Introduction to ArcGIS

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Introductions

- Annie Cahill - DATAMARK
- Becca Mangin - DATAMARK
- Class Attendees

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Agenda

- GIS Overview
- NG9-1-1 and GIS data quality
- NG9-1-1 Data Implications
- GIS Data Validations
- The Path Forward

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GIS in NG9-1-1 Quiz Time

- An MSAG is an example of spatial data.
- The PSAP is responsible for provisioning the best GIS data.
- Synchronizing GIS data with legacy 9-1-1 database (MSAG and ALI) to a 98% match rate constitutes NG9-1-1 data readiness.
- For the PSAP, NG9-1-1 call routing is the sole need for high quality GIS data.
- PSAP boundary's sole purpose is to assist the ECRF in routing 9-1-1 calls to the most appropriate primary PSAP
- Does a transition to ESInet mean better responses?

☒ **False**

☑ **True**

☒ **False**

☒ **False**

☑ **True**

☑ **True**

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GIS Overview

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GIS is…

- A framework for gathering, managing, analyzing and displaying data that has a geographical or spatial component
- An integration of hardware, software, data and people

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GIS is…

A system that allows us to answer questions and make decisions that involve a ‘where’

- Where is it?
- How far away is it?
- What is near it?
- How do I get to it?
- Where is the best location to do X?

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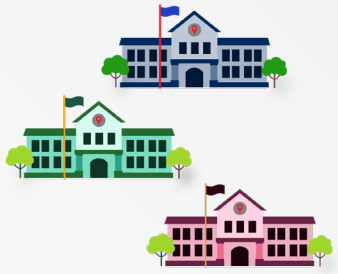
History of GIS

1960's

- Canada Land Inventory System
- Harvard Graduate School of Design

1970's

- Expanded use in universities



1980's

- M&S Computing/Bentley Systems-CAD platform
- ESRI-Environmental Systems Research Institute
- ERDAS-Earth Resource Data Analysis System

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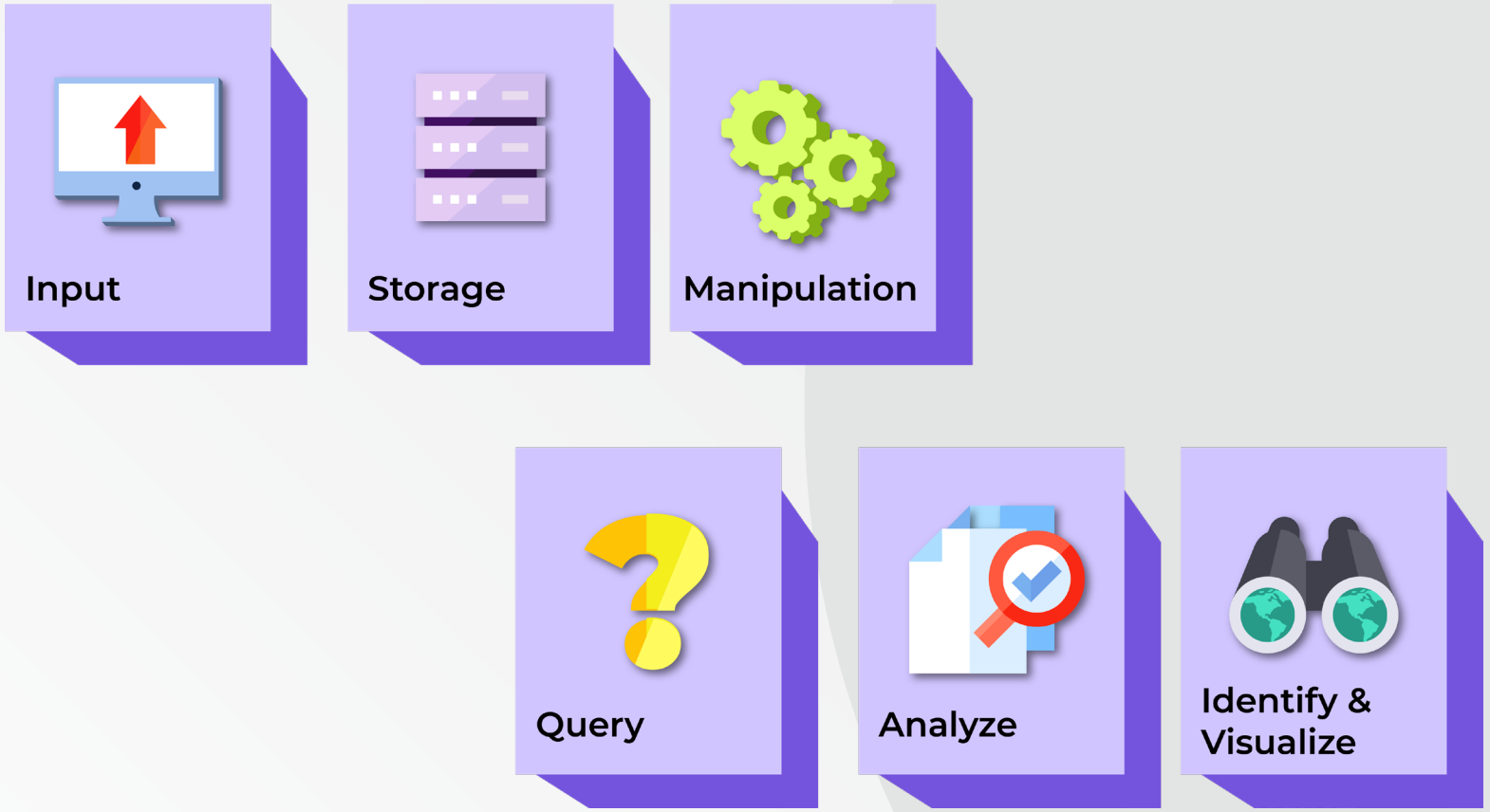
GIS Uses Geospatial Data



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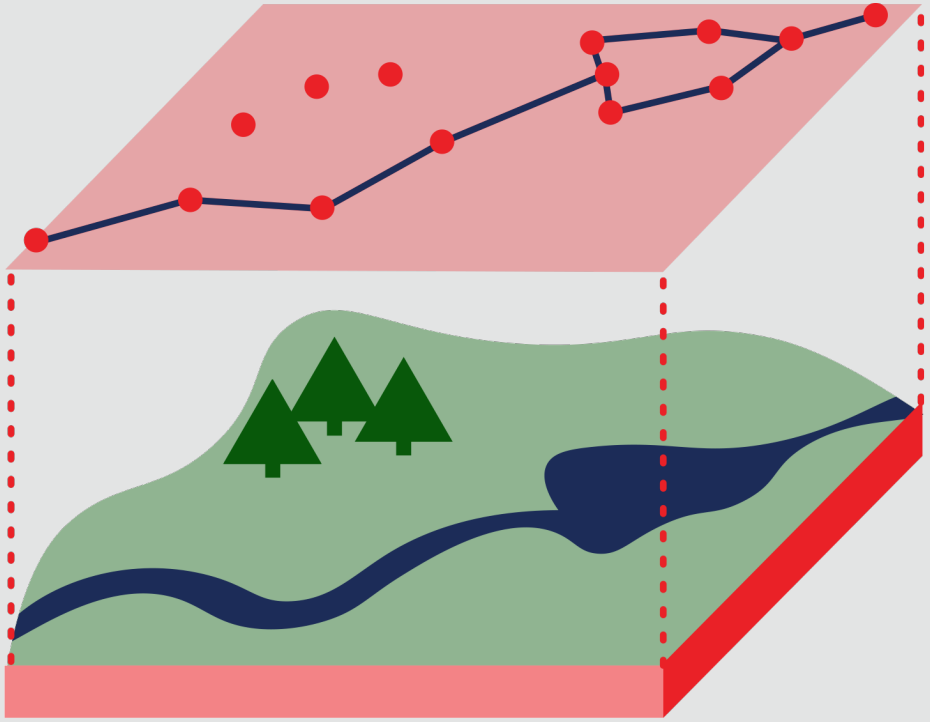
GIS Models Reality

- A combination of cartography, statistical analysis, and database technology
- Identify patterns, relationships, and situations



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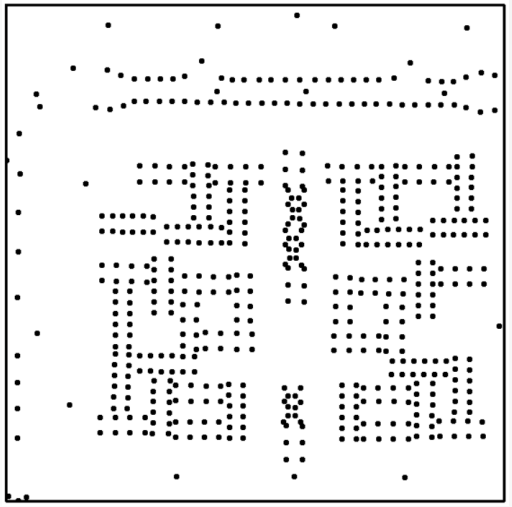
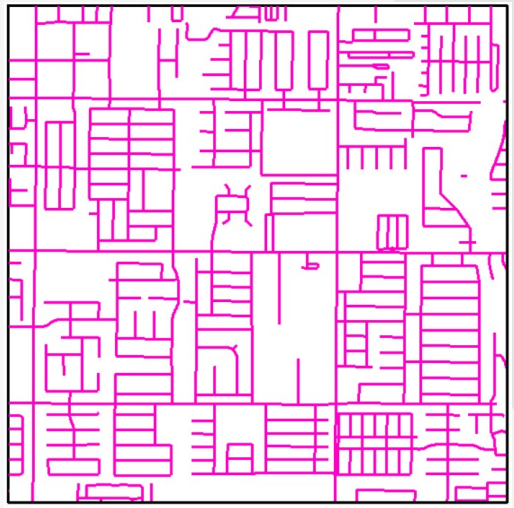
Vector Data Format

- Points, lines, polygons (areas) whose geometry is defined by their associated x,y coordinate pairs
- Topology rules that model the relationships between points, lines and polygons and determine how they share geometry
- Storage options: shapefiles and geodatabases

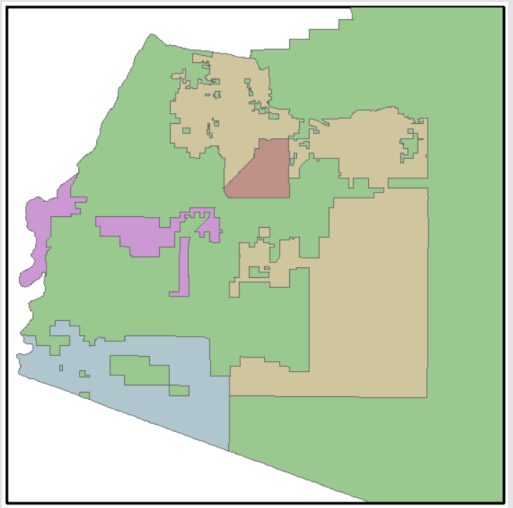
Points



Lines



Polygons



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Raster Data Format

- Matrix of cells organized into rows and columns

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Attributes

- Information about each feature in the data is stored in fields
- Maps are just a picture!
- GIS links maps and data

Hydrants

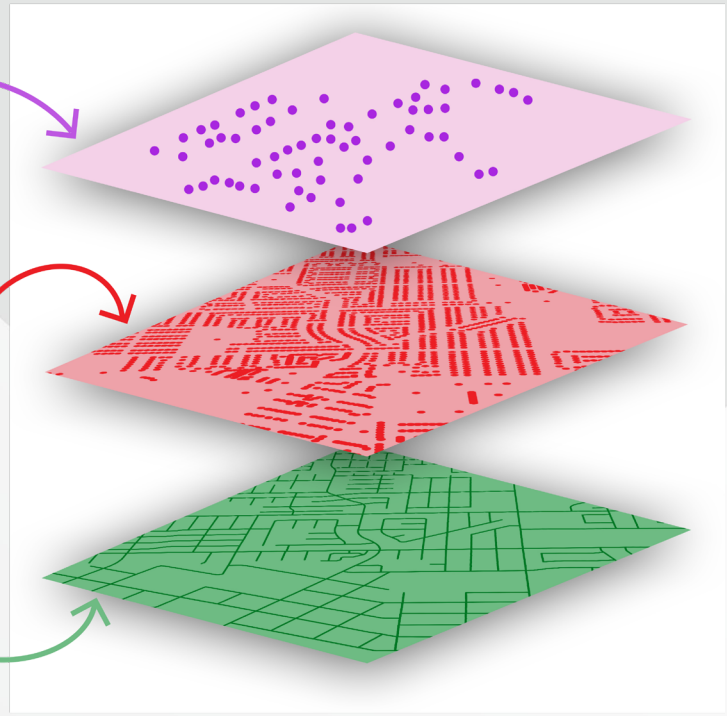
Hydrant #	Pressure	Test Date
22456	441000 PSI	09/01/2020
22457	360000 PSI	09/08/2020
22458	426000 PSI	09/01/2020
22459	439000 PSI	09/01/2020
22460	238000 PSI	09/02/2020
22461	3310100 PSI	09/02/2020
22462	3510100 PSI	09/07/2020

Address Points

USPS Data Element	Address Field	E911 Ex. Value
Street Number	Address	101
Predirectional	PreDir	N
Street Name	Street	Main
Street Suffix	StreetType	ST
Postdirectional	SufDir	NE
Secondary Unit Indicator	Bldg Unit	APT
Secondary Number	BldgName	3
City	City	Guthrie
State	State	OK
Zip	Zip	73044

Road Centerlines

Predir.	Street Name	Street Type	Postdir.
N	Main	St	NE
N	Main	St	NE
N	Main	St	NE
N	Main	St	NE
W	Franklin	Blvd	NW
W	Franklin	Blvd	NW
W	Franklin	Blvd	NW
W	Franklin	Blvd	NW



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Questions:

- Do you use GIS today in your locality?
- What GIS layers do you maintain?

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Creating GIS Data

- Databases
- Digitized maps
- GPS field collection
- Aerial photography
- Remote sensing

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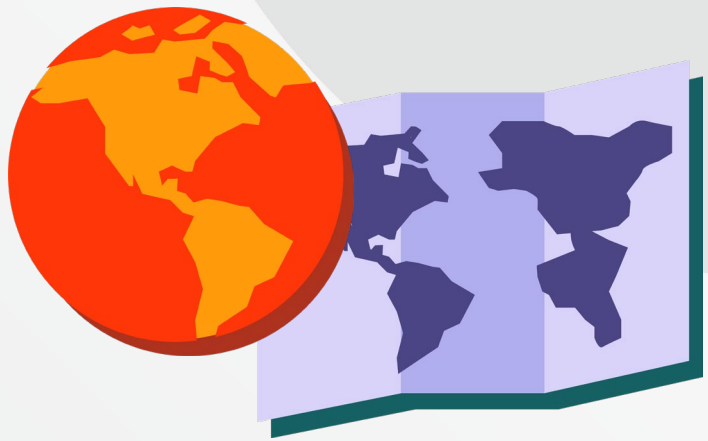
Model the Earth: Coordinate Systems

- Geographic
  - Define locations using a sphere
  - Latitude/longitude based
- Projected
  - Model the earth on a flat surface
- Coordinate systems are integral to NG9-1-1



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What is a GIS Data Model?

- Describes thematic data layers
  - i.e. road centerlines, address points
- Describes spatial representation/formats of layers
  - i.e. points, lines, polygons
- Attributes of the layers (data schema)
- Defines topology-relationships among features within layers or between other layers
  - i.e. node to node topology for road centerlines
  - i.e. county boundaries must be totally contained by their state boundary

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OK Geographic Information NG9-1-1 and Addressing Standard

- Supports the NENA Standard for NG9-1-1 GIS Data Model (NENA-STA-006.1.1-2020)
- Defines layers required for NG9-1-1
- Describes spatial representation of layers
  - i.e. street centerlines are a line dataset
- Defines attributes for each dataset
  - i.e. mandatory, conditional, optional, transportation
- Domain values for standardization

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Intended Use of the Standard

- Primary reference document for NG9-1-1 GIS Components and Address Standards in the State of OK for GIS based addressing, transportation and routing
- Guideline for developing and maintaining NG9-1-1 required GIS datasets
- Provides basic structure/schema for addressing data
- Provides structure for tabular and attribute data
- For both public and private sector

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Who Should Use the Standard

- Approved agencies
- Public Safety Answering Point (PSAP)
- Council of Government
- Vendor
- Agency ID-reference format:
- PSAP: psap.XXXX.ok.gov (XXX is the Registered FCC ID #)
- COG: cog.cogname.ok.gov (Abbreviated name of the COG)
- VENDOR: ven.companyname.ok.gov (Company Name)
- Discrepancy Agency

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NG9-1-1 and GIS Data Quality

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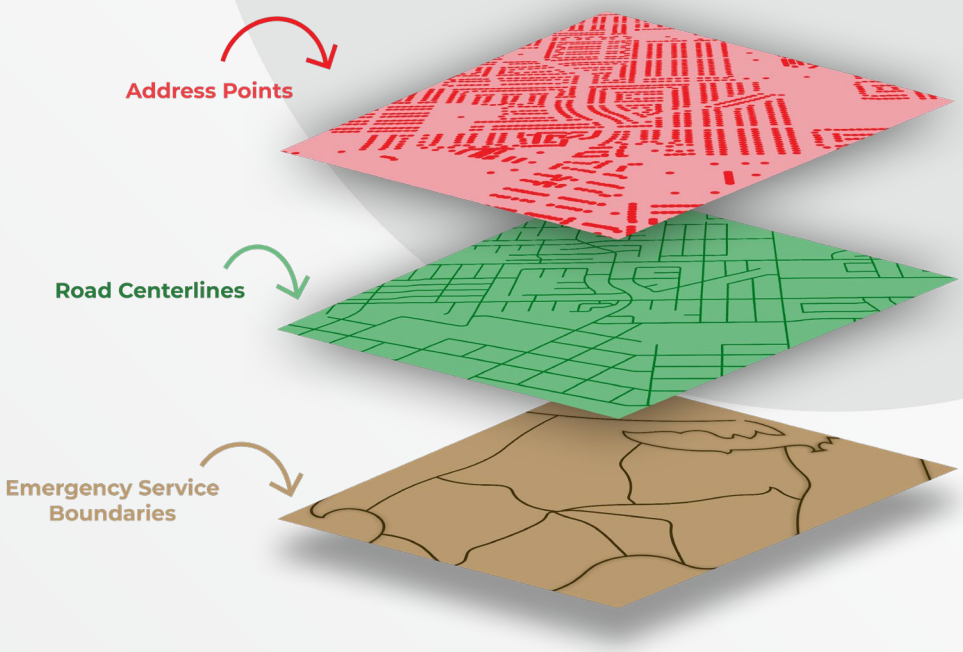
NG9-1-1 Data Layers

- Address Point
- Road Centerline
- Public Safety Answering Point (PSAP) Boundary
- Service Boundary (Police, Fire, EMS)
- Provisioning Boundary (also known as Discrepancy Agency Boundary)



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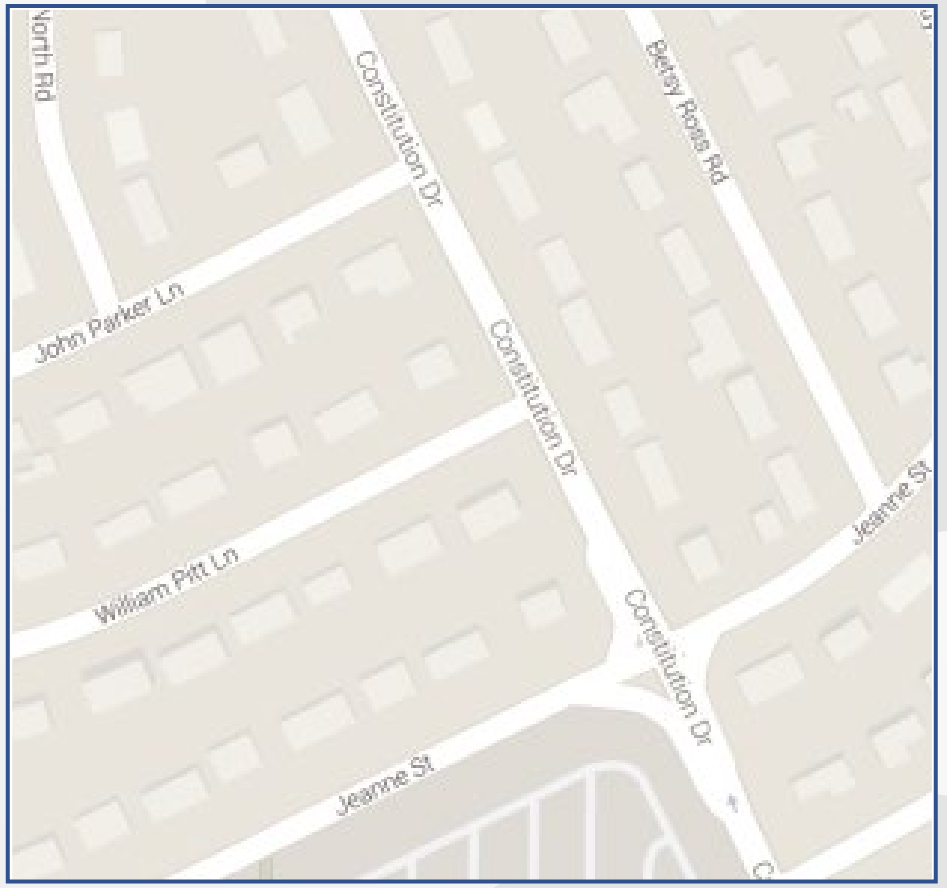
Required Datasets: Road Centerlines

- Edge-matched
- Split at PSAP Boundary
- No gaps, overlaps or duplicate centerlines



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Required Datasets: Address Points

- Most precise call and resource routing
- Includes non-addressed dispatchable locations

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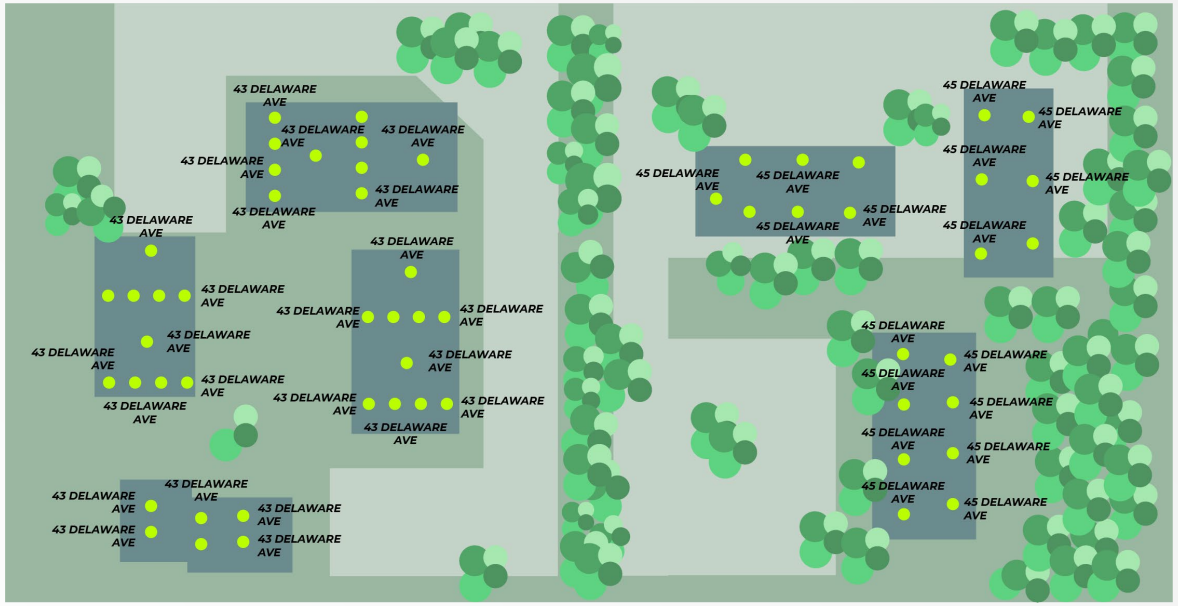
Sub-Addressing (Optional)



- The process of identifying multi-unit structures, who share a common mailing address, with unique identifiers.
- Examples are:
  - Colleges/Universities
  - Military Installation
  - Shopping centers/Malls
  - Strip Malls
  - Apartments/Condominiums

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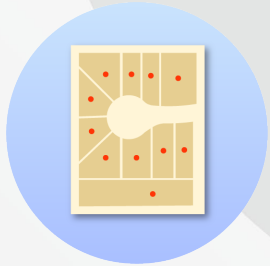
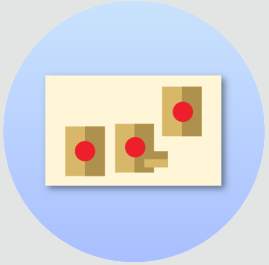
Address Point Placement Methodologies

Geocoding
(from road centerlines)

Site



Parcel



Structure(s)

Front Door of Structure

Property Access

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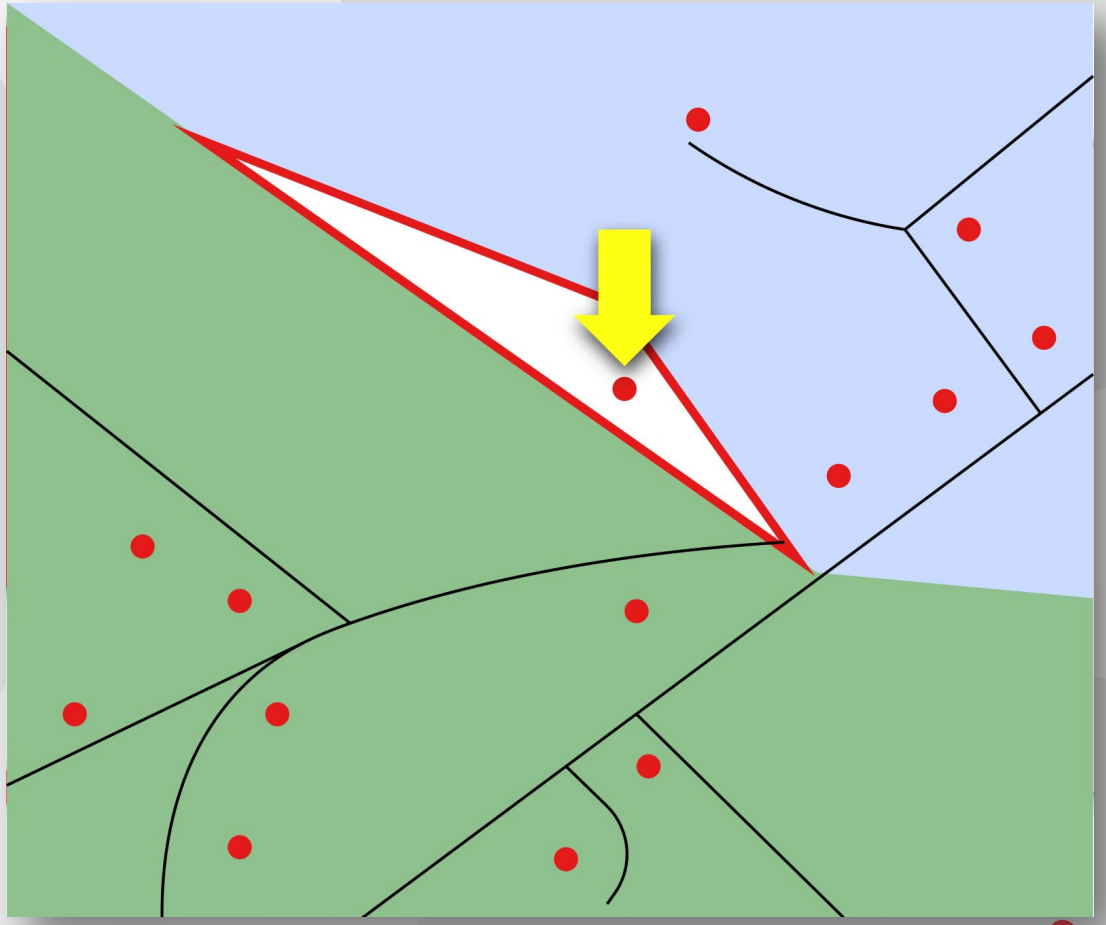
Required Datasets: PSAP Boundary

- Primary PSAP
- Need footprints for neighboring primary PSAPs
- No gaps, overlaps or duplicate polygons
- Follow the State's procedure for modifying PSAP boundaries



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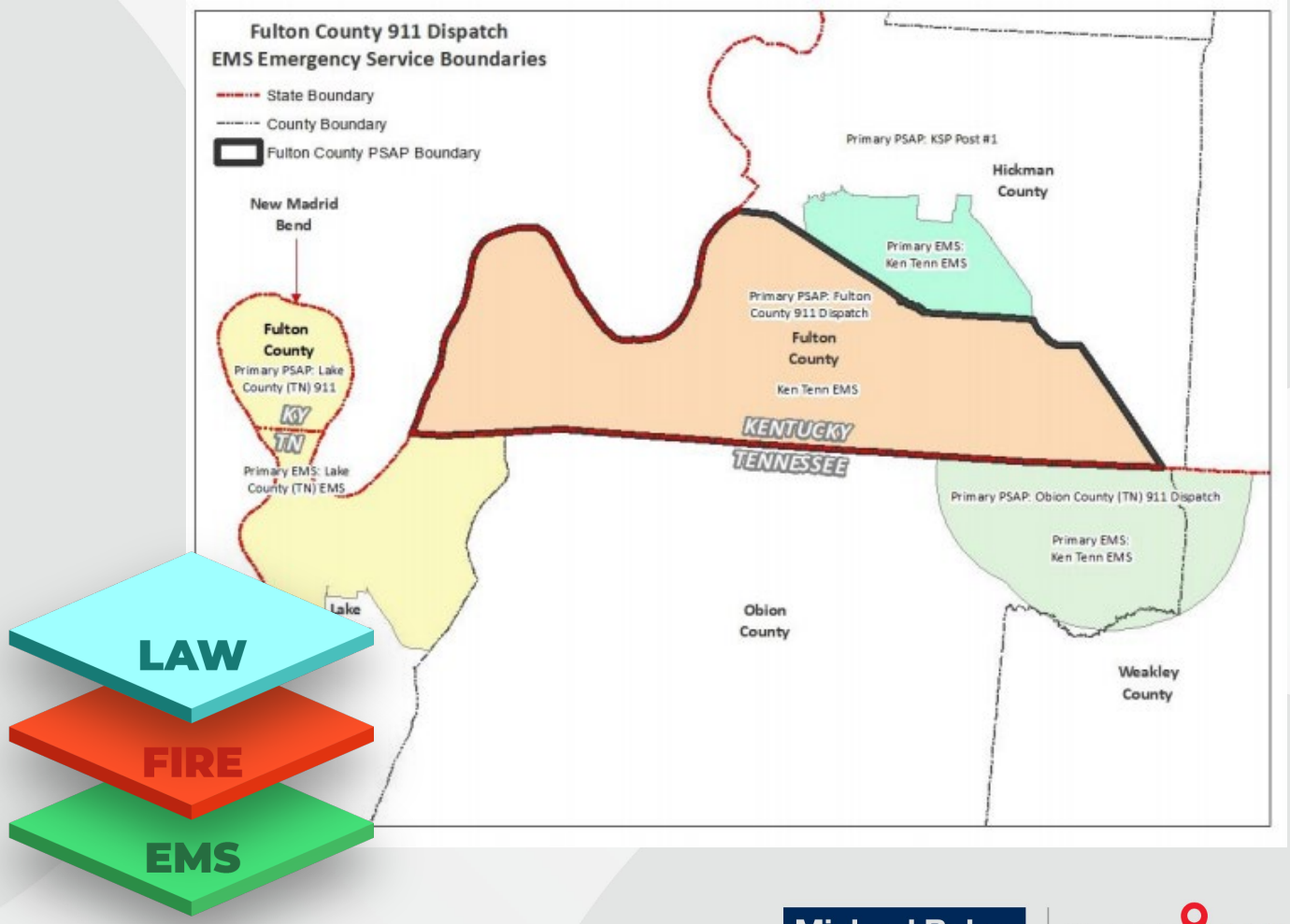
Required Datasets: Service Boundaries

- Police, Fire, EMS Layers
- ESZ Layer
- No gaps, overlaps or duplicates



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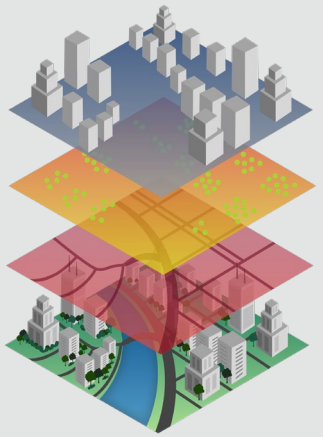
Question

- Which NG9-1-1 data layers do you currently manage?
- What challenges are preventing you from developing quality NG9-1-1 data?
  - Staffing
  - Resources
  - Time
  - Lack of NG9-1-1 experience
  - Lack of GIS experience



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Accuracy and Completeness

- Accuracy
  - Do the geography and attributes correctly reflect what is in the real world?
- Completeness
  - Do I have all the required layers?
  - Am I missing data from a layer? i.e missing address points?
  - Are all required fields present in the data?
  - Are the fields populated?

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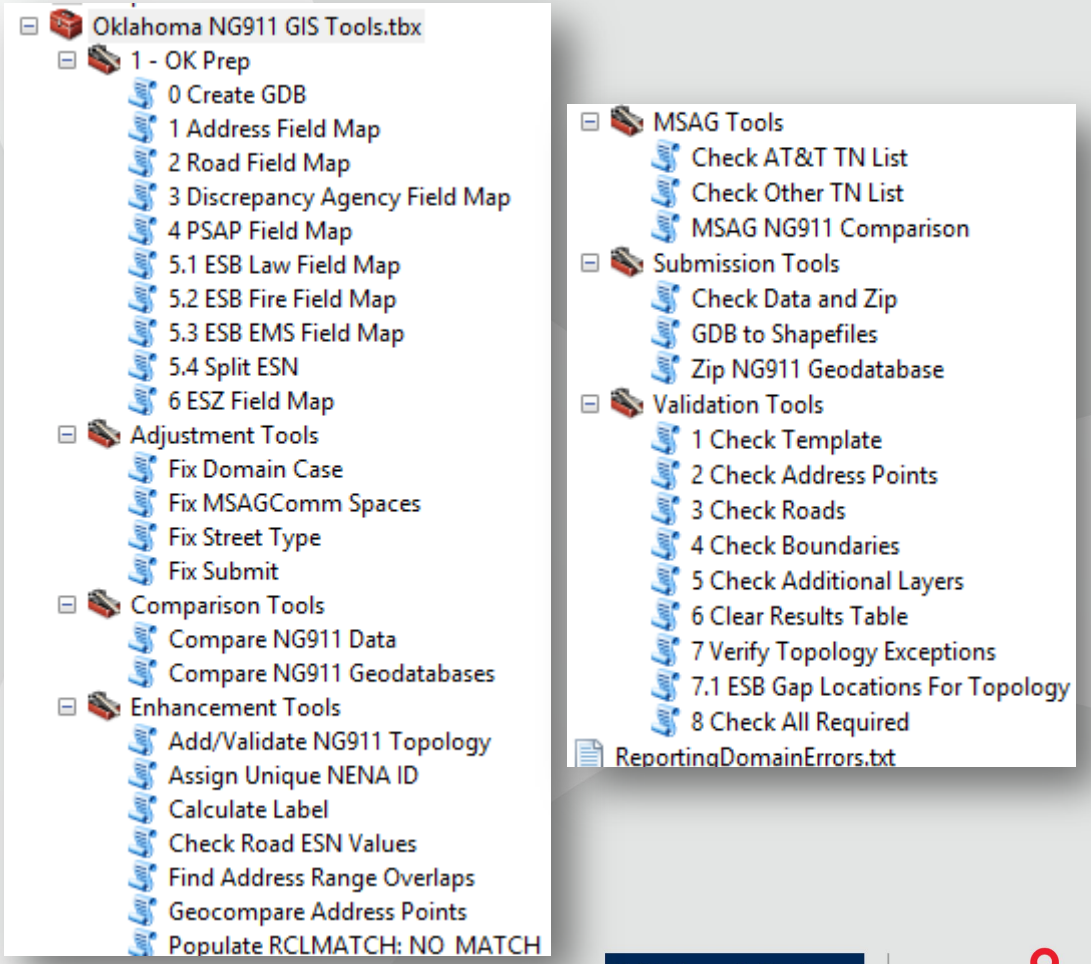
OK NG9-1-1 GIS Toolkit

- The State of OK has developed a toolkit to assist in preparing data for NG9-1-1
- GIS Toolkit classes coming 2024



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NG9-1-1 GIS Data Implications

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Importance of GIS in NG9-1-1

- Can my GIS data support the caller's location?
  - Completeness
  - Accuracy
  - Precision
- Can my GIS data support accurate queries for the proper routing of the 9-1-1 call?
  - Topology
    - Is my geographic representation, correct?
  - Attribution
    - Mandatory and Conditional (for transitional states)

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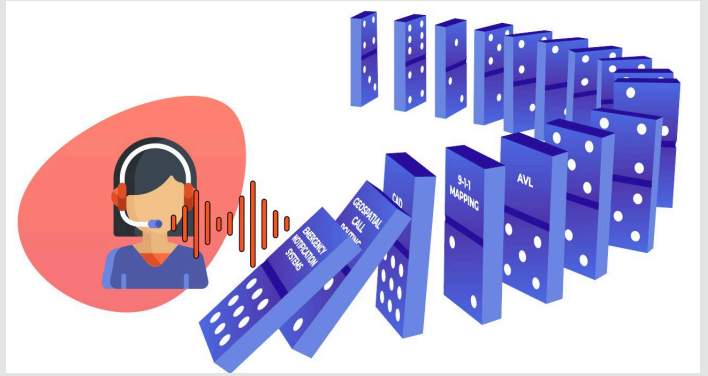
If Not 98%, then What is the Measure?

- NENA standards compliance
- Schema completeness and data accuracy
- Data attribution and topology completeness and quality
- Integrity and reliability of each data layer as they relate to the other data layers
- Legacy to NG9-1-1 comparisons



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Data Quality

AVAILABILITY

Is data available?

COMPLETENESS

Is all necessary data present?

ACCURACY

Does the data reflect the real world?

TIMELINESS

How recently has the data been updated?

CONSISTENCY

Is the data consistent between systems?

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GIS Data Validations

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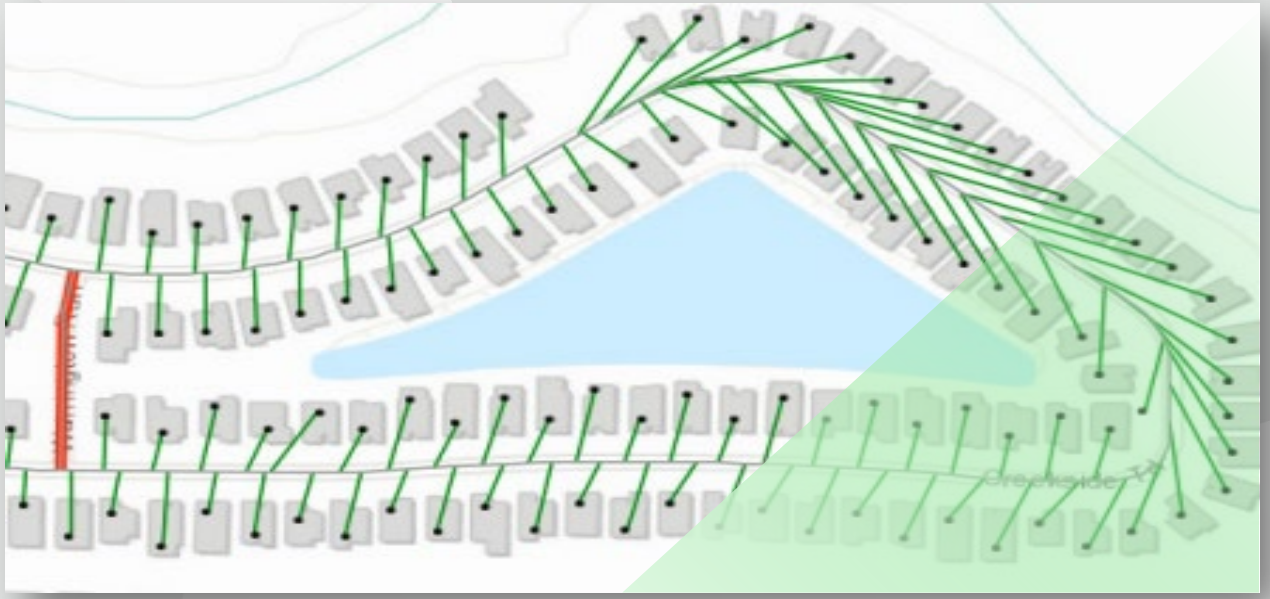
Data Integrity

- Address Points should find a corresponding address-ranged Road Centerlines
- Check for discrepancies between Address Points, Road Centerlines, and Service Boundaries
- A lack of consistency can impact call routing



Road Centerline and Corresponding Address Points and Polygons

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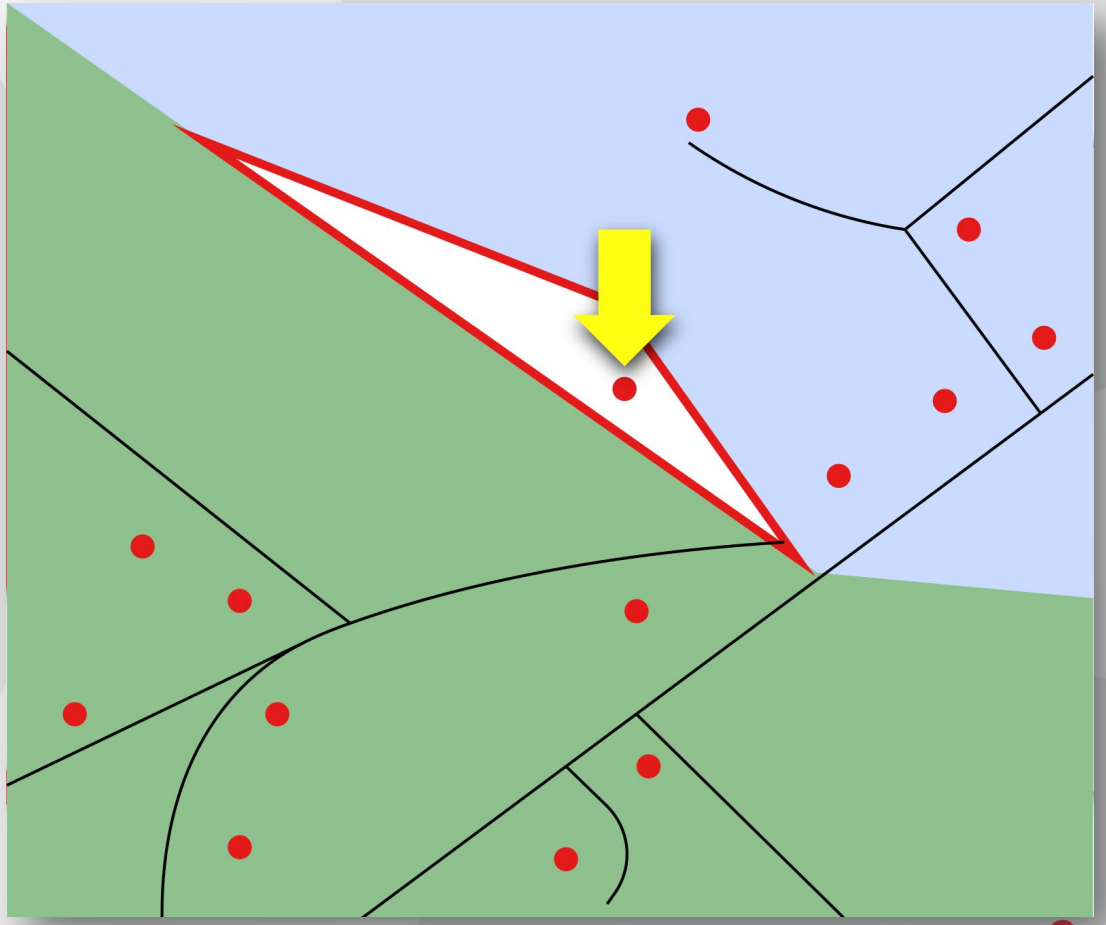
Data Integrity

- Check for discrepancies between Address Points, Road Centerlines, and Service Boundaries
  - Is the problem the gap (boundary)?
  - Is the address point in the right place?
  - Is the road centerline accurate for proper geocoding and routing?



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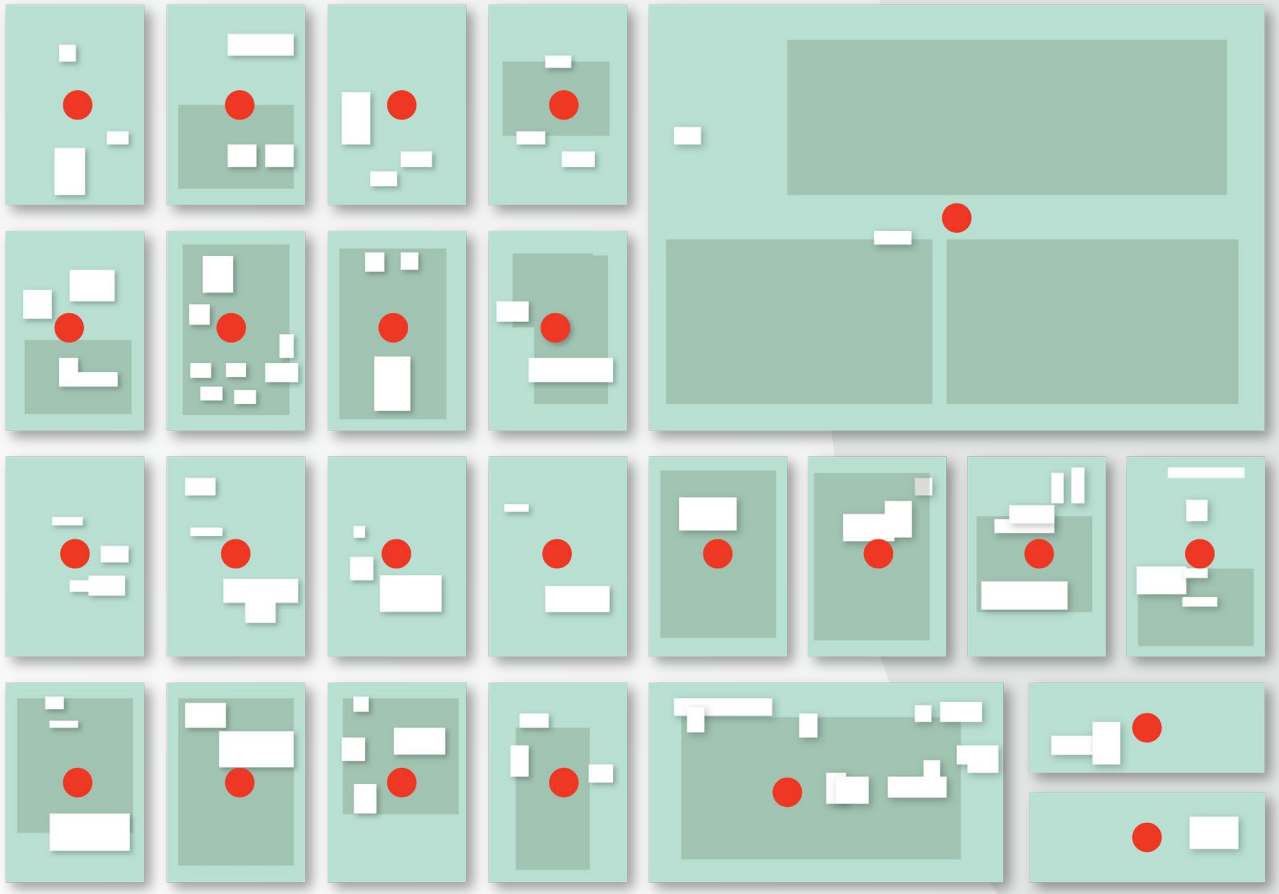
Data Integrity: Accuracy vs. Precision



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Data Integrity: Accuracy vs. Precision

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The Path Forward

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Creating Sustainable Data Management

- Establish workflows
- Increased communication and collaboration among all stakeholders
  - Addressing authority
  - Public safety
  - GIS
  - Municipalities
- Proactive approach to data management
  - QA/QC
  - Workflows
- How should data be managed for NG9-1-1?
- Geospatial first responder!

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Best Practices

- Maintain required fields within data
- Be mindful of how other features impact data attributes
- Address point within road range - ranges may require adjusting when address points are added or removed
- Breaking road centerlines at boundaries and updating attributes appropriately
- Parse address elements
- Standardize attributes
- Leverage domains to reduce inconsistencies and errors
- Avoid blank values in data and replace with NULL

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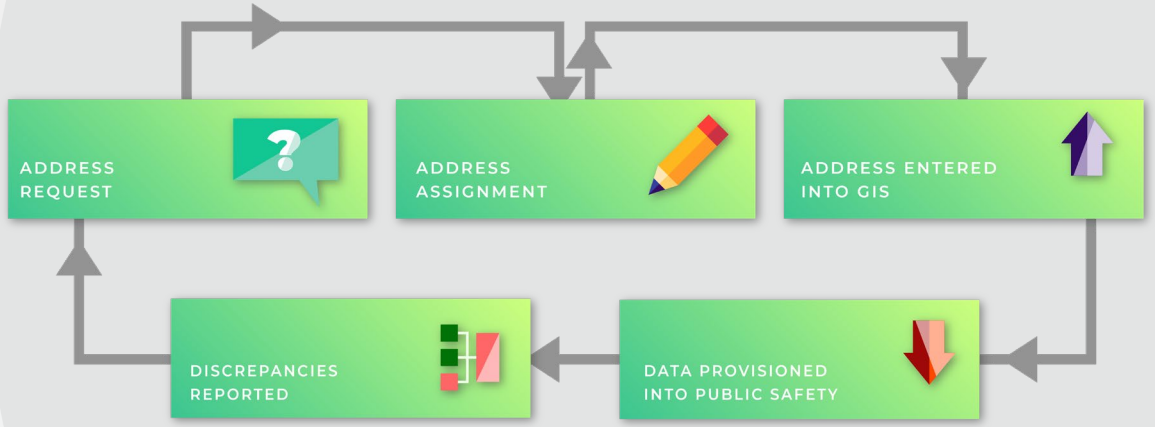
Creating a Quality Assurance Culture

- QA enforces those best practices
- Stakeholder engagement
- Business needs for data - who manages
- NG9-1-1 Education
- Improving existing workflows
- Iterative validations on NG9-1-1 data
- NOT a one and done
- Scheduled - may need more frequently if increased editing and adding data



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Questions?

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