



Maps as Graphs: An Interactive Map Interface for Geospatial Linked Data

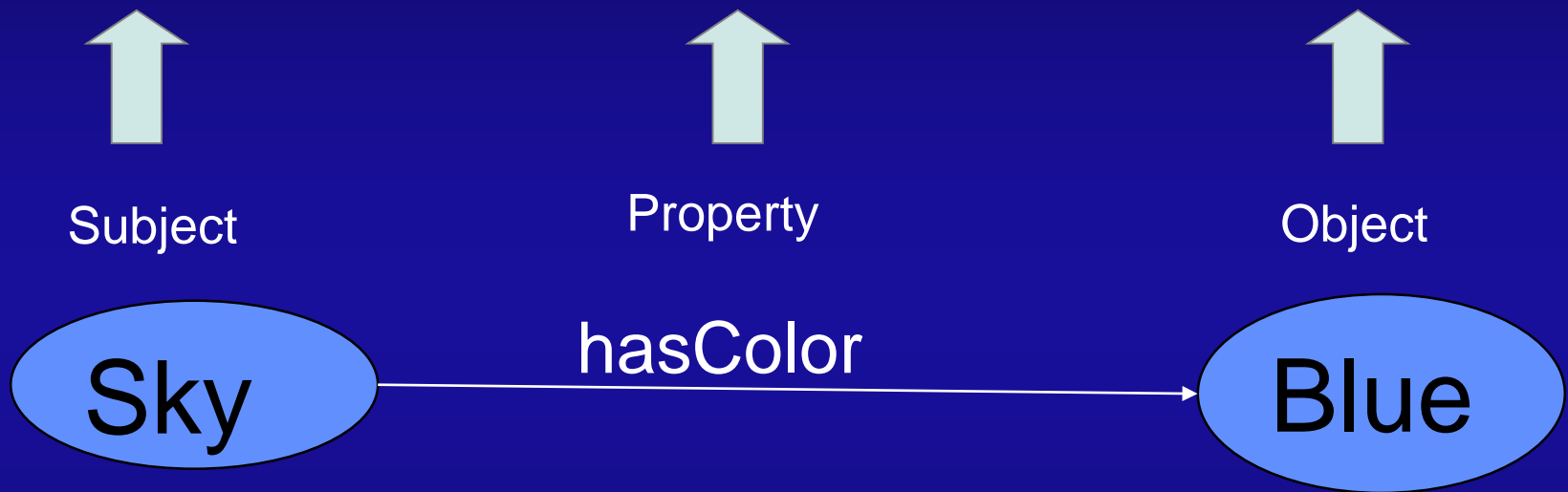
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Frontiers of Geospatial Data Science

UCGIS 2018 Symposium and CaGIS AutoCarto

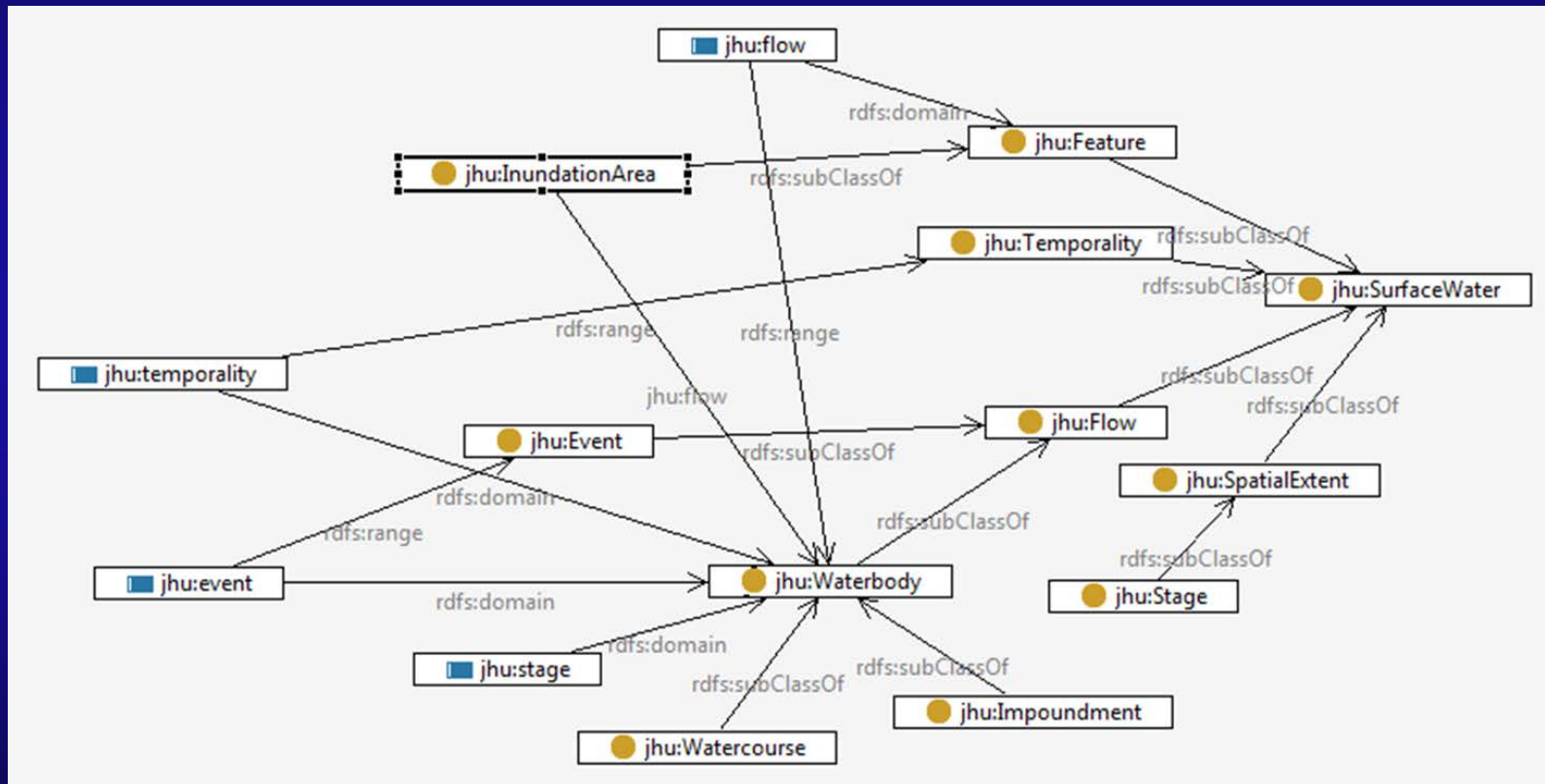
Resource Description Framework (RDF)

`<http://example.com/sky> <http://example.com/hasColor> <http://example.com/blue> .`



- International Resource Identifier (IRI)
- Property is a formal logic axiom
- Property is an executable relation

Graphs



The Map as Knowledge Base

A Knowledge Base (KB):

- Organizes information as logical assertions
- Supports automated reasoning to infer new assertions

LD infers:

- Classes and subclasses
- Properties and subproperties
- Domain and range classes for properties
- Web Ontology Language (OWL) axioms



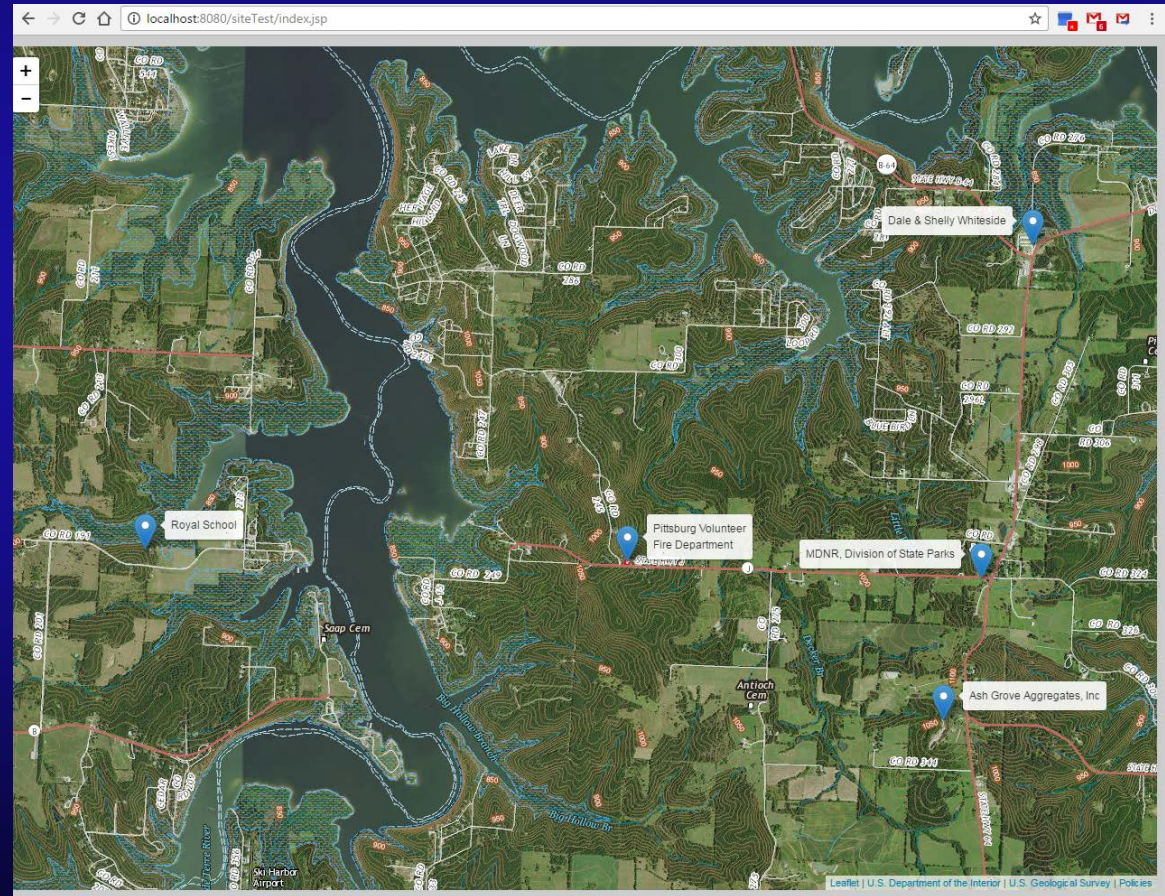


Coordinates
plotted on mapping
software

Hybrid GIS/RDF
solutions

Map semantic
reasoning

- Generalization
- Map scale
- Contour line

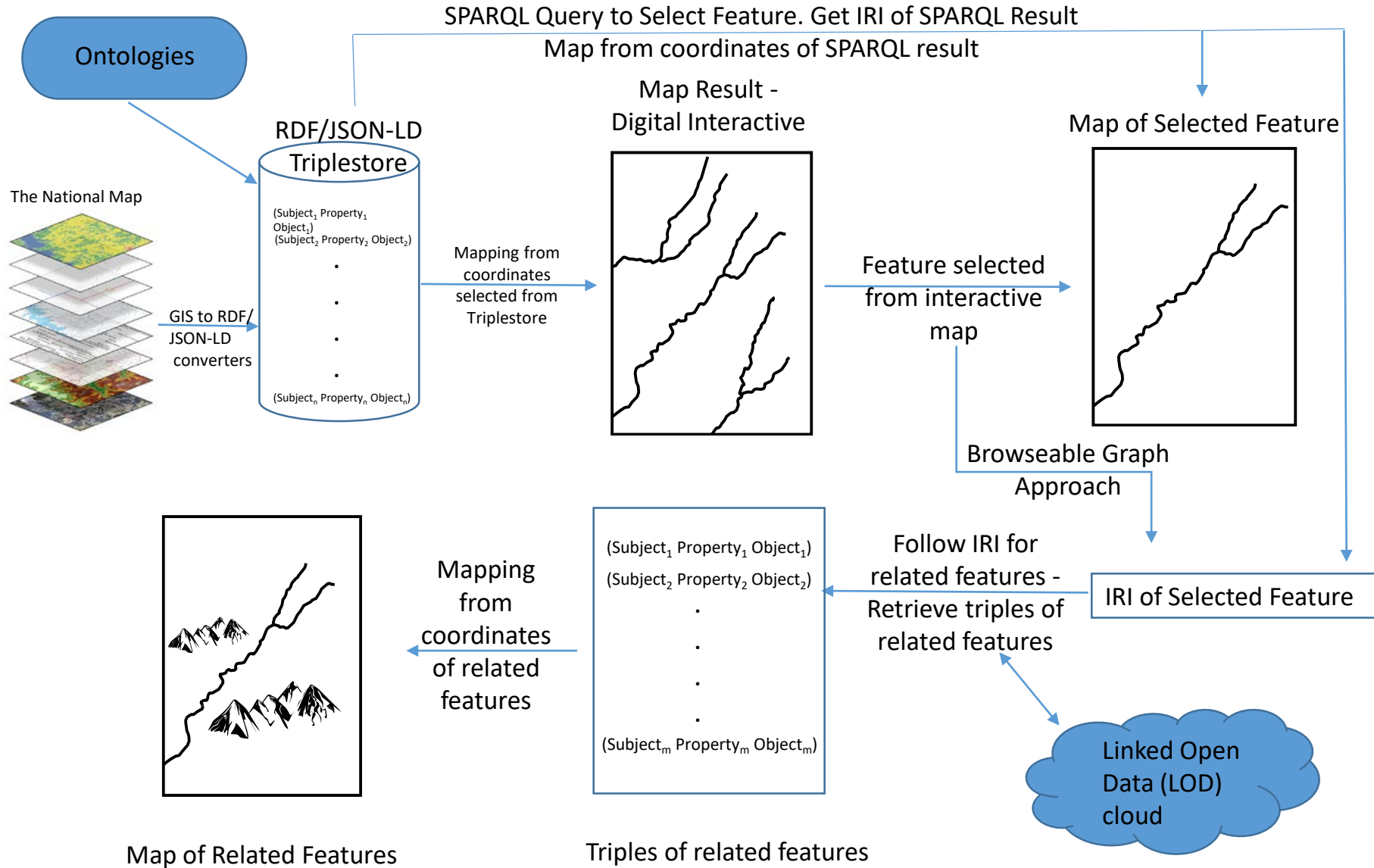


Map Application Axioms

- Each geospatial data feature has a IRI that is accessible with the visual map feature
- Each feature links to other triples that are accessible through the interface
- Each feature has properties for its graphic symbolization and use



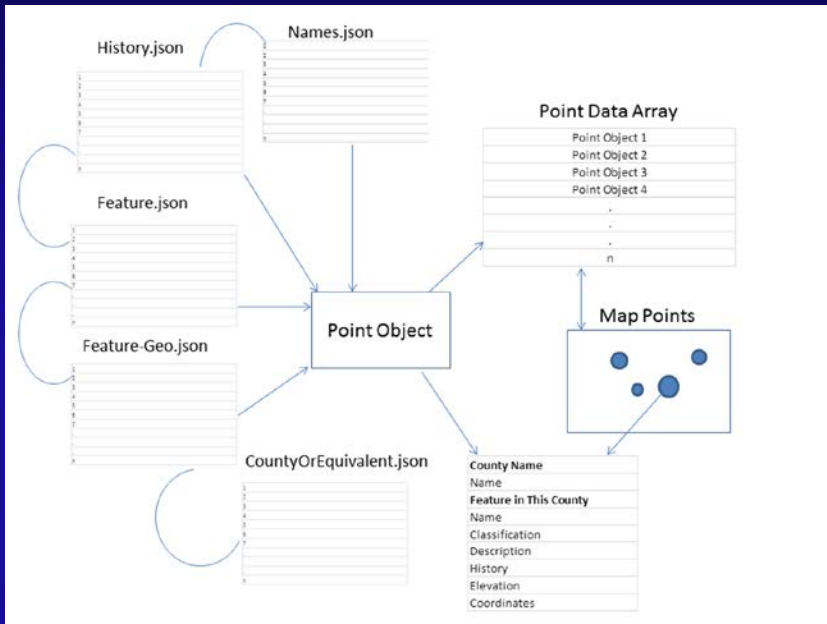
Map as a Knowledge Base



LD Map Architecture

- Convert data of various formats to RDF (LD)
- Compile linked dataset
- Apache Marmotta with Postgres database
- Java servlet creates appropriate data objects
- LD delivered to interface
- Leaflet map functions for background
- Data Driven Documents (D3) for LD overlay

How Are the Data Linked?



Karma

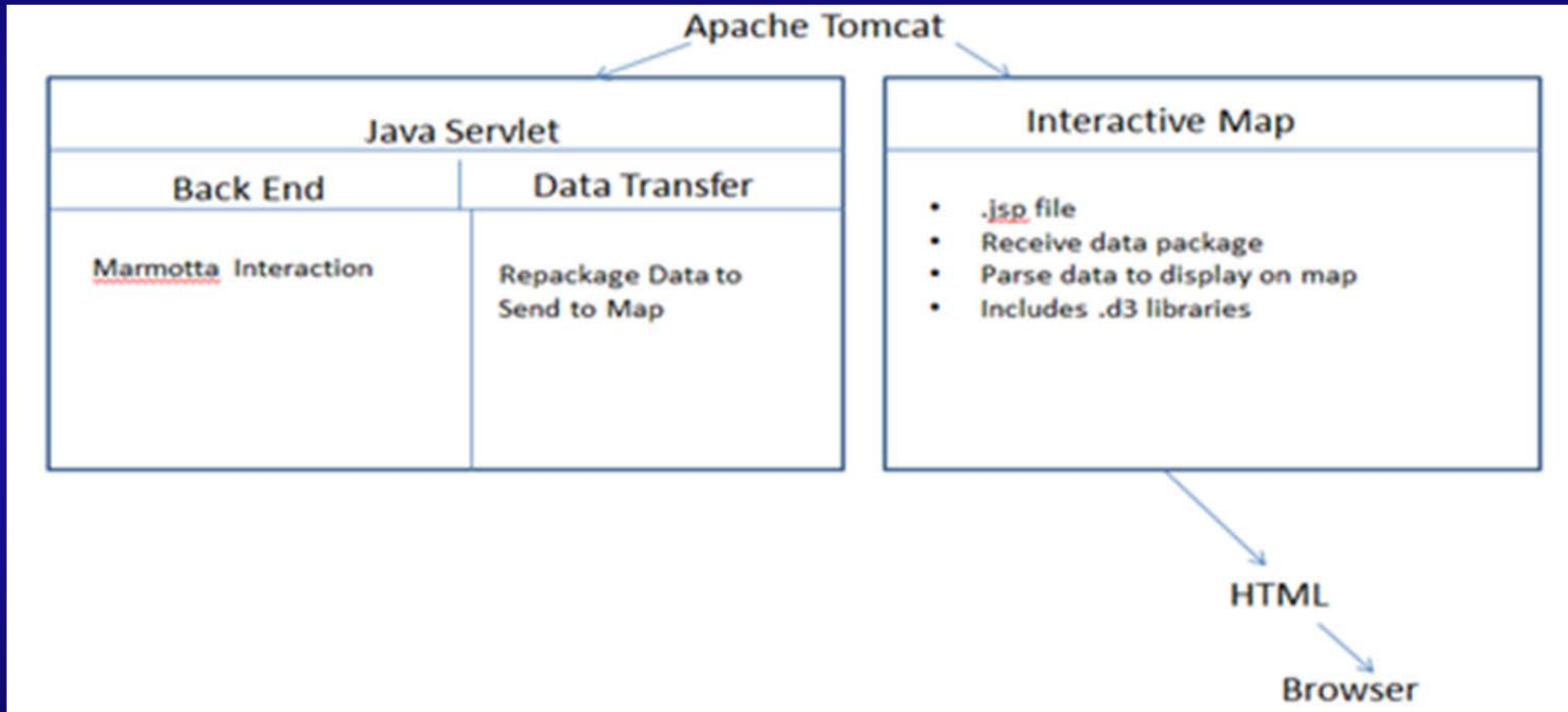
A Data Integration Tool

Silk The Linked Data Integration Framework

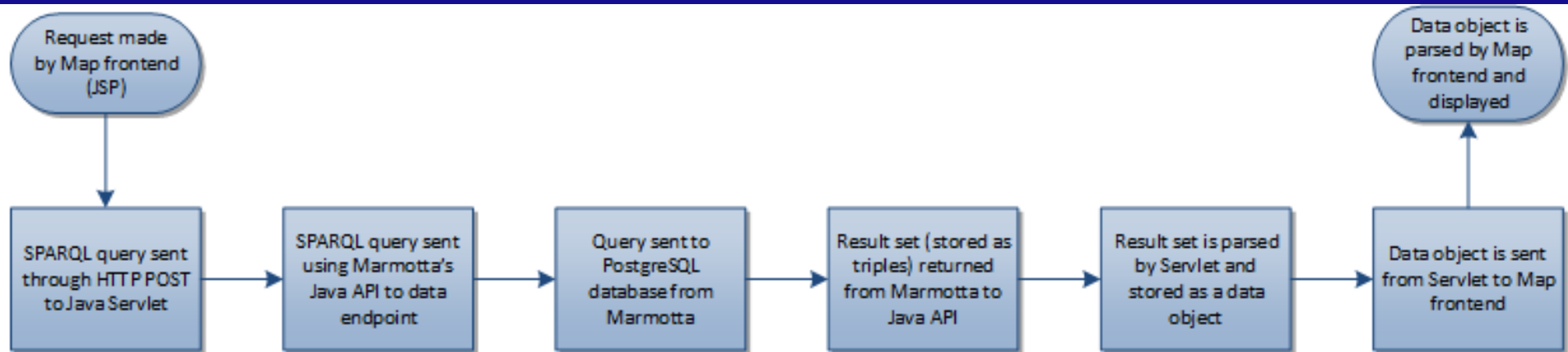
LIMES

Link discovery framework for MEtric Spaces

Architecture



Workflow

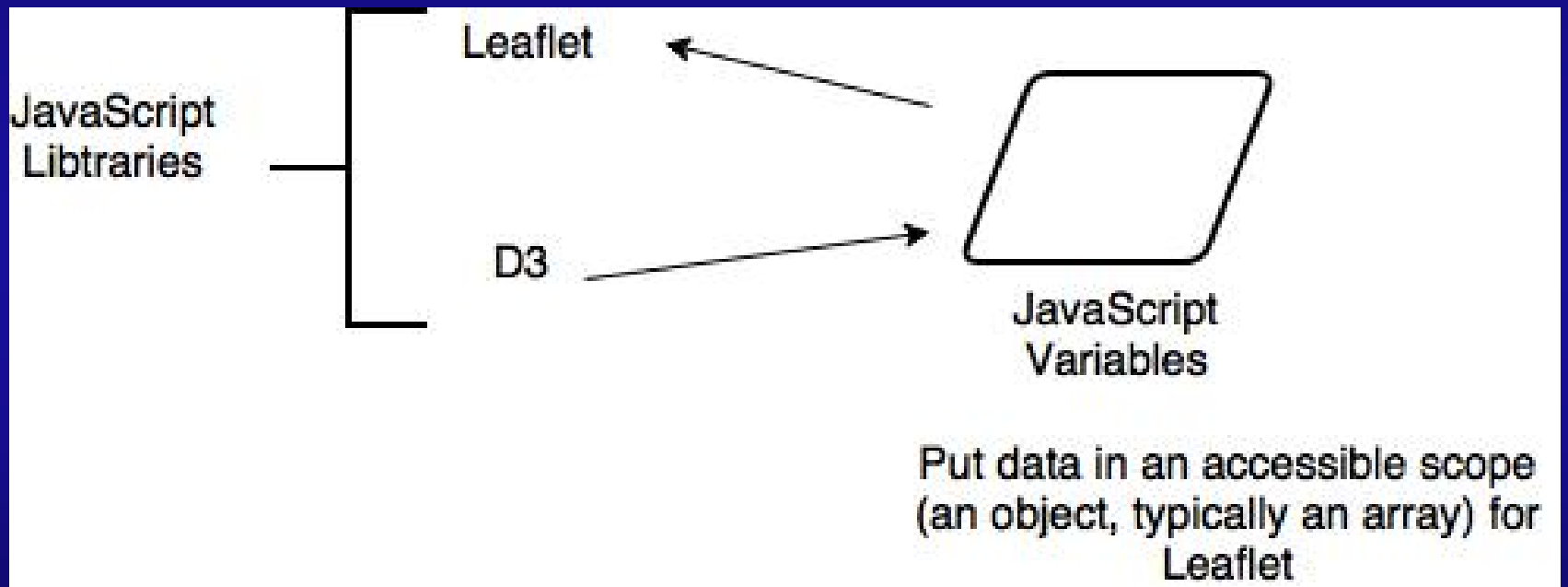


The Map Interface

- JavaScript code for the data objects
- Scalable Vector Graphics (SVG) opens the map framework
- Leaflet accesses data for cartographic formatting
- D3 libraries allow interactivity with the data
- Cascading Style Sheets (CSS) apply visual style elements



Mapping the Data Objects

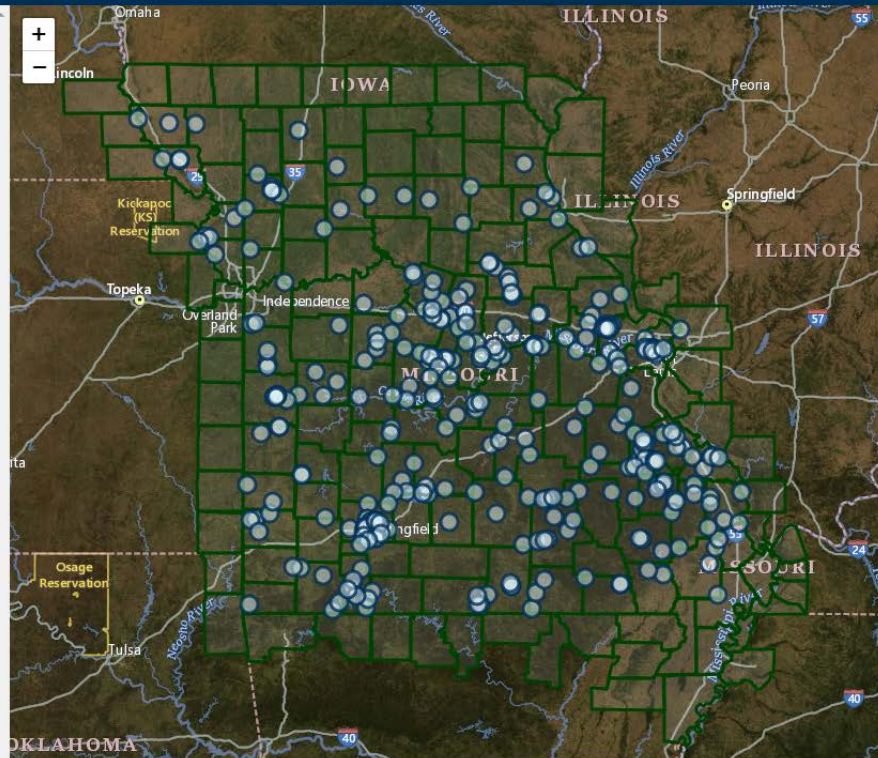


Map Waiting for Interaction

Map of Missouri Streams Drawn Using D3 and Leaflet

Click on a county to pull up its stream data.

Please wait for markers to be drawn before interacting with the map.



Custom SPARQL Query:

```
SELECT * WHERE { ?s ?p ?o } LIMIT 10
```

Submit

Streams within a selected county



Information about a selected stream

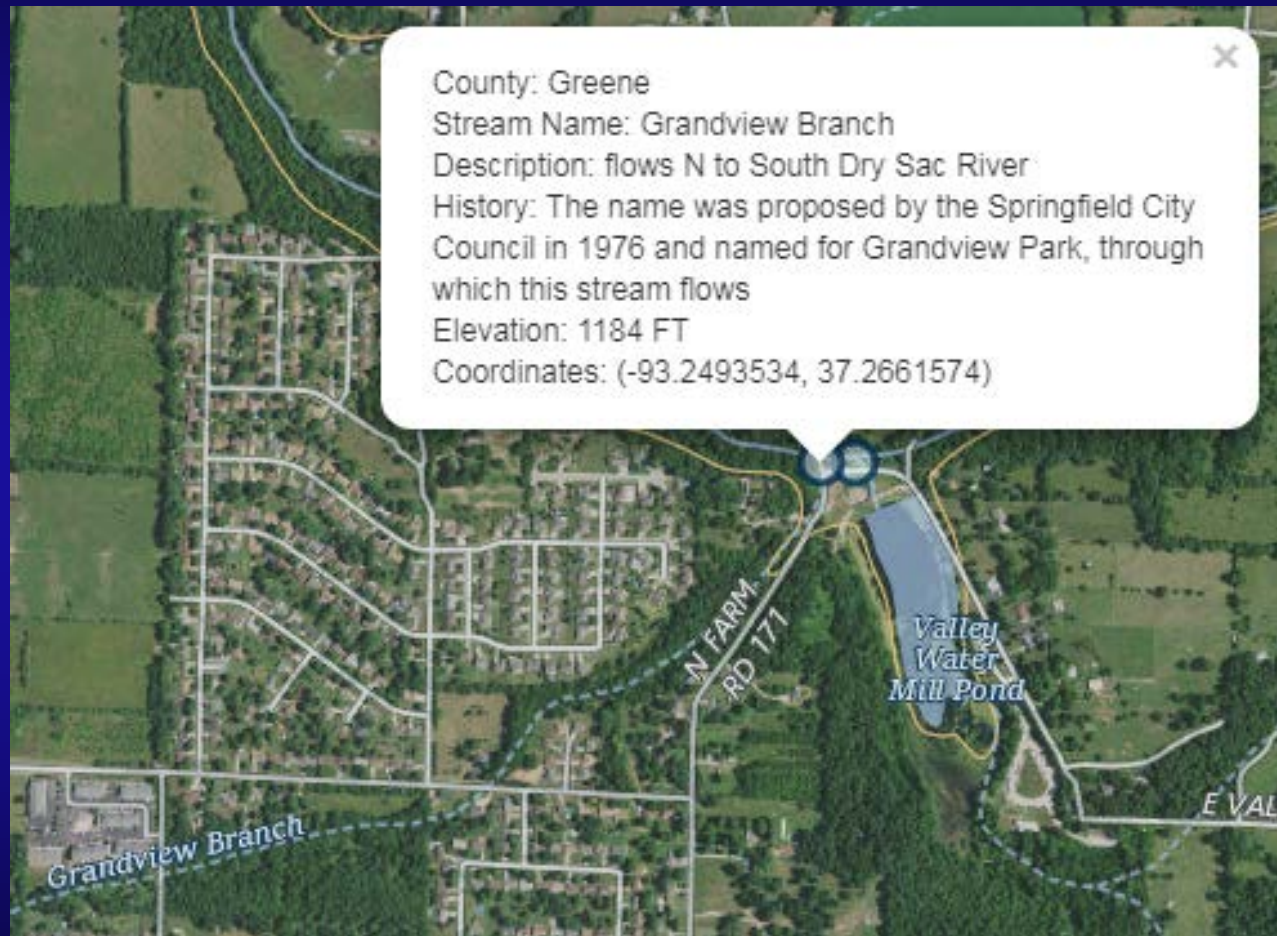
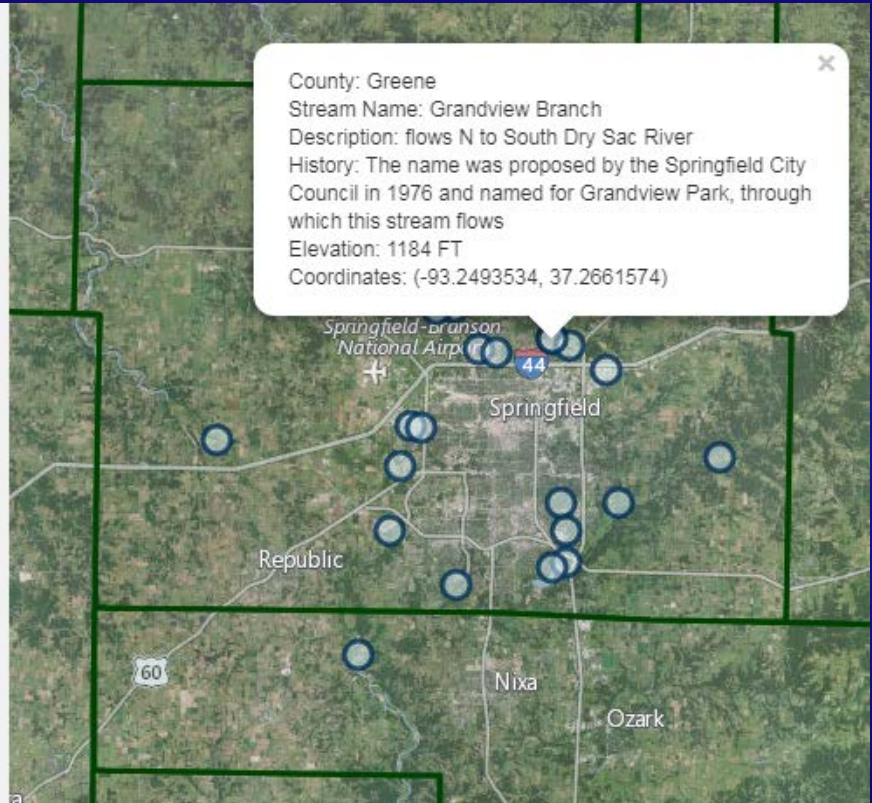


Table links

Sequiota Spring Branch	null	The name was proposed and accepted by the Springfield City Council in 1976. The stream was named for the nearby Sequiota Spring
Grandview Branch	flows N to South Dry Sac River	The name was proposed by the Springfield City Council in 1976 and named for Grandview Park, through which this stream flows
Mustard Branch	null	The name was proposed by the Springfield City Council in 1976 and named for Mustard Way, a street which crosses the stream
Thompson Creek	It flows SSE to Lake Springfield in the James River	null



Thank you.

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