M2B – Mapas y OpenData

TECNOLOGÍAS SIG

UNIVERSITAT POLITÈCNICA DE CATALUNYA
BARCELONATECH
School of Professional & Executive Development

Máster SIG –
2022/2023

Vector-Tiles & MapBox Styles

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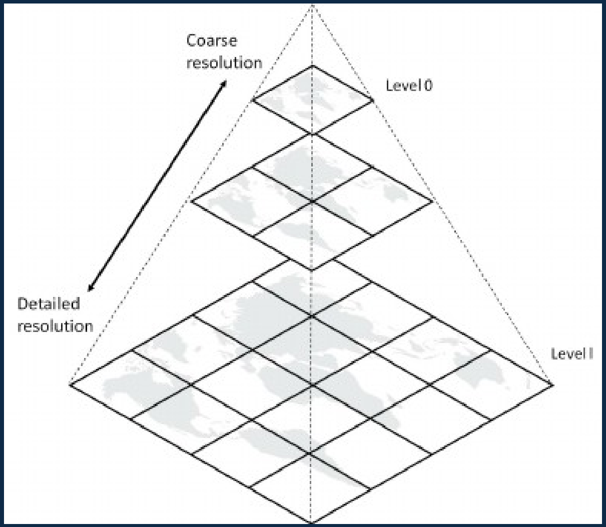
Vector Tiles

- Vector Tiles es un formato para almacenar datos geográficos en formato binario (Google Protobuf) y pensados para la visualización en navegadores web modernos que soporten webGL. Creado por MapBox

- Una tesela vectorial (vector tiles) contiene datos vectoriales georreferenciados (puede contener múltiples capas), recortados en teselas para facilitar su recuperación. Son equivalentes a las teselas raster tradicionales (XYZ,WMTS, TMS) pero retornan datos vectoriales en lugar de una imagen.



Vector Tiles

- Mapbox ha publicado de forma abierta como una especificación la forma de crear vector tiles
- https://docs.mapbox.com/vector-tiles/specification/

Version	**Date of release**	**Updates**
2.1	January 19th, 2016	Correction to the wording in a few locations of the 2.0 specification.
2.0	December 4th, 2015	The focus of version 2.0 of the Mapbox Vector Tile specification is the clarification of the intent of the intial version of the specification and the definition of interior and exterior rings within polygons. The fields within the protobuffer are more clearly defined in this version of the specification and the steps for decoders and encoders are more explicity declared.
1.0.1	July 28, 2014	Update .proto file to match Protocol Buffer style guide, changed namespace
1.0.0	April 13, 2014	First release

Vector Tiles – Caracteristicas

- Cada tile es un contenedor de datos vectores y atributos
- Los Tiles **no tienen estilo**
- Soporta rotación y orientación
- Soporta extrusión y 3D

Vector Tiles

- Cada conjunto de teselas vectoriales tiene su propio esquema. Un esquema consiste en nombres de capas, atributos, selección de elementos.

- Actualmente hay tres esquemas muy utilizados

    - MapBox
    - OpenMapTiles
    - ESRI vector tiles

MapBox Styles

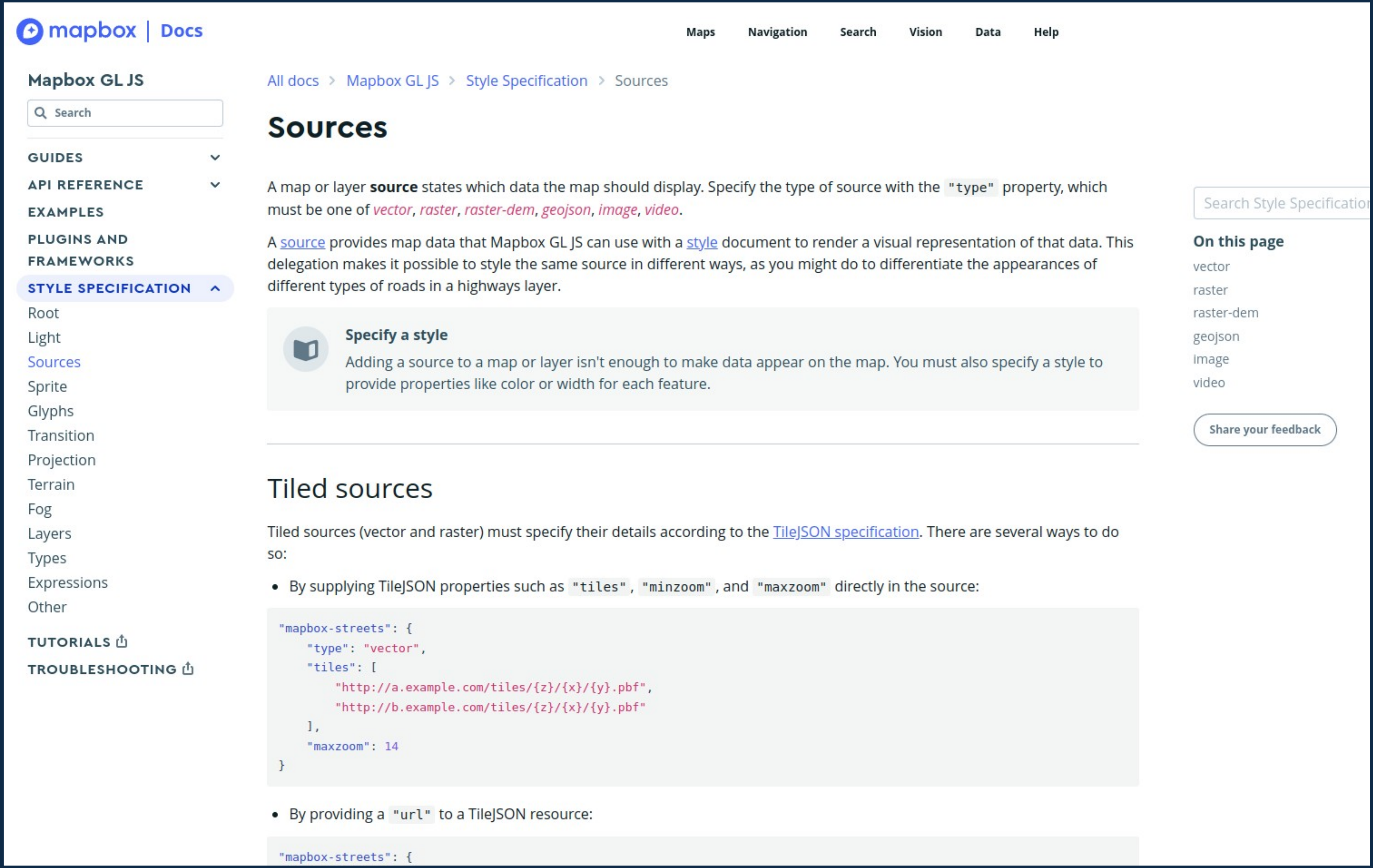
- Es una especificación, también publicada por MapBox, para estilizar los vector tiles
- Se codifica en un archivo JSON

```
{
  "version": 8,
  "name": "ICGC",
  "metadata": {},
  "center": [
    1.537786,
    41.837539
  ],
  "zoom": 12,
  "bearing": 0,
  "pitch": 0,
  "sources": {
    "openmaptiles": {
      "type": "vector",
      "url": "https://geoserveis.icgc.cat/contextmaps/basemap.json"
    }
  },
  "sprite": "https://geoserveis.icgc.cat/contextmaps/sprites/sprite@1",
  "glyphs":
"https://geoserveis.icgc.cat/contextmaps/glyphs/{fontstack}/{range}.pbf
",
  "layers": [
    {
      "id": "background",
      "type": "background",
      "paint": {
        "background-color": "#f8f4f0"
      }
    },
    {
      "id": "landcover-glacier",
      "type": "fill",
      "metadata": {
        "mapbox:group": "1444849388993.3071"
      },
      "source": "openmaptiles",
      "source-layer": "landcover",
      "filter": [
        "==",
        "subclass
```

https://docs.mapbox.com/mapbox-gl-js/style-spec/

MapBox Styles

https://docs.mapbox.com/mapbox-gl-js/style-spec/



Sources

A map or layer **source** states which data the map should display. Specify the type of source with the `"type"` property, which must be one of *vector*, *raster*, *raster-dem*, *geojson*, *image*, *video*.

A source provides map data that Mapbox GL JS can use with a style document to render a visual representation of that data. This delegation makes it possible to style the same source in different ways, as you might do to differentiate the appearances of different types of roads in a highways layer.

Specify a style

Adding a source to a map or layer isn't enough to make data appear on the map. You must also specify a style to provide properties like color or width for each feature.

Tiled sources

Tiled sources (vector and raster) must specify their details according to the TileJSON specification. There are several ways to do so:

- By supplying TileJSON properties such as `"tiles"`, `"minzoom"`, and `"maxzoom"` directly in the source:

```
"mapbox-streets": {
    "type": "vector",
    "tiles": [
        "http://a.example.com/tiles/{z}/{x}/{y}.pbf",
        "http://b.example.com/tiles/{z}/{x}/{y}.pbf"
    ],
    "maxzoom": 14
}
```

- By providing a `"url"` to a TileJSON resource:

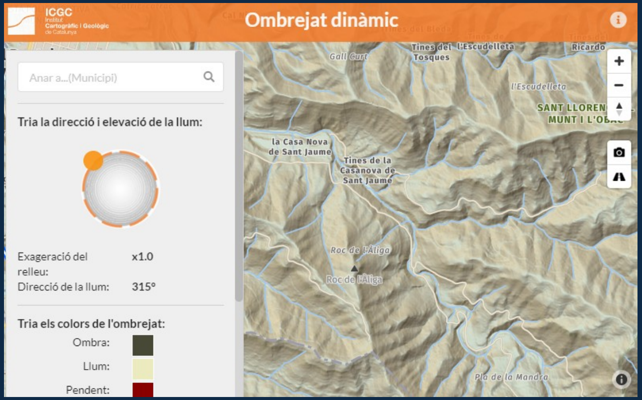
```
"mapbox-streets": {
```

MapBox Styles - ¿Cómo funciona?

Datos
Vector Tiles
(MBTiles)

GeoJSON
WMS (raster)
TMS (raster)

Fichero
estilo.json


ICGC
Institut Cartogràfic i Geològic de Catalunya
Ombrejat dinàmic
Gall Curt
Tines del l'Escudelleta Tosques
Ricardo
l'Escudelleta
SANT LLORENÇ MUNT I L'OBAC
la Casa Nova de Sant Jaume
Tines de la Casanova de Sant Jaume
Roc de l'Àliga
Pla de la Mandra

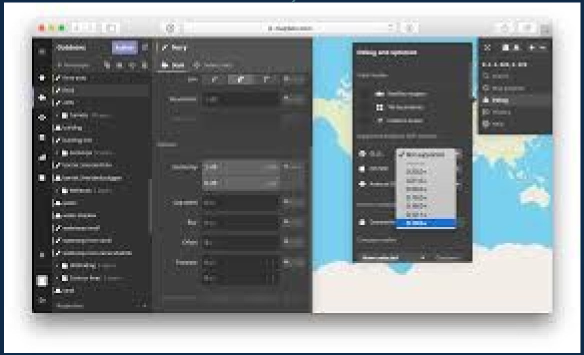
Anar a...(Municipi)

Tria la direcció i elevació de la llum:

Exageració del relleu: x1.0
Direcció de la llum: 315°

Tria els colors de l'ombrejat:
Ombra: ■
Llum: ■
Pendent: ■

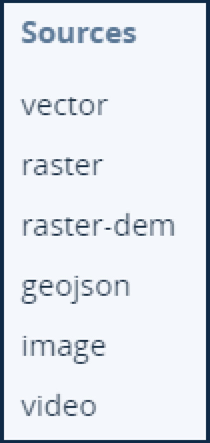
Visor con libreria
Mapbox GL JS



MapBox Studio

MapBox Styles - ¿Componentes?

Sources: Url a los datos



Sources

vector

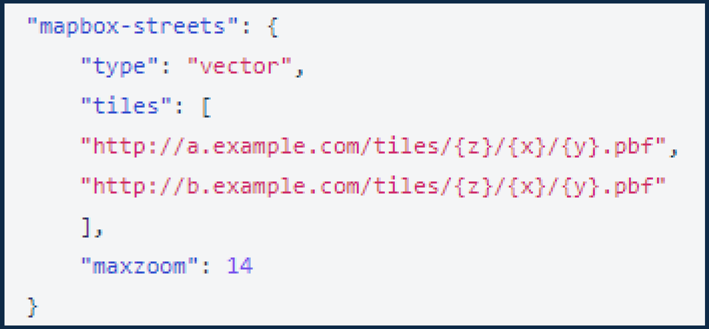
raster

raster-dem

geojson

image

video



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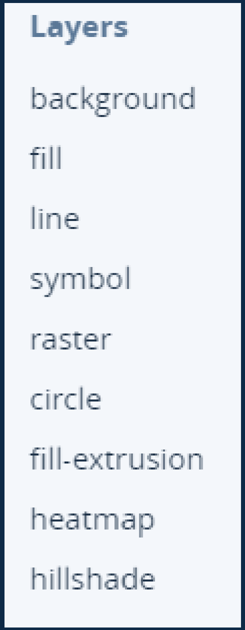
    "http://b.example.com/tiles/{z}/{x}/{y}.pbf"
    ],
    "maxzoom": 14
}
```

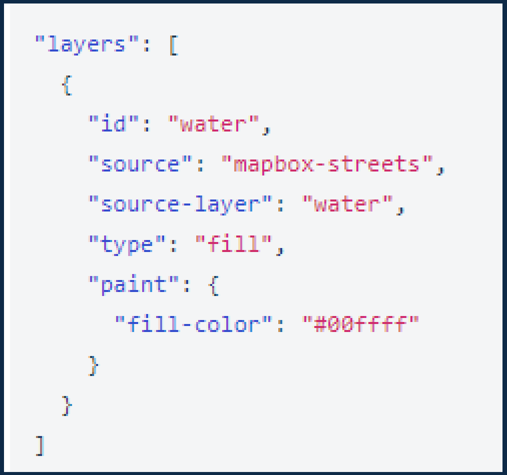
MapBox Styles - ¿Componentes?

Layers: Cada capa tiene sus propiedades «paint» y «layout»

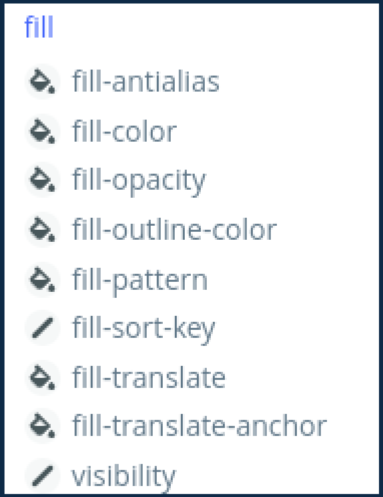


Layers

- background
- fill
- line
- symbol
- raster
- circle
- fill-extrusion
- heatmap
- hillshade



```
"layers": [
  {
    "id": "water",
    "source": "mapbox-streets",
    "source-layer": "water",
    "type": "fill",
    "paint": {
      "fill-color": "#00ffff"
    }
  }
]
```



fill

- fill-antialias
- fill-color
- fill-opacity
- fill-outline-color
- fill-pattern
- fill-sort-key
- fill-translate
- fill-translate-anchor
- visibility

MapBox Styles – Propiedades Layers

- Partes principales de la estilización de los layers:
- **Id**: único del layer
- **Type**: "fill“,"line“,"symbol“,"circle“,"heatmap“,"fill-extrusion“,"raster“,"hillshade”,"background“
- **Source**: id del source a que pertenece la capa
- **Source-layer**: nombre del layer
- **Paint:** Opciones estilos y tematicas “expressions”
- **Layout**: Opciones visualización
- **Filter**: Opciones de filtro con “expressions”

MapBox Styles

- Es una especificación, también publicada por MapBox, para estilizar los vector tiles

- Se codifica en un archivo JSON

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  "name": "ICGC",
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  ],
  "zoom": 12,
  "bearing": 0,
  "pitch": 0,
  "sources": {
    "openmaptiles": {
      "type": "vector",
      "url": "https://geoserveis.icgc.cat/contextmaps/basemap.json"
    }
  },
  "sprite": "https://geoserveis.icgc.cat/contextmaps/sprites/sprite@1",
  "glyphs":
"https://geoserveis.icgc.cat/contextmaps/glyphs/{fontstack}/{range}.pbf
",
  "layers": [
    {
      "id": "background",
      "type": "background",
      "paint": {
        "background-color": "#f8f4f0"
      }
    },
    {
      "id": "landcover-glacier",
      "type": "fill",
      "metadata": {
        "mapbox:group": "1444849388993.3071"
      },
      "source": "openmaptiles",
      "source-layer": "landcover",
      "filter": [
        "==",
        "subclass
```

https://docs.mapbox.com/mapbox-gl-js/style-spec/

MapBox Styles – Editar estilos

Los estilos se pueden generar mediante código en el visor o utilizar un editor gràfico como

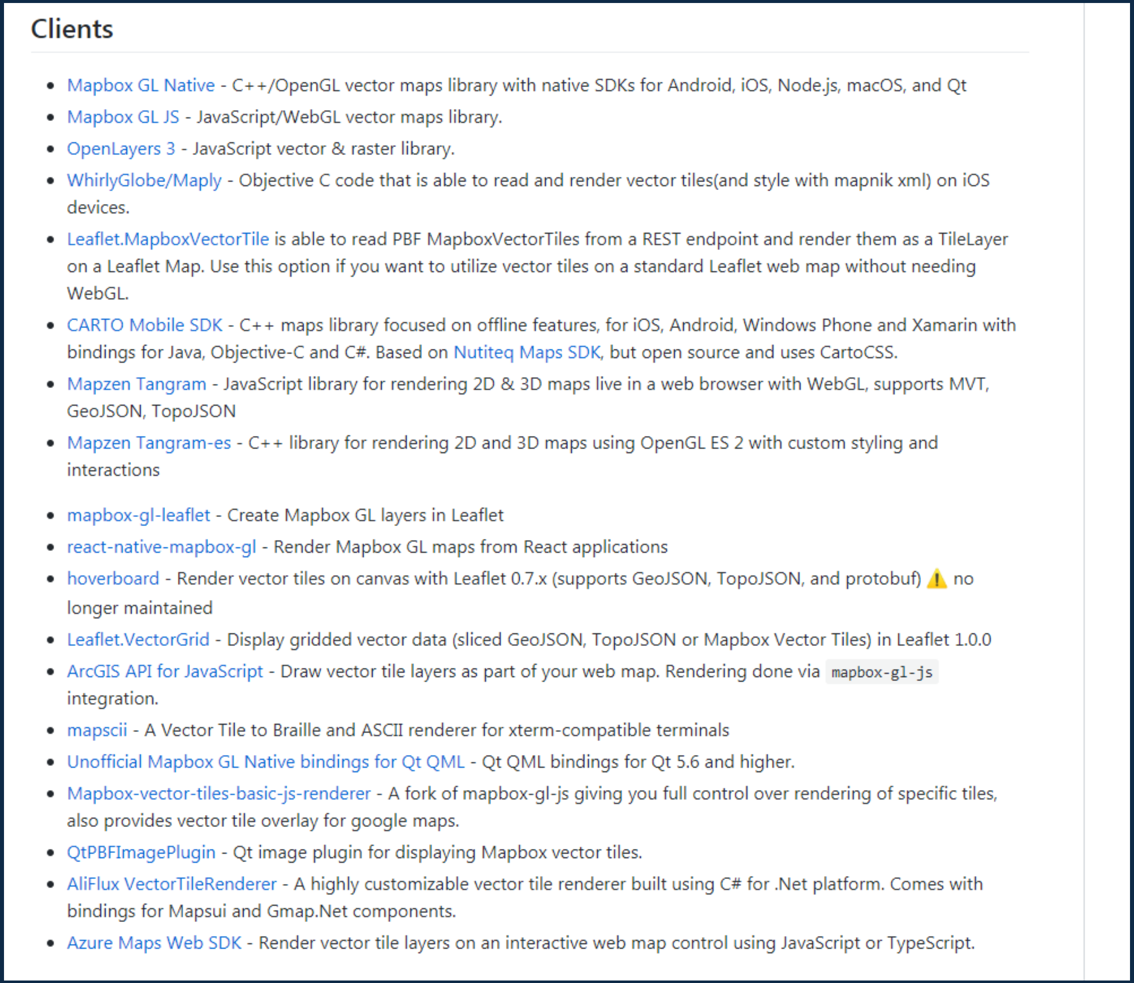
- **Mapbox Studio**

En Mapbox Studio poder cargar nuestros datos y convertirlos a Vector-Tiles (Tilesets)

Los tilesets pueden ser inetegrados como capas dentros de los estilos (styles)

- **Maputnik**
-
- **OpenMapTiles**

Recursos y herramientas



Clients

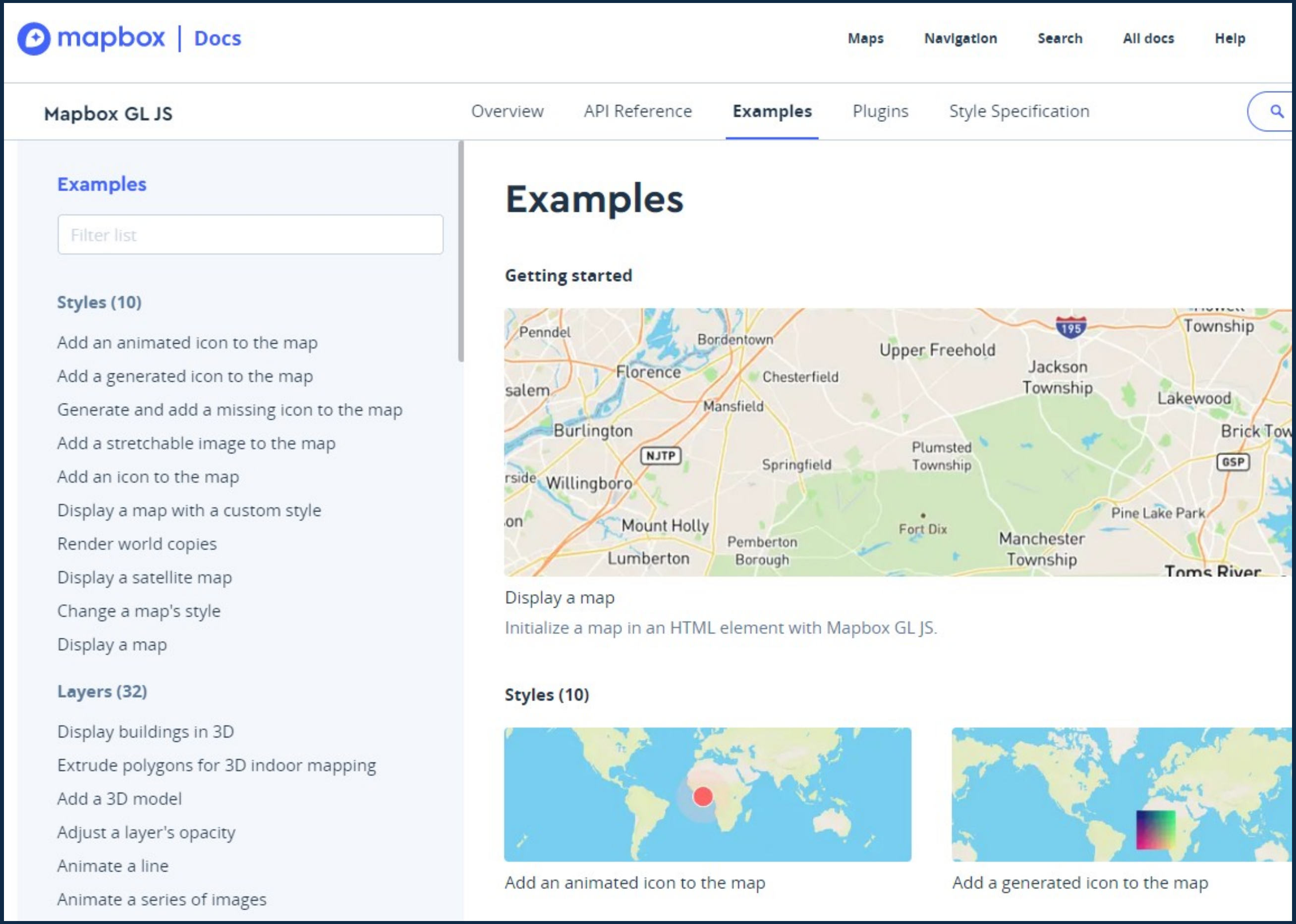
- Mapbox GL Native - C++/OpenGL vector maps library with native SDKs for Android, iOS, Node.js, macOS, and Qt
- Mapbox GL JS - JavaScript/WebGL vector maps library.
- OpenLayers 3 - JavaScript vector & raster library.
- WhirlyGlobe/Maply - Objective C code that is able to read and render vector tiles(and style with mapnik xml) on iOS devices.
- Leaflet.MapboxVectorTile is able to read PBF MapboxVectorTiles from a REST endpoint and render them as a TileLayer on a Leaflet Map. Use this option if you want to utilize vector tiles on a standard Leaflet web map without needing WebGL.
- CARTO Mobile SDK - C++ maps library focused on offline features, for iOS, Android, Windows Phone and Xamarin with bindings for Java, Objective-C and C#. Based on Nutiteq Maps SDK, but open source and uses CartoCSS.
- Mapzen Tangram - JavaScript library for rendering 2D & 3D maps live in a web browser with WebGL, supports MVT, GeoJSON, TopoJSON
- Mapzen Tangram-es - C++ library for rendering 2D and 3D maps using OpenGL ES 2 with custom styling and interactions

- mapbox-gl-leaflet - Create Mapbox GL layers in Leaflet
- react-native-mapbox-gl - Render Mapbox GL maps from React applications
- hoverboard - Render vector tiles on canvas with Leaflet 0.7.x (supports GeoJSON, TopoJSON, and protobuf) ⚠️ no longer maintained
- Leaflet.VectorGrid - Display gridded vector data (sliced GeoJSON, TopoJSON or Mapbox Vector Tiles) in Leaflet 1.0.0
- ArcGIS API for JavaScript - Draw vector tile layers as part of your web map. Rendering done via `mapbox-gl-js` integration.
- mapscii - A Vector Tile to Braille and ASCII renderer for xterm-compatible terminals
- Unofficial Mapbox GL Native bindings for Qt QML - Qt QML bindings for Qt 5.6 and higher.
- Mapbox-vector-tiles-basic-js-renderer - A fork of mapbox-gl-js giving you full control over rendering of specific tiles, also provides vector tile overlay for google maps.
- QtPBFImagePlugin - Qt image plugin for displaying Mapbox vector tiles.
- AliFlux VectorTileRenderer - A highly customizable vector tile renderer built using C# for .Net platform. Comes with bindings for Mapsui and Gmap.Net components.
- Azure Maps Web SDK - Render vector tile layers on an interactive web map control using JavaScript or TypeScript.

https://github.com/mapbox/awesome-vector-tiles

Mapbox GL JS is a JavaScript library that uses WebGL to render interactive maps from vector tiles and Mapbox styles.

Nuestra página de referencia



Examples

Styles (10)

Add an animated icon to the map
Add a generated icon to the map
Generate and add a missing icon to the map
Add a stretchable image to the map
Add an icon to the map
Display a map with a custom style
Render world copies
Display a satellite map
Change a map's style
Display a map

Layers (32)

Display buildings in 3D
Extrude polygons for 3D indoor mapping
Add a 3D model
Adjust a layer's opacity
Animate a line
Animate a series of images

Examples

Getting started

Display a map

Initialize a map in an HTML element with Mapbox GL JS.

Styles (10)

Add an animated icon to the map

Add a generated icon to the map

https://docs.mapbox.com/mapbox-gl-js/examples/