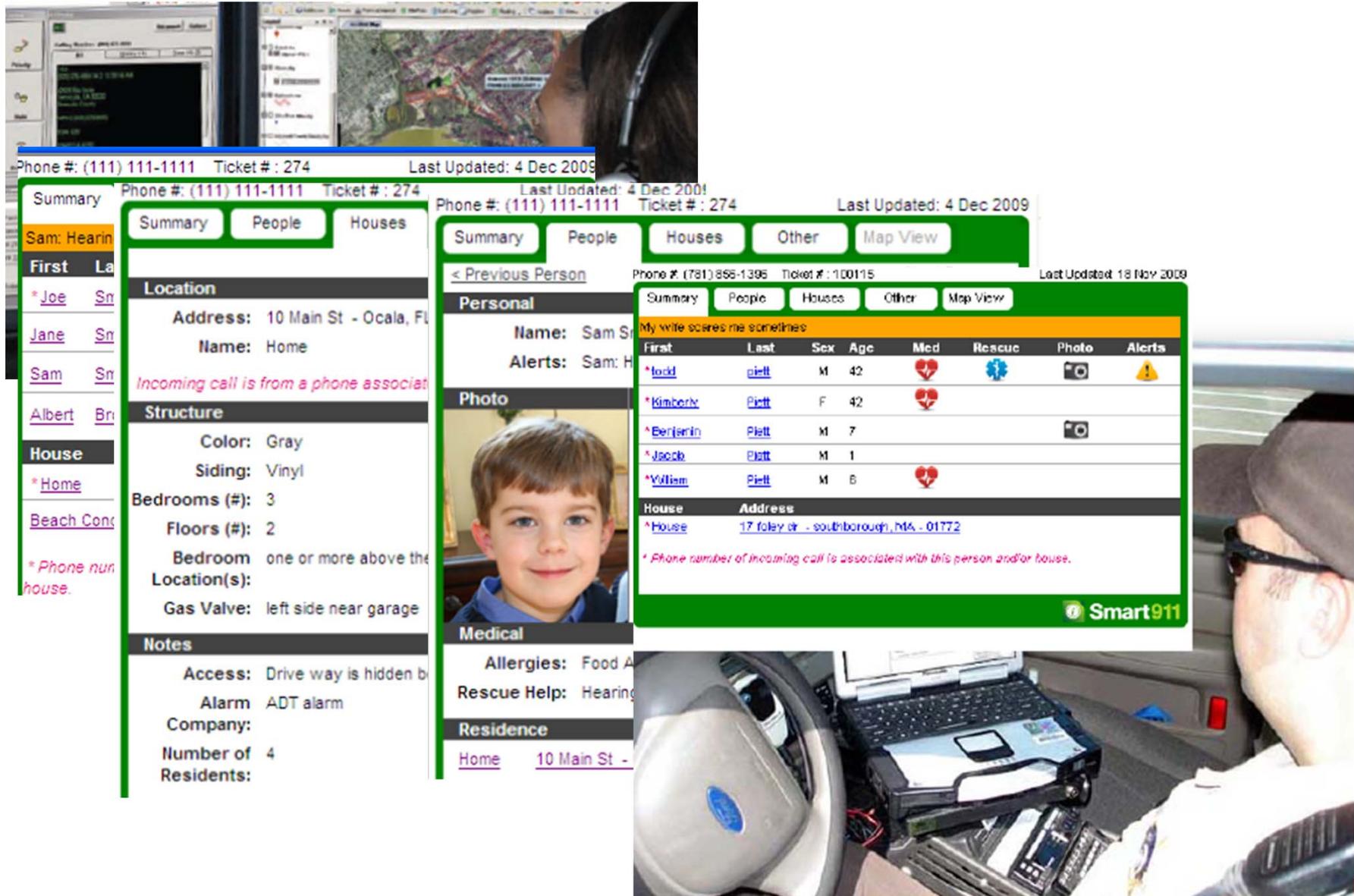
NA  
-1  
TION

# More Information Available to 9-1-1 and Responders



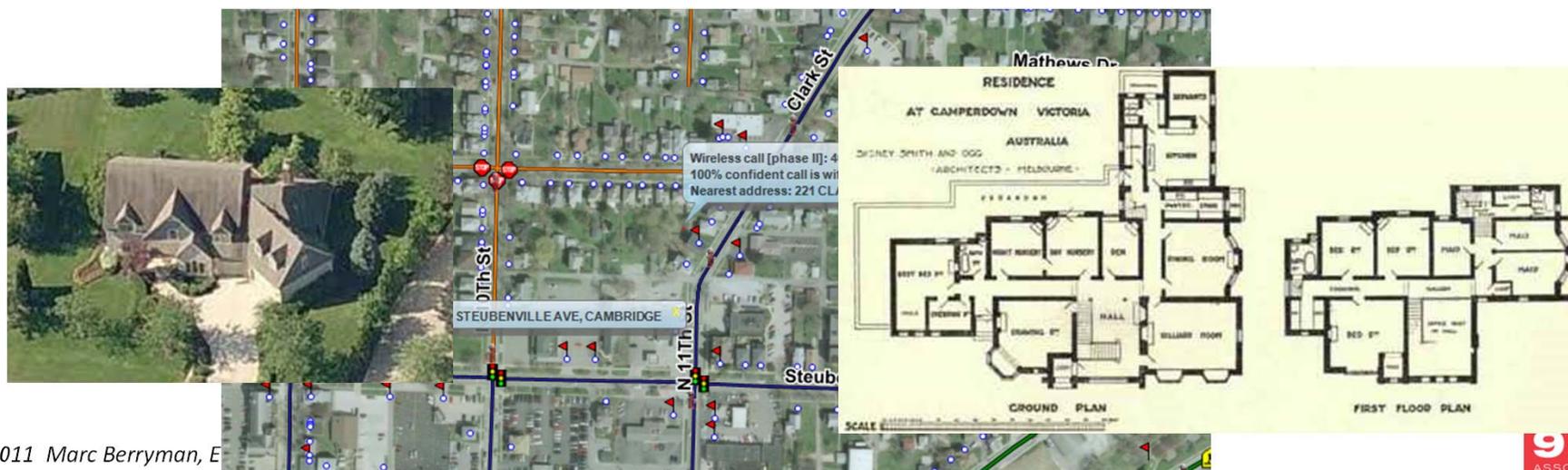


# More Information Available to 9-1-1 and Responders



# NG9-1-1 and GIS

- GIS becomes one of the central data stores in NG9-1-1
- GIS is fully integrated into NG9-1-1
- GIS will be fully integrated into Call Taking, CAD, Emergency Services, Dispatch and Response
- Locations Validated with Local GIS Data
- Responders (any number of them) have service boundaries as polygons with associated contact data



# NG9-1-1 and GIS

NG9-1-1 allows for data to be acquired from multiple locations and provided to the Emergency Responders, when they need it

*Floor Plans*

*Fire Control Panels*

*Ingress, Egress, Stairwells*

*Fire Code Inspections*

*Past historical data (law and fire)*

*Building Inspections*

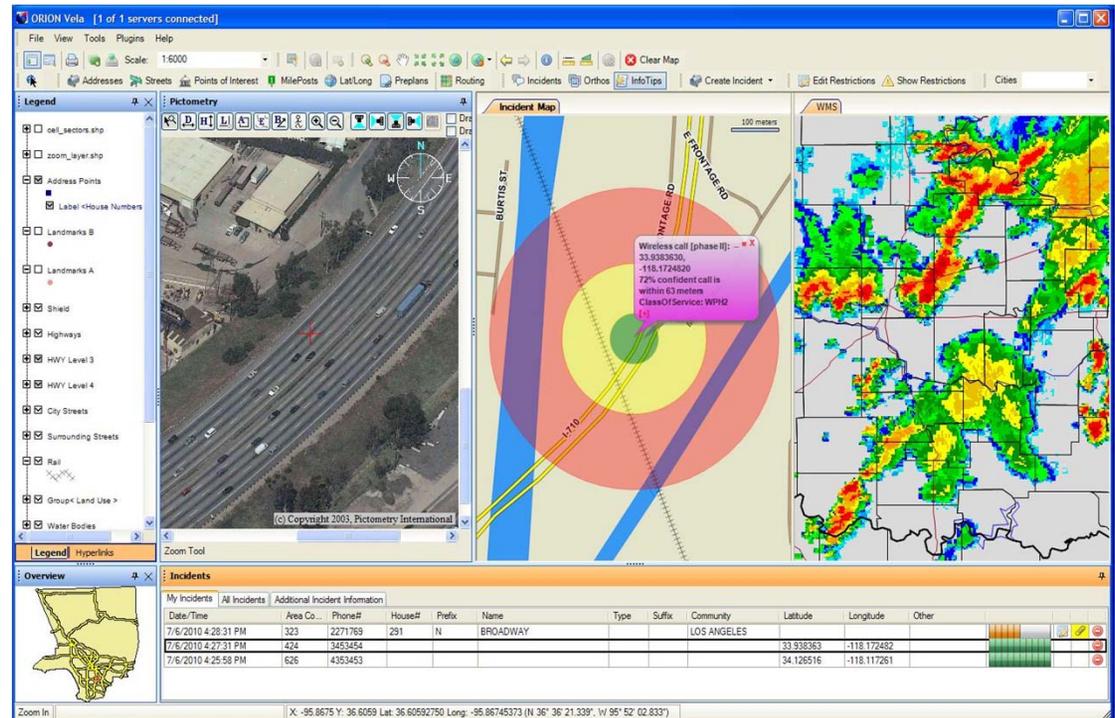
*Hazardous Materials*

*Sensor Locations and Data*

*Historical Data*

*Surveillance Camera Locations*

*Campus / Facilities Layouts*



**Incident Map**



**AVL Map**



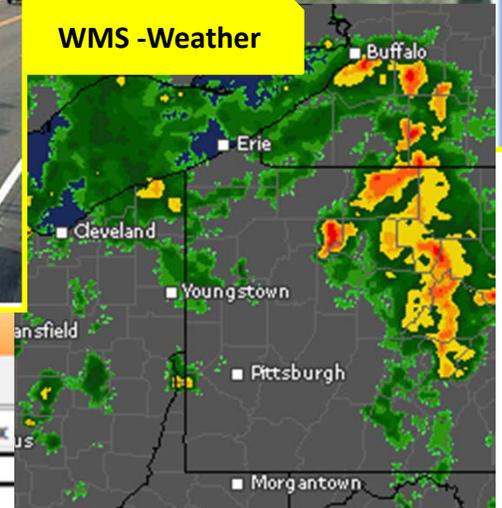
**Cam 110 @ Jefferson**



**Cam - N 10th / Gomber**



**WMS -Weather**



**Incidents**

My Incidents | All Incidents | Additional Incident Information

Date/Time	Area C...	Phone#	House#	UnitNumber	Prefix	Name	Type	Suffix
8/14/2011 9:43:15 AM					/N	GOMBER / 10TH	AVE / ... /	
8/14/2011 9:43:05 AM			1011			GOMBER	AVE	

# Data Requirements

## Location data

- Addresses (points)
- Road Centerlines

## Area / Boundary data

- PSAP
  - Cities, Counties, Municipalities, Jurisdictional
  - Emergency Services



In NG9-1-1 the data requirements become highly Standardized and more detailed



# Data Requirements - Standards

Standards will

- Allow exchange of data with local, regional, state and federal agencies
- Allow Interoperability
- Allows call transfers to anywhere
- Must take place for NG9-1-1 to work



<p>NENA Data Standards for the Provisioning and Maintenance of MSA VDBs and ERDs</p> <p><b>9-1-1</b> NENA</p> <p>NENA Data Standards for the Provisioning and Maintenance of MSA VDBs and ERDs NENA 02-013, Version 3, June 7, 2008</p> <p>Prepared by: National Emergency Number Association (NENA) Data Technical Committee (VDB/MSAG Working Group)</p> <p>Published by NENA Printed in USA</p>	<p>NENA Data Standards for Local Exchange Carriers, ALI Service Providers and Other Jurisdictions</p> <p><b>9-1-1</b> NENA</p> <p>NENA Data Standards for Local Exchange Carriers, ALI Service Providers and Other Jurisdictions Issue 6, November 21, 2006</p> <p>Prepared by: National Emergency Number Association (NENA) Technical Committee</p> <p>Published by NENA Printed in USA</p>	<p>NENA Procedures for Notification of ERD and VPC Operators of 9-1-1 Administrative Operations Information</p> <p><b>9-1-1</b> NENA</p> <p>NENA Procedures for Notification of ERD and VPC Operators of 9-1-1 Administrative Operations Information NENA 87-503, Version 1 January 8, 2008</p> <p>Prepared by: National Emergency Number Association (NENA) Working Group</p> <p>Published by NENA Printed in USA</p>	<p>NENA GIS Data Collection and Maintenance Standards</p> <p><b>9-1-1</b> NENA</p> <p>NENA GIS Data Collection and Maintenance Standards NENA 02-014, Version 1, July 17, 2007</p> <p>Prepared by: National Emergency Number Association (NENA) Data Technical Committee (GIS Mapping Working Group)</p> <p>Published by NENA Printed in USA</p>	<p>NENA Functional Interface Standard: Next Generation 9-1-1 Version 1.0 (i3)</p> <p><b>9-1-1</b> NENA</p> <p>NENA Functional and Interface Standards for Next Generation 9-1-1 Version 1.0 NENA 08-002, Version 1.0, December 18, 2007</p> <p>Prepared by: National Emergency Number Association (NENA) Technical Committee</p> <p>Published by NENA Printed in USA</p>	<p>NENA NG9-1-1 System and PSAP Operational Features and Capabilities Requirements</p> <p><b>9-1-1</b> NENA</p> <p>NENA NG9-1-1 System and PSAP Operational Features and Capabilities Requirements Document 58-73XX, v1 Draft, November 1, 2010</p> <p>Prepared by: National Emergency Number Association (NENA) Operations Committee NG Requirements Working Group</p> <p>Published by NENA Printed in USA</p>
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# Data Requirements - Standards

Compliance with NENA i3 NG9-1-1

- Improved Emergency Response
- Higher Levels of Quality & Accuracy
- Integration with other systems
- Maintenance, Consistency and Integrity of data
- Data Sharing and Interoperability
- NG9-1-1



# Data Maintenance

Communication between all parties involved

- GIS is regional now, time to adopt that mentality
- Maintenance is eternal



Have a documented process in place

- Roads closed, detours put in, lane closures
- Streets renamed, added, moved, removed
- Annexations, service boundary changes

# Data Requirements – Checklist for GIS

- Does it agree with you MSAG?
- Does it agree with your ALI?
- Is it continually Updated and Maintained?
- Does it include Address Points?
- **Willing to Risk YOUR Agencies Reputation on it?**

## Synchronizing GIS with MSAG & ALI

Date added: Thu, 09/24/2009 - 5:59am

### Document Information

**Full name:** NENA Information Document for Synchronizing Geographic Information System databases with MSAG & ALI  
**Document type:** Informational  
**Standard number:** 71-501

### NENA Information Document for Synchronizing Geographic Information System Databases with MSAG & ALI



NENA Information Document for Synchronizing Geographic Information System databases with MSAG & ALI, NENA 71-501, Version 1.1, September 8, 2009

Prepared by:  
National Emergency Number Association (NENA) Joint Data Technical/PSAP Operations & Next Generation Integration Committees, Next Generation Data Development Working Group

Published by NENA  
Printed in USA



# Data Synchronization

If an entire state, or a number of regions, are preparing for NG9-1-1 concurrently, the ability to make the MSAG changes in a timely manner can be a “choke point” for the synchronization process

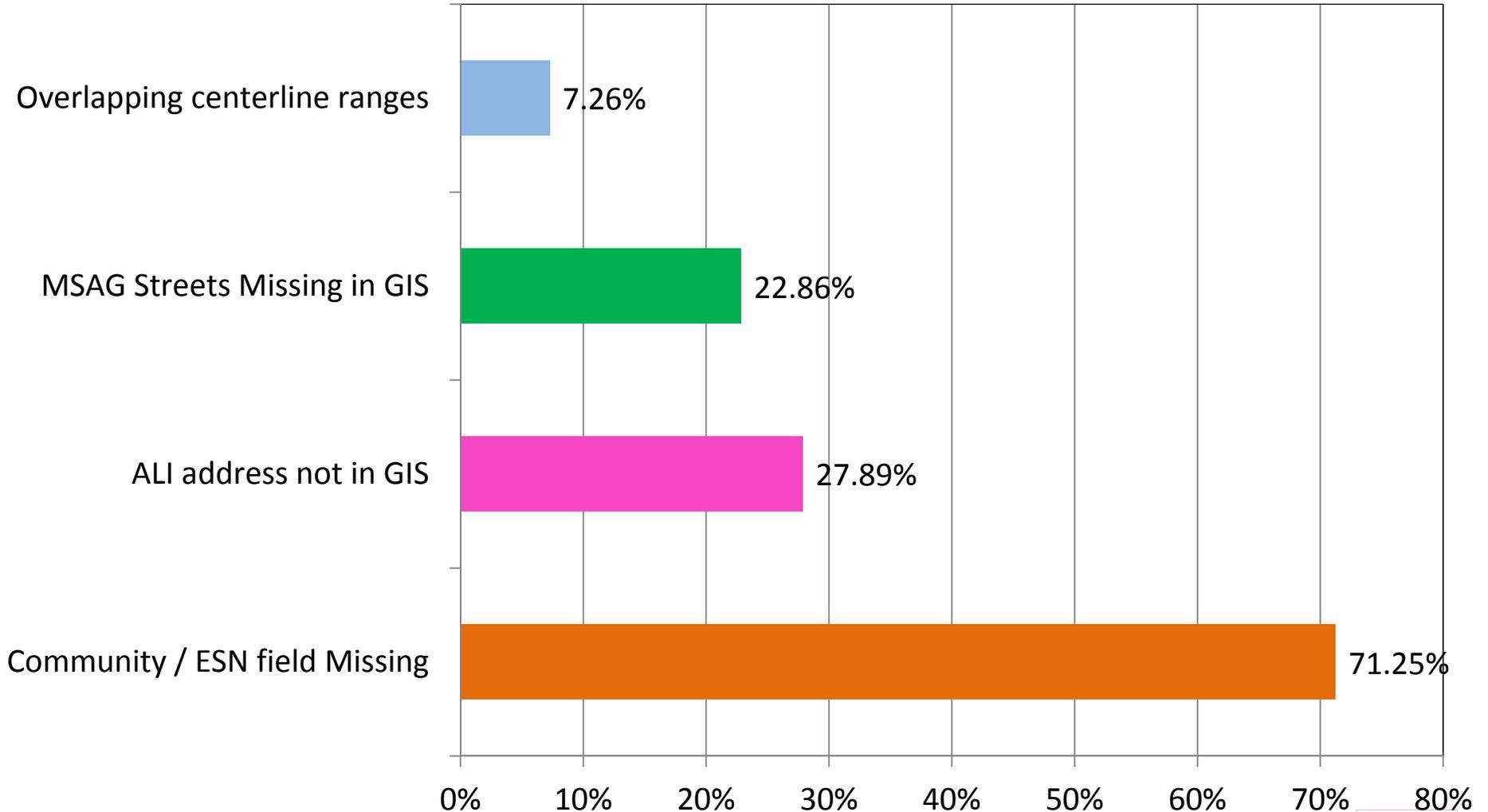
In jurisdictions within the states of Minnesota and Texas the edit rate percentage was found to be 85% of the total MSAG records



# Data Synchronization

## Common Errors

Compiled from 60 most recent Data Validation Reports from across the US



# Data Synchronization

**GIS, ALI, and MSAG data must match near 100%**

**Integration and synchronization process**

- **Frustrating and Time consuming**
- **Analysis – fallout review**
- **Adjustment**
- **Re-evaluation**



# Data Requirements - Synchronization

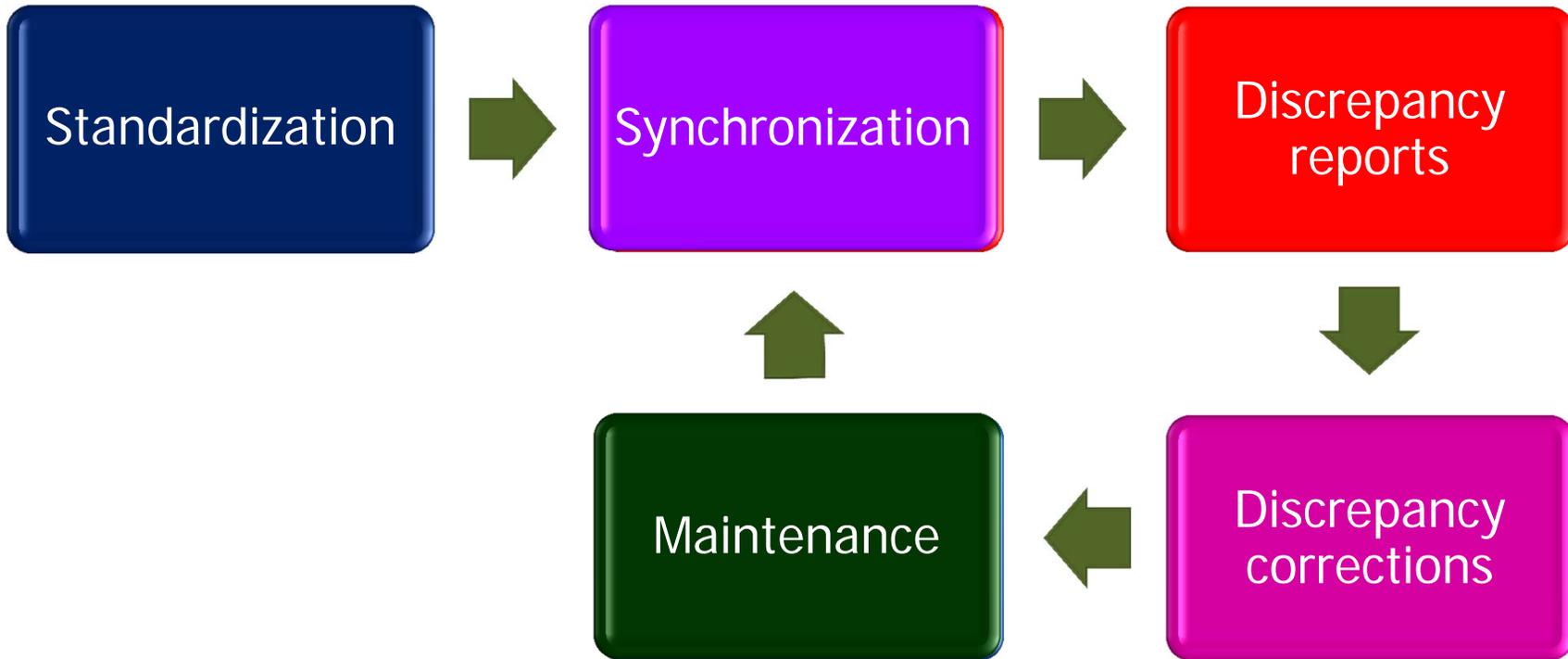
**Accurate and current data is of paramount importance to 9-1-1 entities**

**Developing common datasets that follow a single standard**

**Facilitate local, regional, and nationwide exchanging of data and information**

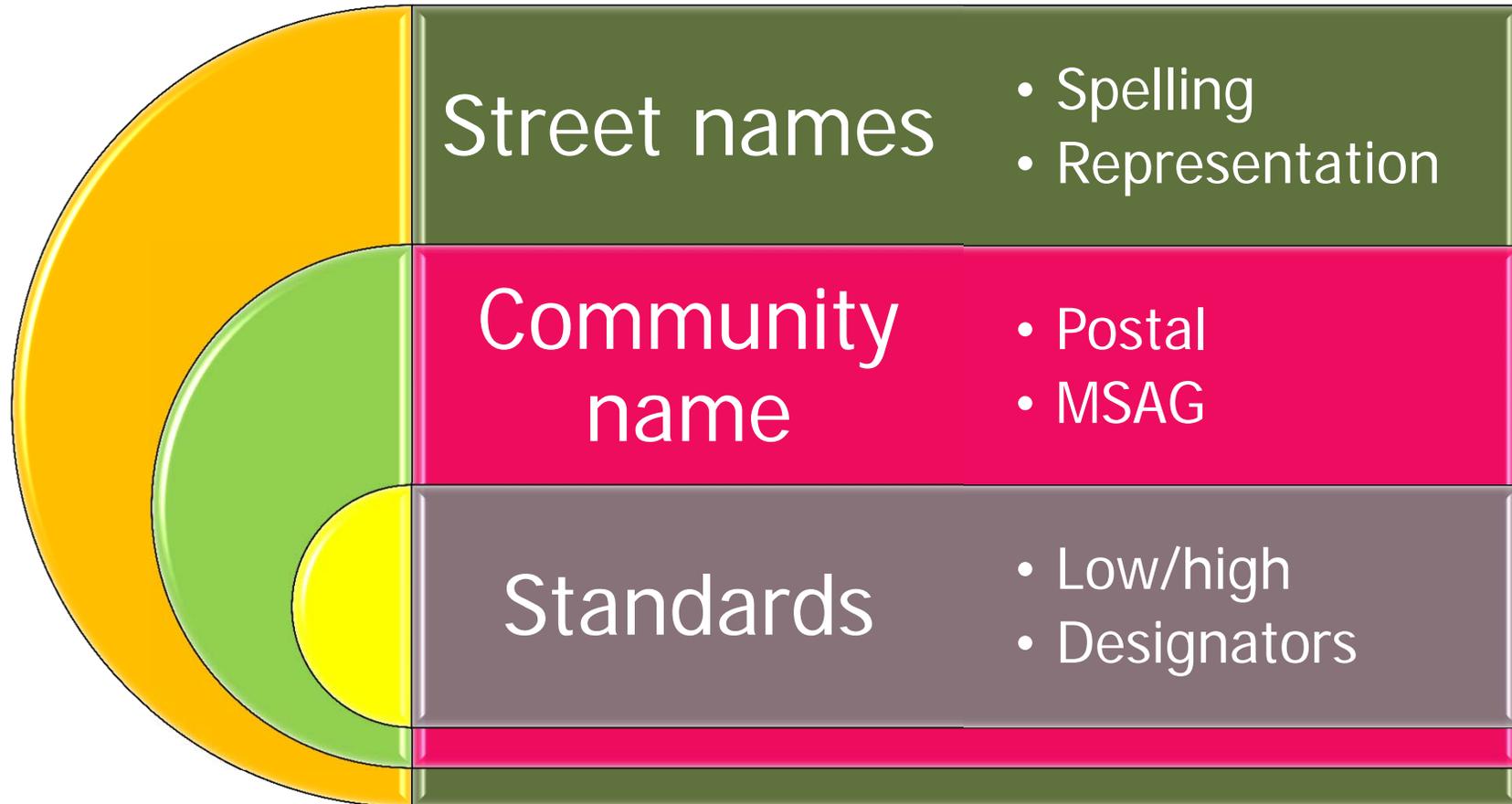
**The synchronization will reveal fictitious data, incomplete information, and data that exist in only one database**

# Synchronization Steps

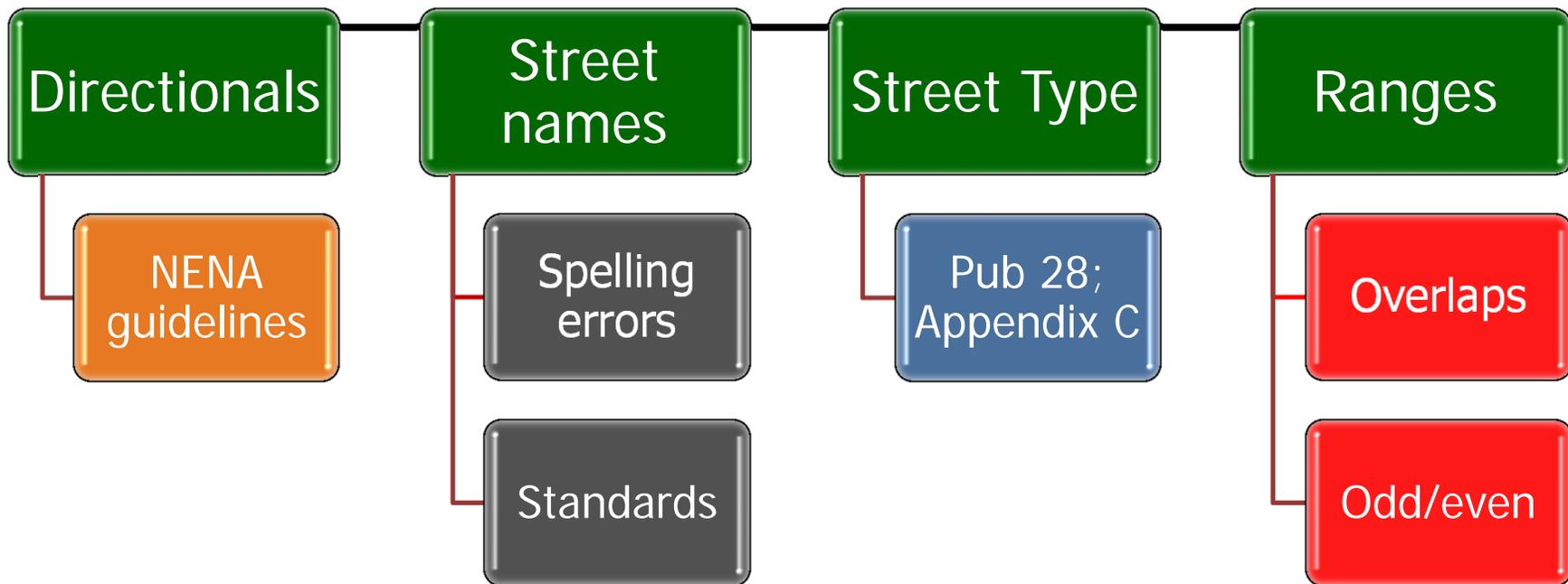


Continuous Process Improvement (CPI)

# Standardize MSAG

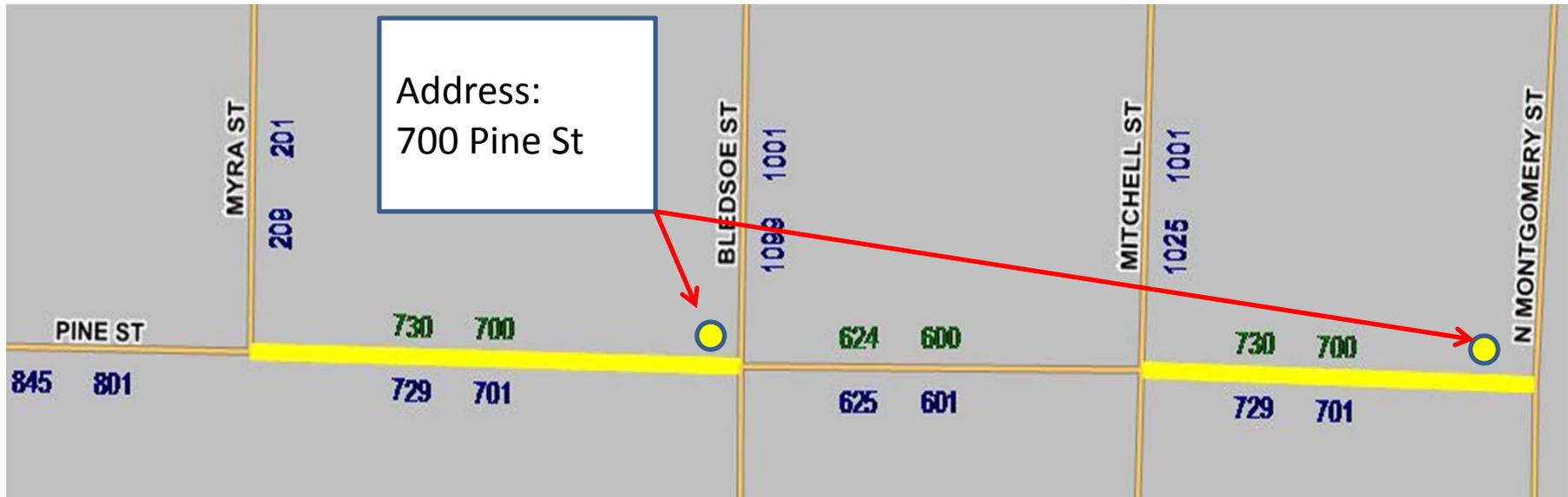


# Standardize Streets Fields



# Standardize Streets Geometry

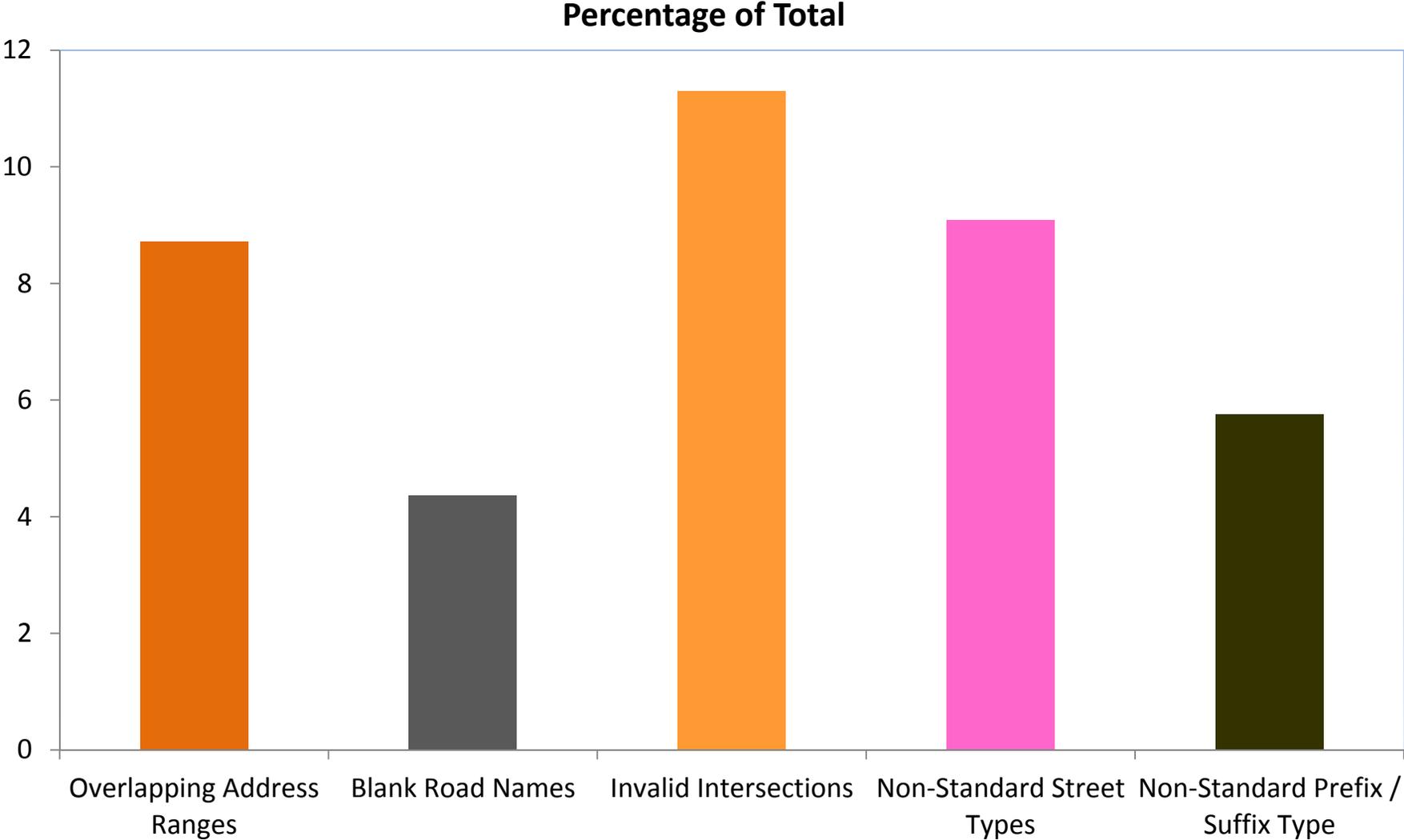
## Duplicate Centerline Ranges



A 9-1-1 call for 700 PINE ST would result in two locations with the same address plotting on the map.

If a 9-1-1 call needs to be geocoded within this centerline record's address range, multiple location points may plot or the call may not map at all.

# Discrepancies - GIS



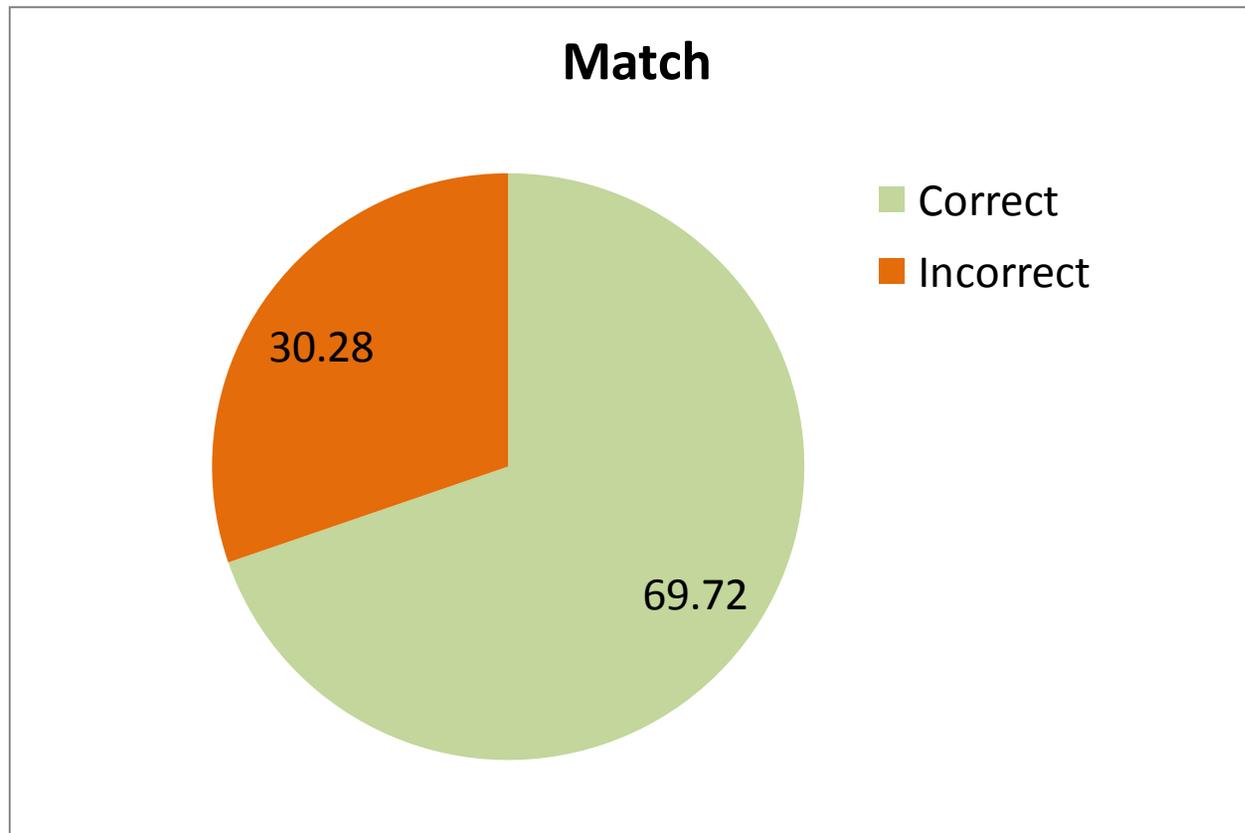
# Standardize MSAG / GIS

The MSAG and the GIS data **MUST MATCH**

PD	STREET	LOW	HIGH	O_E	ESN	EXCH	CHANGE_TO
	COPPERWOOD	8200	8499		144	JVG	Copperwood Dr
	FLAIR OAKS	7500	7599		144	JVG	Flair Oaks Dr
	SPLIT PINE	8000	8199		144	JVG	Split Pine Dr
	SWEETGUM TRACE	8000	8199		144	JVG	Sweetgum Trace Dr
	WESTERN OAK	7600	7899		144	JVG	Western Oak Ln
	WINDING MEADOW	8200	8299		144	JVG	Winding Meadow Ct
	WOOD BLUFF	6900	7499		144	JVG	Wood Bluff Blvd
	WOODOAK	7300	7499		144	JVG	Woodoak Dr
	NUECES CREEK	7401	7499	O	171	5404	Neuces Creek
	CARTWRIGHT CT	6701	6799		177	ROS	Low 6700 in ESN 180
	GRAND GABLES DR	5501	6199		177	ROS	Grande Gables Dr (IN ESN 180)
	HERITAGE HAVEN CT	6701	6799		177	ROS	in ESN 180
	CANDLER	1000	1099		179	ROS	Candler Rd
	LONGHORN	3000	3199		180	ROS	Longhorn Dr (Range 2900 - 3299)
	MAHLMAN	1100	1799		180	ROS	Mahlmann St

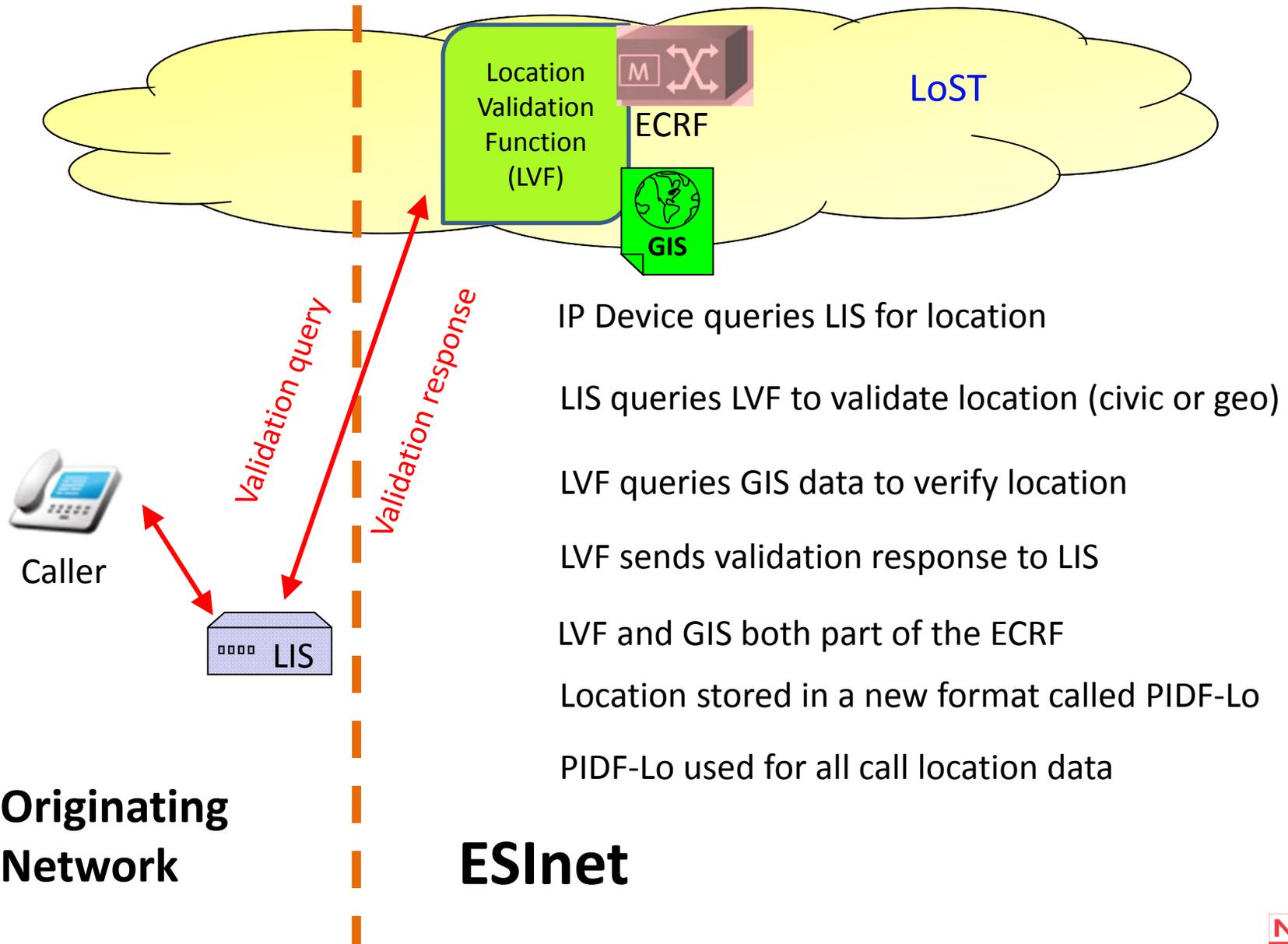
# Discrepancies - GIS to MSAG

## MSAG Names without Matching Road Centerline Names \*



\* After removing FX, wireless, and VoIP Shell records

# Basic Location Validation in i3



- IP Device queries LIS for location
- LIS queries LVF to validate location (civic or geo)
- LVF queries GIS data to verify location
- LVF sends validation response to LIS
- LVF and GIS both part of the ECRF
- Location stored in a new format called PIDF-Lo
- PIDF-Lo used for all call location data

# NENA i3 - PIDF-Lo Format

<b>Validated Address Point</b>	<b>PIDF-LO Element</b>	<b>Example</b>
<b>House Num</b>	HNO	102
House Number Suffix	HNS	
<b>Prefix Directional</b>	PRD	N
<b>Street Name</b>	A6	Franklin
<b>Street Suffix</b>	STS	Ave
<b>Post Directional</b>	POD	E
<b>MSAG Community</b>	A3	Rose
Postal Community	PCN18	Nashville
State Province	A1	TN
County Name	A2	Cook
Postal Code	PC	07654
Country	Country	US
Latitude	gml:coordinates	32.20912
Longitude	gml:coordinates	-86.77791
Building	BLD	A
Floor	FLR	2
Unit	UNIT	7
Room	ROOM	701

This figure is simplified for illustrative purposes

# MSAG / ALI Standardization

## Before Standardization

Prefix	STREET	Street Suffix	Post Directional
	North Elm	St	
N	Grand W Parkway		
	Barton Trail		
	South Pasadena	Rd	
	Cana Road		
	Stockyard's	PKY	
	Mary's Place	S	
	Market Plaza		
	M.L.K.	BV	
	W 9		
	Av J		
	St Albans	Ln	
	M. D. Anderson	Blvd	
E	R. Jones Road		

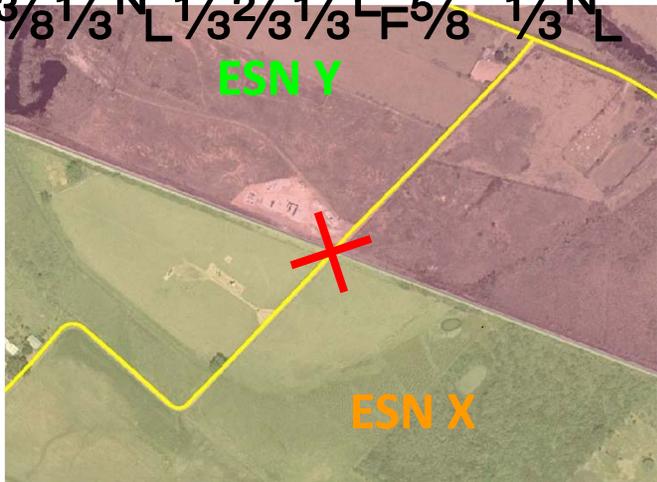
Not all fields are shown

# 'Breaks' in Street Segments

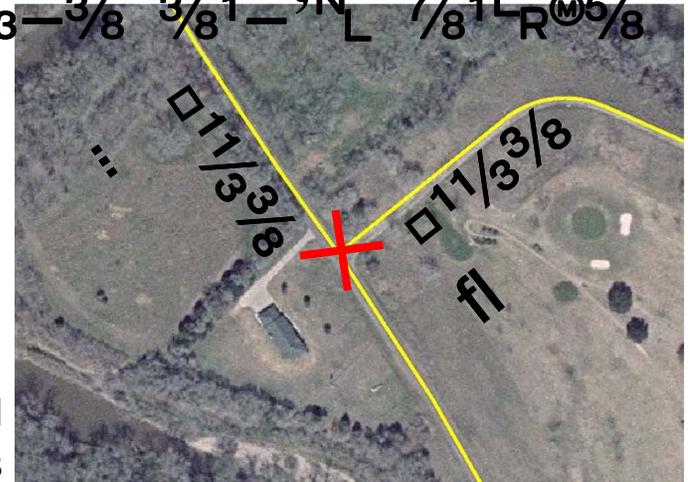
●  $1/3^C/5/8$   $1/3^N$   $L^N$   $L^C$   $R^C$   $2/3^V$   $N^L$   $1 - 1/8^P$   $1/3 - 5/8^M$   $L^F$   $€ - N^L$   $5/8^P$

$3/8$   $1/3^N$   $L$   $1/3$   $2/3$   $1/3^L$   $F$   $5/8$   $1/3^N$   $L$   $2/3^C$   $R$   $5/8$   $1/3^C$   $u$   $L^F$   $1/3 - 3/8$   $3/8$   $1 - N^L$   $7/8$   $1^C$   $R$   $5/8^M$

$N^L$   $1$   $L^F$   $- 1/3^H$   $T$  ●



ESN  
Boundaries



Road  
Intersections



County  
Lines



City  
Limits

# Synchronize ALI/Address to GIS

House Number	Street Name	Street Type	Community	Location
705	TIFFIN	ST	WASHINGTON	LOT 19
705	TIFFIN	ST	WASHINGTON	LOT 2
705	TIFFIN	ST	WASHINGTON	LOT 20
705	TIFFIN	ST	WASHINGTON	LOT 21
705	TIFFIN	ST	WASHINGTON	LOT 22
705	TIFFIN	ST	WASHINGTON	LOT 25
710	CLAY	ST	STANTON	APT9
710	CLAY	ST	STANTON	APT14
710	CLAY	ST	STANTON	APT27
710	CLAY	ST	STANTON	APT18
710	CLAY	ST	STANTON	APT 5
110	BAUER	CT	CRESTLINE	UNIT A-1
110	BAUER	CT	CRESTLINE	UNIT B-1
110	BAUER	CT	CRESTLINE	UNIT B-2
110	BAUER	CT	CRESTLINE	UNIT C-2
110	BAUER	CT	CRESTLINE	UNIT D-1
110	BAUER	CT	CRESTLINE	UNIT D-2