

A Developer's Guide to Open Source Web Mapping Libraries

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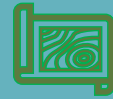
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From Teaching to Tech



Agenda

Intro to Mapping



Web Mapping Libraries



ArcGIS/Esri Integrations



Real-World Examples



The Role of Mapping



Visualization



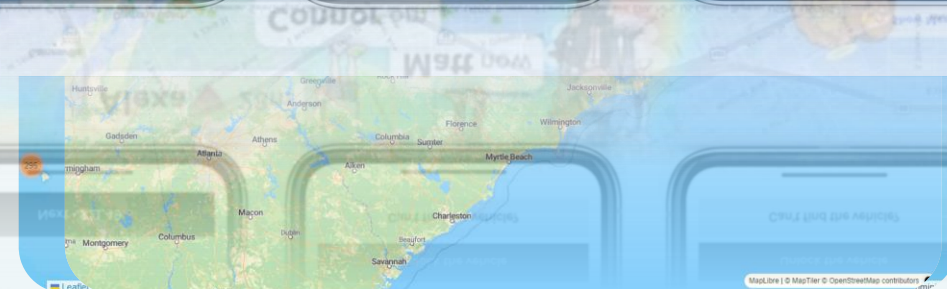
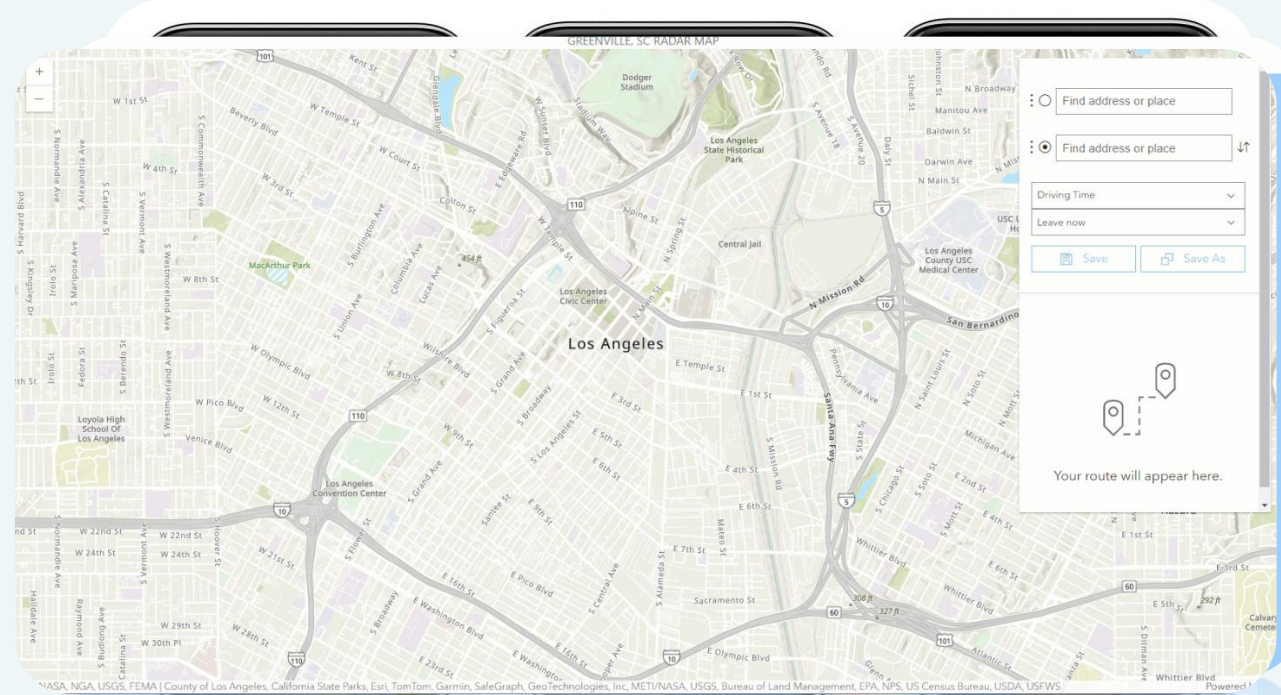
Navigation



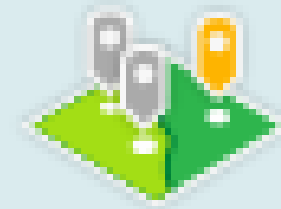
Communication



Prediction



Key Mapping Concepts



Layers &
Data

Geocoding

Library Commonalities

Similarities among Leaflet, MapLibre GL JS, & OpenLayers



Core Tech

- Built on JavaScript
- Compatible with HTML & CSS
- Works across modern browsers



Open Source

- Community-driven
- Modifiable



Easy to Learn

- Simple APIs
- Extensive documentation



Key Features

- Interactive & mobile friendly
- Customizable
- Web Mercator projection

Leaflet

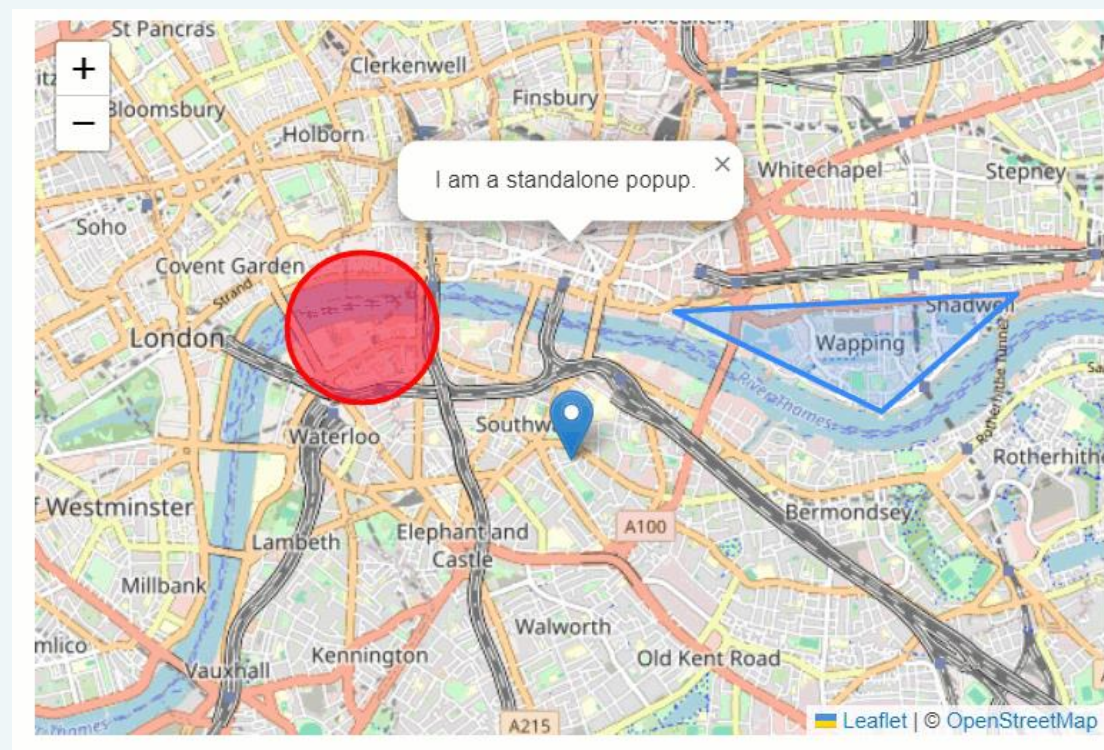
 leafletjs.com



github.com/Leaflet



- Lightweight (~42 KB JS)
- Tons of plugins
- Focuses on simplicity and performance





Leaflet: Simple Map Demo

Leaflet – Simple Map



```
const map = L.map('map').setView([lat, long], zoom)  
L.tileLayer('tileURL/{z}/{x}/{y}.png').addTo(map)
```

Create map
at div id

Basemap tile
function

Initializes
map's center

Latitude (y),
Longitude (x)
Tile position

Zoom level
(0 to ~19)
Raster/Static
images

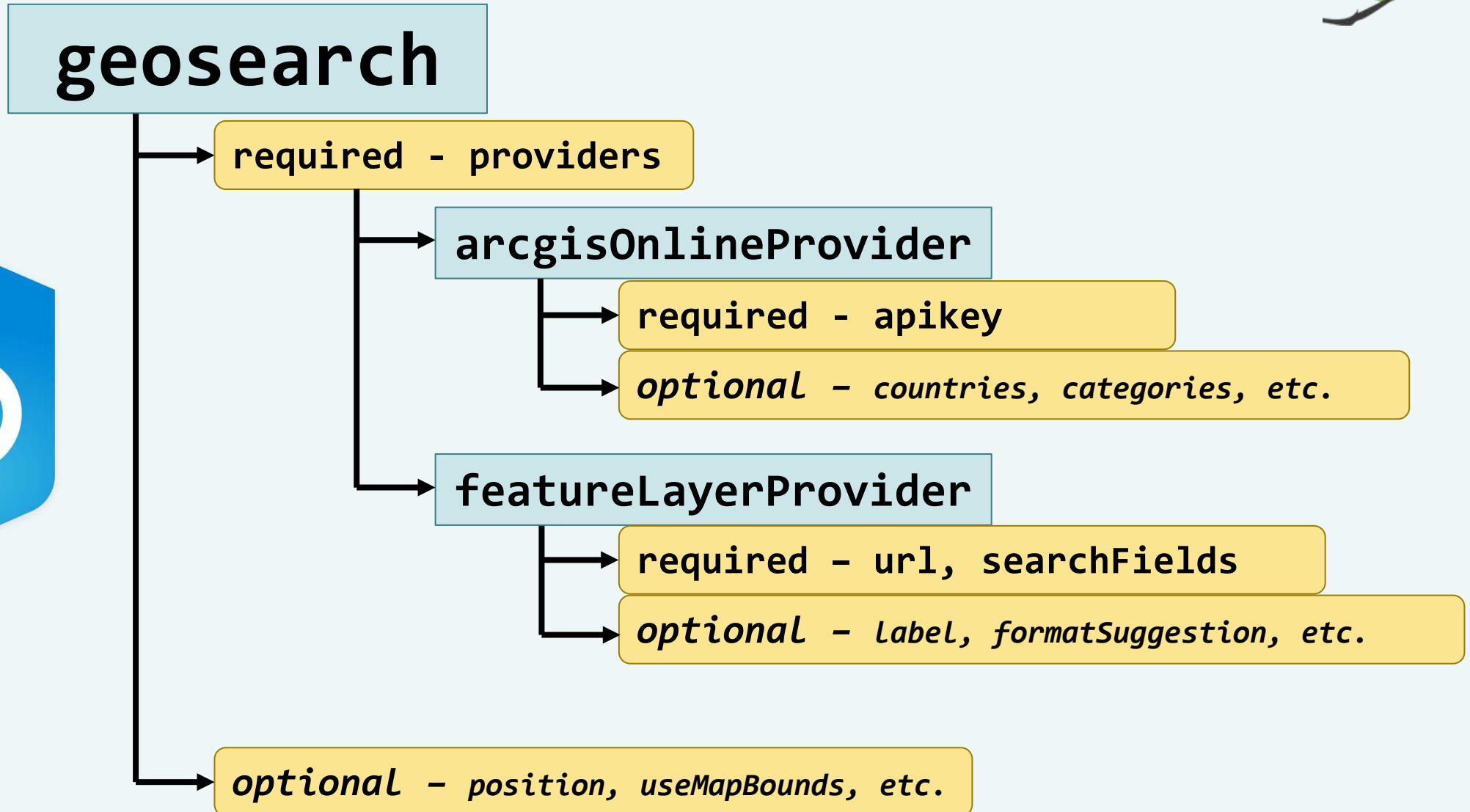
Required



Leaflet + Esri

Leaflet Demo

Leaflet + Esri Leaflet Geosearch



Leaflet + Esri Leaflet Cluster



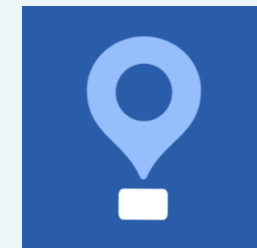
```
L.esri.Cluster.featureLayer({  
  url: 'featureLayerURL',  
  showCoverageOnHover: false,  
  disableClusteringAtZoom: 8,  
  maxClusterRadius: 10  
}).addTo(map)
```

Disables showing
bounds of its markers

No clustering after
this zoom level

max radius cluster will
cover from central marker

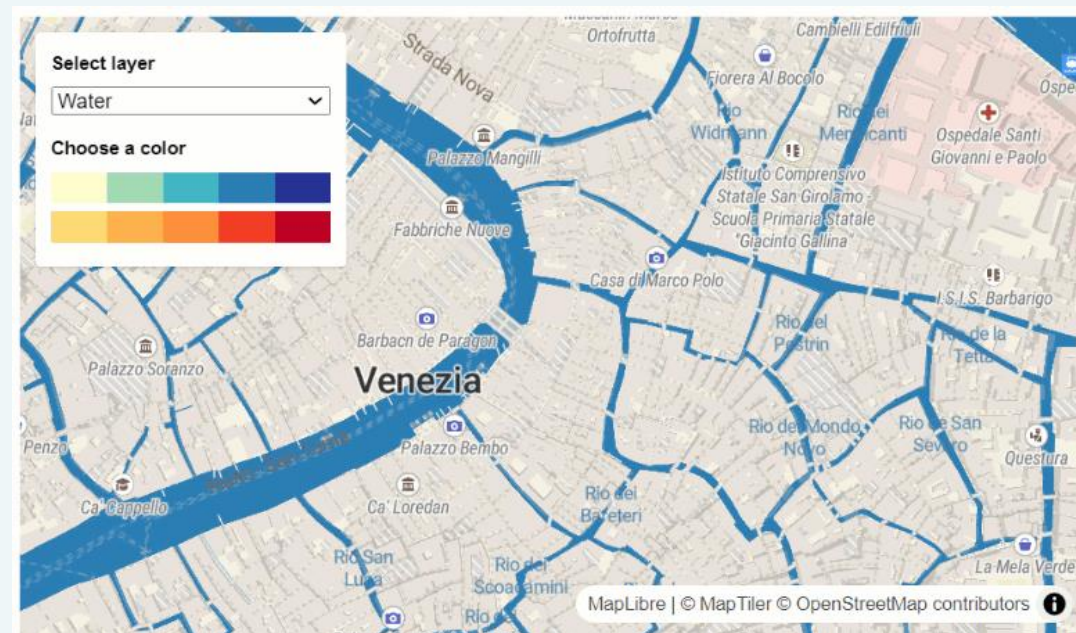
MapLibre GL JS



 maplibre.org

 github.com/maplibre/maplibre-gl-js

- Fork of Mapbox GL JS 1.x
- WebGL rendering
- Dynamic data integration
- Customizable styling options





MapLibre GL JS: Simple Map Demo

MapLibre GL JS – Simple Map



```
const map = new maplibregl.Map({  
  container: 'map',  
  style: 'tileURL/style.json',  
  center: [long, lat],  
  zoom: 2  
})
```

Create map object
contained in div id

Vector tile basemap
layer style

Longitude (x),
Latitude (y)

Zoom level
(0 to ~22)



MapLibre GL JS + ArcGIS Demo

MapLibre GL JS + ArcGIS



ArcGIS basemap integration

```
style: `https://basemapstyles-  
api.arcgis.com/...`
```

Dynamic queries

```
executeQuery("STUTERATIO > 15")
```

WebGL and pagination for large datasets

```
arcgisRest.queryFeatures({  
  resultOffset: 0,  
  resultRecordCount: 2000,  
})
```

Visualized features

```
map.on('click', 'school-  
points', showPopup);
```

OpenLayers

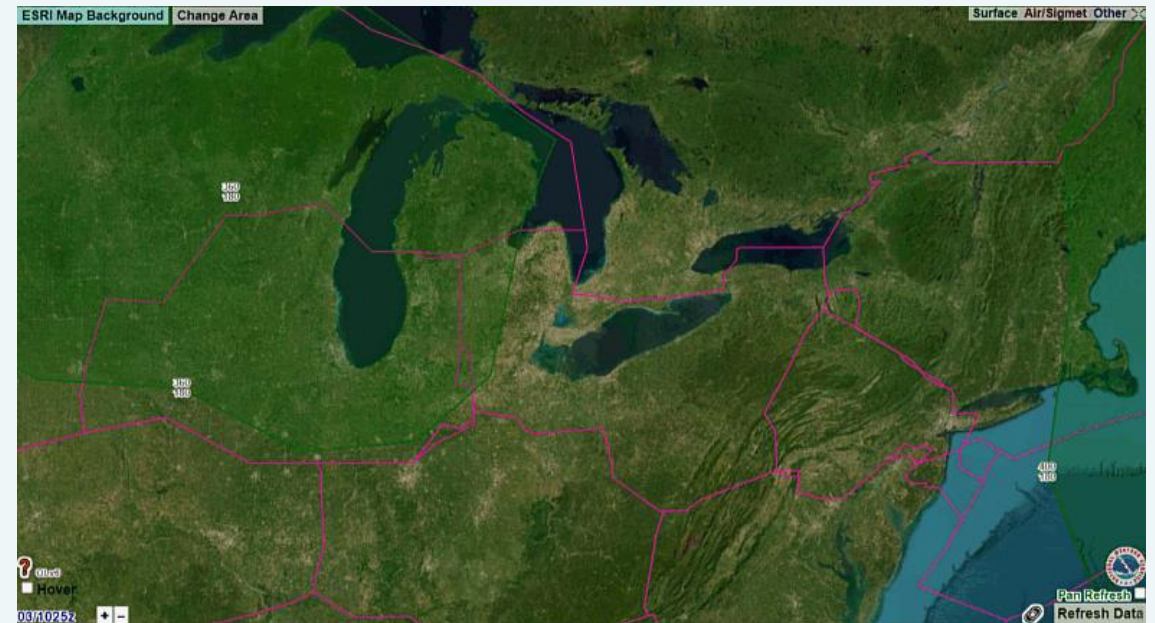


 openlayers.org



<https://github.com/openlayers>

- Supports many map formats
- Advanced geospatial analysis
- Excels with multiple layers
- Multi-projection support





OpenLayers: Simple Map Demo

OpenLayers – Simple Map



```
const map = new ol.Map({  
  target: 'map',  
  layers: [  
    new ol.layer.Tile({  
      source: new ol.source.OSM()  
    })  
  ],  
  view: new ol.View({  
    center: ol.proj.fromLonLat([long, lat]),  
    zoom: 12  
  })  
})
```

Create map object targeted in div id

Raster tile basemap layer style

Projection style

Longitude (x), Latitude (y)

Zoom level (0 to ~28)



OpenLayers + ArcGIS Demo

OpenLayers + ArcGIS



```
arcgisRest.queryDemographicData({
  studyAreas: [{geometry:{x:lonLat[0], y:lonLat[1]}}],
  authentication: arcgisRest.ApiKeyManager.fromKey(key),
  analysisVariables: [
    'PetsPetProducts.MP26001H_B',
    'maritalstatustotals.MARRIED_CY'
  ]
}).then(res => {
  const data = res.results[0].value.FeatureSet[0].features[0].attributes
}).then(res => {
  const message = `Pop: ${data.TOTPOP}<br> Avg HH: ${data.AVGHHSZ}`
  popup.show(event.coordinate, message)
  const data = res.results[0].value.FeatureSet[0].features[0].attributes
  const message = `Pets: ${data.MP26001h_B}<br>Married: ${data.MARRIED_CY}`
  popup.show(event.coordinate, message)
})
})
})
```

Real-World Applications



Summary



Leaflet

Strengths

- Lightweight, easy
- Many plugins

Weaknesses

- Limited for large datasets
- Simple visualizations



MapLibre GL JS

Strengths

- large dataset handling
- vector basemaps

Weaknesses

- Resource-intensive



OpenLayers

Strengths

- Advanced projections
- Multiple layers and layer types

Weaknesses

- Steep learning curve



Thank you, Carolina Code Conference!

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bit.ly/os-mapping-carolina-code

