Next Generation 9-1-1 in New Jersey: GIS Preparations

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NJ Office of GIS

Topics

- Wayback Machine trip to 9-1-1 origins
- Overview of Next Gen 9-1-1
- GIS Requirements for NG 9-1-1
- What We Are Doing in New Jersey for NG 9-1-1

9-1-1, Yesterday … And Today

9-1-1 Before 1968

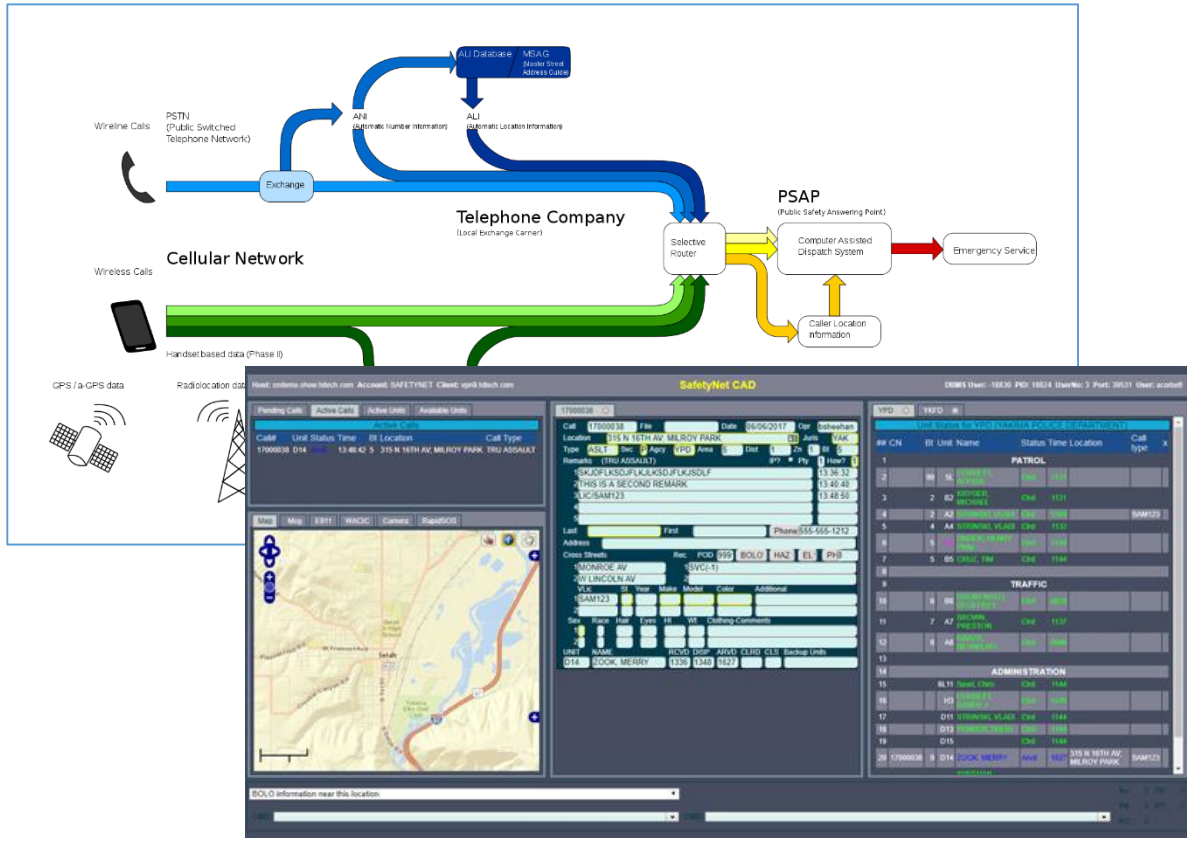
- There was no 9-1-1 before 1968

It Was a Big Deal

- First 911 system in the US was Haleyville, Alabama, 1968
- 911 became the emergency number in the US through 70's, 80's
- Further enhancement in mid-1970's
- Automatic Number Identification (ANI): the system could see your telephone number (caller ID for customers was not a thing, yet)
- Automatic Location Identification (ALI) gives subscriber address
- Led to "Enhanced 9-1-1" – now known as E9-1-1

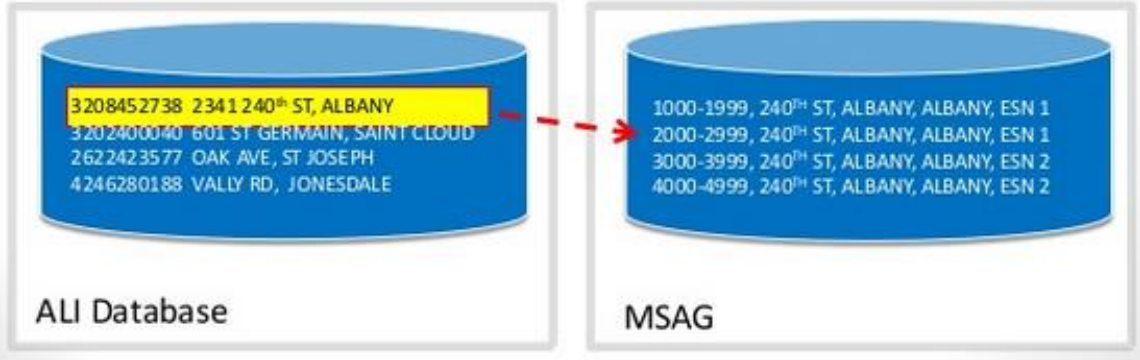
ANI/ALI Improves Call Routing and Response

- 911 is often a local function, so getting a 911 call to the right place is not trivial
- NJ has ~180 primary Public Safety Answering Points (PSAPs)
- Calls route to those PSAPs based on ANI/ALI/MSAG
- Caller location info also enables automation for the dispatch response once call is answered



9-1-1, What is Your Emergency?

- Call routing by tabular lookup using phone number as database key
- Address ranges in an “MSAG” table (Master Street Address Guide)
- Works well for landline phones
- Operator has caller location even if the caller doesn’t know, or can’t speak
- Reliable enough that it became common to ask the nature of the emergency first, before location: “9-1-1, what is your emergency?”
- Still in use in most states



“9-1-1, Where is Your Emergency?”

- Now >80% of 9-1-1 calls are from wireless phones
- In E9-1-1, wireless device location is included in the data stream, but system is NOT able to use it for call routing
- And “phase 2” location is not very accurate
- Wireless calls are routed by tower location, sometimes with bad results
- Many operators now answer “9-1-1, where is your emergency?”

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BUSINESS

Why Uber Can Find You but 911 Can’t

Accurate location data is on smartphones, so why don’t more wireless carriers use it to locate emergency callers?

Why This Really Matters

- Georgia, December 2014: Shanell Anderson drove into a lake and couldn’t get her doors open
- Her 9-1-1 call routed to the neighboring county
- That PSAP’s system didn’t have road data for her county, and the operator couldn’t figure out the location
- Shannell Anderson was pulled from the water alive but did not survive
- Other things went wrong after the call routing went wrong, but the call routing started those in motion

A Happier Scenario

Faster Location Information Leads To Faster Response

Example: 911 call with ELS available through the NG911 Clearinghouse in NCTCOG, TX

The Situation:

Caller is in a major accident with injuries and verbally provides incident location as XXX St & Main St (several miles west from actual incident).

0 sec

ELS location came in immediately with the call.

30 sec

Phase 2 location took 30 seconds to arrive.

911 Call-Taker:
"Are you at XXX and Main? Because I am showing you at a different location...

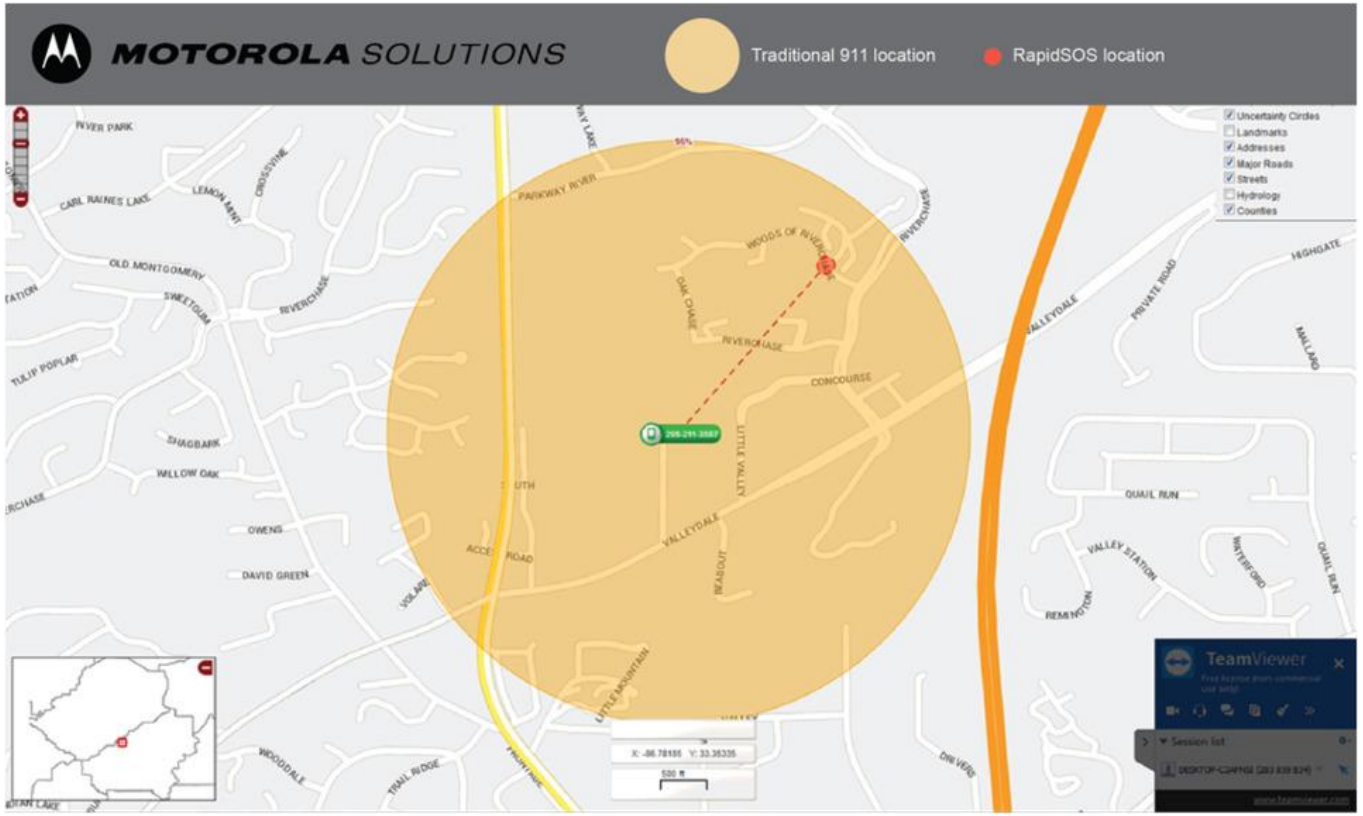
Caller:
"I'm not sure of the cross street..."

The Response:

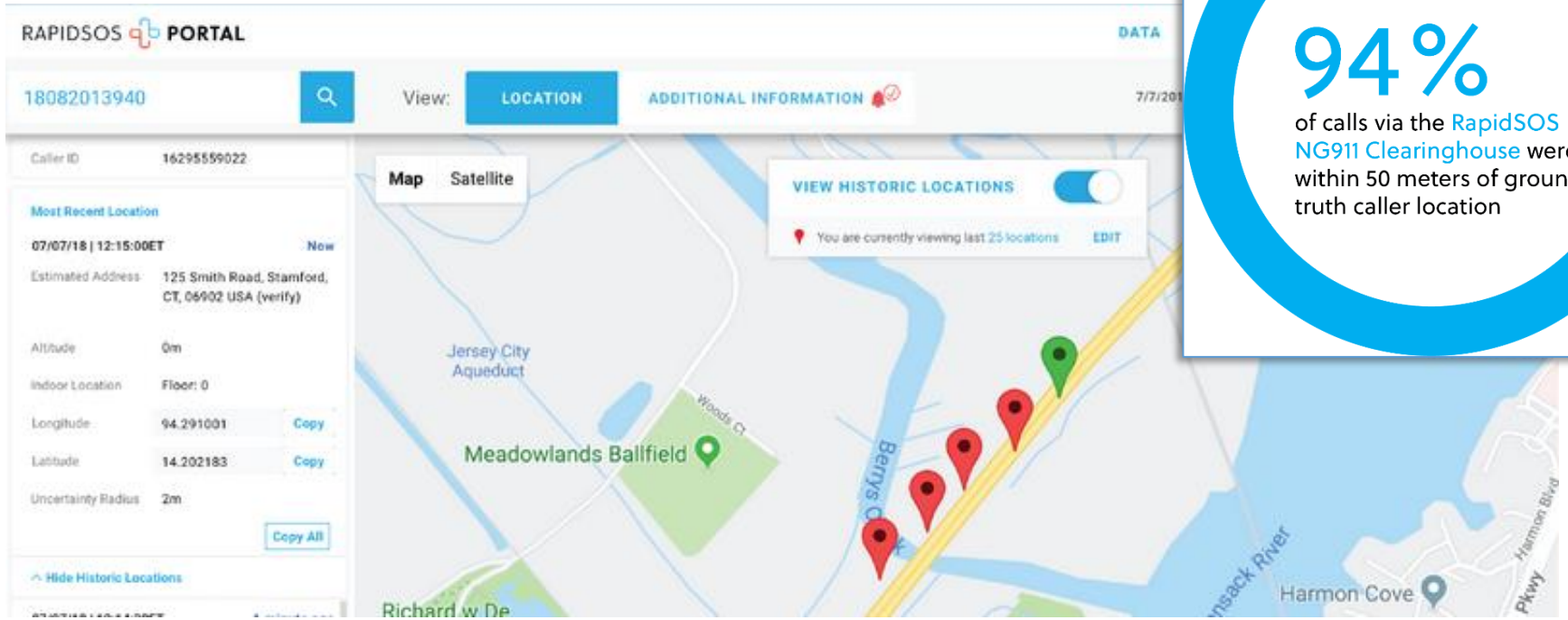
1. Call-taker had location on screen before caller could verbalize address
2. Call-taker was able to confirm location with caller as the ELS location, units were dispatched correctly
3. When Phase 2 was available, call had already been dispatched

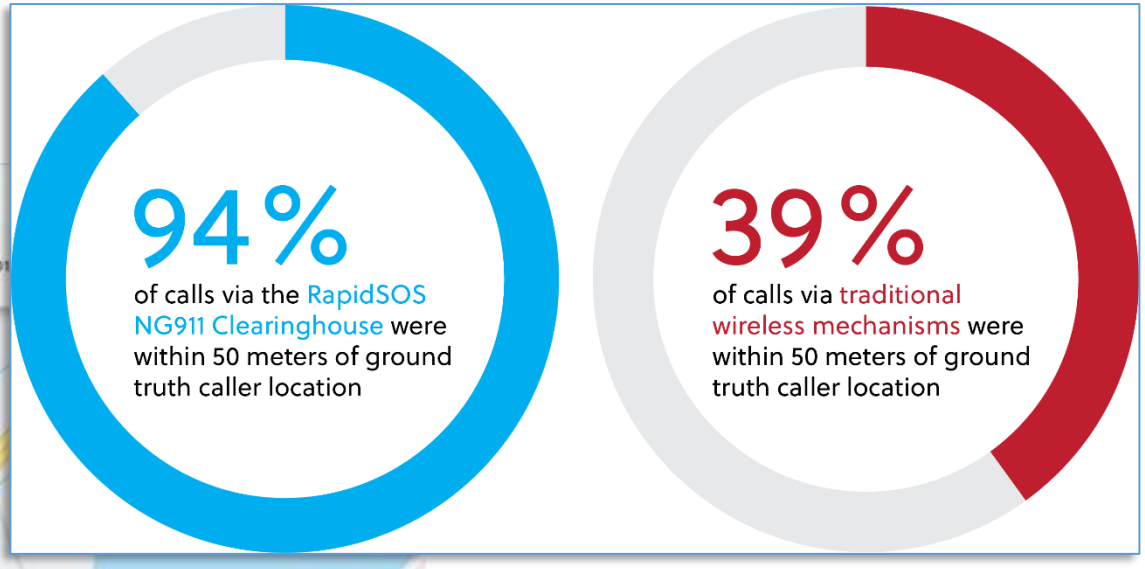
We Can Have Better Location Information

- FCC-mandated “phase 2” location info is inadequate
- Smartphone OS makers have partnered with a clearinghouse to make precise location info available for 911 – “RapidSOS”
- Still can’t be used in E-911 call routing
- Available for E-911 dispatch



“Game Changer”

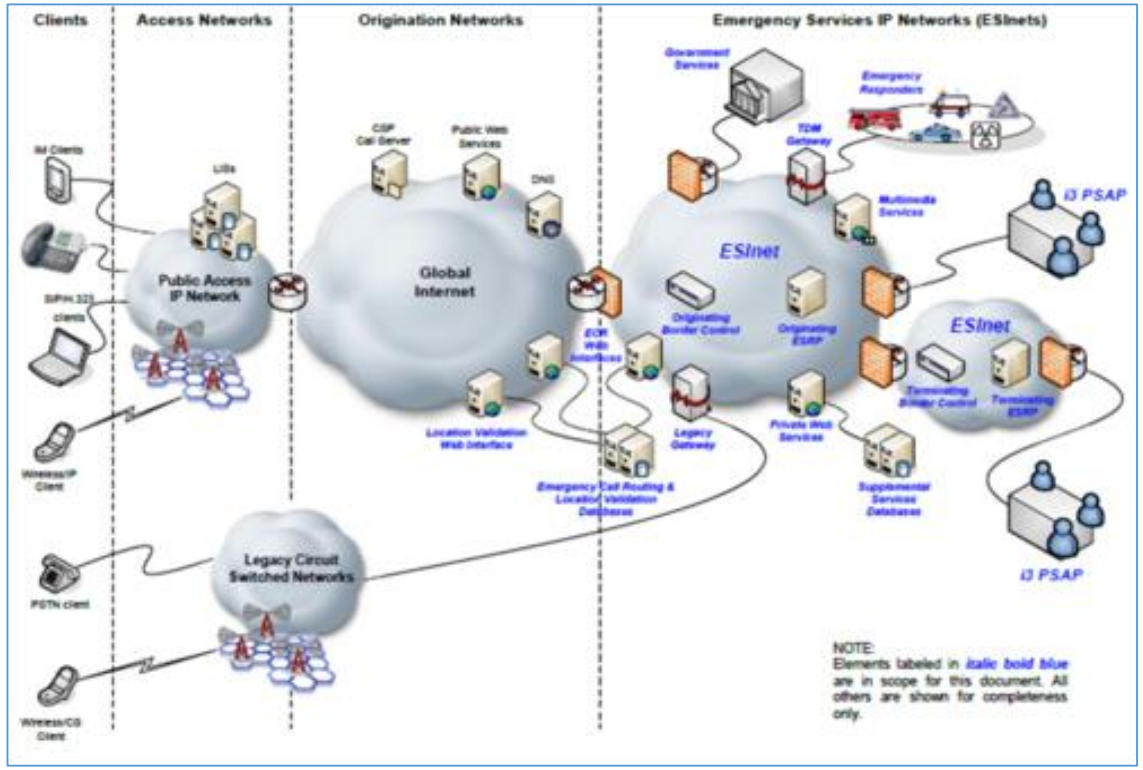




Next Generation 9-1-1 Overview

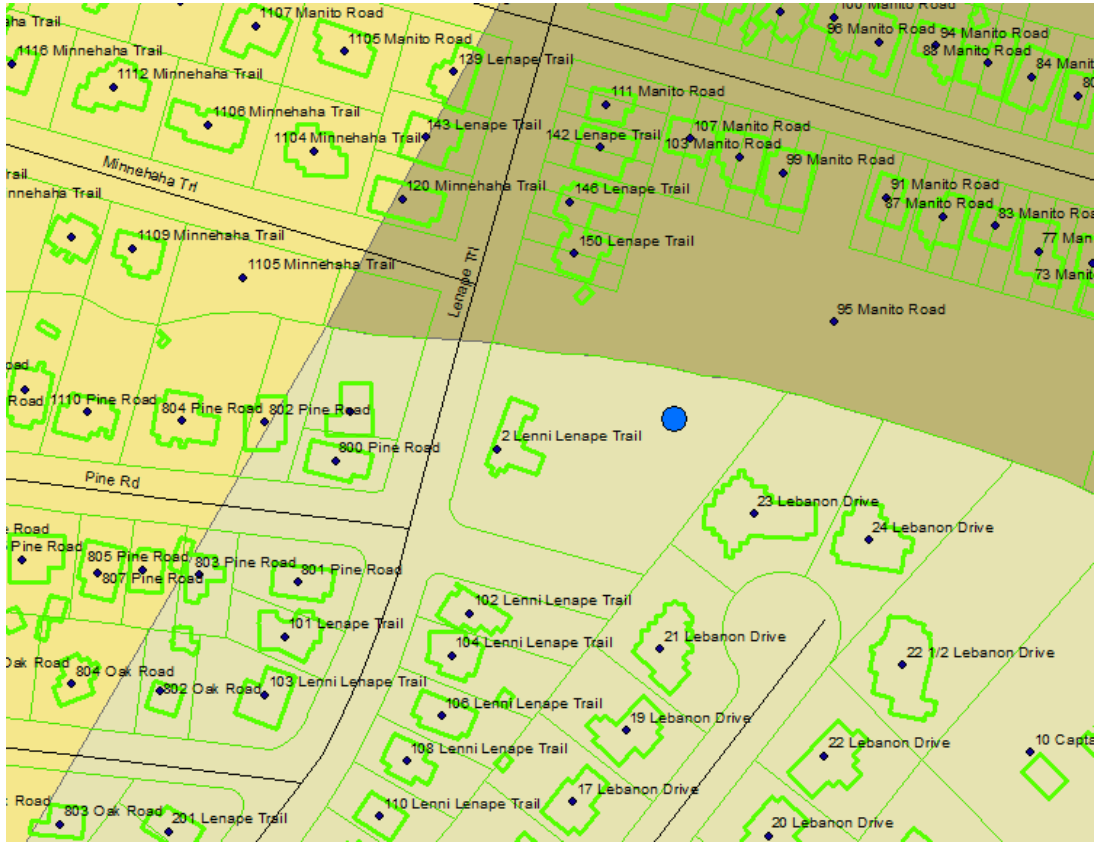
What is Next Gen 9-1-1?

- Private network separate from the publicly switched telephone network, connected to it by gateways
- IP-based network can receive input as voice, text, video, and can take from or send to automated systems (collision notification, fire alarm, etc.)
- PSAP failover more robust and dynamic



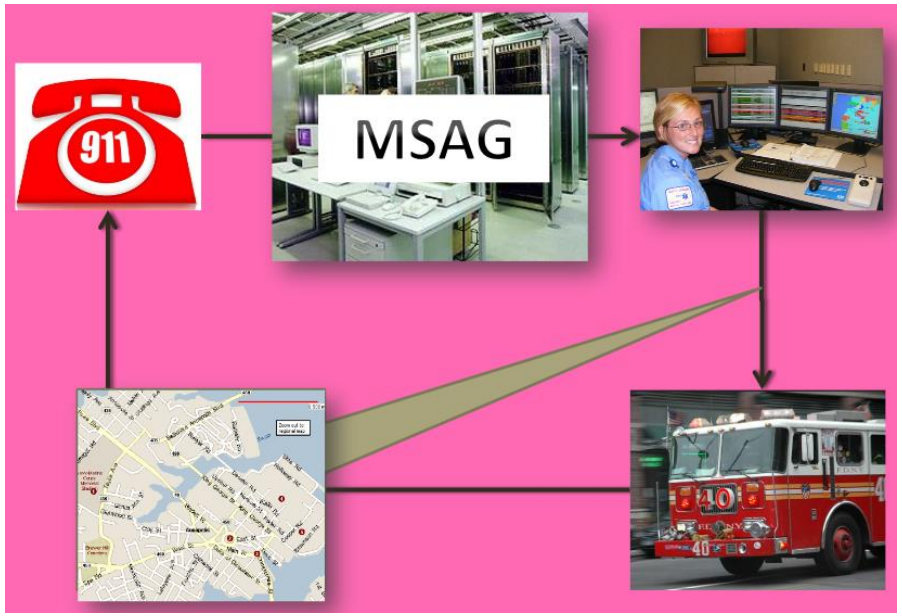
GIS Aspects of NG 9-1-1

- Wireless call routing based on device location, point-in-polygon
- Wireless location converts to dispatchable address by reverse geocoding
- Landline call routing based on point-in-poly lookup of address
- Determination of police/fire/EMS by point in poly

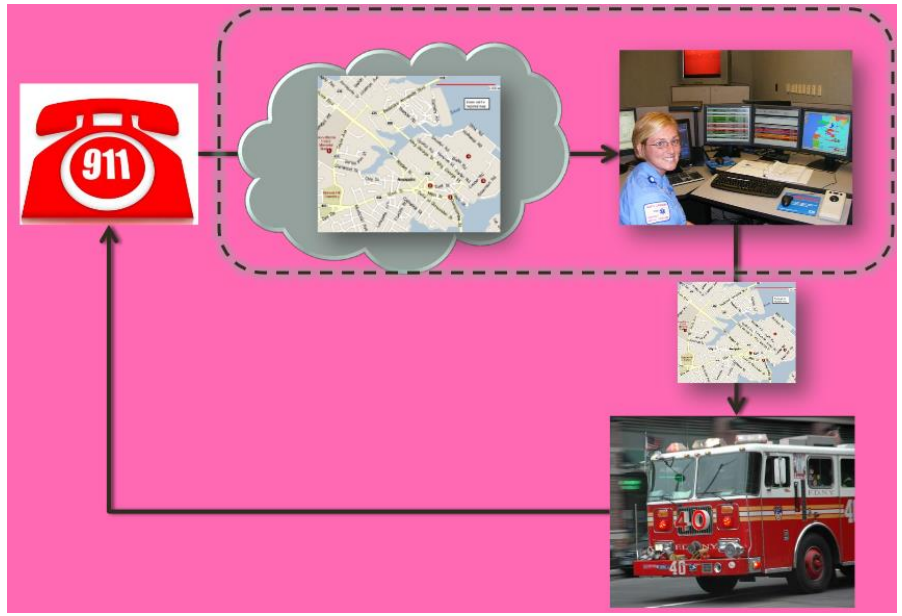


No Longer an Enhancement

E9-1-1
GIS comes into play after the call is answered



NextGen 9-1-1
GIS is part of the call routing functionality



Graphics from K Liljequist

Some Terms Defined

- NENA: National Emergency Number Association – defines standards for 911

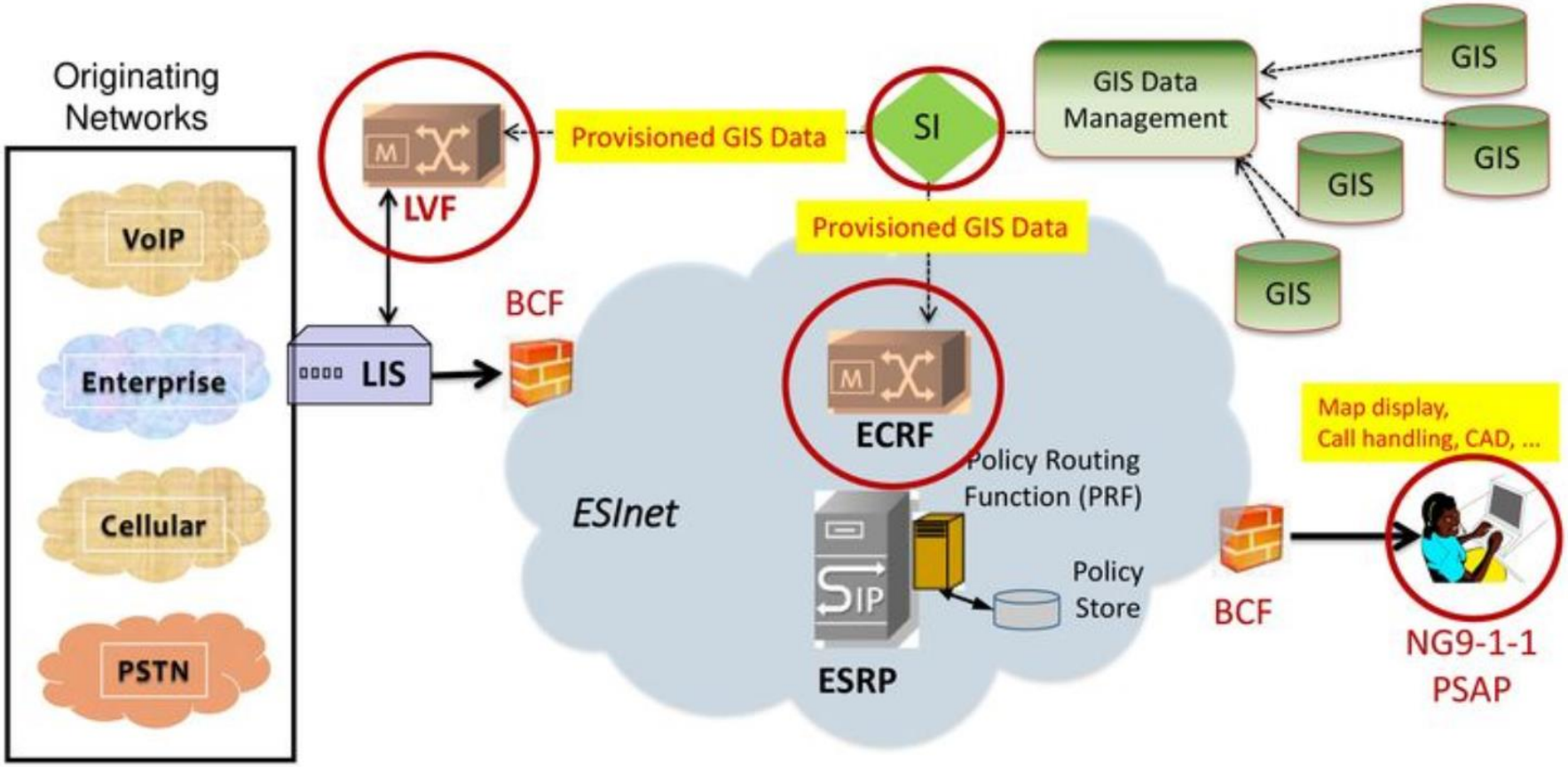
E9-1-1

- ALI: Automatic Location Identification (Looks up street address based on phone number)
- MSAG: Master Street Address Guide (tabular list of address ranges and corresponding emergency service zones)

NextGen 9-1-1

- i3: The set of NENA standards that define NextGen 911 technology
- ESINet: Emergency Services IP Network (the NG911 network)
- LIS: Location Information Server (provides caller locations)
- LVF: Location Validation Function
- ECRF: Emergency Call Routing Function
- SI: Spatial Interface, for provisioning GIS data into LVF/ECRF

GIS is at the Core of NG 9-1-1

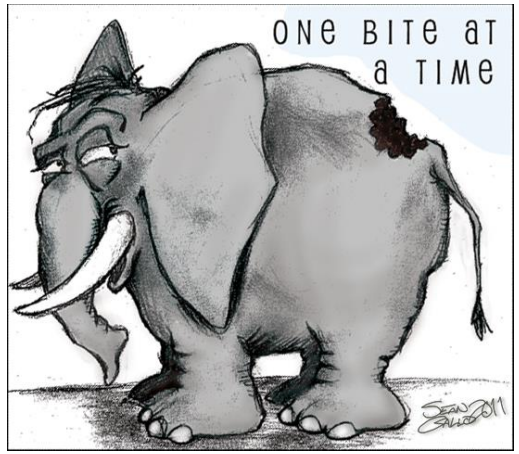


Graphics from Marc Berryman, “The Future of GIS in the 9-1-1 World”

Who's Responsible for the Data?

"When provisioning data for an ECRF and LVF through the SI, a **9-1-1 Authority** (or 9-1-1 Authority designee) MUST only include GIS data for their geographic area of responsibility and MUST ensure the data includes coverage for the entire extent of that area. Note: **The 9-1-1 Authority is ultimately responsible for the GIS data** within the area they provide service for." (NENA-STA-006.1-2018)

(But we will help.)



NG 9-1-1 GIS Preparation for NJ

njoit

New Jersey's Overall NG9-1-1 Initiative

- Lead entity is the Office of Emergency Telecommunication Services, another unit within OIT
- RFP process for initial work to get NG9-1-1 implemented is taking longer than expected
- In the meantime OGIS is working on the foundation data: addresses, roads, boundaries

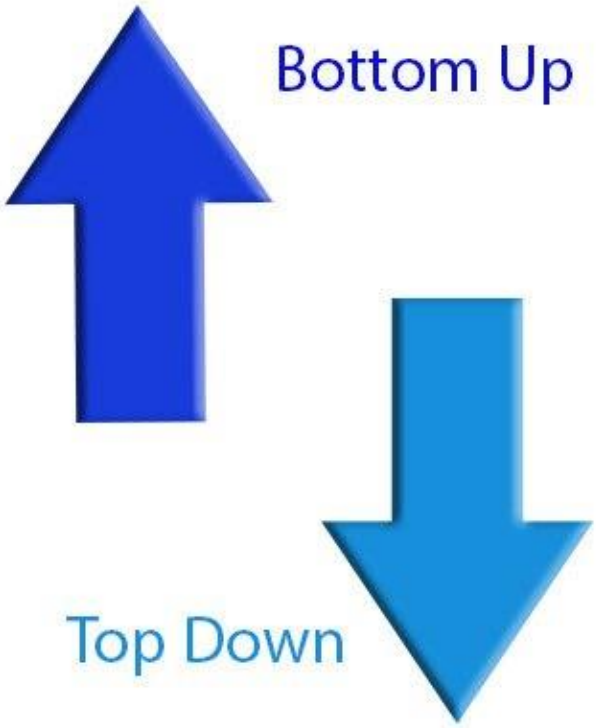
Goals for GIS to Support NG9-1-1

- Highest quality, complete GIS data in required layers
  - A challenge, to be sure, but also a huge opportunity to build data assets
- Open data exchange statewide and with other states
  - There is nothing in these data sets that justifies marking them as sensitive, we must make sure they continue to be available for non-911 purposes
- Data management workflows that 9-1-1 staff can sustain
  - Lessons learned: keep it simple
- QA and data distribution
- 9-1-1 personnel will be at the heart of it once Next Gen goes live, but they need help from the GIS community to get to the starting line

State of NJ GIS Data Program

NJ Office of GIS (in NJOIT) coordinates GIS data development across the executive branch and with federal and local partners

- Some layers are created/maintained by a state agency (imagery, elevation, government boundaries, etc.)
- Some are created at the local level and aggregated into statewide composites (property parcel boundaries)
- Some are maintained through state-local collaboration (roads, address points)



GIS Layers Specified by NENA for NG9-1-1 (with completeness indicator for NJ)

REQUIRED

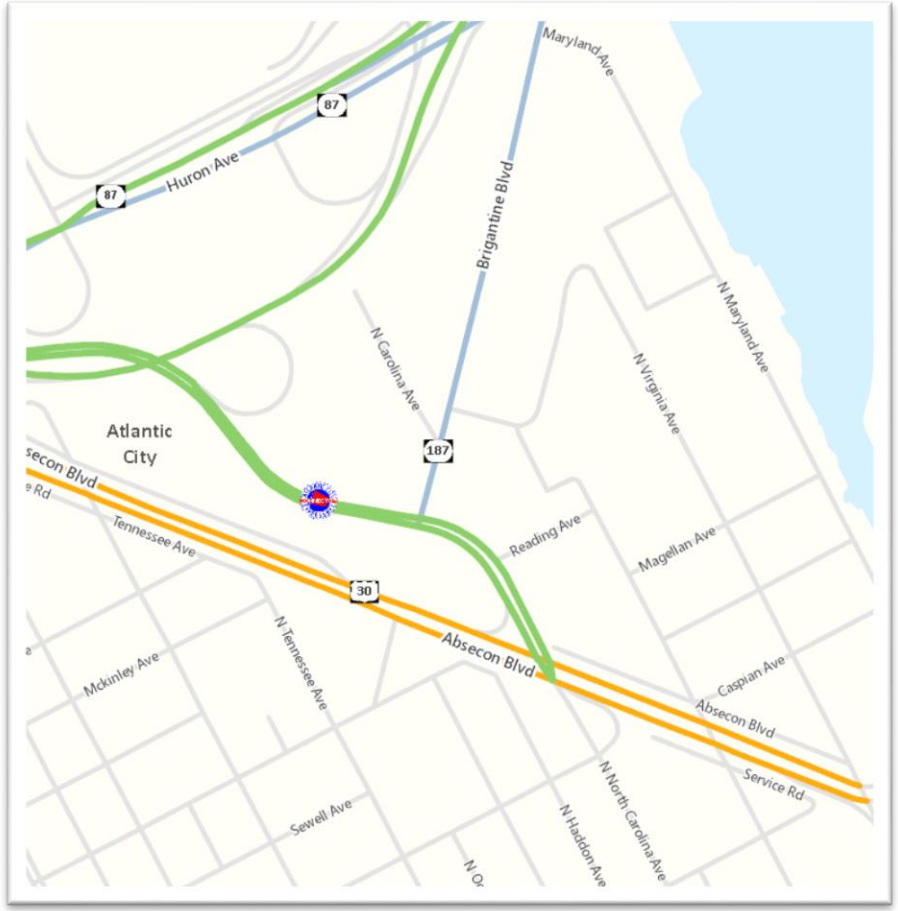
- Road centerlines with address ranges
- Site/structure address points
- PSAP jurisdiction boundaries
- Emergency service boundaries
- Provisioning boundary

STRONGLY RECOMMENDED

- Municipal/county/state boundaries
- Street name aliases
- Landmarks
- Community boundaries
- Neighborhood boundaries

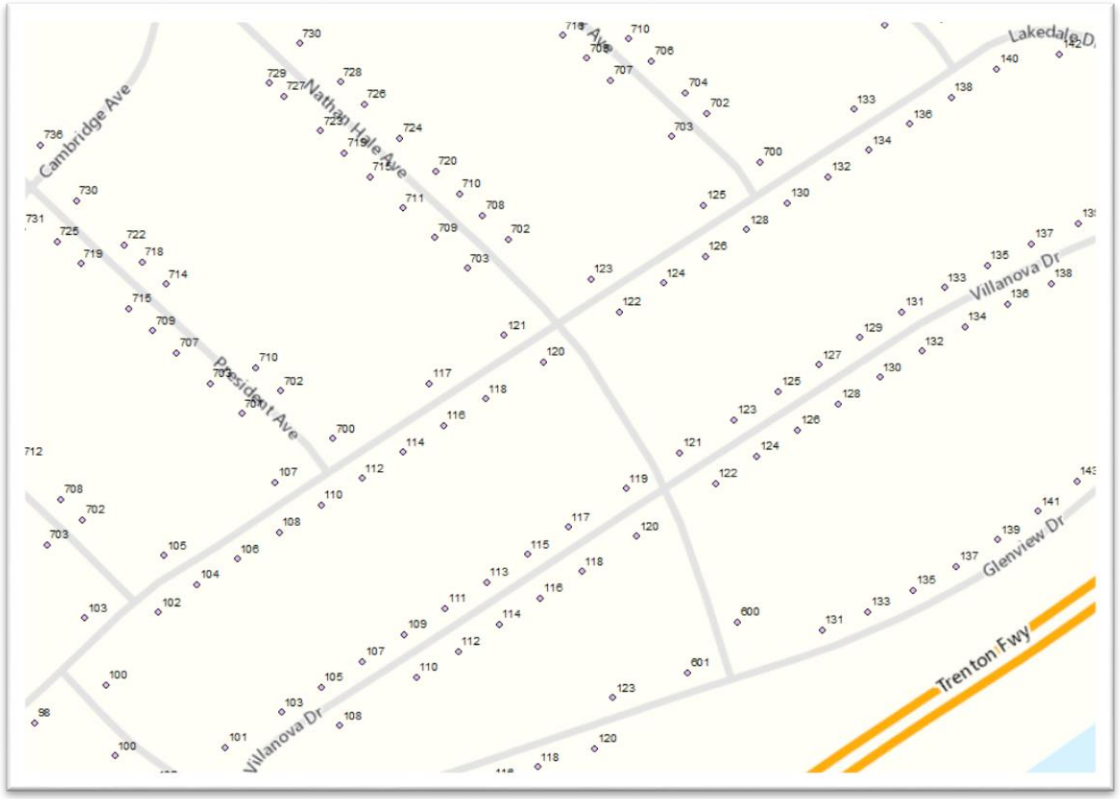
Roads: Existing Statewide Data

- NJOGIS worked with NJDOT to create road centerline data with names, address ranges, other attributes
- Maintained by NJOGIS since 2012
- NJ-specific data model
- Haven't succeeded in unifying this data with the LRS network, but we have a new strategy for that



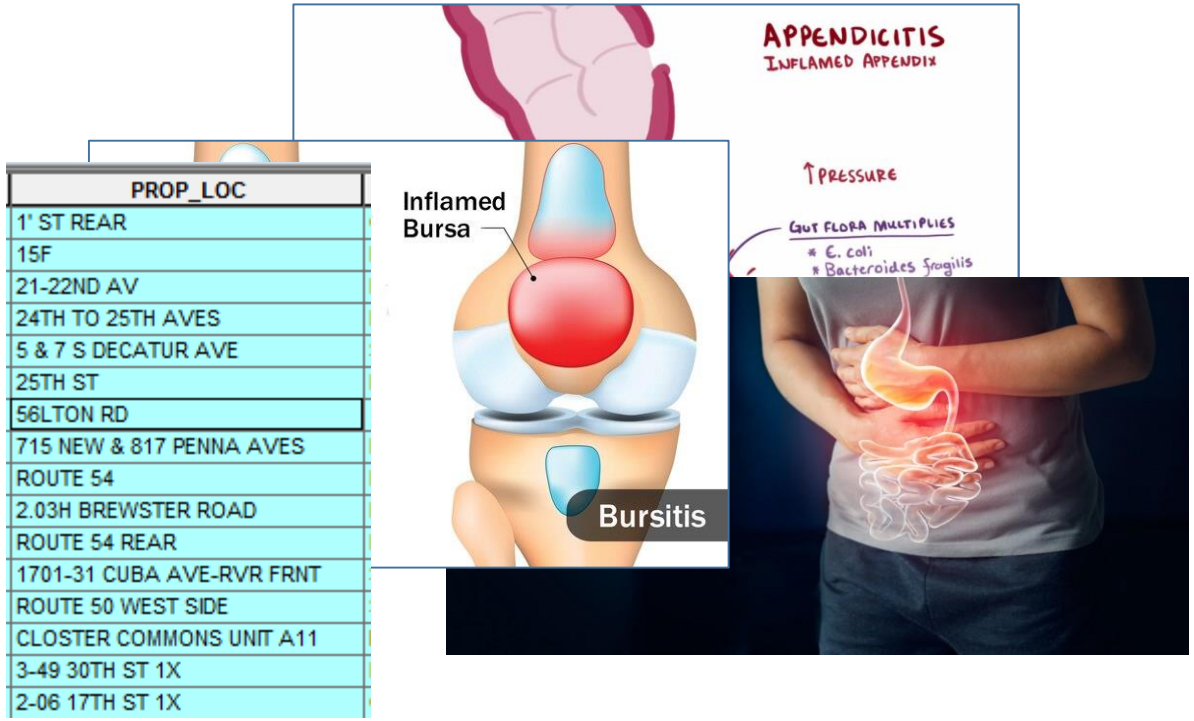
Address Points: Existing Statewide Data

- Initial data created from property tax records
- Coverage good on single units and condos; lacking on multi-unit complexes
- Point location at road frontage
- Collaborating with several counties, more to come



The Perils of Situs

- Property tax data is the only statewide source we have with both location and address
- But address is situs address
- Some issues because it isn't meant to be an address DB
- Some issues that are plain old bad data quality



PROP_LOC
1' ST REAR
15F
21-22ND AV
24TH TO 25TH AVES
5 & 7 S DECATUR AVE
25TH ST
56LTON RD
715 NEW & 817 PENNA AVES
ROUTE 54
2.03H BREWSTER ROAD
ROUTE 54 REAR
1701-31 CUBA AVE-RVR FRNT
ROUTE 50 WEST SIDE
CLOSTER COMMONS UNIT A11
3-49 30TH ST 1X
2-06 17TH ST 1X

"You don't want none of them sitis's"

A Common Problem

Identify

Identify from: <Top-most layer>

- AddressPoints_NJ
  - Wh-Ham Sq

Location: 439,522.939 500,624.902 Feet

Field	Value
PRE_NUM	<null>
ADDR_NUM	1200
SUF_NUM	<null>
PRE_DIR	
PRE_TYPE	
PRE_MOD	
NAME	Wh-Ham Sq
SUF_TYPE	Road
SUF_DIR	
SUF_MOD	
NAME_FULL	Wh-Ham Sq Road
STREET_ADDR	1200 Wh-Ham Sq Road
BLDG	<null>
FLOOR	<null>
UNIT_TYPE	<null>
UNIT_ID	<null>
ROOM	<null>
LOCTN	<null>
SUB_ADDR	<null>
ZIP_NAME	<null>
ZIP_CODE	<null>
ZIP_PLUS4	<null>
ZIP_SRC	<null>
GNIS	Hamilton Township, Mercer
PRMRY_PT	Yes
LOC_TYPE	Parcel Centroid

Identified 1 feature

NENA GIS Data Model

NENA Standard for NG9-1-1 GIS Data Model

Abstract: This document defines the GIS data information, formats, requirements and related information used in NENA Next Generation 9-1-1 (NG9-1-1) Core Services (NGCS).

NENA Standard for NG9-1-1 GIS Data Model

NENA-STA-006.1-2018
DSC Approval: 05/08/2018
PRC Approval: 06/12/2018
NENA Executive Board Approval: 06/16/2018
Next Scheduled Review Date: 06/16/2019

Prepared by:
National Emergency Number Association (NENA) Data Structures Committee, NG9-1-1 GIS Data Model Working Group

Published by NENA
Printed in USA

Descriptive Name	Field Name	M/C/O	Type	Field Width
Discrepancy Agency ID	DiscrpAgID	M	P	75
Date Updated	DateUpdate	M	D	-
Effective Date	Effective	O	D	-
Expiration Date	Expire	O	D	-
Road Centerline NENA Globally Unique	RCL_NGUID	M	P	254
Left Address Number Prefix	AdNumPre_L	C	P	15
Right Address Number Prefix	AdNumPre_R	C	P	15
Left FROM Address	FromAddr_L	M	N	6
Left TO Address	ToAddr_L	M	N	6
Right FROM Address	FromAddr_R	M	N	6
Right TO Address	ToAddr_R	M	N	6
Parity Left	Parity_L	M	P	1

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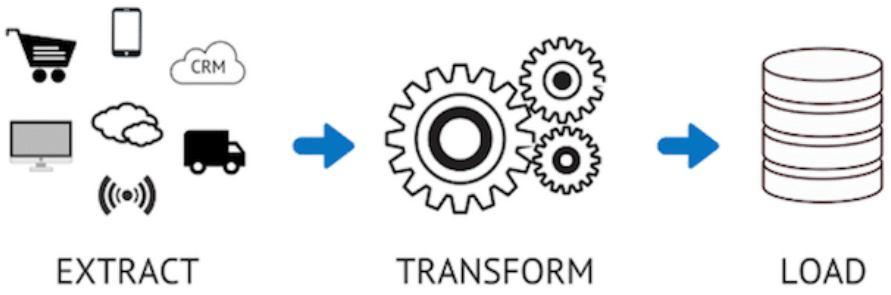
Descriptive Name	Field Name	M/C/O	Type	Field Width
Parity Right	Parity_R	M	P	1
Street Name Pre Modifier	St_PreMod	C	E	15
Street Name Pre Directional	St_PreDir	C	P	9
Street Name Pre Type	St_PreTyp	C	E	50
Street Name Pre Type Separator	St_PreSep	C	E	20
Street Name	St_Name	M	E	60
Street Name Post Type	St_PosTyp	C	E	50
Street Name Post Directional	St_PosDir	C	P	9

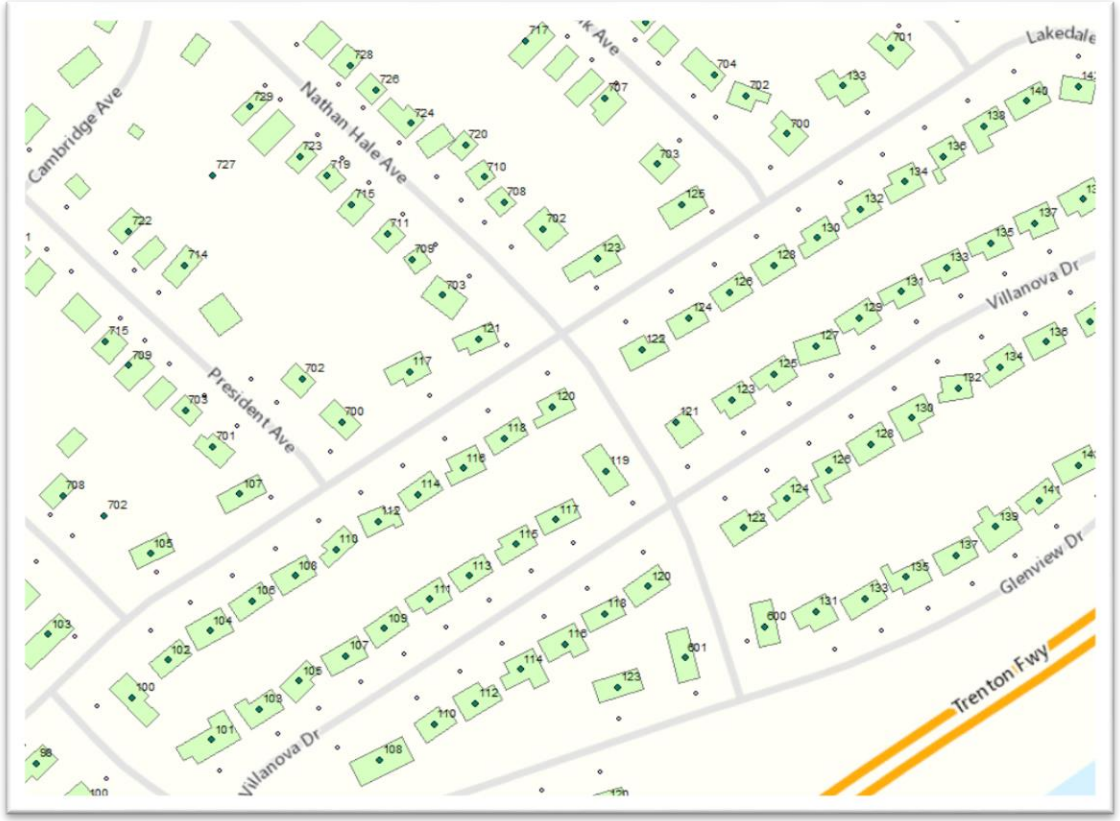
Roads: Activities Underway

- NENA Data Model for GIS data published 2018
- Conversion of NJOGIS data to the NENA model is in progress
- Product evaluation for new editing tools (off-the-shelf)
- Major advantage of NENA data model is a variety of tools work with it, partners can use different ones



Address Points: Work Under Way

- Conversion to NENA model in progress
- Moving point location to building centroid



What Needs More Work?

- Newer local roads may be missing
- Missing addresses in multi-unit complexes
- Moving address points onto buildings when automated method can’t
- Overall address accuracy improvement

What Will NG Look Like?

- Local provisioning of data through SI
- Statewide (and neighboring states) data available to all
- Centralized repository, replicated for availability
- Some details for NJ will emerge once the contract is awarded

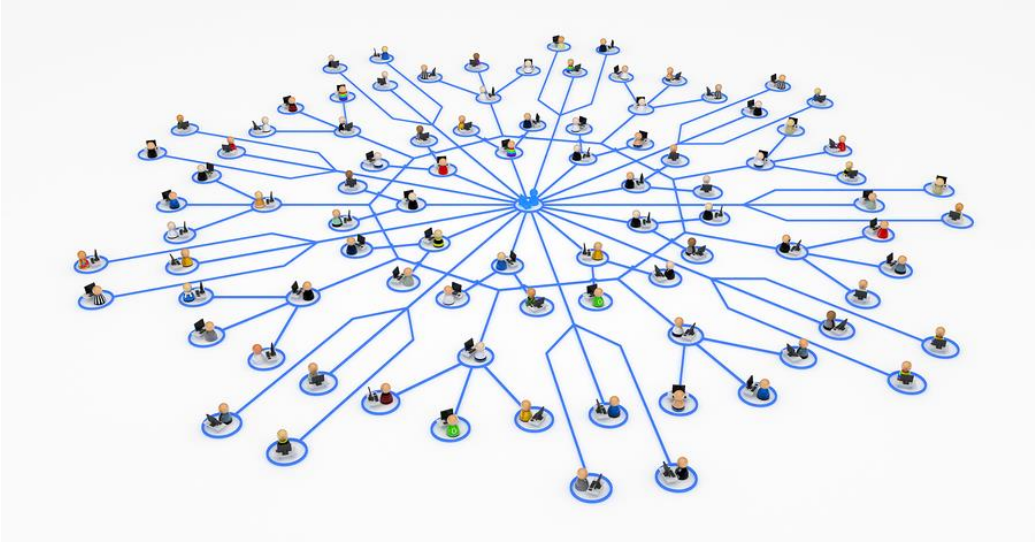


Image from logicbay.com

What Can We Do In the Meantime?

- The data that we have now can be used now in dispatch systems
- Templates available for editing data in the NENA model
- Need to start building partnerships between state/local GIS staffs and 9-1-1 staffs
- Improve data completeness and quality

Questions?

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