A Developer's Guide to Open Source Web Mapping Libraries

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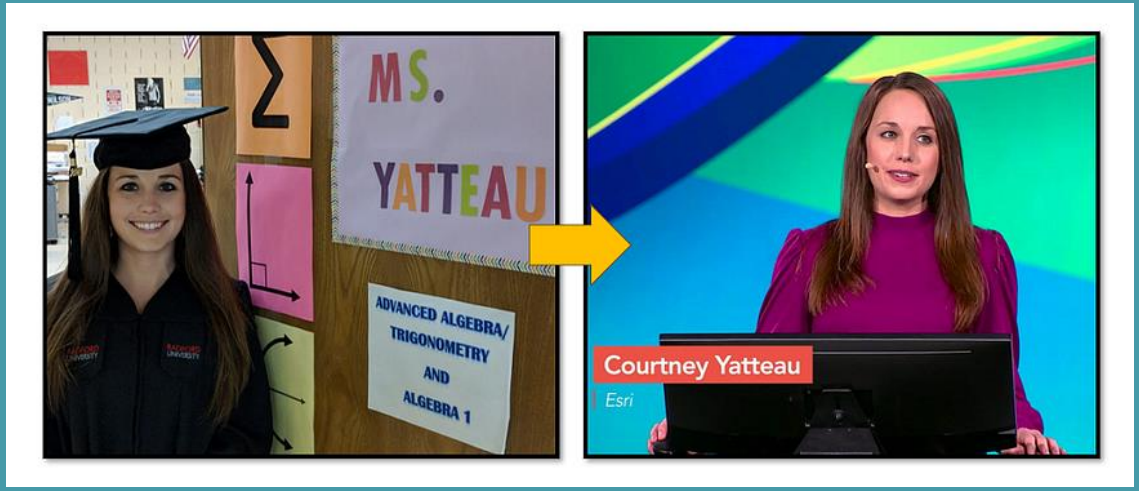
From Teaching to Tech



Agenda

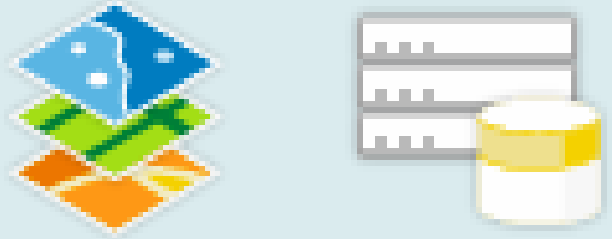
- Intro to Mapping
- Web Mapping Libraries
- ArcGIS & Esri Integrations

- Real-World Examples

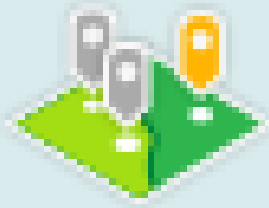
The Role of Mapping

- 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

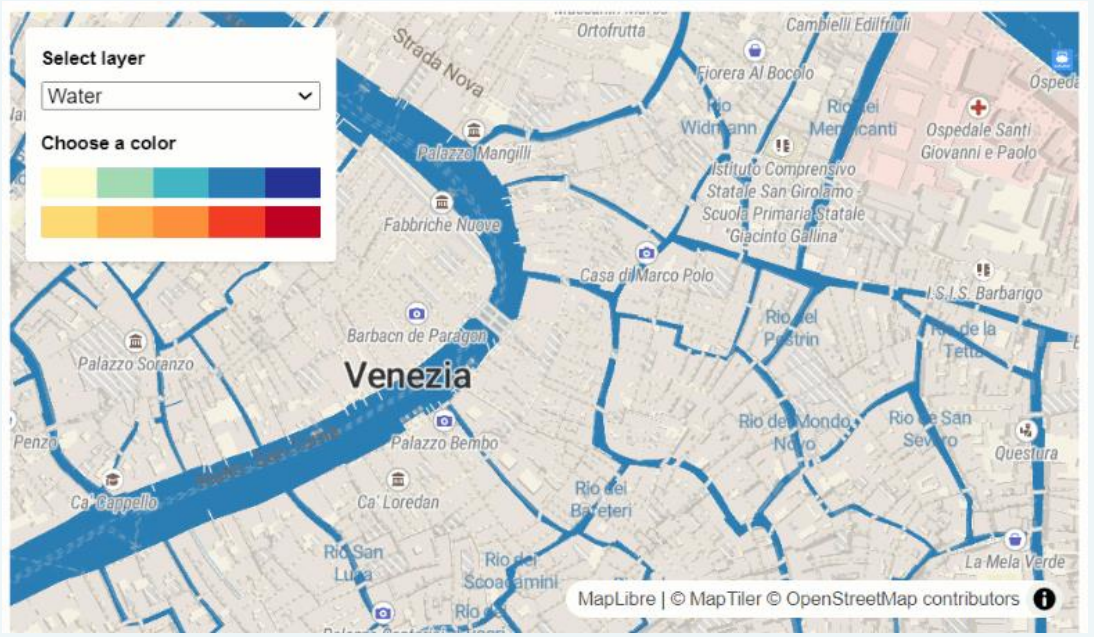
Leaflet + Esri Leaflet Geosearch

- geosearch
  - required - providers
    - arcgisOnlineProvider
      - required - apikey
      - *optional – countries, categories, etc.*
    - featureLayerProvider
      - required – url, searchFields
      - *optional – label, formatSuggestion, etc.*
  - *optional – position, useMapBounds, etc.*

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}`
    const data = res.results[0].value.FeatureSet[0].features[0].attributes
    popup.show(event.coordinate, message)
    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

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