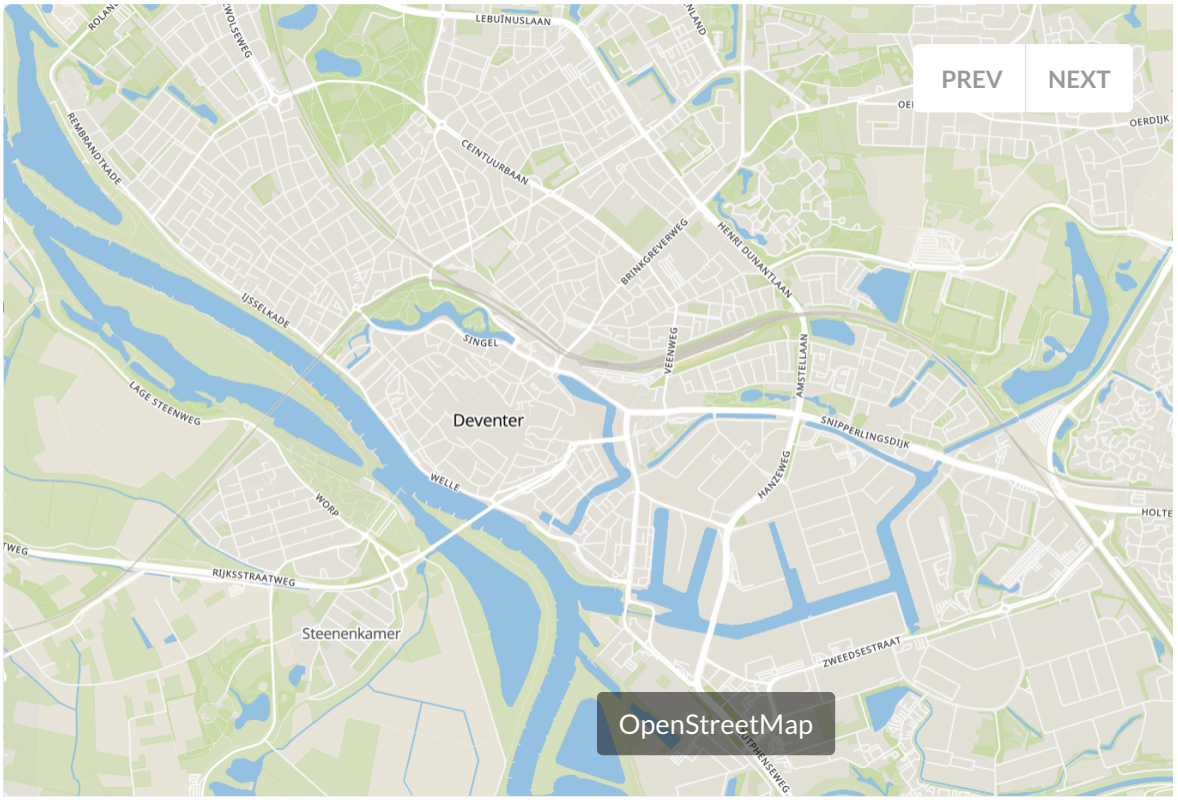


Generating self-hosted maps using tilemaker

MARCH 18TH AT 2:55PM / WOUTER VAN KLEUNEN / OPENSTREETMAP

For some web applications is required to add a map to a website. When this is required, many web developers immediately turn to online services hosting the web page. However, for many applications this is not required. It is actually quite easy to generate maps yourself and host them from your own webspace. Using freely available data from OpenStreetmap and using open-source tools it is possible to add beautiful vector graphics maps to your website/webappli-

cation.

In this post I would like to explain how maps can be generated from openstreetmap using tilemaker. This is mostly suited for hosting regional exports, hosting the complete planet still requires significant amounts of storage (60G).

The openstreetmap data we will be using in this tutorial is:

- Openstreetmap data from the Planet
- Openstreetmap region from GeoFabrik.
- Coastline data from OSMData

And the openstreetmap tools:

- GeoFabrik Calc
- Osmium-tool
- OSMConvert
- Tilemaker
- Tileserver-php

Finally for the frontend:

- MapLibre
- Klokantech GL fonts
- OpenMapTiles styles

The steps required to add an openstreetmap vector to your map are as follows:

- Create a regional export of the openstreetmap data for the region you want to add to your page
- Generate the tiles from the regional openstreetmap extract
- Install the tileserver-php to host the tiles on your server
- Create the html page that displays the tiles using maplibre gl js

Please note that creating large maps (country size) reguires significant memory to generate the map (8 to 16G).

Creating a regional export

First step we need to do is create an export of the region we would like to host. It is possible to download the complete openstreetmap of the full planet here: Planet OSM.

This file is quite big (around 60G) and will take some time to download and to process. It is possible to get pregenerated exports from here: GeoFabrik.

Even country extracts are available on this website. This can reduce the processing time and downloading time significantly. Note however, that if we would like to export a region (for example Netherlands), we would actually like a rectangular export. So we would like to include also some parts around the border. The exports from geofabrik are extracted around the borders of the country and bordering countries will appear as gray areas if we bound the map to a rectangular area.

So we decided we would like to export a country, for example Netherlands. We can create a nice rectangular cut-out from a larger region (for example Europe) and generate this. The extract (cut-out) we can create with a tool called osmium. So we download the Europe area first from GeoFabrik, and the next step is to determine the bounding box of the region we would like to extract.

GeoFabrik has a nice tool available to determine the bounding box, it is available from here: GeoFabrik Calc. Using this tool I select a rectangle around The Netherlands, and the lat/lon coordinates of this bounding box are available from the 'Coordinate Display' tab, from the field 'Simple Copy'. The bounding I have selected is: 2.68 50.72 7.55 54.12

On Ubuntu I can now install the osmium tool using:

```
sudo apt-get install osmium-tool
```

or on MacOS:

```
brew install osmium-tool
```

To create the regional export run:

```
osmium extract --bbox=2.68,50.72,7.55,54.12 --set-bounds --
strategy=smart europe-latest.osm.pbf  --output netherlands.osm.pbf
```

For Windows you can use the OSMConvert tool:

```
osmconvert europe-latest.osm.pbf -b=2.68,50.72,7.55,54.12 --complete-
ways -o=netherlands.osm.pbf
```

It takes some time and memory, but after this, you will have a nice rectangular extract of the region you would like to host.

Generating tiles from the extract

Next step we want to do is generating the vector tiles from the regional extract. For this we will be using Tilemaker. It is possible to build this project yourself, but precompiled binaries are available here.

Download and extract the file:

```
wget https://www.kleunen.nl/tilemaker-tutorial/tilemaker.tar.gz
tar xvzf tilemaker.tar.gz
```

We also need data from international waters and coastlines:

```
wget https://osmdata.openstreetmap.de/download/water-polygons-
split-4326.zip
unzip water-polygons-split-4326.zip
```

You can now start generating the map using tilemaker:

```
./linux/tilemaker --input netherlands.osm.pbf --output nether-
lands.mbtiles --process resources/process-openmaptiles.lua --config re-
sources/config-openmaptiles.json
```

Based on the size of the extract, this can take from several minutes to several hours and may use significant memory, up to many gigabytes. Start therefore with a small region export. When the conversion is finished, tilemaker will say:

```
Filled the tileset with good things at netherlands.mbtiles
```

We are now ready to start hosting these tiles.

Hosting the tiles

For hosting the tiles we need a webserver with php enabled. Also, the php should have sqlite enabled, the mbtiles files is a sqlite database file which will be opened by our tileserver. For hosting the map, we will be using Tileserver-php. Clone this repository with git on your webserver:

```
cd /var/www/html
git clone  https://github.com/maptiler/tileserver-php
```

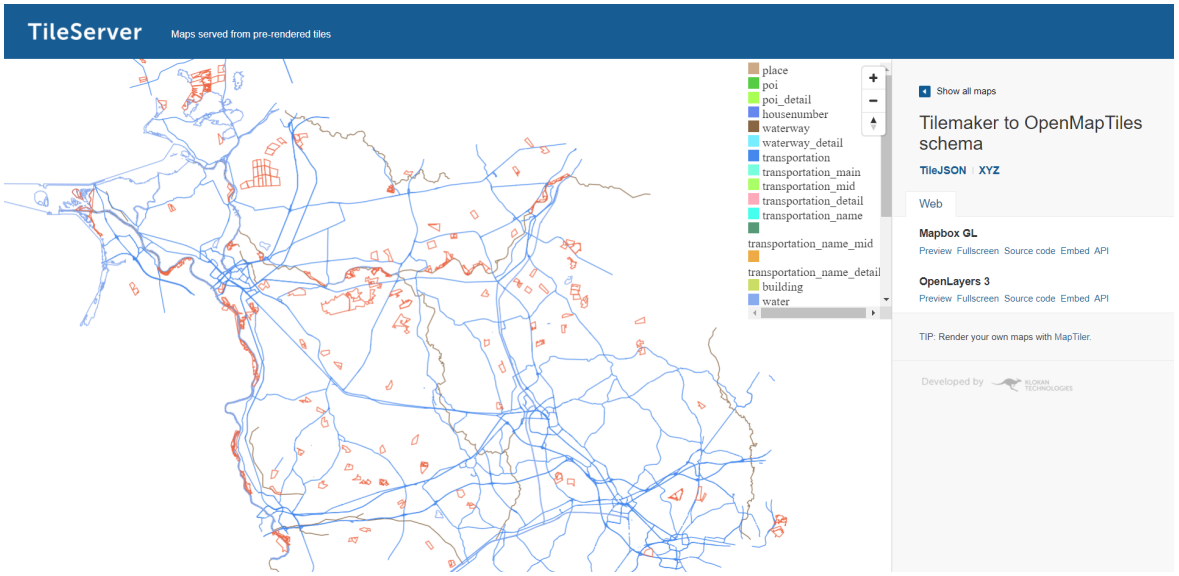
Copy the mbtiles file into the directory of tileserver-php:

```
cp netherlands.mbtiles /var/www/html/tileserver-php
```

If you use the apache webserver, all things are set now. If you use nginx, you need to add url rewriting rules to the nginx configuration:

```
location /tileserver-php/ {
    try_files $uri /tileserver-php/tileserver.php$is_args$args;
}
```

If all things went correctly, you can open the url to tileserver-php and see your map.



Display the page on your website

Now we are ready to use the generated tiles on our own website. For this, we will be using the Mapbox GL JS library together with a style from OpenMapTiles

Create a small webpage displaying the map:

```
<!DOCTYPE html>
<html>
<head>
<meta charset="utf-8" />
<title>Display a map on a webpage</title>
<meta name="viewport" content="initial-scale=1,maximum-scale=1,user-
scalable=no" />
<script src="https://cdn.maptiler.com/maplibre-gl-js/v1.13.0-rc.4/
mapbox-gl.js"></script>
<link href="https://cdn.maptiler.com/maplibre-gl-js/v1.13.0-rc.4/mapbox-
gl.css" rel="stylesheet" />
<style>
    body { margin: 0; padding: 0; }
    #map { position: absolute; top: 0; bottom: 0; width: 100%; }
</style>
</head>
<body>
<div id="map"></div>

<script>
var bounds = [ [2.68, 50.72], [7.55, 54.12] ];

mapboxgl.accessToken =
'pk.eyJ1Ijoid2tsZXVuZW4iLCJhIjoiY2lvYndseWF4MDA1NXZqbTVsNzI1cTZxZSJ9.Oia
ID7onSRgGBWRwmgOZqQ';
var map = new mapboxgl.Map({
  container: 'map',
  center: [ (bounds[0][0] + bounds[1][0]) / 2, (bounds[0][1] + bounds[1]
[1]) / 2],
  zoom: 9,
  minZoom: 5,
  style: 'netherlands_style.json',
  maxBounds: bounds
});

map.addControl(new mapboxgl.NavigationControl());
```

```
</script>
</body>
</html>
```

You also need to install the netherlands_style.json file. You can download it from this blog or use another style from OpenMapTiles.

Inside this file you need to edit two URLs to point to your tileserver. The name 'netherlands.json' corresponds with the file 'netherlands.mbtiles'.

```
"sources": {
  "openmaptiles": {
    "type": "vector",
     "url": "https://www.kleunen.nl/tileserver-php/netherlands.json"
  }
},
"glyphs": "https://www.kleunen.nl/fonts/{fontstack}/{range}.pbf"
```

And you need to install the fonts onto your server:

```
git clone https://github.com/klokantech/klokantech-gl-fonts fonts
ln -sf 'KlokanTech Noto Sans Bold' fonts/Bold
ln -sf 'KlokanTech Noto Sans Regular' fonts/Regular
```

If all is well, you should see now your own hosted map. Read further here to learn how to improve hosting speed.

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Leonard Ehrenfried
0 points · 23 months ago

That's a really nice write-up.

I have a question though: does tileserver-php cache the vector tiles or is extracting them from the mbtiles file so quick that it isn't necessary?

W

Wouter van Kleunen MODERATOR
0 points · 23 months ago

Yes, you should be able to extract them. This should improve the hosting speed, although speed is already quite good. I have not tried this myself yet, I can update the tutorial if I have more information. You can use mb-util for this, but I have not checked how this works yet.

https://github.com/mapbox/mbutil

Also note that I edited the config-openmaptiles.json to include highways and waterways at zoom-level 6+7. I think tilemaker will get improved styling for lower zoom levels soon.

arminus
0 points · 23 months ago

Thanks for the write-up, after having set this up I get the following 2 error (the map shows up, though)

Uncaught TypeError: mapboxgl.Navigation is not a constructor (I'm using Leaflet - not familiar with Mapbox although I'm using my own key for this test) - any idea?

Error: Source layer "boundary" does not exist on source "openmaptiles" as specified by style layer "admin*sub" (-> same for other admin* boundaries) - how do I get those into the mbtiles?

Wouter van Kleunen MODERATOR
0 points · 23 months ago

Hello Arminus,

yes, the admin boundaries are available in newer versions of maptiler. It has been added only recently. It has been added last week. So if you compile the version yourself from github, make sure you update and you use the latest config-openmaptiles.json and process-openmaptiles.lua.

https://github.com/systemed/tilemaker/commit/40834a06a535f8b44eb50d506f76a07fa0d3152f

or use this precompiled: https://github.com/systemed/tilemaker/actions/runs/695090523

The constructor error I also have on my mapbox client, i have no idea why this is. So if you know what this is, let me know.

Wouter van Kleunen MODERATOR
0 points · 22 months ago

The error regarding the navigation is related to 'mapboxgl.Navigation' this should be 'mapboxgl.NavigationControl'. I changed this in the article, you can change it as well.

```
map.addControl(new mapboxgl.NavigationControl());
```

S

Steve Williams
0 points · 13 months ago

To process a whole 60G planet pbf, is there a time or memory limitation holding this back?

I am curious how easily you think such a map could be converted in one go using tilemaker, assuming I can requisition a computer with 100+ gigs of ram to avoid memory constraints. Or is this the kind of conversion that takes days/weeks regardless of the computer used?

Wouter van Kleunen MODERATOR
0 points · 13 months ago

Hello Steve,

planet conversion in a single go can be done. On the tilemaker github there are several people who did:

on a 256G ram machine, finished in 10 hours on 32C/64T machine https://github.com/systemed/tilemaker/discussions/336

Or with reduced memory (144GB ram) https://github.com/systemed/tilemaker/issues/315

Initially, tilemaker did not allow using temporary disk storage. But now it does and bigger conversion

can be done.

NS
0 points · just now

Hello and thank you for the tutorial, it is really useful, however I am stuck at some point. So far, I have managed to properly see the data in tile-server.

From then on, I downloaded the positron style from openmaptiles, renamed to greece_style.json, downloaded the fonts and replaced the values within the json to greece.json (to correspond to greece.mbtiles) and the fonts folder. I also replaced the js with maplibre.js

However, when I load the map, I just get an empty page, no errors whatsoever.. Any ideas?

dieterdreist
0 points · 15 months ago

are you displaying the mapbox logo which is linking to www.mapbox.com because of the frontend mapbox-gl instead of maplibre-gl or is it a general requirement?

Wouter van Kleunen MODERATOR
0 points · 15 months ago

no it is not a general requirement, it is because the mapbox client is used. You could use maplibre-gl as well, this does not have the logo.

Wouter van Kleunen MODERATOR
0 points · 15 months ago

I changed the example to maplibre, the logo is gone now

Johannes Kohlschütter
0 points · 13 months ago

This is a most useful tutorial!
Just a note for those having problems with tileserver-php on Apache:
- Check that Apache considers the .htaccess file. In Debian, that would be set in /etc/apache2/apache2.conf: "AllowOverride" should be set to "All" for the tileserver directory.
- Make sure that the rewrite module is enabled: In Debian, type "sudo a2enmod rewrite" in the console.

Wouter van Kleunen MODERATOR
0 points · 13 months ago

Hello Johannes.

Thank you for sharing this note and good look with generating maps.

Lorenzo Brutti
0 points · 3 months ago

Hello, thanks for this great guide! do you know if extrusion height datasets are available? is this info included in OSM tiles? thanks again!

John Croucher
0 points · 11 months ago

Is it possible to use tileserver-php with Leaflet clients?

Wouter van Kleunen MODERATOR
0 points · 11 months ago

Leaflet does not support vector graphics, and tileserver-php can not convert to bitmaps. So no. This would not work

Felix Klein
0 points · 10 months ago

Hello,

how can I create tiles larger than zoomlevel 16? I get the following message which I don't know what to do with:

Compile tilemaker with -DFAT*TILE*INDEX to enable tile output at zoom level 17 or greater

Thank you and best regards

Wouter van Kleunen MODERATOR
0 points · 10 months ago

Add the following line to cmake:
`add_definitions(-DFAT_TILE_INDEX)`

And then build using cmake.

Or if you build with the makefile, add:
`-DFAT_TILE_INDEX`

to CXXFLAGS

Anurag Vohra
0 points · 7 months ago

how do one host glyphs ? I see you have used url : "https://www.kleunen.nl/fonts/{fontstack}/{range}.pbf", but how do one generate his own ? I am also not able to see street names and tags (hospitals, schools...) usually present in OpenStreetMaps

keegan lobo
0 points · 7 months ago

Really nice Blog. Very informative. I was wondering if you know how to edit the lua script that creates the mbtiles. I can't find any good source of documentation for the same. I want to customize the lua script to be able to control the features I show on the map.

Fabian Schreiber
0 points · 4 months ago

Thank you so much for the tutorial - It's very useful. When I generate the tiles, the map works great but the ocean is missing it's colour. It's just grey so the coastline is really hard to see. Any ideas, what I'm doing wrong? I'm trying for two weeks now- makes me go crazy :-(

realPilotfish
0 points · just now

Maybe you had the same problem like me. After unzipping water-polygons-split-4326.zip you need to rename that folder to "coastline" oder create al link: ln -s water-polygons-split-4326 coastline

Lukas Hansson
0 points · 3 months ago

Hi and thaks for a wery nice tutorial!! Im trying to build a europe map but wuold like to use the swedish language on all countrties as in this map.

Is the language settings in the build process or can a set up this afterwards?

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