



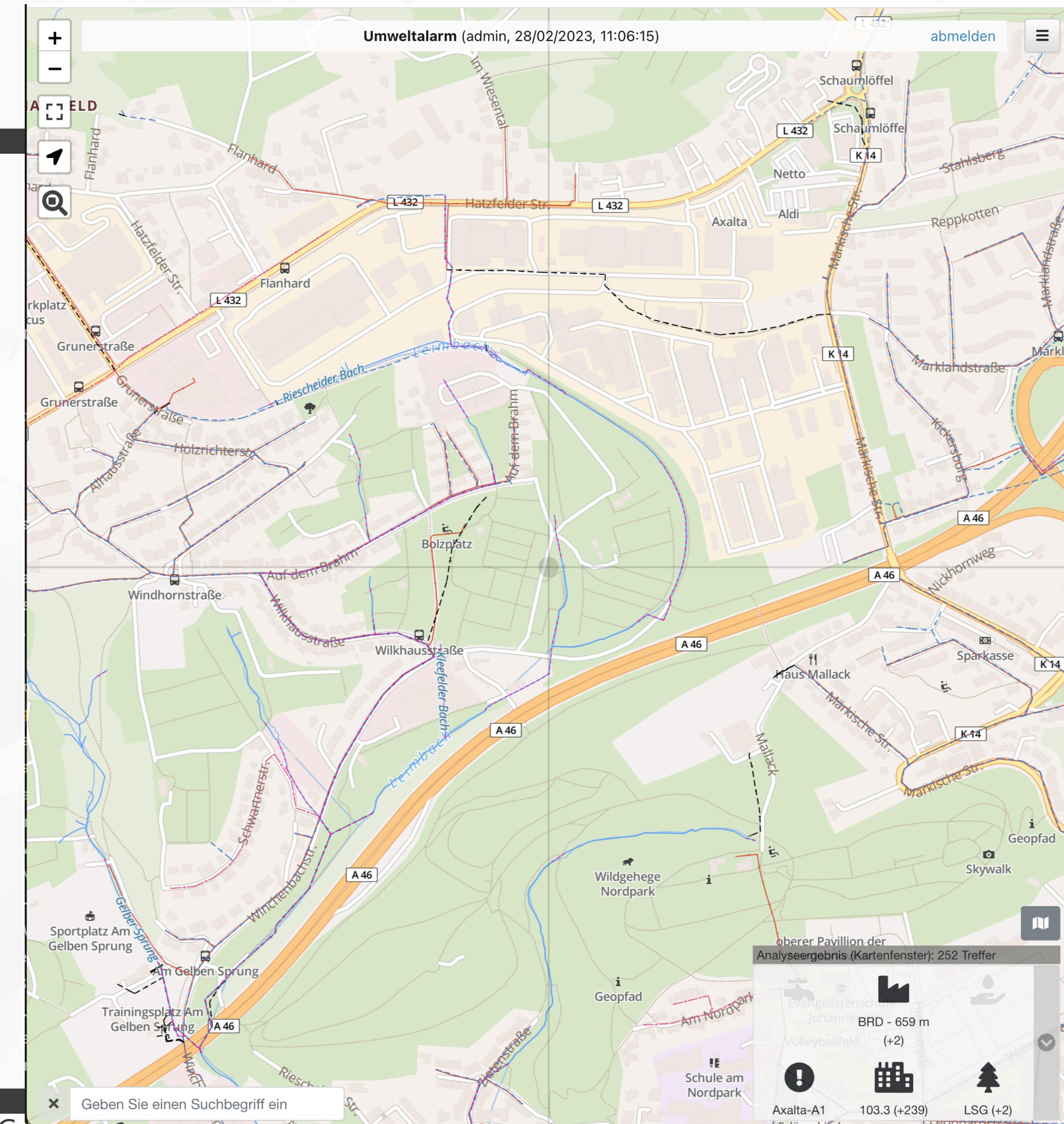
Offline Maps Recipe with PWA's

thorsten.hell@cismet.de | @hellth on the internet

... and it just works.

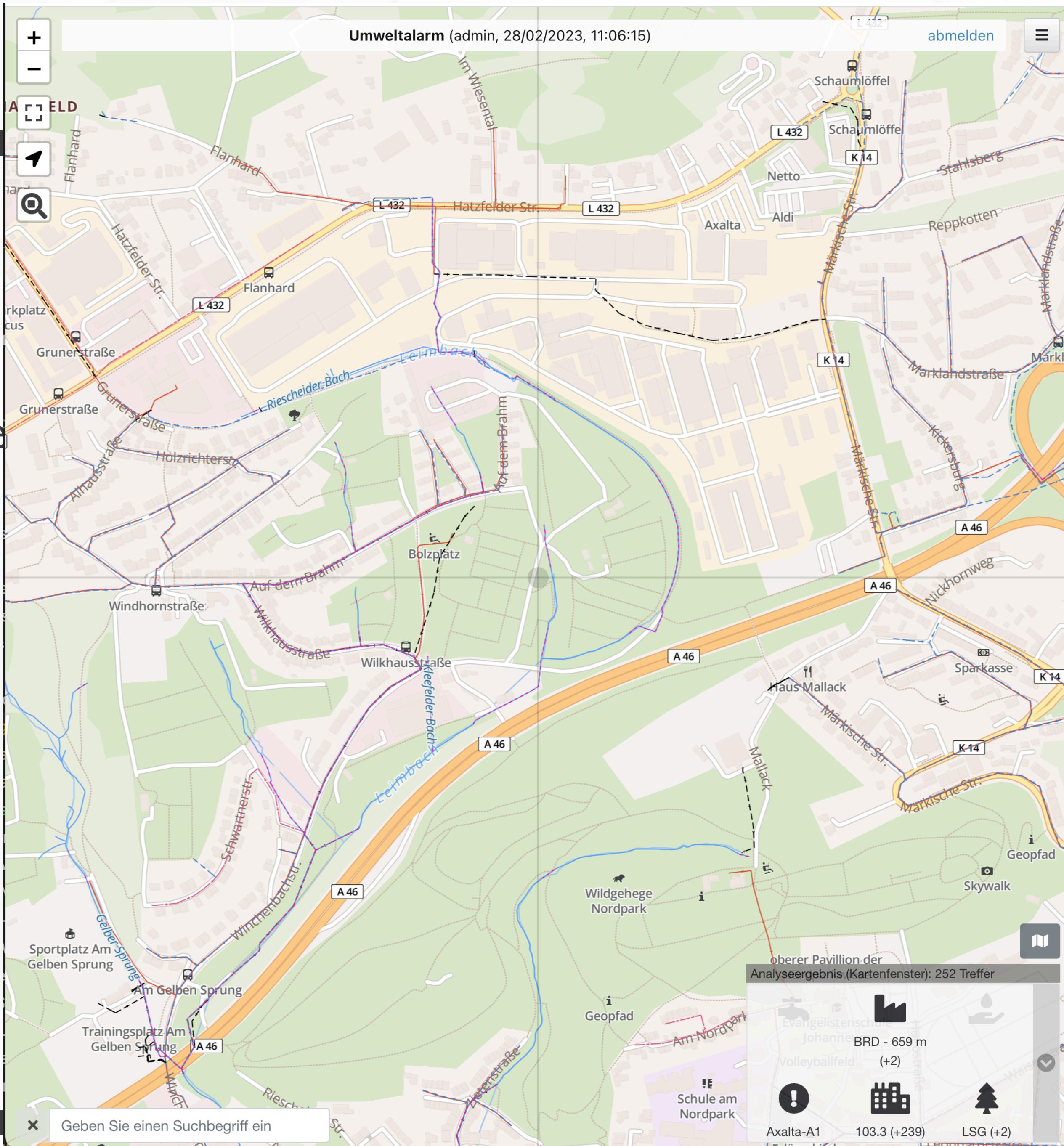
Why? / Occasion

- TopicMap for Environmental Alert Team
@ Wuppertal
- Need to work offline



Why? / Occasion

- TopicMap for Environmental Alert Team
@ Wuppertal
- Need to work offline
- Offline data is easy to achieve (indexedDB / Dexie)
- Offline App also (PWA with serviceWorker)
- Map background ???



How?

- ServiceWorker?

Listing 4.4. The `fetch` event inside a Service Worker

```
1 self.addEventListener('fetch', function(event) {  
2   if (/\.jpg$/.test(event.request.url)) {  
3     event.respondWith(  
4       fetch('/images/unicorn.jpg'));  
5   }  
6 });
```

copy

How?

- ServiceWorker?
 - Hard to debug. No real feeling of success. >>

How?

- ~~ServiceWorker?~~
- ~~Schlecht zu debuggen. Kein wirkliches Erfolgserlebnis.~~ >>

The screenshot shows a Stack Overflow question page. The question title is "Load local .mbtiles with maplibre-gl-js". It was asked 1 year, 6 months ago and modified 1 year, 2 months ago, with 1k views. The question text asks how to load a local .mbtiles file using maplibre-gl-js in a Cordova app. The code provided is:

```
maplibregl.addProtocol('mbtiles', (params, callback) => {
  console.log('I get this log.');
  // but what to do here to get local mbtiles vector tiles loaded?
});
```

The style is defined like this:

```
...
"sources": {
  "openmaptiles": {
    "type": "vector",
    "url": "mbtiles://map/data/test.mbtiles"
  }
}, ...
}
```

How?

- ~~ServiceWorker?~~
- ~~Hard to debug. No real feeling of success.~~ >>
- `maplibreGl.addProtocol`
- Sets a custom load tile function that will be called when using a source that starts with a custom url schema.
- Just what we needed \o/

MapLibre GL JS Docs

API REFERENCE ^

Map

Properties and options

Markers and controls

Geography and geometry

User interaction handlers

Sources

Events

EXAMPLES

PLUGINS

STYLE SPECIFICATION

addProtocol

src/index.ts

Sets a custom load tile function that will be called when using a source that starts with a custom url schema. The example below will be triggered for custom:// urls defined in the sources list in the style definition. The function passed will receive the request parameters and should call the callback with the resulting tile data, for example a pbf vector tile, non-compressed, represented as ArrayBuffer.

Parameters

`customProtocol` ([string](#)) the protocol to hook, for example 'custom'

`loadFn` ([Function](#)) the function to use when trying to fetch a tile specified by the customProtocol

Implementation (Step0)

- Simple MapLibre Layer in Leaflet



Path	Status	Type	Initiator	Size	T..	Waterfall
/styles/klokantech-basic/style.json	200	fetch	maplibre-gl.js:31	136 B	2...	
/data/v3.json	200	fetch	maplibre-gl.js:31	135 B	1...	
/data/v3/14/8519/5465.pbf	200	fetch	94de2ca5-59e9-4fd3-ac6e-b8a2f16...	(disk cache)	2...	
/fonts/Klokantech%20Noto%20Sans%20Regular/0-255.pbf	200	fetch	maplibre-gl.js:31	(disk cache)	2...	
/data/v3/14/8519/5464.pbf	200	fetch	94de2ca5-59e9-4fd3-ac6e-b8a2f16...	(disk cache)	4...	
/data/v3/14/8520/5464.pbf	200	fetch	94de2ca5-59e9-4fd3-ac6e-b8a2f16...	(disk cache)	170 kB	1...
/data/v3/14/8520/5465.pbf	200	fetch	94de2ca5-59e9-4fd3-ac6e-b8a2f16...	(disk cache)	3...	
/data/v3/14/8520/5466.pbf	200	fetch	94de2ca5-59e9-4fd3-ac6e-b8a2f16...	(disk cache)	4...	
/data/v3/14/8519/5465.pbf	200	fetch	94de2ca5-59e9-4fd3-ac6e-b8a2f16...	(disk cache)	5...	
/data/v3/14/8520/5464.pbf	200	fetch	94de2ca5-59e9-4fd3-ac6e-b8a2f16...	(disk cache)	6...	
/data/v3/14/8519/5464.pbf	200	fetch	94de2ca5-59e9-4fd3-ac6e-b8a2f16...	(disk cache)	5...	
/data/v3/14/8519/5464.pbf	200	fetch	94de2ca5-59e9-4fd3-ac6e-b8a2f16...	(disk cache)	3...	
/data/v3/14/8521/5465.pbf	200	fetch	94de2ca5-59e9-4fd3-ac6e-b8a2f16...	(disk cache)	6...	
/data/v3/14/8521/5464.pbf	200	fetch	94de2ca5-59e9-4fd3-ac6e-b8a2f16...	(disk cache)	6...	
/data/v3/14/8520/5464.pbf	200	fetch	94de2ca5-59e9-4fd3-ac6e-b8a2f16...	(disk cache)	6...	
/data/v3/14/8519/5465.pbf	200	fetch	94de2ca5-59e9-4fd3-ac6e-b8a2f16...	(disk cache)	6...	
/data/v3/14/8520/5465.pbf	200	fetch	94de2ca5-59e9-4fd3-ac6e-b8a2f16...	(disk cache)	6...	
/data/v3/14/8521/5464.pbf	200	fetch	94de2ca5-59e9-4fd3-ac6e-b8a2f16...	(disk cache)	1...	
/data/v3/14/8519/5464.pbf	200	fetch	94de2ca5-59e9-4fd3-ac6e-b8a2f16...	(disk cache)	8...	

33 / 49 requests | 170 kB / 3.3 MB transferred | 6.3 MB / 24.8 MB resources | Finish: 50.18 s | DOMContentLoaded: 615 ms | Load: 623 ms

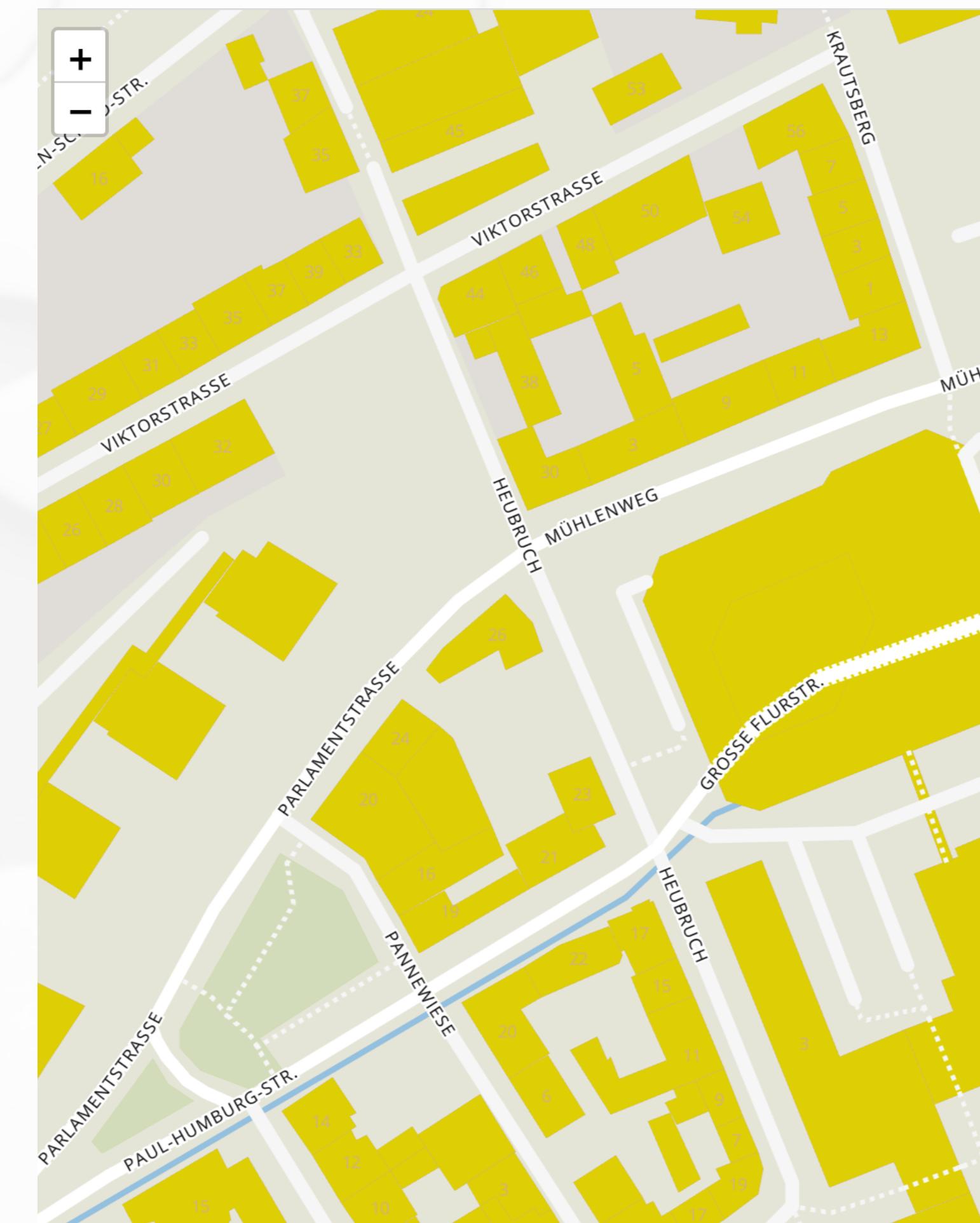
Implementation (Step1)

- Simple MapLibre Layer with local VectorStyle Object

```
import vectorStyle from "./style";

layerConf.layers[12].paint = {
  ...layerConf.layers[12].paint,
  "fill-color": "rgba(222, 211, 0, 1)",
};

<Map style={mapStyle} center={position} zoom={18} maxZoom={25}>
  <MapLibreLayer style={layerConf} />
</Map>
```



Implementation (Step2)

- Simple MapLibre Layer with local VectorStyle Object

```
import vectorStyle from "./style";

const layerConf = JSON.parse(JSON.stringify(vectorStyle));
layerConf.glyphs = "custom://" + layerConf.glyphs;
layerConf.sources.openmaptiles.tiles[0] =
  "custom://" + layerConf.sources.openmaptiles.tiles[0];

<Map style={mapStyle} center={position} zoom={18} maxZoom={25}>
  <MapLibreLayer style={layerConf} />
</Map>
```

```
Line 6:4:  'Link' is defined but never used  no-unused-vars
✖ ►Fetch API cannot load custom://https://omt.map-hosting.de/data/v3/14/8519/54
  not supported.

✖ ►►Error {message: 'Failed to fetch'} ⓘ
  message: "Failed to fetch"
  ► [[Prototype]]: Object

✖ ►Fetch API cannot load custom://https://omt.map-hosting.de/data/v3/14/8519/54
  not supported.

✖ ►►Error {message: 'Failed to fetch'}
✖ ►Fetch API cannot load custom://https://omt.map-hosting.de/data/v3/14/8519/54
  not supported.

✖ ►►Error {message: 'Failed to fetch'}
✖ ►Fetch API cannot load custom://https://omt.map-hosting.de/data/v3/14/8519/54
  not supported.

✖ ►►Error {message: 'Failed to fetch'}
✖ ►Fetch API cannot load custom://https://omt.map-hosting.de/data/v3/13/4259/27
  not supported.

✖ ►►Error {message: 'Failed to fetch'}
✖ ►Fetch API cannot load custom://https://omt.map-hosting.de/data/v3/12/2129/13
  not supported.

✖ ►►Error {message: 'Failed to fetch'}
✖ ►Fetch API cannot load custom://https://omt.map-hosting.de/data/v3/11/1064/68
  not supported.

✖ ►►Error {message: 'Failed to fetch'}
✖ ►Fetch API cannot load custom://https://omt.map-hosting.de/data/v3/10/532/34
  not supported.

✖ ►►Error {message: 'Failed to fetch'}
✖ ►Fetch API cannot load custom://https://omt.map-hosting.de/data/v3/9/266/170
  not supported.

✖ ►►Error {message: 'Failed to fetch'}
✖ ►Fetch API cannot load custom://https://omt.map-hosting.de/data/v3/8/133/85
  not supported.

✖ ►►Error {message: 'Failed to fetch'}
✖ ►Fetch API cannot load custom://https://omt.map-hosting.de/data/v3/7/66/42.p
  not supported.

✖ ►►Error {message: 'Failed to fetch'}
✖ ►Fetch API cannot load custom://https://omt.map-hosting.de/data/v3/14/8520/54
  not supported.

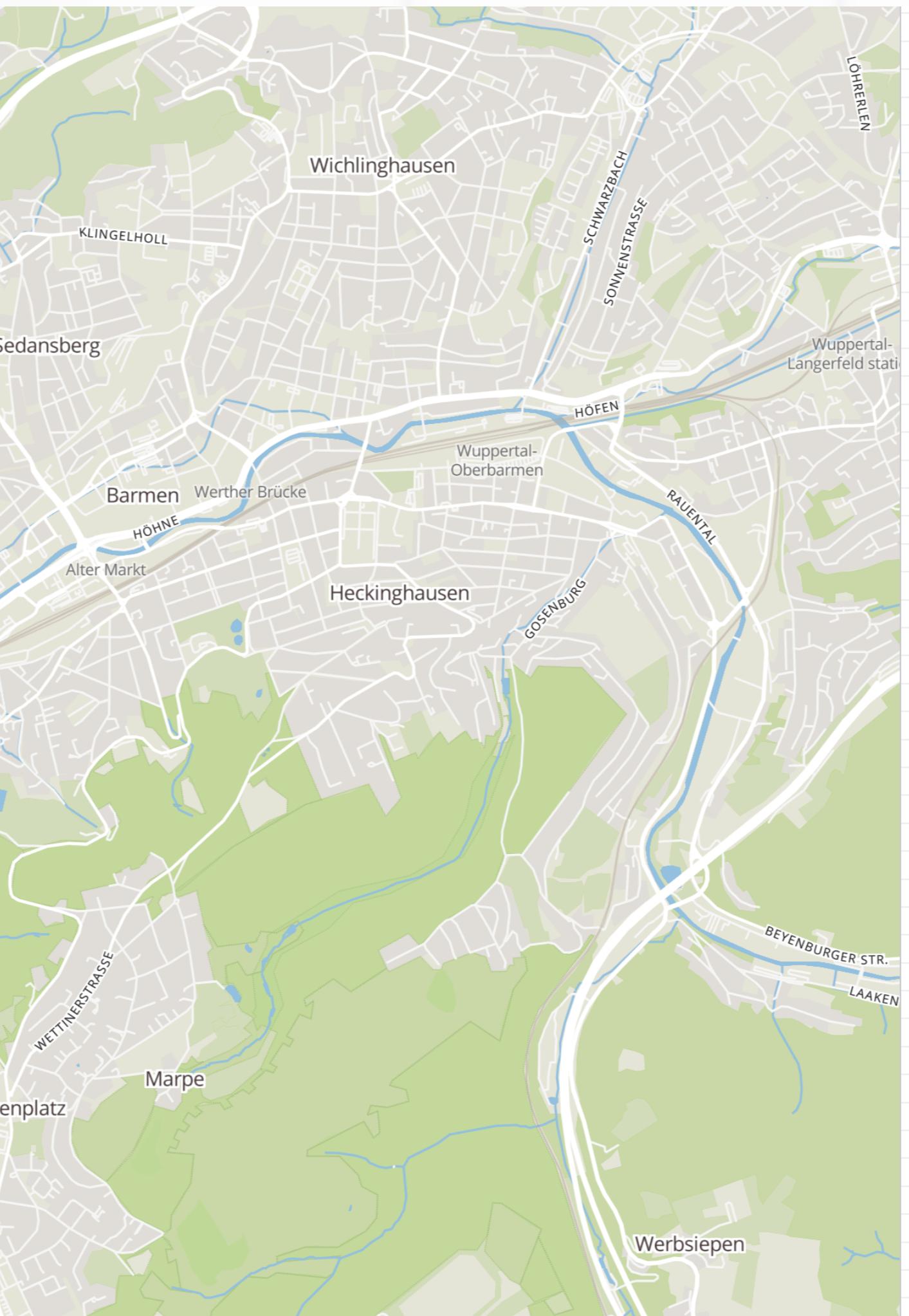
✖ ►►Error {message: 'Failed to fetch'}
✖ ►Fetch API cannot load custom://https://omt.map-hosting.de/data/v3/14/8520/54
  not supported.

✖ ►►Error {message: 'Failed to fetch'}
✖ ►Fetch API cannot load custom://https://omt.map-hosting.de/data/v3/14/8520/54
  not supported.
```

Implementation (Step3)

- Intercepting with addProtocol

```
useEffect(() => {
  const fetchOnline = (url, callback) => {
    fetch(url)
      .then((res) => res.arrayBuffer())
      .then((buf) => {
        console.log("fetched arrayBuffer", buf);
        callback(null, buf, null, null);
      });
  };
  maplibreGl.addProtocol("custom", (params, callback) => {
    console.log("custom protocol interception", params.url);
    let url = params.url.replace("custom://", "");
    fetchOnline(url, callback);
  });
});
```



Vorbereitung (Step4)

- Loading the prepared data (w.zip ~30MB) to the indexedDB

```
const offlineConfig = {
  dataStores: [
    {
      name: "Vektorkarte für Wuppertal",
      key: "WuppBasemap",
      url: "w.zip",
    },
  ],
  consoleDebug: true,
};

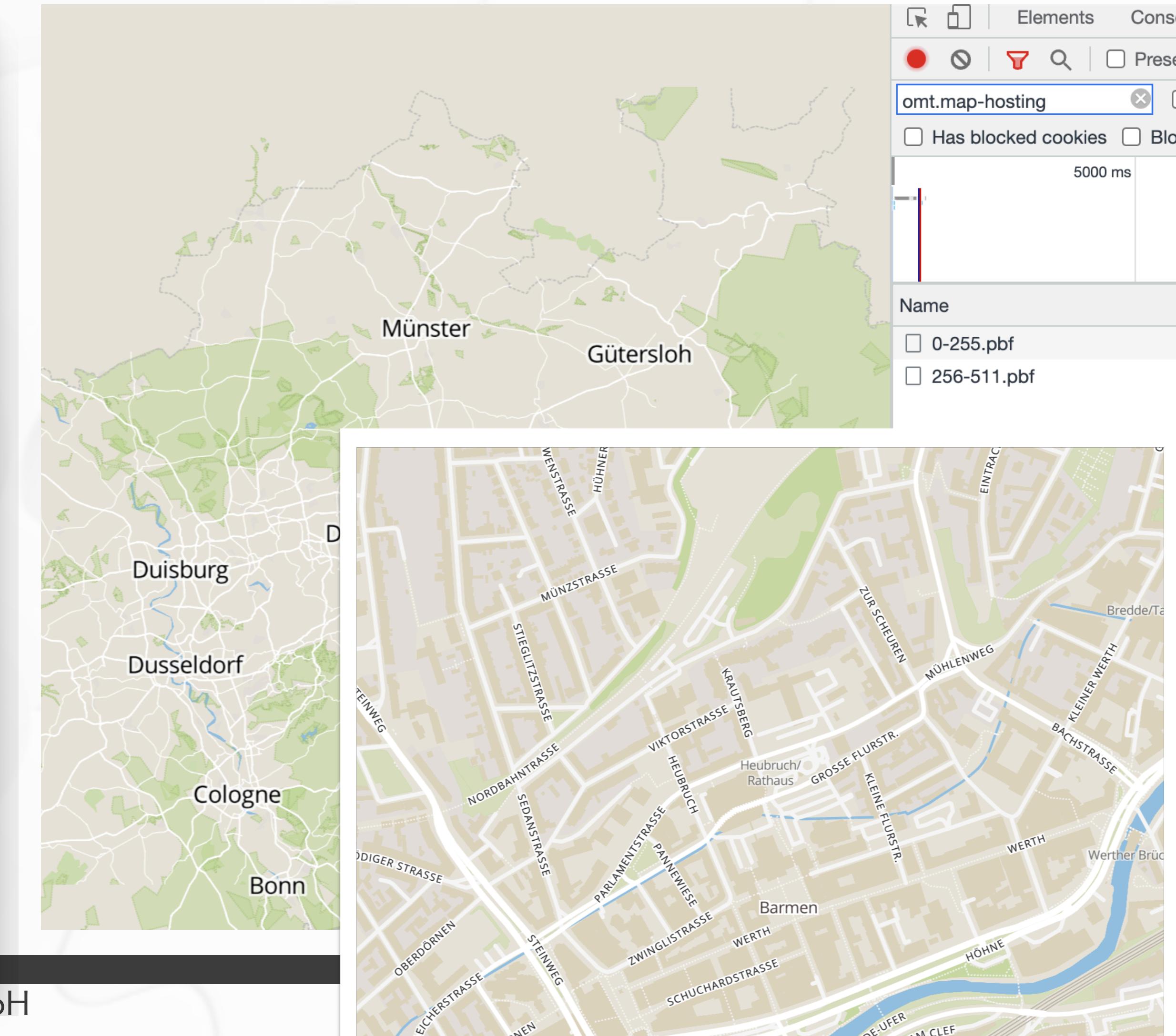
useEffect(() => {
  loadAndCacheOfflineMapData(offlineConfig, (key, info) => {
    console.log("loadAndCacheOfflineMapData", key, info);
  });
}
```

Application		
#	Key (Key path: "key")	Value
0	"md5.wuppBasemap"	► {key: 'md5.wuppBasemap', value: 'cc59af2bf4a18ee0c074f62963f3c83'}
1	"tiles/10/531/340.pbf"	► {key: 'tiles/10/531/340.pbf', value: Uint8Array(588)}
2	"tiles/10/531/341.pbf"	► {key: 'tiles/10/531/341.pbf', value: Uint8Array(12668)}
3	"tiles/10/531/342.pbf"	► {key: 'tiles/10/531/342.pbf', value: Uint8Array(6470)}
4	"tiles/10/532/340.pbf"	► {key: 'tiles/10/532/340.pbf', value: Uint8Array(4594)}
5	"tiles/10/532/341.pbf"	► {key: 'tiles/10/532/341.pbf', value: Uint8Array(195410)}
6	"tiles/10/532/342.pbf"	► {key: 'tiles/10/532/342.pbf', value: Uint8Array(44303)}
7	"tiles/10/533/340.pbf"	► {key: 'tiles/10/533/340.pbf', value: Uint8Array(753)}
8	"tiles/10/533/341.pbf"	► {key: 'tiles/10/533/341.pbf', value: Uint8Array(9889)}
9	"tiles/10/533/342.pbf"	► {key: 'tiles/10/533/342.pbf', value: Uint8Array(3644)}
10	"tiles/11/1063/681.pbf"	► {key: 'tiles/11/1063/681.pbf', value: Uint8Array(875)}
11	"tiles/11/1063/682.pbf"	► {key: 'tiles/11/1063/682.pbf', value: Uint8Array(17402)}
12	"tiles/11/1063/683.pbf"	► {key: 'tiles/11/1063/683.pbf', value: Uint8Array(15337)}
13	"tiles/11/1063/684.pbf"	► {key: 'tiles/11/1063/684.pbf', value: Uint8Array(16888)}
14	"tiles/11/1064/681.pbf"	► {key: 'tiles/11/1064/681.pbf', value: Uint8Array(6283)}
15	"tiles/11/1064/682.pbf"	► {key: 'tiles/11/1064/682.pbf', value: Uint8Array(104606)}
16	"tiles/11/1064/683.pbf"	► {key: 'tiles/11/1064/683.pbf', value: Uint8Array(153720)}
17	"tiles/11/1064/684.pbf"	► {key: 'tiles/11/1064/684.pbf', value: Uint8Array(58311)}
18	"tiles/11/1065/681.pbf"	► {key: 'tiles/11/1065/681.pbf', value: Uint8Array(4673)}
19	"tiles/11/1065/682.pbf"	► {key: 'tiles/11/1065/682.pbf', value: Uint8Array(114381)}
20	"tiles/11/1065/683.pbf"	► {key: 'tiles/11/1065/683.pbf', value: Uint8Array(108312)}
21	"tiles/11/1065/684.pbf"	► {key: 'tiles/11/1065/684.pbf', value: Uint8Array(59820)}
22	"tiles/11/1066/681.pbf"	► {key: 'tiles/11/1066/681.pbf', value: Uint8Array(719)}
23	"tiles/11/1066/682.pbf"	► {key: 'tiles/11/1066/682.pbf', value: Uint8Array(15518)}
24	"tiles/11/1066/683.pbf"	► {key: 'tiles/11/1066/683.pbf', value: Uint8Array(11332)}
25	"tiles/11/1066/684.pbf"	► {key: 'tiles/11/1066/684.pbf', value: Uint8Array(6562)}
26	"tiles/12/2127/1363.pbf"	► {key: 'tiles/12/2127/1363.pbf', value: Uint8Array(1720)}
27	"tiles/12/2127/1364.pbf"	► {key: 'tiles/12/2127/1364.pbf', value: Uint8Array(34694)}
28	"tiles/12/2127/1365.pbf"	► {key: 'tiles/12/2127/1365.pbf', value: Uint8Array(25445)}
29	"tiles/12/2127/1366.pbf"	► {key: 'tiles/12/2127/1366.pbf', value: Uint8Array(18871)}
30	"tiles/12/2127/1367.pbf"	► {key: 'tiles/12/2127/1367.pbf', value: Uint8Array(35647)}

Implementation (Step4)

- Intercepting and loading the tiles from the indexedDB (Dexie.js)

```
useEffect(() => {
  loadAndCacheOfflineMapData(offlineConfig, (key, info) => {
    console.log("loadAndCacheOfflineMapData", key, info);
  });
  ...
  maplibreGl.addProtocol("indexedDB", (params, callback) => {
    let url = params.url.replace("indexedDB://", "");
    console.log("indexeddb protocol interception", url);
    //Just do the tiles for now (starting with "https://omt.map-hosting.de/data/v3/")
    if (url.startsWith("https://omt.map-hosting.de/data/v3/")) {
      const dbKey = url.replace(
        "https://omt.map-hosting.de/data/v3/",
        "tiles/"
      );
      // local anonymous async block ---
      (async () => {
        const hit = await db[OBJECTSTORE].get(dbKey);
        if (hit) {
          callback(null, hit.value.buffer, null, null);
        }
      })();
      // -----
    } else {
      fetchOnline(url, callback);
    }
  });
});
```



Implementation (Step5)

- ... fetchOnline if nothing is found

```
...  
  
// local anonymous async block ---  
  (async () => {  
    const hit = await db[OBJECTSTORE].get(dbKey);  
    if (hit) {  
      callback(null, hit.value.buffer, null, null);  
    } else {  
      fetchOnline(url, callback);  
    }  
  })();  
// -----
```

Implementation (Step6)

- offlineFetch with helper Function (evaluates ruleset)

```
const offlineConfig = {
  dataStores: [
    {
      name: "Vektorkarte für Wuppertal",
      key: "wuppBasemap",
      url: "w.zip",
    },
  ],
  consoleDebug: true,
  rules: [
    {
      origin: "https://omt.map-hosting.de/fonts/Klokantech Noto",
      cachePath: "fonts/Open",
      realServerFallback: false,
    },
    {
      origin: "https://omt.map-hosting.de/fonts",
      cachePath: "fonts",
      realServerFallback: false,
    },
    {
      origin: "https://omt.map-hosting.de/data/v3",
      cachePath: "tiles",
      realServerFallback: false,
    },
  ],
};
```

```
maplibreGl.addProtocol("indexedDB", (params, callback) => {
  let url = params.url.replace("indexedDB://", "");
  console.log("indexeddb protocol interception", url);
  customOfflineFetch(url, offlineConfig).then((buffer) => {
    if (buffer) {
      callback(null, buffer, null, null);
    } else {
      callback(null, new ArrayBuffer(), null, null);
    }
  });
});
```

Implementation (Step7)

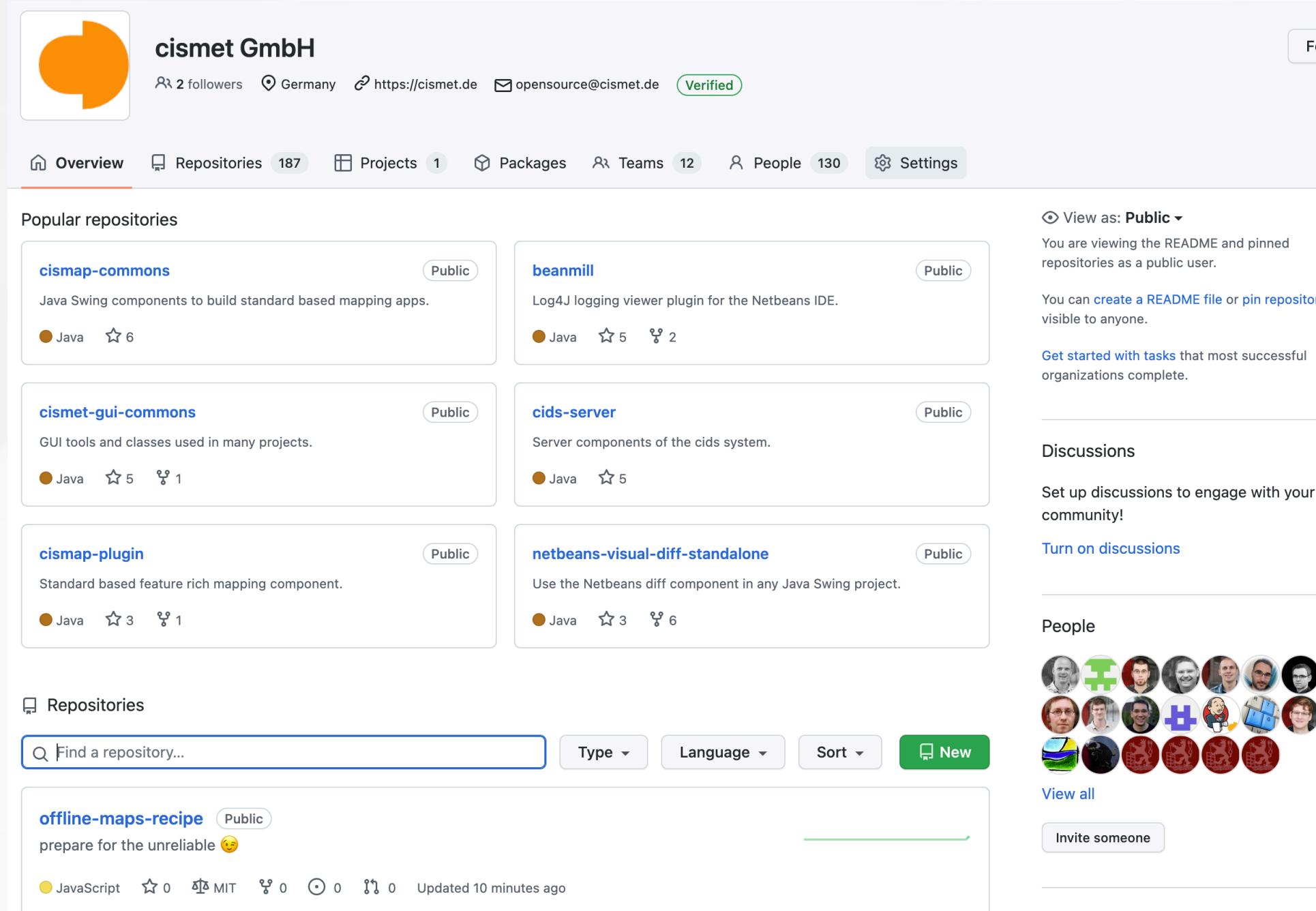
- realServerFallback: true

```
const offlineConfig = {
  dataStores: [
    {
      name: "Vektorkarte für Wuppertal",
      key: "wuppBasemap",
      url: "w.zip",
    },
  ],
  consoleDebug: true,
  rules: [
    {
      origin: "https://omt.map-hosting.de/fonts/Klokantech Noto",
      cachePath: "fonts/Open",
      realServerFallback: true,
    },
    {
      origin: "https://omt.map-hosting.de/fonts",
      cachePath: "fonts",
      realServerFallback: true,
    },
    {
      origin: "https://omt.map-hosting.de/data/v3",
      cachePath: "tiles",
      realServerFallback: true,
    },
  ],
};
```

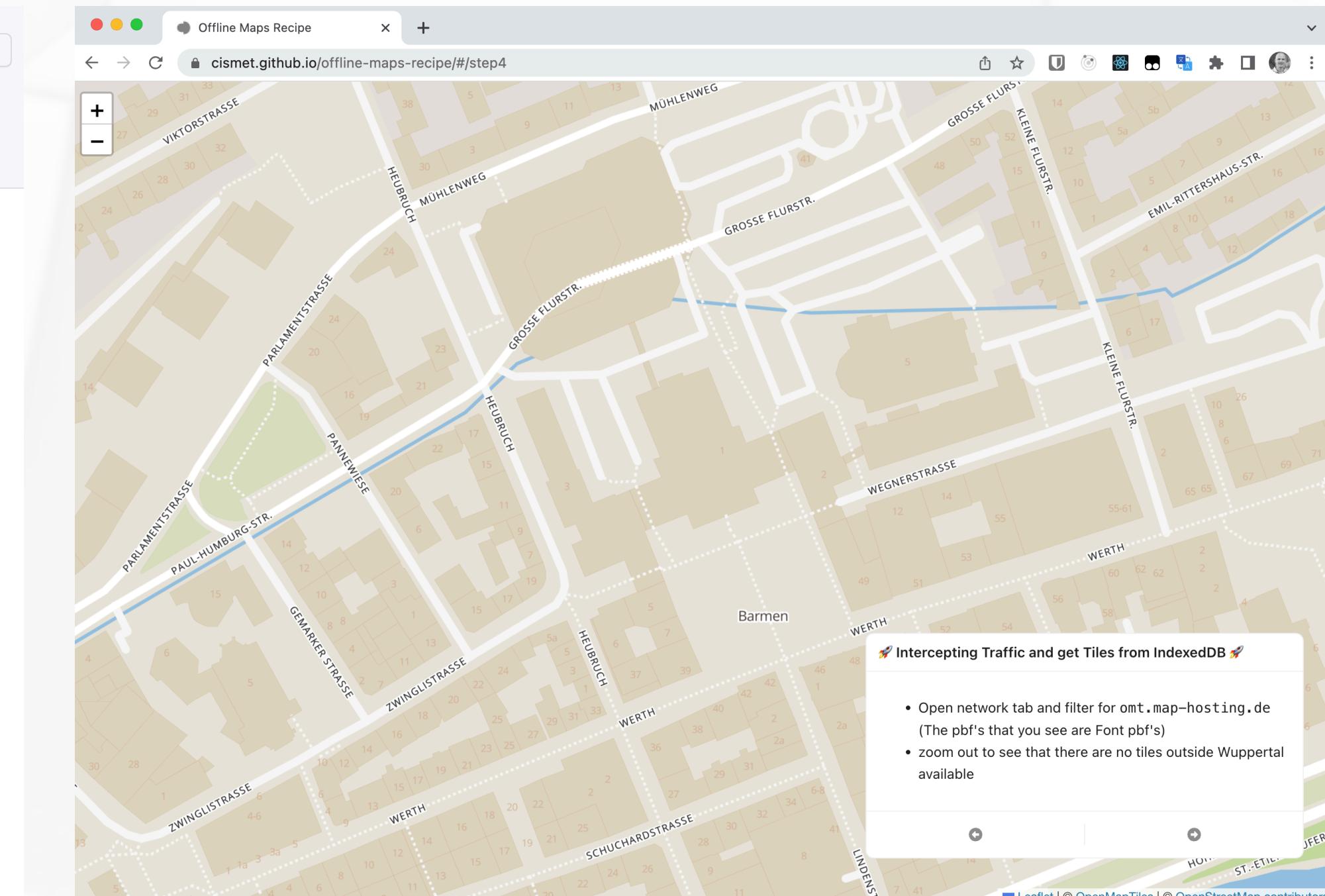
```
maplibreGl.addProtocol("indexedDB", (params, callback) => {
  let url = params.url.replace("indexedDB://", "");
  console.log("indexeddb protocol interception", url);
  customOfflineFetch(url, offlineConfig).then((buffer) => {
    if (buffer) {
      callback(null, buffer, null, null);
    } else {
      callback(null, new ArrayBuffer(), null, null);
    }
  });
});
```

Demoprojekt

- GitHub Project: <https://github.com/cismet/offline-maps-recipe> 
- Running instance: <https://cismet.github.io/offline-maps-recipe>



The screenshot shows the GitHub organization page for cismet GmbH. It features a header with the organization's logo, name, and basic statistics. Below this, there are sections for 'Popular repositories' and 'Repositories'. The 'Popular repositories' section displays six repositories: cismap-commons, beanmill, cismet-gui-commons, cids-server, cismap-plugin, and netbeans-visual-diff-standalone. The 'Repositories' section includes a search bar and a table with columns for repository name, type, language, and last update. The 'offline-maps-recipe' repository is listed in this section.



- What's missing
 - PWA Setup
- Sprites through ServiceWorker prefetching (doesn't work with addProtocol) 

If you have any questions about the topic or ...



Vielen Dank

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...are interested in an exciting job 😊 just get in touch!



OpenSource GIS Development

Leaflet

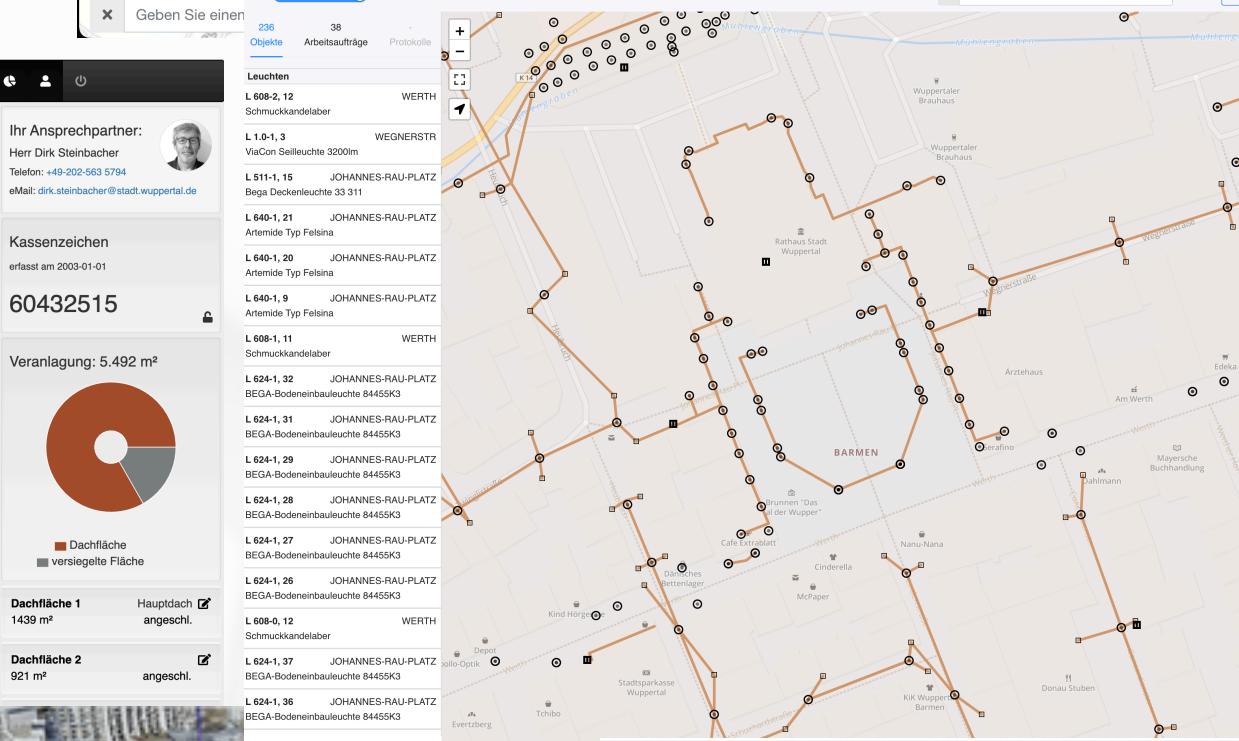
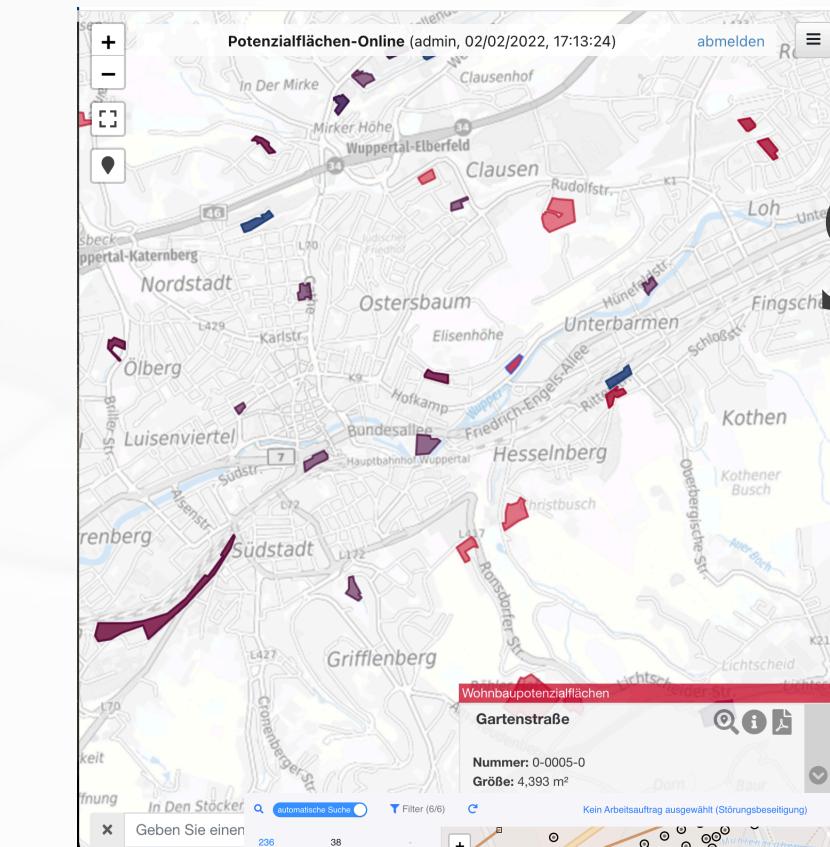
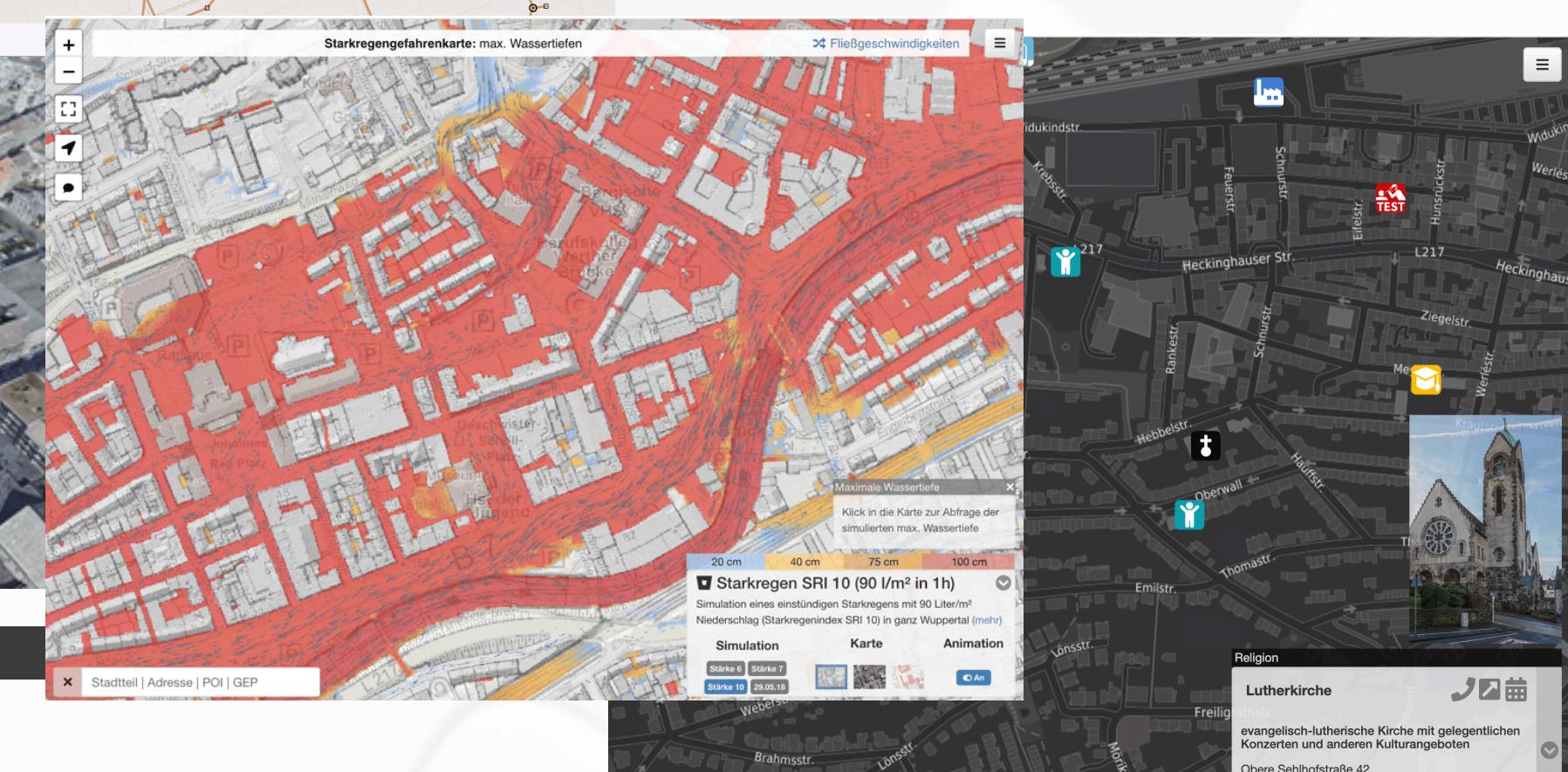
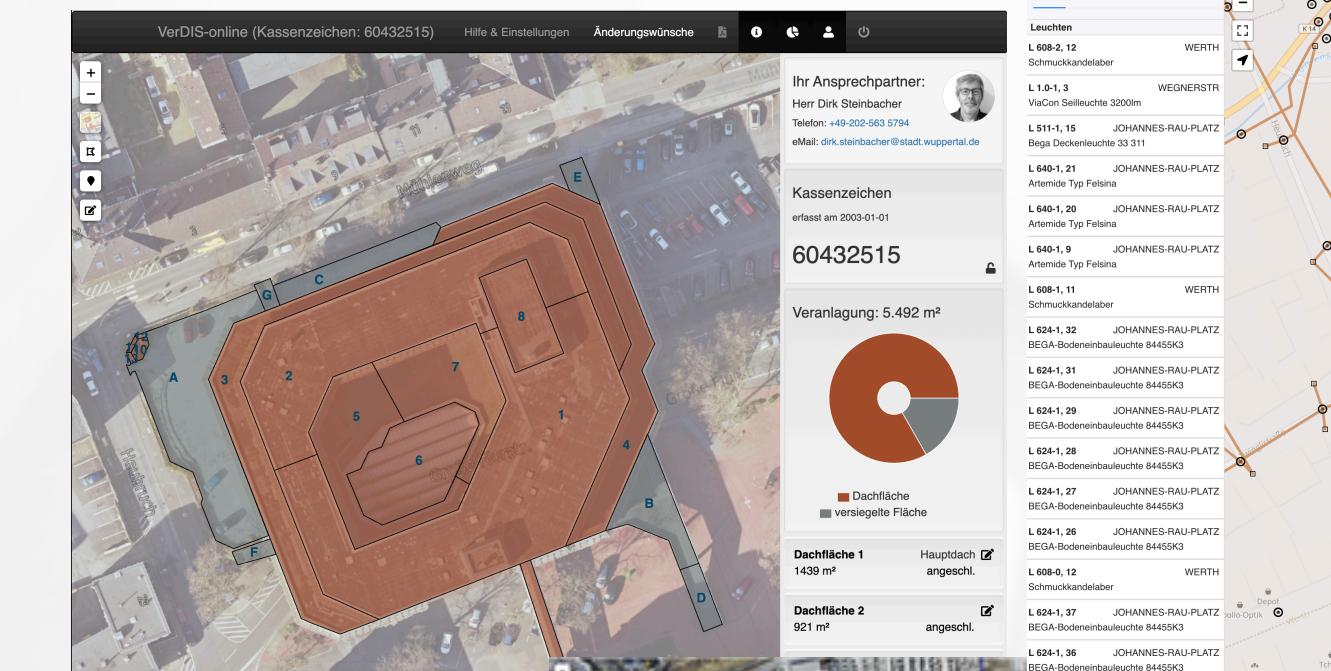
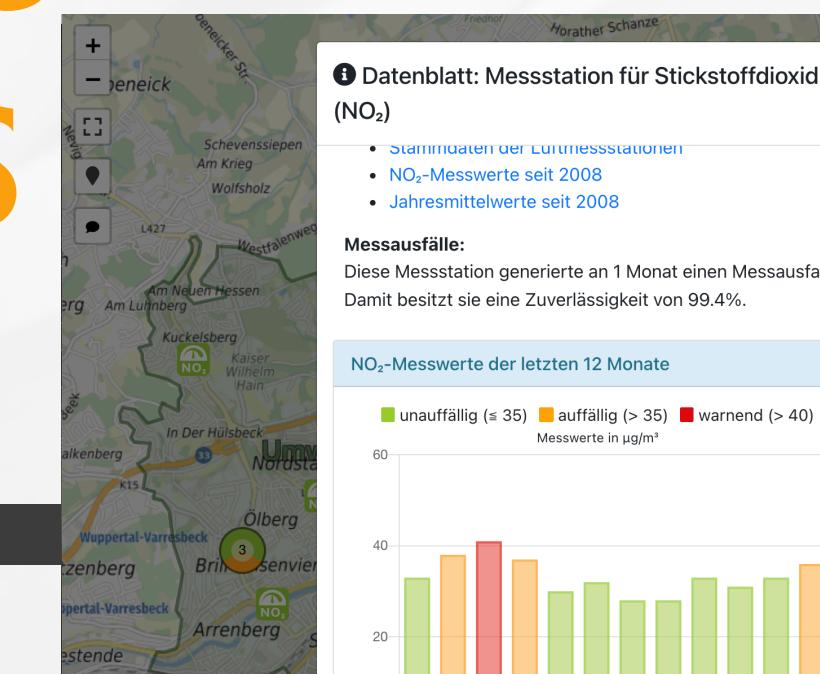
MapLibre

Docker React

100% Remote

CesiumJS

PostGIS



Student / Geek / Nerd
Fachinformatiker
Bachelor / Master
Teams

And it just works ...



Thank you

cismet GmbH

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Create Offline Package

- Download osm.pbf
- Create mbtiles (Openmaptiles or Tilemaker)
- unpack (mb-util)
- Unzip the single pbf's
- Add fonts
- Zip it up
- Calculate md5 and write it to accompanying file