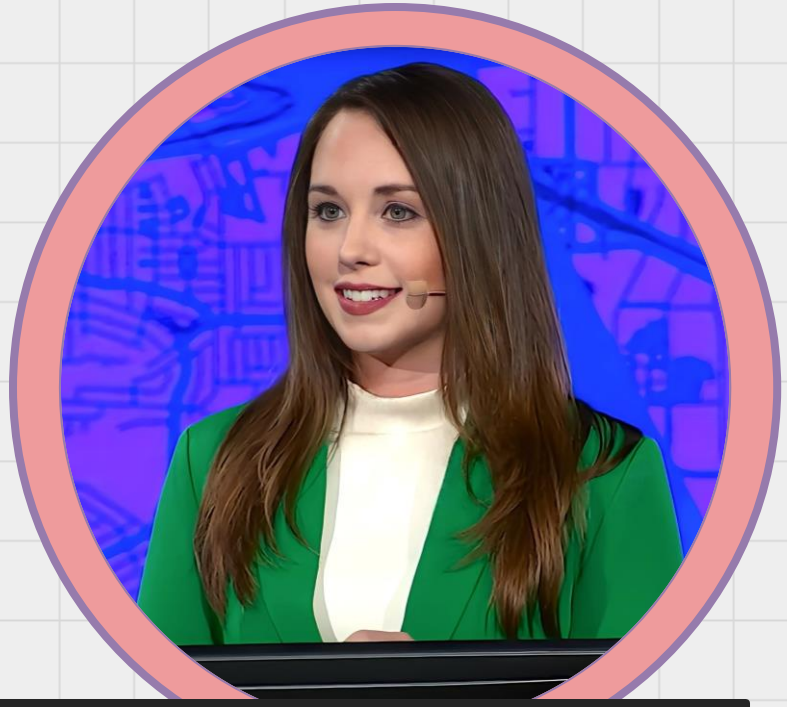
A Developer's Guide to

Open Source Web Mapping Libraries

Courtney Yatteau



HELLO!

Courtney Yatteau

Developer Advocate, Esri

c_yatteau

c_yatteau

cyatteau

courtneyyatteau

Agenda

01

Intro to Mapping

02

Web Mapping Libraries

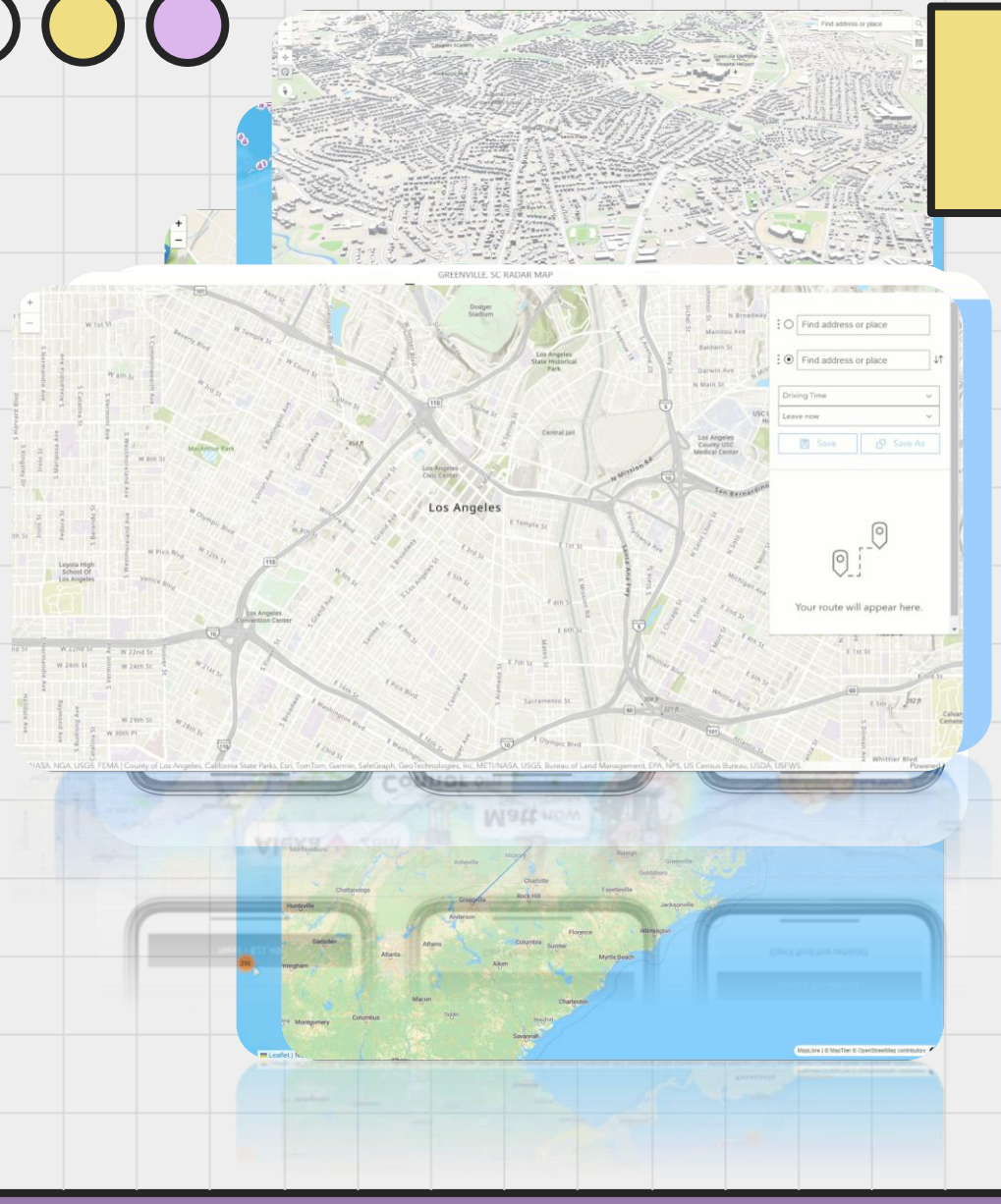
03

ArcGIS/Esri Integrations

04

Real-World Examples & Conclusions

The Role of Mapping



- Visualization
- Navigation
- Communication
- Prediction

Key Mapping Concepts

Basemaps

Data layers

Geocoding

Basemap Types

Static Raster Tiles

- Pre-made map images
- Fast & simple
- Fixed look

Vector Tiles

- Map data rendered on-the-fly
- Dynamic styling
- Always sharp

Library Commonalities

Core Tech

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

Open Source

- Cost-Effectiveness
- Community-driven
- Modifiable
- Interoperable

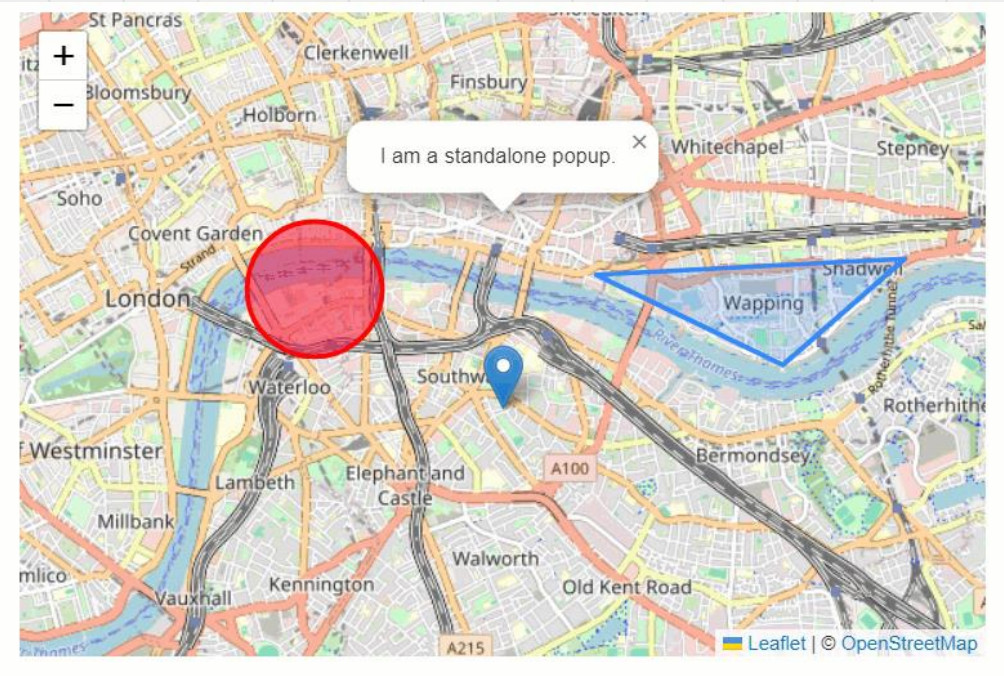
Easy to Learn

- Simple APIs
- Extensive documentation
- Abundance of Resources

Key Features

- Interactive & mobile friendly
- Customizable
- Web Mercator projection

Leaflet



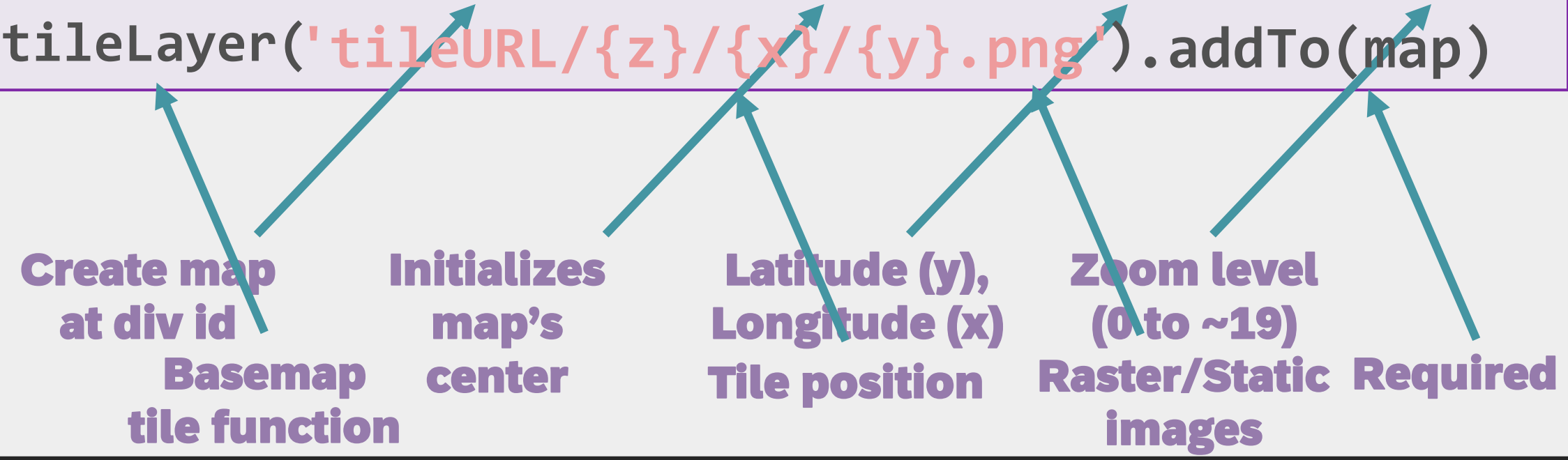
💻 leafletjs.com 🧑‍💻 github.com/Leaflet

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

Leaflet: Simple Map Demo

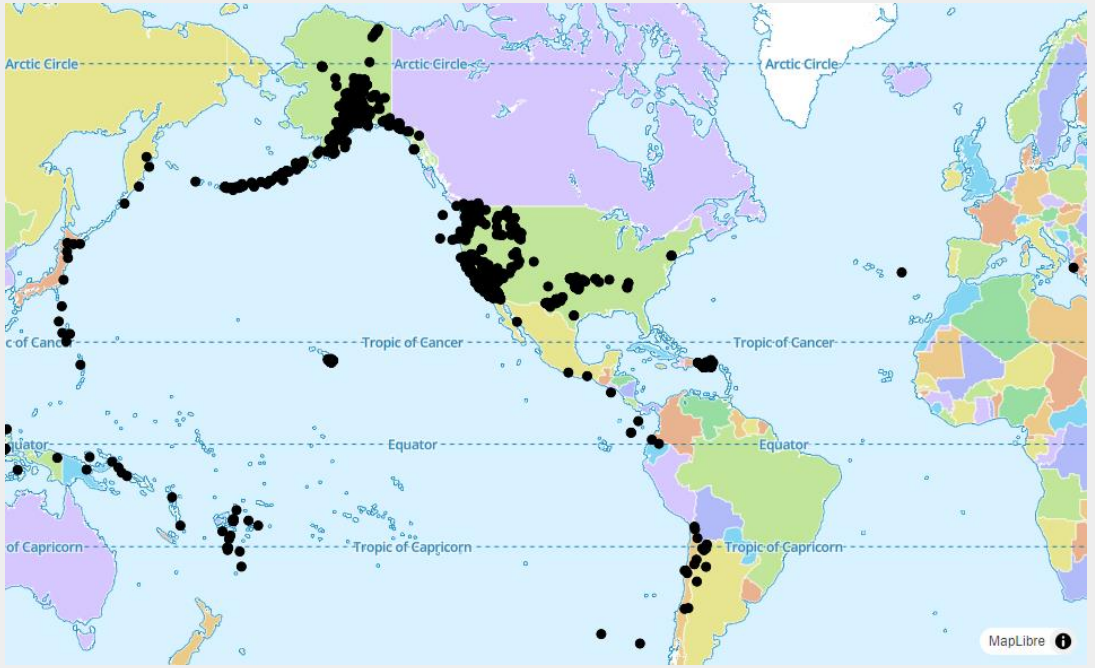
Leaflet – Simple Map

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



Feature Layers

- Geometry and attributes
- Interactive mapping



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.*

Leaflet + Esri Leaflet Cluster

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

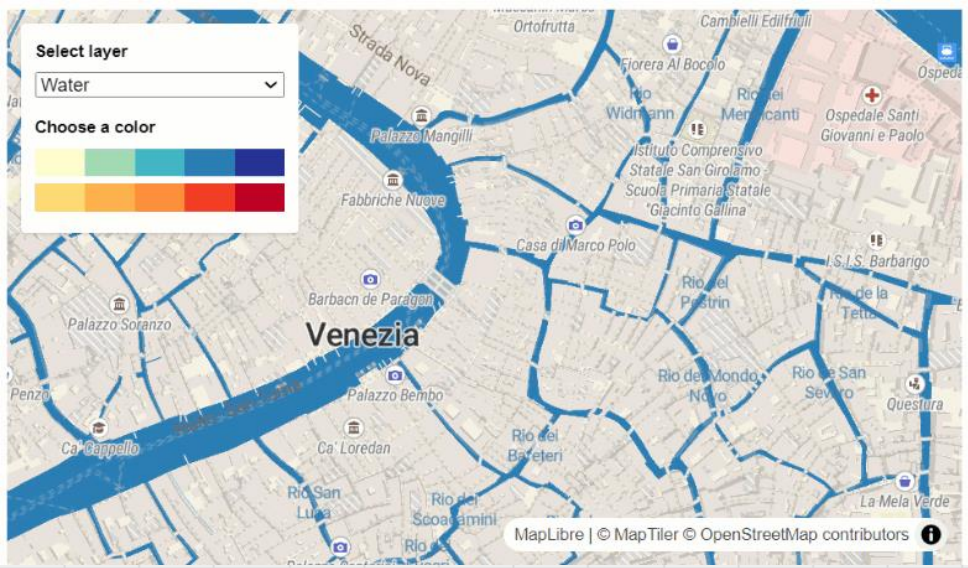
Disables showing bounds of its markers

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

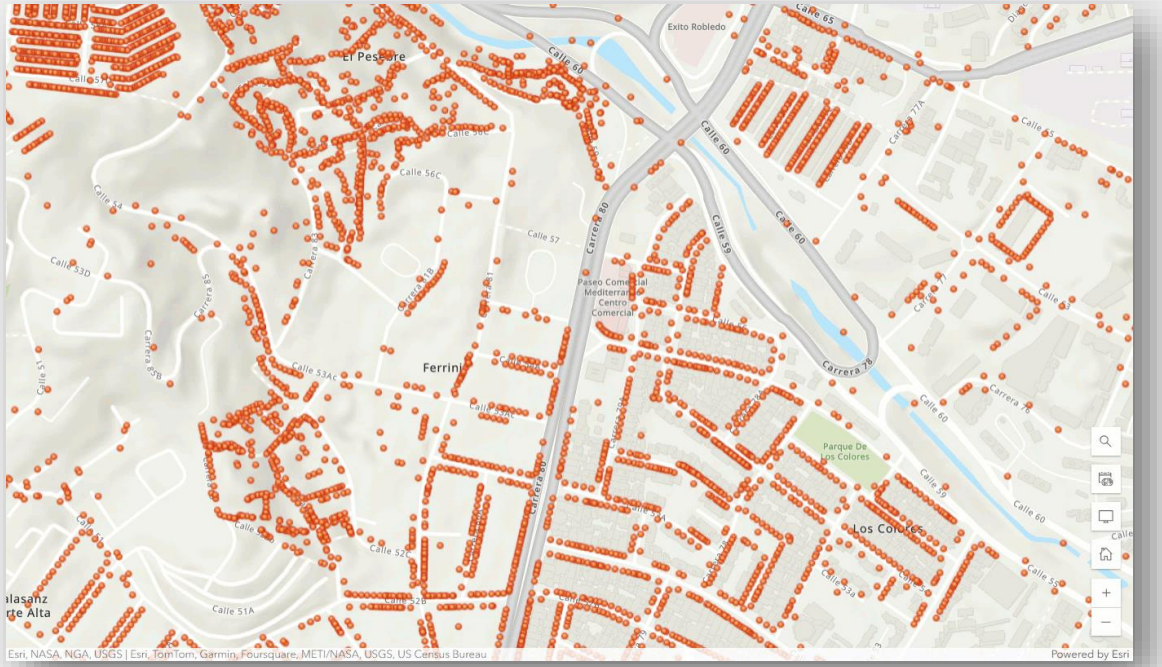
Vector tile basemap layer style

Longitude (x), Latitude (y)

Zoom level (0 to ~22)

Vector Tile Layers

- Pre-rendered
- Large datasets



MapLibre GL JS + ArcGIS Demo

MapLibre GL JS + ArcGIS

ArcGIS basemap integration

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

Dynamic queries

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

Visualized features

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

WebGL and pagination for large datasets

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

Vector Tile Layer

```
map.addSource('layer-id', {
  type: 'vector',
  tiles: [
    ‘vectorTileURL/tile/{z}/{y}/{x}.pbf'
  ]
})
```

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 => {
  }).then(res => {
    const data = res.results[0].value.FeatureSet[0].features[0].attributes
    const data = res.results[0].value.FeatureSet[0].features[0].attributes
    const message = `Pop: ${data.TOTPOP}<br> Avg HH: ${data.AVGHHSZ}`
    const message = `Pets: ${data.MP26001H_B}<br>Married: ${data.MARRIED_CY}`
    popup.show(event.coordinate, message)
    popup.show(event.coordinate, message)
  })
  })
})
```

Real-World Applications

craigslist

outdooractive

MTA New York City Subway

Summary

Leaflet

Pros
- Lightweight, easy
- Many plugins

Cons
- Limited for large datasets
- Simple visualizations

MapLibre GL JS

Pros
- Large dataset handling
- vector basemaps

Cons
- Resource-intensive

OpenLayers

Pros
- Advanced projections
- Multiple layers and layer types

Cons
- Steep learning curve

Thank you, RUAJS!

Courtney Yatteau

c_yatteau

courtneyyatteau

cyatteau

https://github.com/cyatteau/rvajs25-dev-guide-open-source-mapping