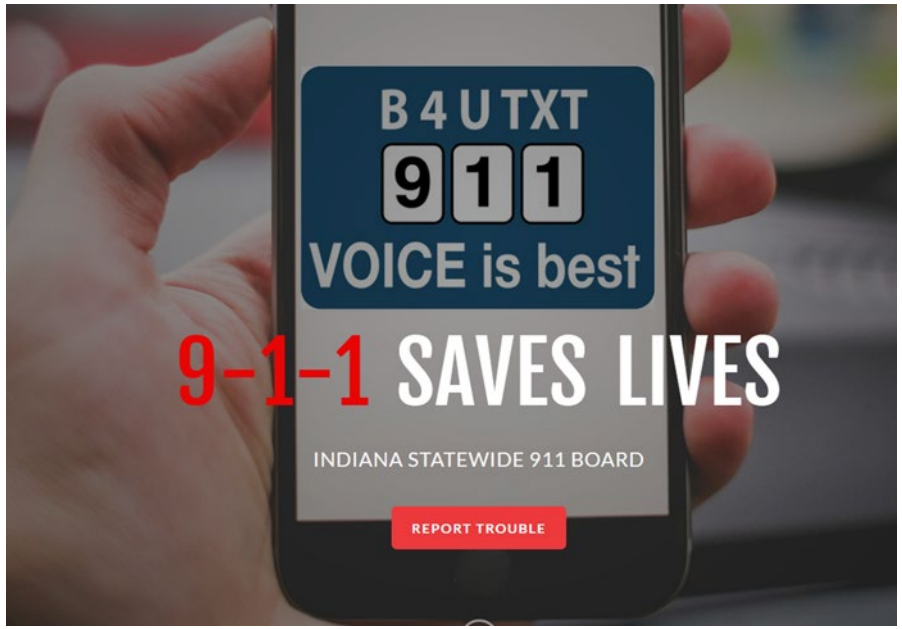
INDIANA'S NG 9-1-1 GIS DATA STANDARD

Aaron Shaw – GIS Administrator, IPSC
Charline Avey – GIS Consultant, TechHow

Agenda

- Introductions
- Why NG 9-1-1 GIS Standard
- Quick Overview
- Deep Dive
- The Geodatabase
- QC Roads
- Road Forward



Introductions

- Charline Avey– GIS Consultant, TechHow

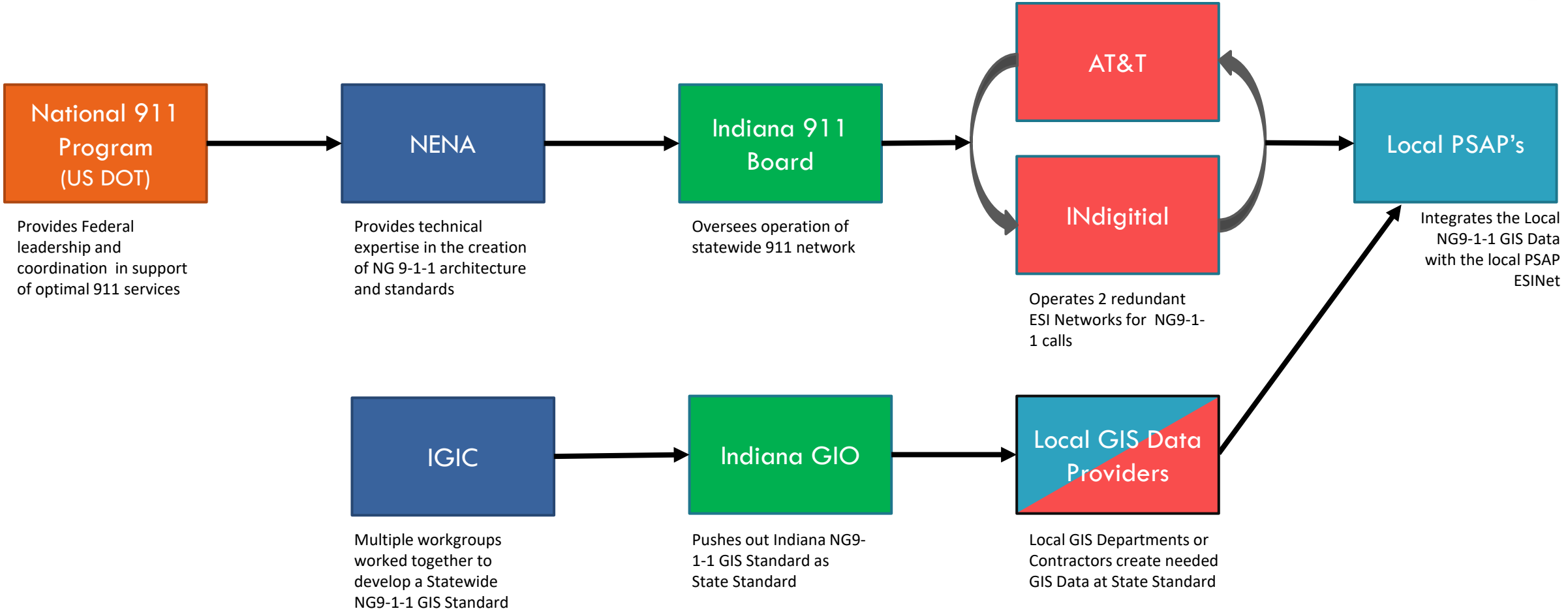
- Aaron Shaw – GIS Administrator, IPSC

What is Next Generation 911?

- A system comprised of hardware, software, data and operational policies and procedures briefly described to:
  - Provide standardized interfaces from call and message services
  - Process all types of emergency calls including non-voice (multi-media) messages
  - Acquire and integrate additional data useful to call routing and handling
  - Deliver the calls/messages and data to the appropriate PSAPs and other appropriate emergency entities
  - Support data and communications needs for coordinated incident response and management
  - Provide a secure environment for emergency communications

https://cdn.ymaws.com/www.nena.org/resource/resmgr/ng9-1-1_project/whatisng911.pdf

Governance of NG 9-1-1



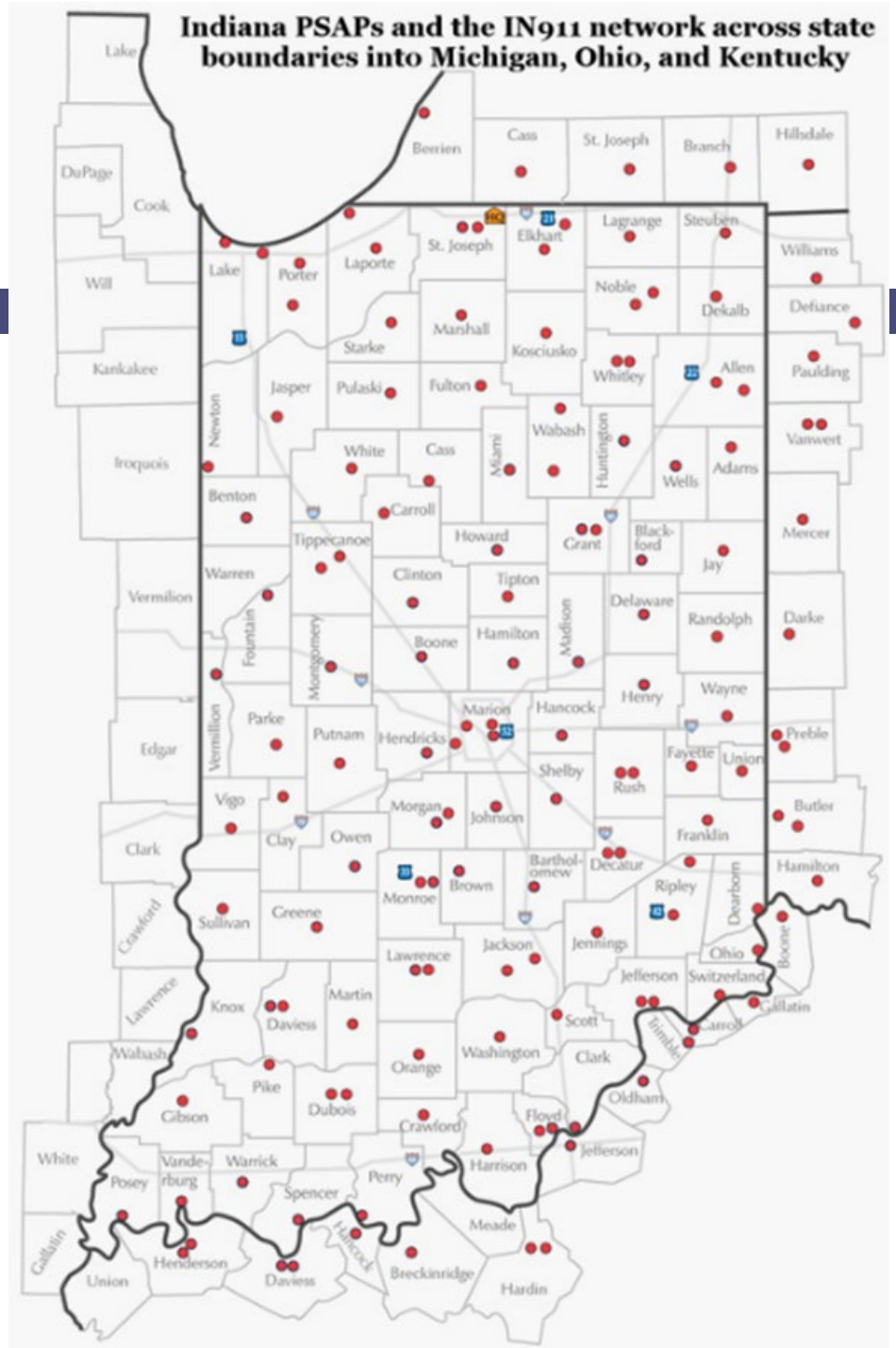
Building Block of NG9-1-1

- ESI Net: Emergency Services IP Network
  - broadband technology capable of carrying voice and large amounts of data using Internet Protocols and standards.
  - Hierarchical (network of networks) in a tiered design approach to support local, regional, state and national emergency management authorities.

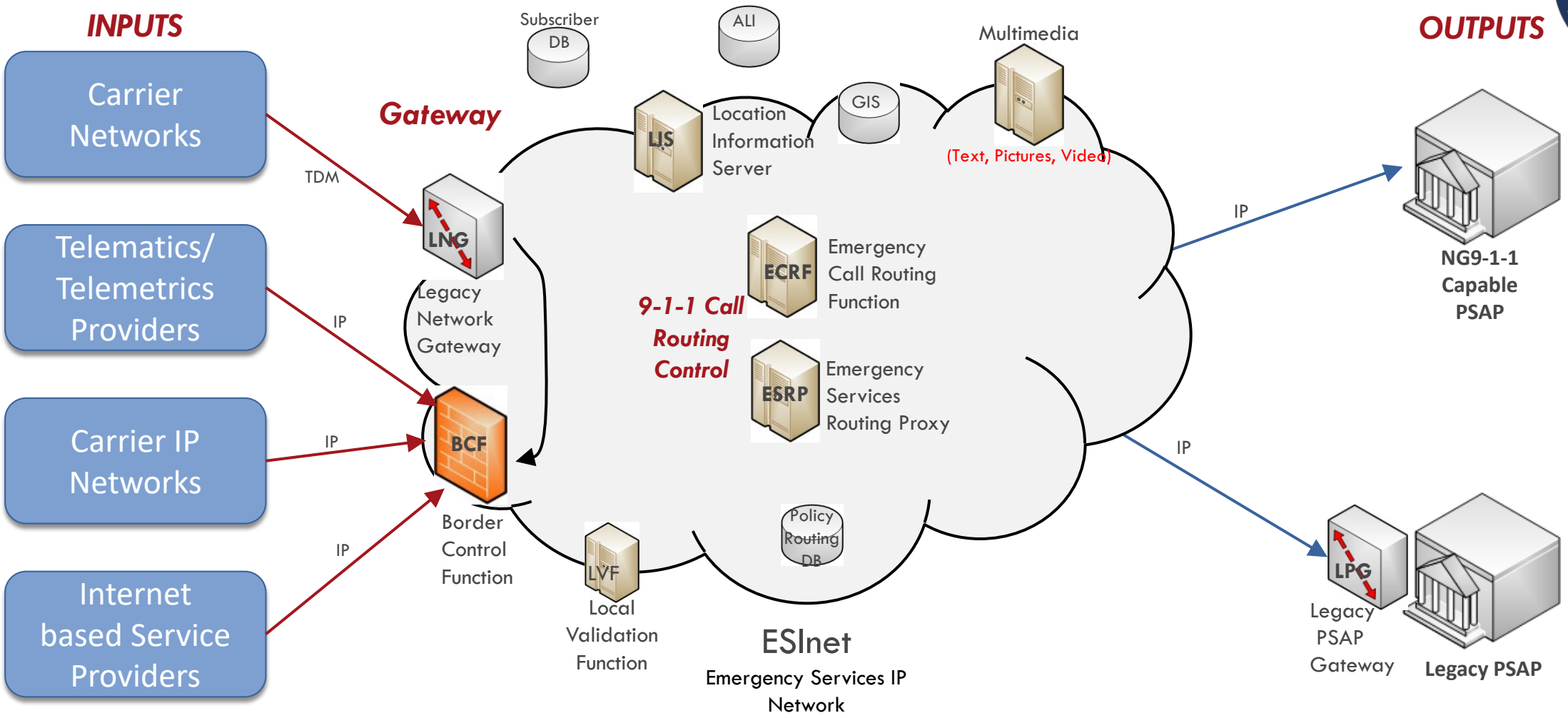
Building Block of NG9-1-1

- Since 2005 Indiana- single redundant ESInet statewide network
- Serving 122 PSAPs.
- By 2020 will have two redundant ESInet statewide networks for NG911.
- Annual cost for the statewide deployments is **$17.5 million**.

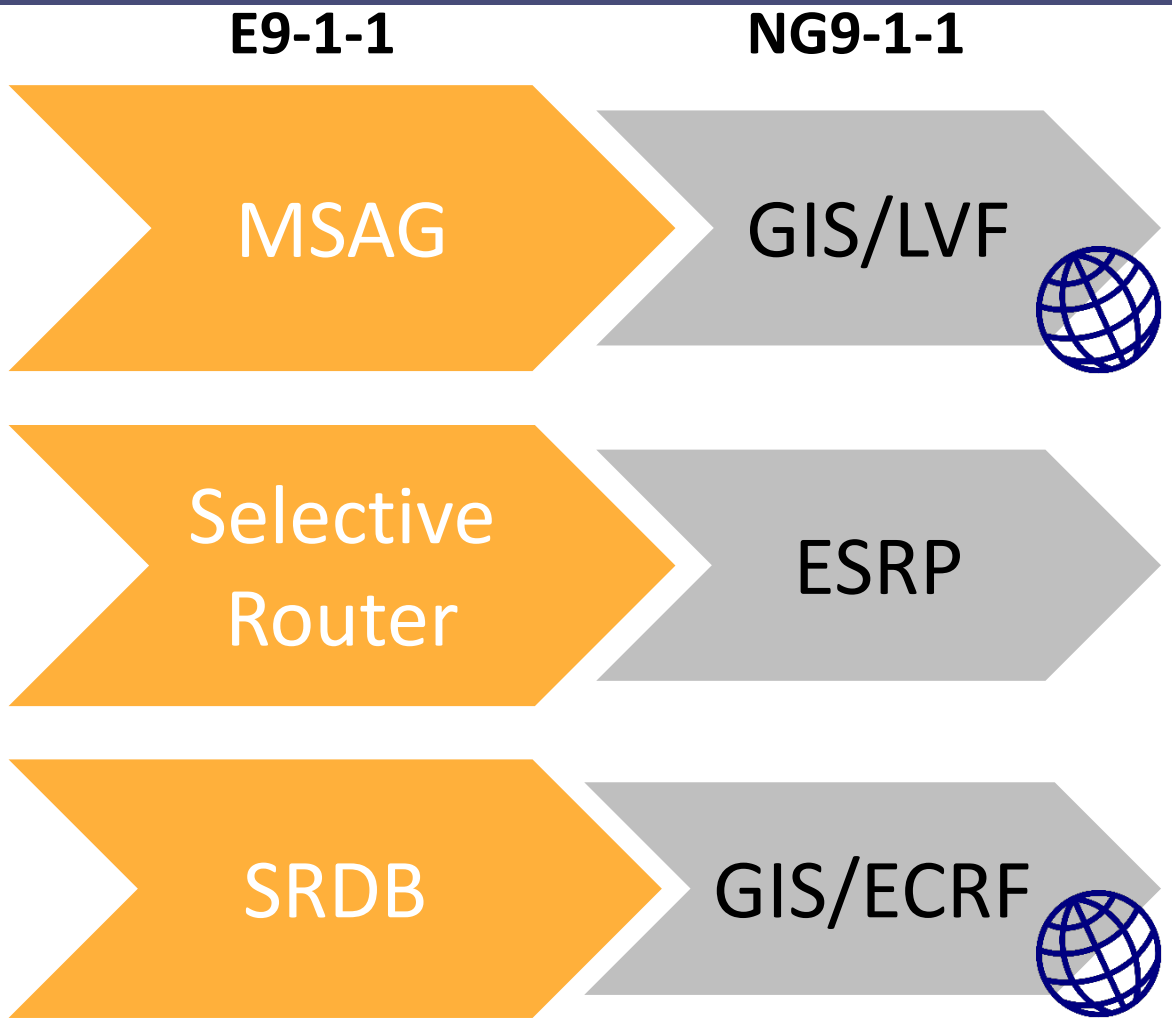
ESInet


Indiana PSAPs and the IN911 network across state boundaries into Michigan, Ohio, and Kentucky
Lake
Porter
Laporte
Berrien
Cass
St. Joseph
Branch
Hillsdale
DuPage
Cook
Will
Kankakee
Iroquois
Newton
Jasper
Pulaski
Starke
Marshall
Fulton
Kosciusko
Elkhart
Lagrange
Steuben
Noble
Dekalb
Williams
Defiance
Whitley
Allen
Paulding
Wabash
Huntington
Vanwert
White
Cass
Miami
Wells
Adams
Benton
Carroll
Howard
Grant
Blackford
Jay
Mercer
Tippecanoe
Warren
Clinton
Tipton
Vermilion
Fountain
Montgomery
Boone
Hamilton
Madison
Delaware
Randolph
Darke
Henry
Wayne
Parke
Vermillion
Edgar
Putnam
Hendricks
Marion
Hancock
Preble
Shelby
Rush
Fayette
Union
Vigo
Clay
Owen
Morgan
Johnson
Butler
Franklin
Clark
Bartholomew
Decatur
Ripley
Dearborn
Hamilton
Monroe
Brown
Crawford
Sullivan
Greene
Jackson
Jennings
Ohio
Switzerland
Jefferson
Lawrence
Knox
Daviess
Martin
Scott
Gallatin
Orange
Washington
Clark
Oldham
Walbash
Pike
Dubois
Gibson
Crawford
Floyd
Jefferson
White
Posey
Vanderburg
Warrick
Spencer
Perry
Harrison
Meade
Gallatin
Union
Henderson
Daviess
Hancock
Breckinridge
Hardin

NG 9-1-1 System (Simplified diagram)

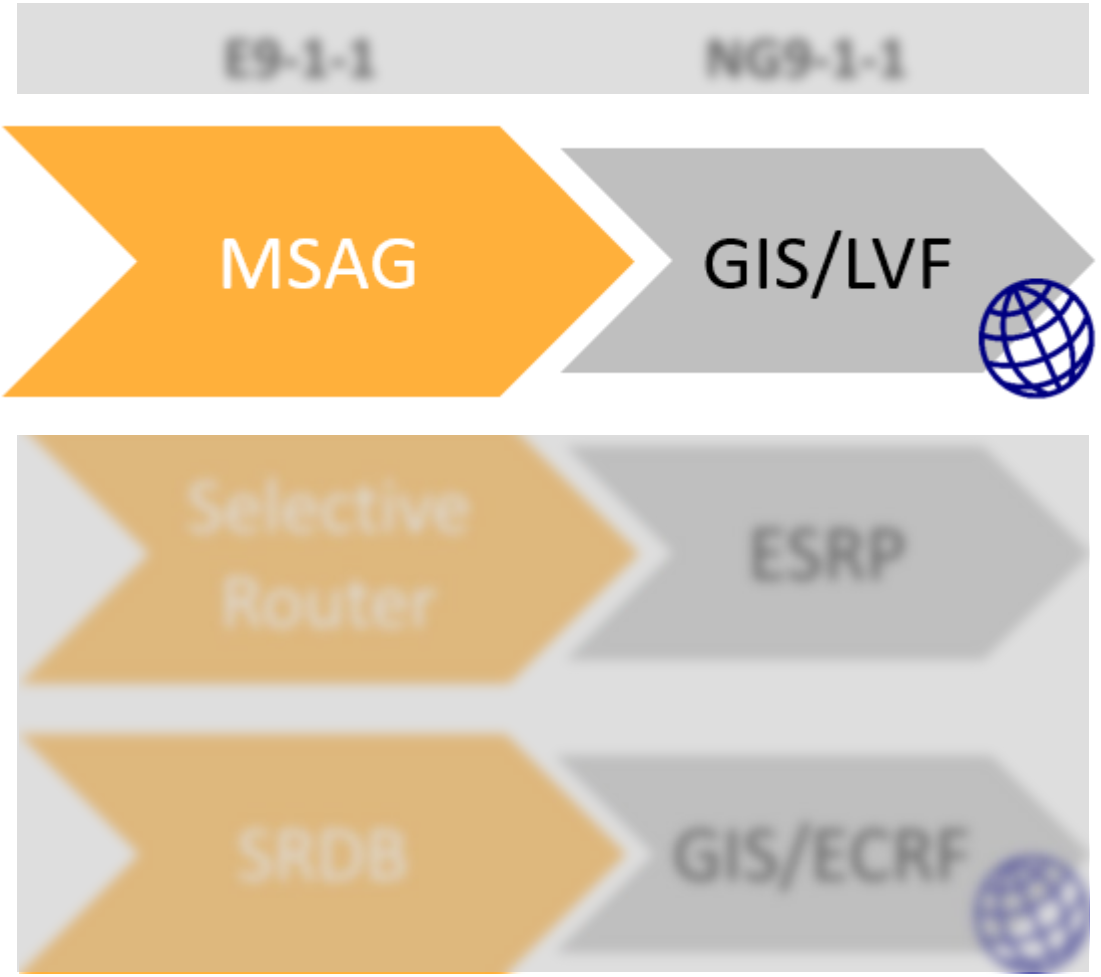


Goals of NG 9-1-1

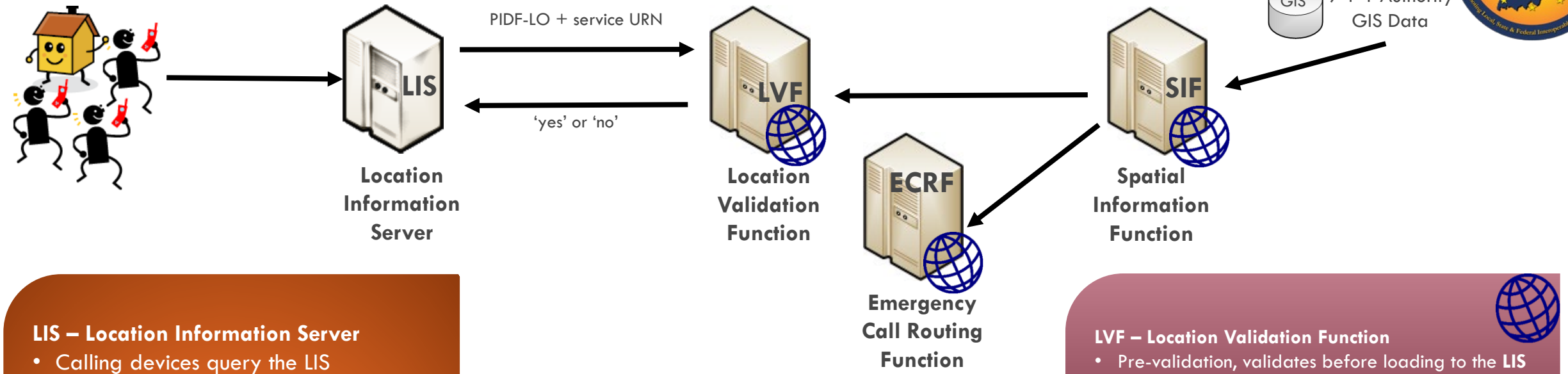


How is GIS Used?

- Instead of tabular MSAG data, GIS is used for Location Validation



NG9-1-1& GIS Location Validation



LIS – Location Information Server

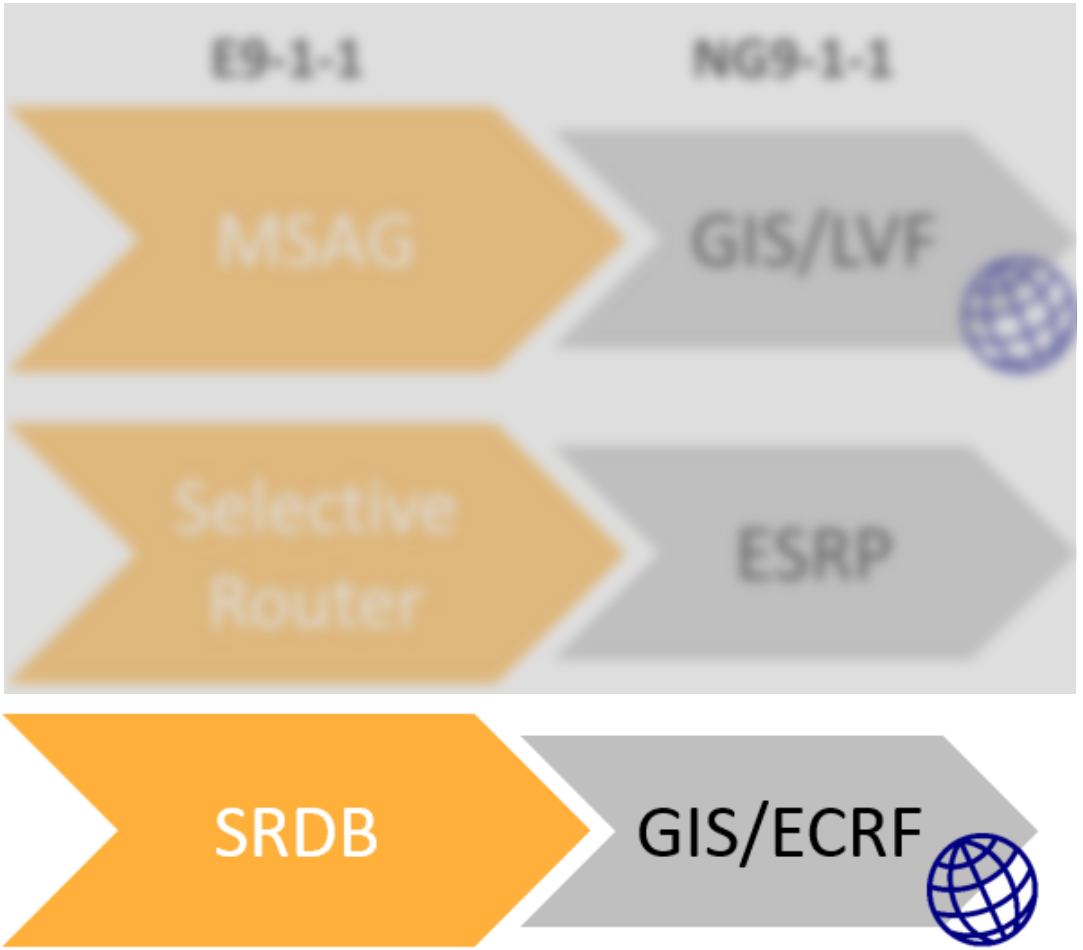
- Calling devices query the LIS
- Civic addresses are validated prior to being stored in the LIS by the LVF – validated against the GIS
- Returns a **PIDF-LO (Presence Information Data Format – Location Object)** – can be a civic address or a geo-coordinate

LVF – Location Validation Function

- Pre-validation, validates before loading to the **LIS** database
- Similar to MSAG, verifies that the civic location matches a known address in the 9-1-1 Authorities service area
- Able to validate an address, not just address range
- Receives as input: **PIDF-LO** and **service URN** – returns – location validation
- Queried by **LOST protocol**

How is GIS Used?

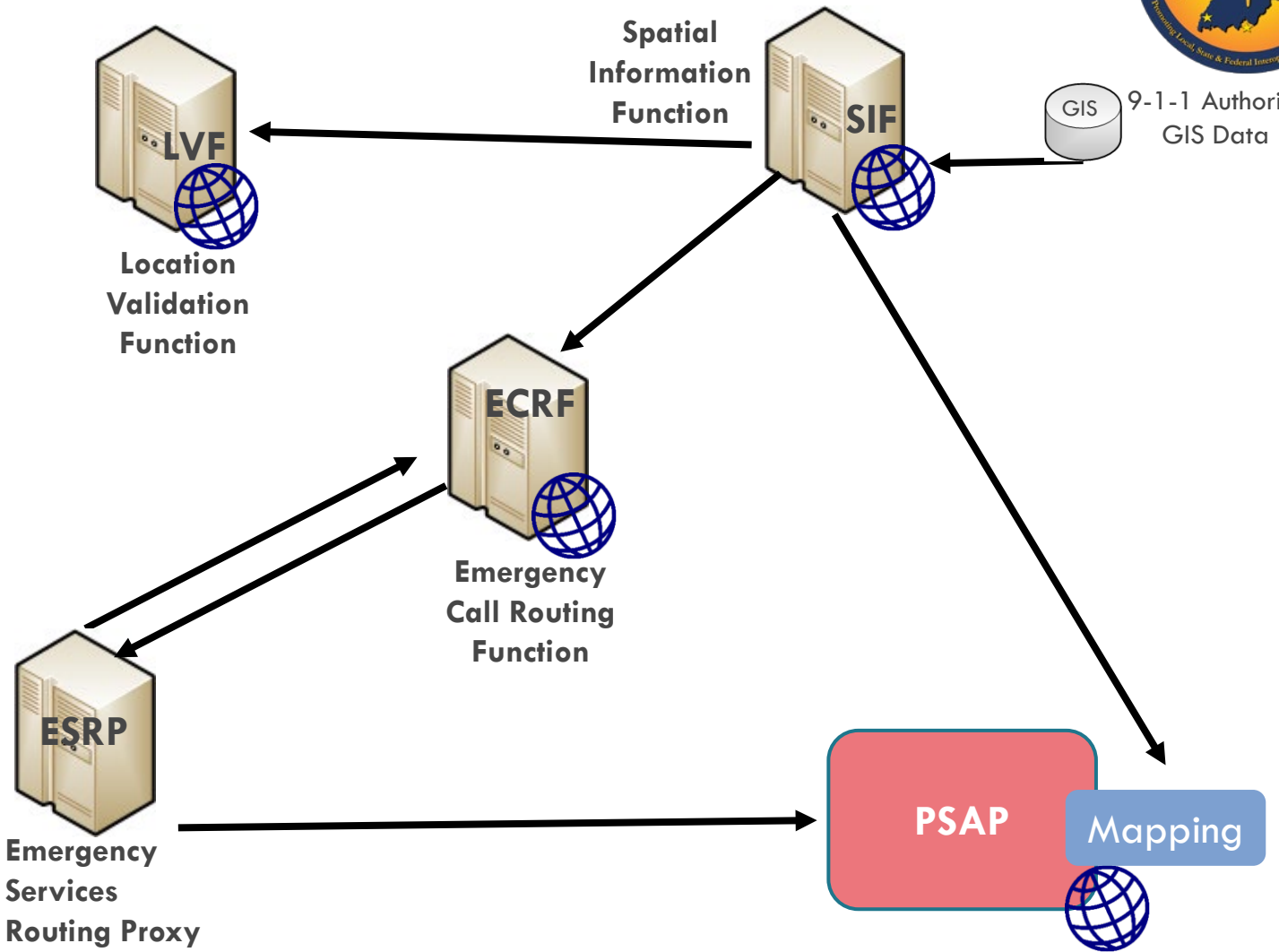
- Instead of Selective Routing Database which is the table that contains telephone number to ESN relationship the GIS



NG9-1-1& Geospatial Call Routing

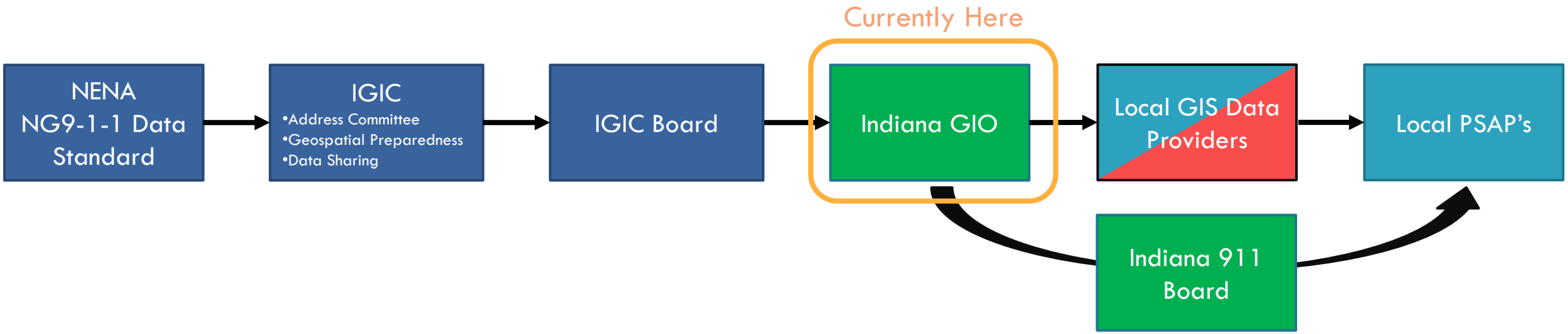
LIS – Location Information Server
- Calling devices query the LIS
- Civic addresses are validated prior to being stored in the LIS by the LVF – validated against the GIS
- Returns a **PIDF-LO (Presence Information Data Format – Location Object)** – can be a civic address or a geo-coordinate

LVF – Location Validation Function
- Pre-validation, validates before loading to the **LIS** database
- Similar to MSAG, verifies that the civic location matches a known address in the 9-1-1 Authorities service area
- Able to validate an address, not just address range
- Receives as input: **PIDF-LO** and **service URN** – returns – location validation
- Queried by **LOST protocol**



GIS Data Standards

- NENA developed a NG9-1-1 GIS Data Model
- Indiana developing/developed an Indiana NG9-1-1 Data model.



What is the Indiana GIS Data Standards

- Required Data Layers
  - Road Centerlines
  - Site/Structure Address Points
  - Emergency Service Boundaries
  - PSAP Boundary
  - Provisioning/Jurisdictional Boundary
  - Street Name Alias Table
- Strongly Recommended
  - County Boundary
  - Incorporated Municipal Boundary
  - Landmark Name Alias Table
  - Mile Marker Location
  - Neighborhood Community Boundary
  - Unincorporated Community Boundary
- Recommended
  - Cell Site Location
  - Hydrology Line
  - Hydrology Polygon
  - Railroad Centerlines

Deep Dive-Charline

- Standard & Geodatabase

General

- **Inclusion of Attributes**
  - Attributes in this standard are the minimum required set, not and exclusive set. Any other attributes may be added for local use.
- **Letter Case and Special Characters**
  - Per NENA-STA-004.1.1-2014, NG9-1-1 allows for special characters and upper/lower case as *legally established by the Local Addressing Authority*
- **NENA Globally Unique ID's (NGUID)**
  - The GIS Data Provider will calculate a unique identifier based on the layer abbreviation, feature ID, and authoring 911 Authority, State and Country.
    - Example, a road centerline (RCL) street segment with a feature ID of 2044 would have a NGUID of RCL2044@911authority.IN.US.
- **Effective and Expiration Dates**
  - fields associated with layers are used when the date and time for a change are known.
    - Example, the time and date of an annexation or the dates when a road segment(s) will be out of service due to a road closure.

General

- **Mandatory/Conditional/Optional**
  - Mandatory (M), Conditional (C), or Optional (O) for values in the Indiana GIS Technical Standard for NG9-1-1.
  - This follows the NENA convention used in NENA-STA-006.1-2018 with some modifications

- **Attribute Types**
  - **Type Column**
    - **A – Alphanumeric (Text fields in ESRI shapefiles and geodatabases)**
    - **D – Date and time**
    - **I – Integer (Any non-negative integer like a house address)**
    - **F – Float (Numbers with decimal places like X, Y Coordinates)**
    - **U – A Uniform Resource Identifier as defined in RFC 3986 [9]**

- **Spatial Reference**
  - Coordinate Reference System and Datum – Use of the World Geodetic System of 1984 (WGS84) [6] is required for GIS information within the ECRF/LVF.

General

- **Domains**
  - Several attributes in this standard only have a narrow set of values which can be assigned.
  - Only values within the domain associated with such attributes are allowed.
  - Indiana GIO will manage Domains for the State
  - In cases where no value exists it may be left 'null' or blank.
    - For example, the parity on one side of a Road Centerline can only be either 'O' or 'E' (Odd or Even).

- Country
- County
- LegacyStreetNameDirectional
- OneWay
- Parity
- PlacementMethod
- PlaceType
- RoadClass
- SpeedLimit
- State
- StreetNameDirectional
- StreetNamePreTypeSeparators
- StreetNameTypes
- Zipcodes

Domain Examples

- PlacementMethod
  - Geocoding
  - Parcel
  - Property Access
  - Structure
  - Site
  - Unknown
- PlaceType
  - aircraft
  - airport
  - arena
  - automobile
- StreetNameDirectional
  - North
  - South
  - East
  - West
  - Northeast
  - Northwest
  - Southeast
  - Southwest

Domain Examples

- StreetNameTypes
  - Acres
  - Alcove
  - Alley
  - Annex
  - Approach
  - Arcade
  - Avenue
  - Avenue Court
  - Bayou
  - Beach

- RoadClass
  - Primary
  - Secondary
  - Local
  - Ramp
  - Service Drive
  - Vehicular Trail
  - Walkway
  - Stairway
  - Alley
  - Private
  - Parking Lot
  - Trail
  - Bridle Path
  - Other

Required Layers-Road Centerlines

Discrepancy Agency ID
Date Updated
Effective Date
Expiration Date
Road Centerline NENA Globally Unique
Left Address Number Prefix
Right Address Number Prefix
Left FROM Address
Left TO Address
Right FROM Address
Right TO Address
Parity Left
Parity Right
Street Name Pre Modifier
Street Name Pre Directional
Street Name Pre Type
Street Name Pre Type Separator
Street Name
Street Name Post Type
Street Name Post Directional
Street Name Post Modifier
ESN Left*
ESN Right*
Country Left
Country Right
State Left
State Right
County Left
County Right
Incorporated Municipality Left
Incorporated Municipality Right
Unincorporated Community Left
Unincorporated Community Right
Neighborhood Community Left
Neighborhood Community Right
One-Way
Speed Limit
X Coordinate of Starting Vertex
Y Coordinate of Starting Vertex
X Coordinate of Ending Vertex
Y Coordinate of Ending Vertex
Submit Left
Submit Right
Left FROM Potential Address
Left TO Potential Address
Right FROM Potential Address
Right TO Potential Address
Legacy Street Name Pre Directional
Legacy Street Name
Legacy Street Name Type
Legacy Street Name Post Directional
MSAG Community Name Left
MSAG Community Name Right

Required Layers- Site Addresses

Discrepancy Agency ID
Date Updated
Effective Date
Expiration Date
Site NENA Globally Unique ID
Address Number Prefix
Address Number
Address Number Suffix
Street Name Pre Modifier
Street Name Pre Directional
Street Name Pre Type
Street Name Pre Type Separator
Street Name
Street Name Post Type

Street Name Post Directional
Street Name Post Modifier
ESN*
Country
State
County
Incorporated Municipality
Unincorporated Community
Neighborhood Community
Legacy Street Name Pre Directional
Legacy Street Name
Legacy Street Name Type
Legacy Street Name Post Directional
MSAG Community Name*

Additional Code
Additional Data URI
Postal Code
ZIP Plus 4
Postal Community Name
Building
Floor
Unit
Room
Seat
Additional Location Information
Complete Landmark Name
Mile Post
Place Type

Placement Method
Primary
Longitude
Latitude
Elevation

Required Layers- Street Name Alias Table

Discrepancy Agency ID

Date Updated

Effective Date

Expiration Date

Alias Street Name NENA Globally Unique ID

Road Centerline NENA Globally Unique ID

Alias Street Name Pre Modifier

Alias Street Name Pre Directional

Alias Street Name Pre Type

Alias Street Name Pre Type Separator

Alias Street Name

Alias Street Name Post Type

Alias Street Name Post Directional

Alias Street Name Post Modifier

Alias Legacy Street Name Pre Directional

Alias Legacy Street Name

Alias Legacy Street Name Type

Alias Legacy Street Name Post Directional

Street Name Parsing

- Road Centerlines
- Site Addresses
  - Street Name Pre Modifier
  - Street Name Pre Directional
  - Street Name Pre Type
  - Street Name Pre Type Separator
  - Street Name
  - Street Name Post Type
  - Street Name Post Directional
  - Street Name Post Modifier

Street Name Standardization

- Follow NENA-STA-004.1.1-2014
- All street name data elements will be completely spelled out except for the Country and State element
- No abbreviations are recognized for any other CLDXF elements.
  - You don't have to change a field the authority uses for day to day operations, but the authority must be capable of sharing data without abbreviations.
- There shall be no spaces at the beginning or end of a street name element.
- Standardize street post type according to USPS Publication No. 28 – Appendix D

Street Name Validates to MSAG

- Concatenation of these fields compares

- Trim(St_PreMod,Space,St_PreDir,Space,St_Pre_Type ,Space,St_PreSep,Space,StreetName,Space,St_PosT ype,Space,St_PosDir,Space,St_Pos_Mod)
- Examples:

St_PreMod	St_PreDir	St_PreTyp	St_PreSep	StreetName	St_PosTyp	St_PosDir	St_PosMod	St_FullName
	East			STOP 18	ROAD			East STOP 18 ROAD
	South	United States Highway		31				South United States Highway 31
	North	State Route		37				North State Route 37
				COUNTRY AIRE	LANE			COUNTRY AIRE LANE
				ST ANNES	COURT			ST ANNES COURT
				CLARY CIRCLE	DRIVE	EAST		CLARY CIRCLE DRIVE EAST
				CLARY CIRCLE	DRIVE	NORTH		CLARY CIRCLE DRIVE NORTH
				SADDLE CLUB	ROAD			SADDLE CLUB ROAD

Required Layers- PSAP Boundary

Discrepancy Agency ID

Date Updated

Effective Date

Expiration Date

Emergency Service Boundary NENA Globally Unique ID

State

Agency ID

Service URI

Service URN

Service Number

Agency vCard URI

Display Name

Required Layers- Emergency Service Boundaries

Discrepancy Agency ID

Date Updated

Effective Date

Expiration Date

Emergency Service Boundary NENA Globally Unique ID

State

Agency ID

Service URI

Service URN

Service Number

Agency vCard URI

Display Name

Required Layers- Provisioning Boundary

Discrepancy Agency ID

Date Updated

Effective Date

Expiration Date

Provisioning Boundary NENA Globally Unique ID

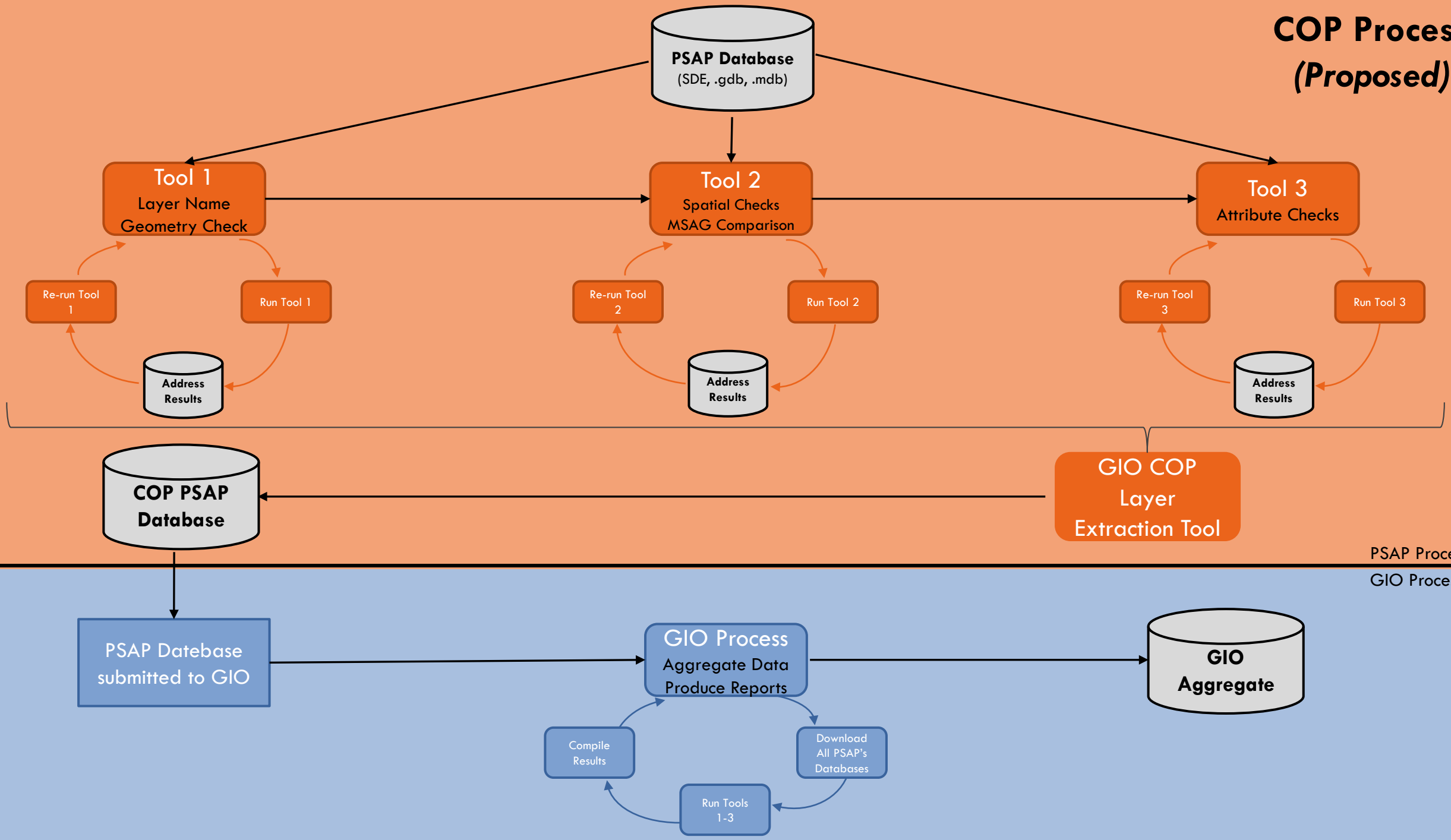
INDIANA NG 9-1-1 GIS Common Operational Picture (COP)-*Proposed*

- COP as a Process
  - Iterative process by nature (continual improvement)
  - Custom Geoprocessing Tools to automate QA/QC process
    - Tool 1 – Name and geometry checks
    - Tool 2 – Spatial Checks: MSAG Comparison
    - Tool 3 – Attribute checks
    - Tool 4 – Layer(s) Extraction Tool

INDIANA NG 9-1-1 GIS Common Operational Picture (COP)-*Proposed*

- Indiana PSAP's utilize tools to produce standardized IN NG 9-1-1 GIS dataset
  - PSAP's run tools and make corrections based on tool outputs
  - Minimum attribution in compliance with IN NG 9-1-1 GIS Data Standard
- Extract data to send to State 911 Board and Indiana GIO Office
- GIO office aggregates all PSAP COP data into Statewide dataset

COP Process *(Proposed)*



COP Databases

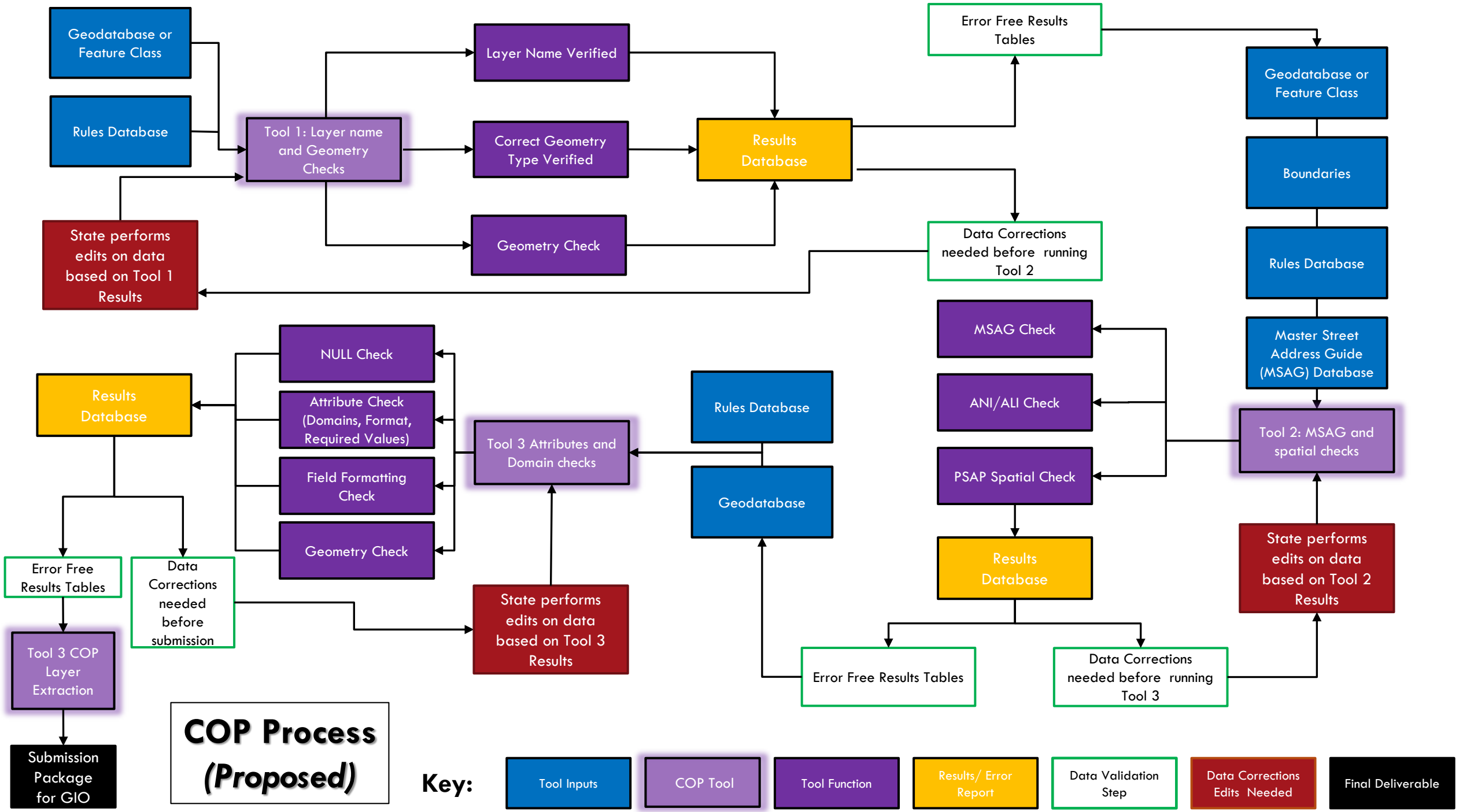
- 'Logic' Behind the Tools
  - Allows for Modification without re-writing tools
  - Used for Quick Reference
- Rules database
  - Feature Classes
  - *'Recommended'* Attributes
  - Domain Keys
  - Primary Key
  - Error messages for Tools

COP Databases

- MSAG database
  - Current Road Centerline inventory

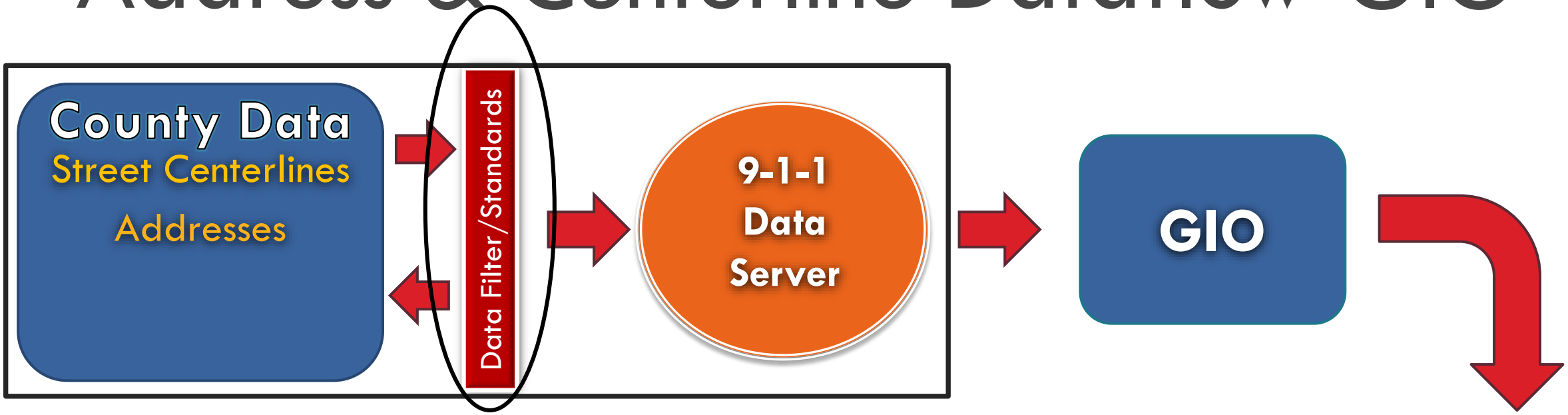
COP Custom Geoprocessing Tools

- Automates QA/QC process
- Utilizes external databases for rules and logic
- Iterative in Nature
  - PSAP builds upon previous COP Tool corrections
  - Makes corrections manageable – able to run one feature class at a time.


Geodatabase or Feature Class
Rules Database
Tool 1: Layer name and Geometry Checks
Layer Name Verified
Correct Geometry Type Verified
Geometry Check
Results Database
Error Free Results Tables
Data Corrections needed before running Tool 2
State performs edits on data based on Tool 1 Results
Geodatabase or Feature Class
Boundaries
Rules Database
Master Street Address Guide (MSAG) Database
Tool 2: MSAG and spatial checks
MSAG Check
ANI/ALI Check
PSAP Spatial Check
Results Database
Error Free Results Tables
Data Corrections needed before running Tool 3
State performs edits on data based on Tool 2 Results
Rules Database
Geodatabase
Tool 3 Attributes and Domain checks
NULL Check
Attribute Check (Domains, Format, Required Values)
Field Formatting Check
Geometry Check
Results Database
Error Free Results Tables
Data Corrections needed before submission
State performs edits on data based on Tool 3 Results
Tool 3 COP Layer Extraction
Submission Package for GIO
COP Process (Proposed)
Key:
Tool Inputs
COP Tool
Tool Function
Results/ Error Report
Data Validation Step
Data Corrections Edits Needed
Final Deliverable

Other Factors:

Address & Centerline Dataflow-GIO



- Dept of Natural Resources
- IN Office of Technology
- Dept of Transportation
- Dept of Agriculture
- Homeland Security
- State Dept of Health
- IN State Police
- Dept of Revenue
- Family and Social Services Agency
- Dept of Workforce Development
- Integrated Public Safety Commission
- Bureau of Motor Vehicles
- Management and Performance Hub
- Census

Aaron Shaw

IPSC GIS Administrator

317-282-3428

ashaw2@ipsc.in.gov

Charline Avey

TechHow GIS Consultant

317-407-3621

techhowgirl@gmail.com