

Visualising VGI data with Leaflet

Dr. Peter Mooney



Map tiles by Stamen Design, under CC BY 3.0. Data by OpenStreetMap, under CC BY SA.

**There's no need to be afraid but there
WILL be computer code in this lecture**



Aims of this lecture today

- To introduce you to some basic concepts of Visualising VGI data (spatial) data on a Web-based Map
- After the lecture you should be able to create simple visualisations of VGI data on web-based maps using Open Source Components
- You will see that much of the work in Visualisation of VGI comes from preparing the VGI for display on the web-based maps

TIMETABLE FOR TODAY

- Session 1 09:30 – 11:30 (no break)
- Session 2 14:00 – 16:00 (no break)
- The class today is a little shorter than normal as I am teaching in other lectures outside of the times mentioned above.

Which browser should you use for the lecture today?



Safari



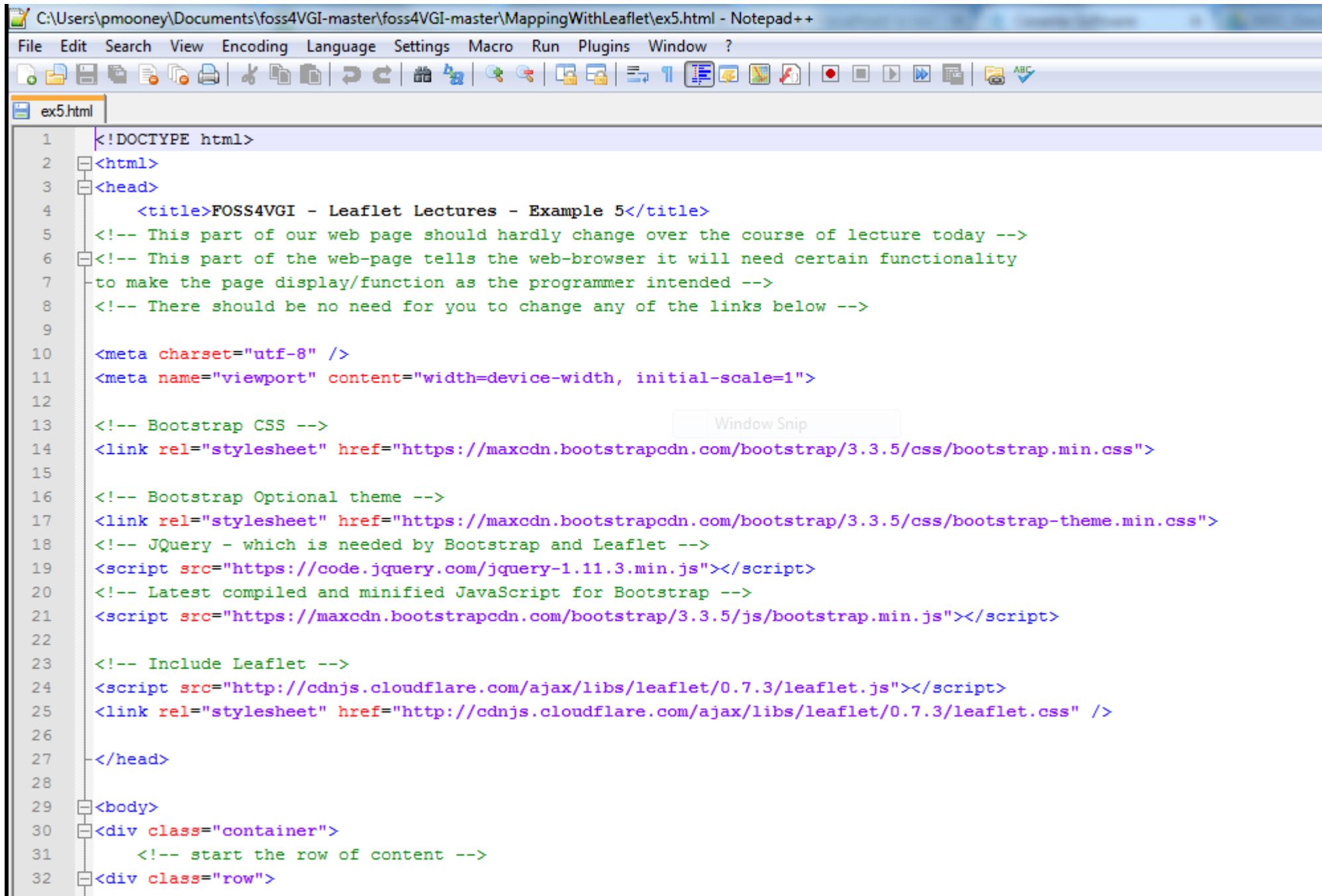
We are also going to need to have a nice text editor installed

- A text editor is one of the most important tools which a web developer uses
- Like web servers there are LOTS of options.
- We need a text editor which will give us some user friendly editing functionality for HTML and Javascript

Suggested Text Editors

- **ANY ONE OF**
- The Geany
- Bluefish
- Notepad++
- Sublime
- Perhaps Bracket or TextMate for MAC specifically
- The links are available on the GitHub page

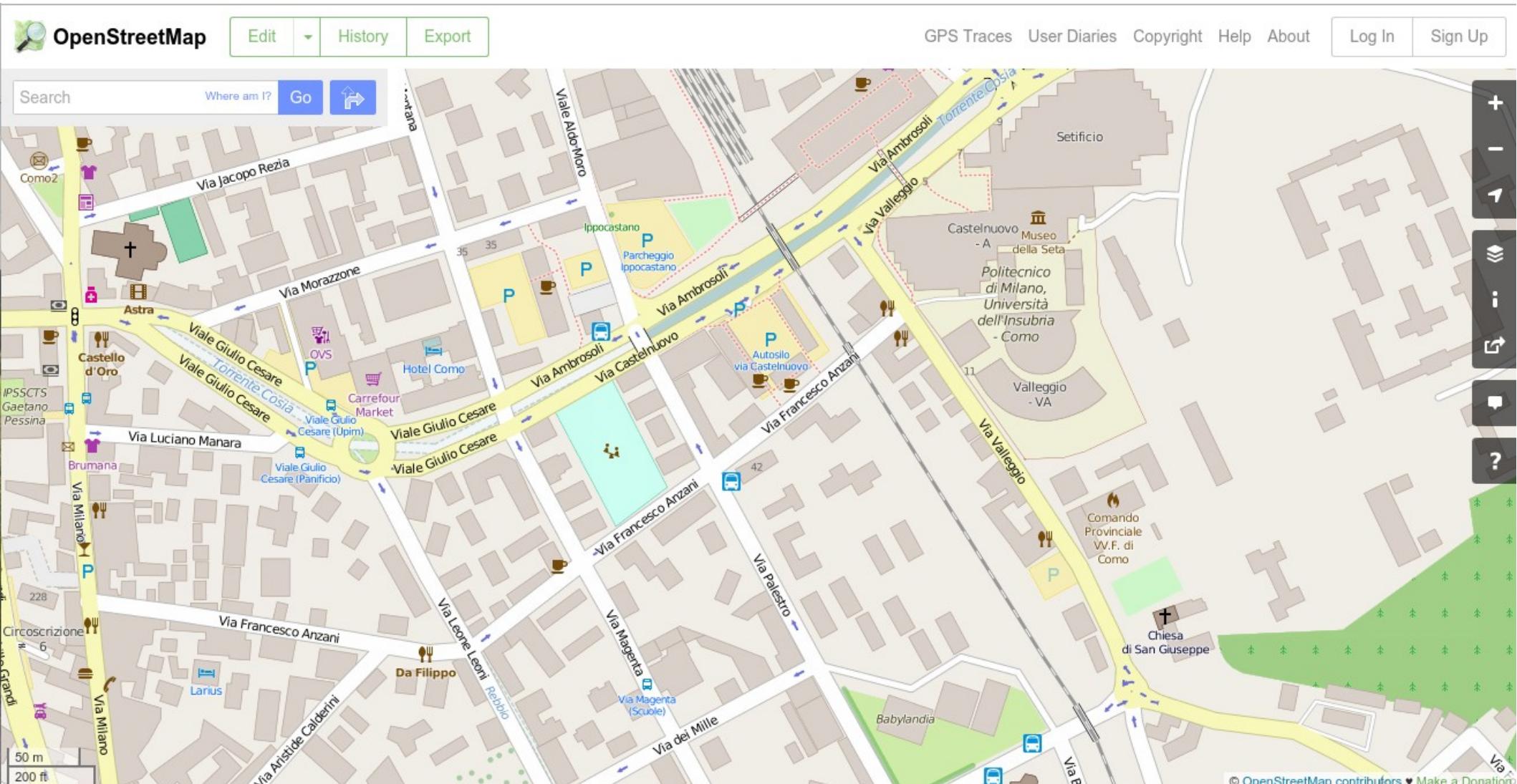
Notepad++ is installed



The screenshot shows the Notepad++ interface with the file `ex5.html` open. The code is an HTML document with various parts commented out with `<!--` and `-->`. The code includes meta tags for charset and viewport, Bootstrap CSS links, jQuery, and Leaflet scripts. A tooltip labeled "Window Snip" is visible over the code area.

```
1  <!DOCTYPE html>
2  <html>
3  <head>
4      <title>FOSS4VGI - Leaflet Lectures - Example 5</title>
5      <!-- This part of our web page should hardly change over the course of lecture today -->
6  <!-- This part of the web-page tells the web-browser it will need certain functionality
7  to make the page display/function as the programmer intended -->
8  <!-- There should be no need for you to change any of the links below -->
9
10 <meta charset="utf-8" />
11 <meta name="viewport" content="width=device-width, initial-scale=1">
12
13 <!-- Bootstrap CSS -->
14 <link rel="stylesheet" href="https://maxcdn.bootstrapcdn.com/bootstrap/3.3.5/css/bootstrap.min.css">
15
16 <!-- Bootstrap Optional theme -->
17 <link rel="stylesheet" href="https://maxcdn.bootstrapcdn.com/bootstrap/3.3.5/css/bootstrap-theme.min.css">
18 <!-- JQuery - which is needed by Bootstrap and Leaflet -->
19 <script src="https://code.jquery.com/jquery-1.11.3.min.js"></script>
20 <!-- Latest compiled and minified JavaScript for Bootstrap -->
21 <script src="https://maxcdn.bootstrapcdn.com/bootstrap/3.3.5/js/bootstrap.min.js"></script>
22
23 <!-- Include Leaflet -->
24 <script src="http://cdnjs.cloudflare.com/ajax/libs/leaflet/0.7.3/leaflet.js"></script>
25 <link rel="stylesheet" href="http://cdnjs.cloudflare.com/ajax/libs/leaflet/0.7.3/leaflet.css" />
26
27 </head>
28
29 <body>
30 <div class="container">
31     <!-- start the row of content -->
32 <div class="row">
```

OpenStreetMap is more than just a map...



Search

Where am I?

Go

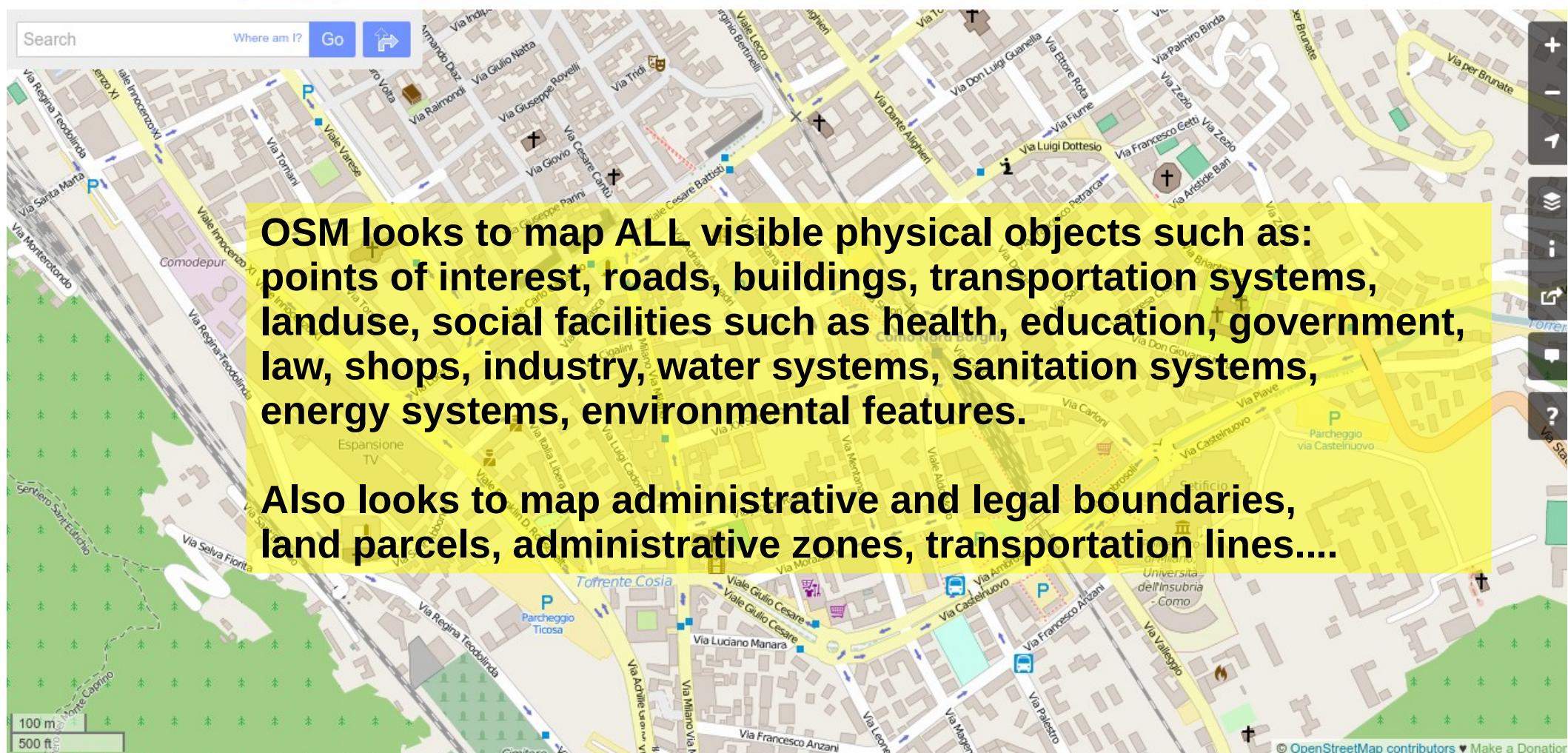


+ - 1

+ - 1

OSM looks to map ALL visible physical objects such as: points of interest, roads, buildings, transportation systems, landuse, social facilities such as health, education, government, law, shops, industry, water systems, sanitation systems, energy systems, environmental features.

Also looks to map administrative and legal boundaries, land parcels, administrative zones, transportation lines....



OpenStreetMap is actually a massive spatial database

PostgreSQL



Map Compare

tools.geofabrik.de/mc/#17/45.8023/9.0951&num=4&mt0=mapnik&mt1=google-map&mt2=bing-map&mt3=nokia-map

Como search Help Switch tool... ▾

Map Compare

Choose map type: OSM Mapnik

Choose map type: Google Map

Choose map type: Bing Map

Choose map type: HERE Map

zoom=17 number of maps: 1 2 3 4 6 8

All maps except Bing/Google/HERE based on OSM data © [OpenStreetMap](#) (License: ODbL 1.0), OSM Tiles licensed CC-BY-SA 2.0 - [help](#) - [contact](#) - [fullscreen](#)

<http://tools.geofabrik.de/mc/>

Exercise with Map Compare

- Let's look at Map Compare for an area which you are very familiar with – your home, your university, your favourite town, etc
- **Exercise and Discussion:** Use Map Compare to make a visual comparison of OSM in this area with Google Maps, Bing etc.
- Can you make some statements about: coverage, missing data, overall quality of the map data?

**What web technologies are we
using today for the lecture?**

We are using Leaflet for our map container Javascript



an open-source JavaScript library
for mobile-friendly interactive maps

[Overview](#) [Tutorials](#) [Docs](#) [Download](#) [Plugins](#) [Blog](#)

Leaflet is the leading open-source JavaScript library for mobile-friendly interactive maps. Weighing just about 33 KB of JS, it has all the mapping [features](#) most developers ever need.

We are using Bootstrap to make our pages display in a responsive way

Bootstrap

Getting started

CSS

Components

JavaScript

Customize

Expo

Blog



B

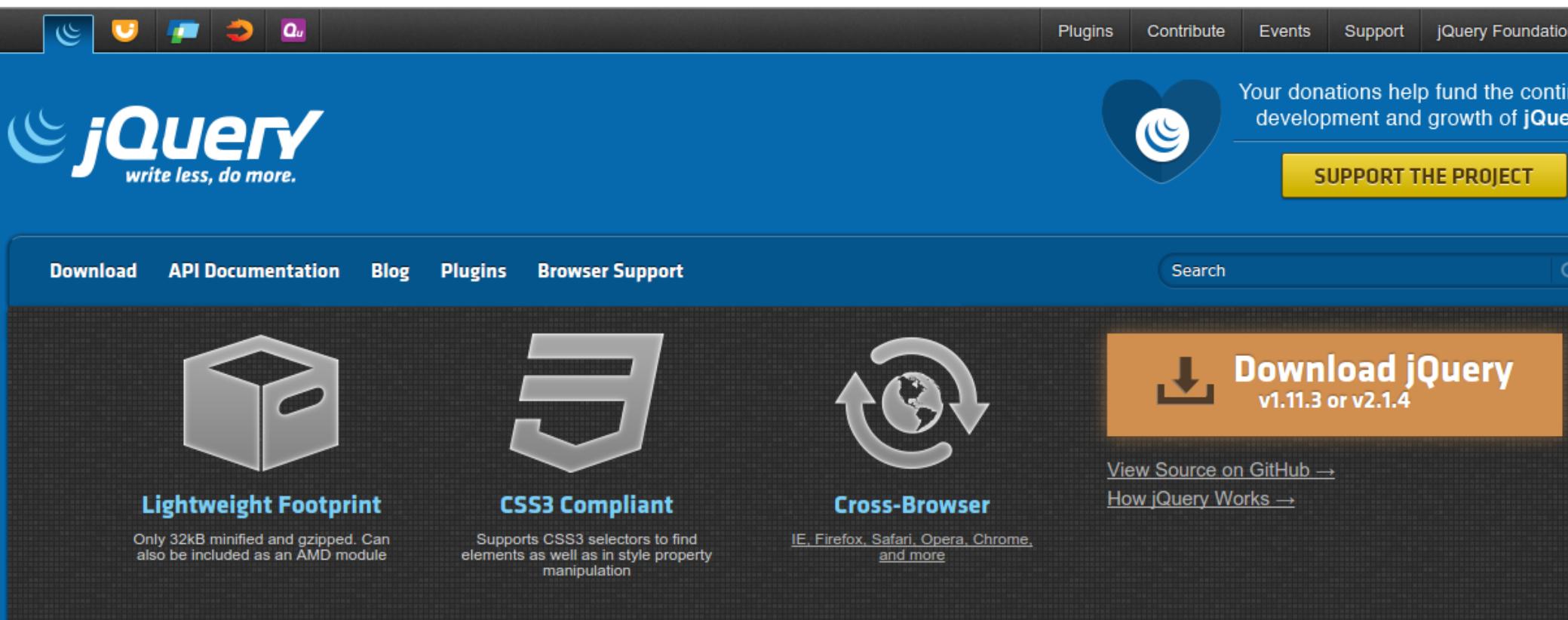
Bootstrap is the most popular HTML, CSS, and JS framework for developing responsive, mobile first projects on the web.

Download Bootstrap

Currently v3.3.5



Jquery provides LOTS of very useful Javascript functionality



The screenshot shows the official jQuery website. At the top, there's a dark header bar with social media icons (Facebook, Twitter, LinkedIn, YouTube, GitHub) and navigation links for Plugins, Contribute, Events, Support, and jQuery Foundation. Below the header is a large blue banner featuring the jQuery logo, a heart icon with a swirl, and a yellow "SUPPORT THE PROJECT" button. The main content area has a dark background with four key features highlighted: "Lightweight Footprint" (32kB minified and gzipped), "CSS3 Compliant" (supports CSS3 selectors), "Cross-Browser" (works across IE, Firefox, Safari, Opera, Chrome, and more), and a prominent orange "Download jQuery v1.11.3 or v2.1.4" button. The "What is jQuery?" section defines it as a fast, small, and feature-rich JavaScript library. The "Resources" section links to the Core API Documentation, Learning Center, Blog, and Contribute pages.

What is jQuery?

jQuery is a fast, small, and feature-rich JavaScript library. It makes things like HTML document traversal and manipulation, event handling, animation, and Ajax much simpler with an easy-to-use API that works across a multitude of browsers. With a combination of versatility and extensibility, jQuery has changed the way that millions of people write JavaScript.

Resources

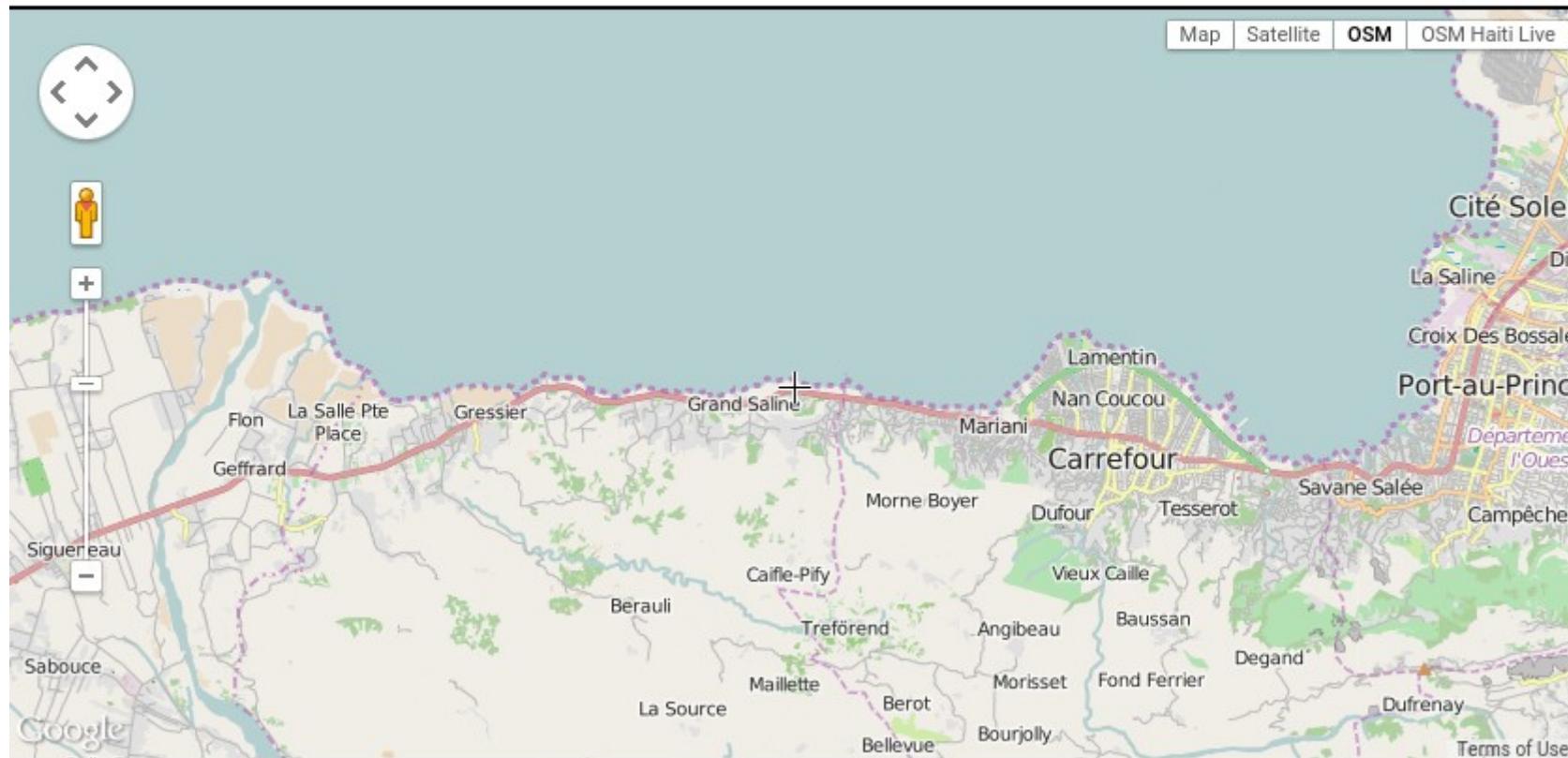
- [jQuery Core API Documentation](#)
- [jQuery Learning Center](#)
- [jQuery Blog](#)
- [Contribute to jQuery](#)

Finding the Latitude Longitude of any point will be very useful today

Get Lat Lon

Find the latitude and longitude of a point on a map.

Place name: [Zoom to place](#)



Latitude, Longitude: 18.54732, -72.46788

Getting Started

Get the Latitude Longitude of ANY point on the earth

<http://dbsgeo.com/latlon/>

Get Lat Lon

Find the latitude and longitude of a point on a map.

Place name: Zoom to place [Zoom to my location \(by IP\)](#)

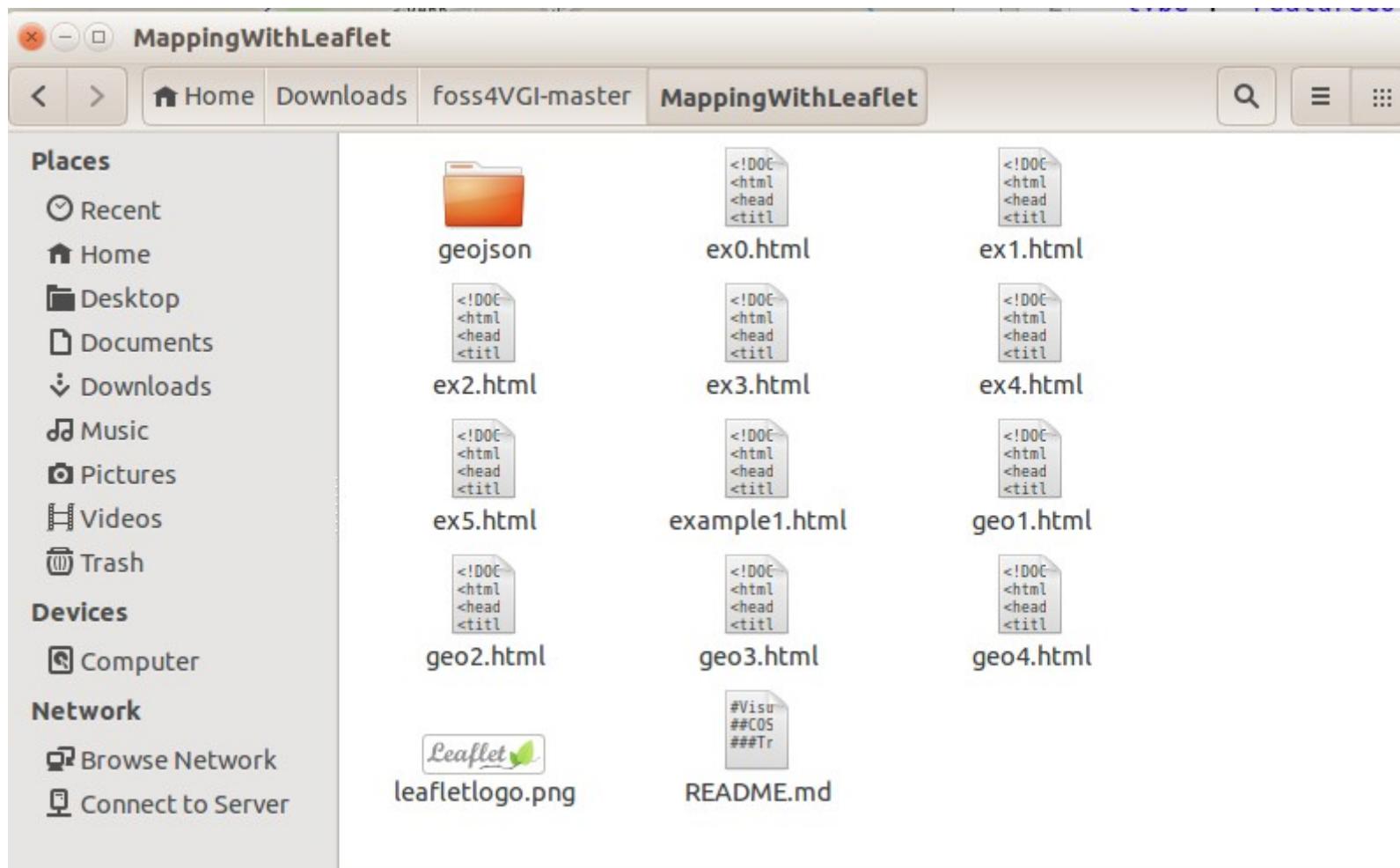
Pan and Zoom into your place of interest – the Lat/Long will change accordingly

Latitude, Longitude: 45.81291, 9.07210

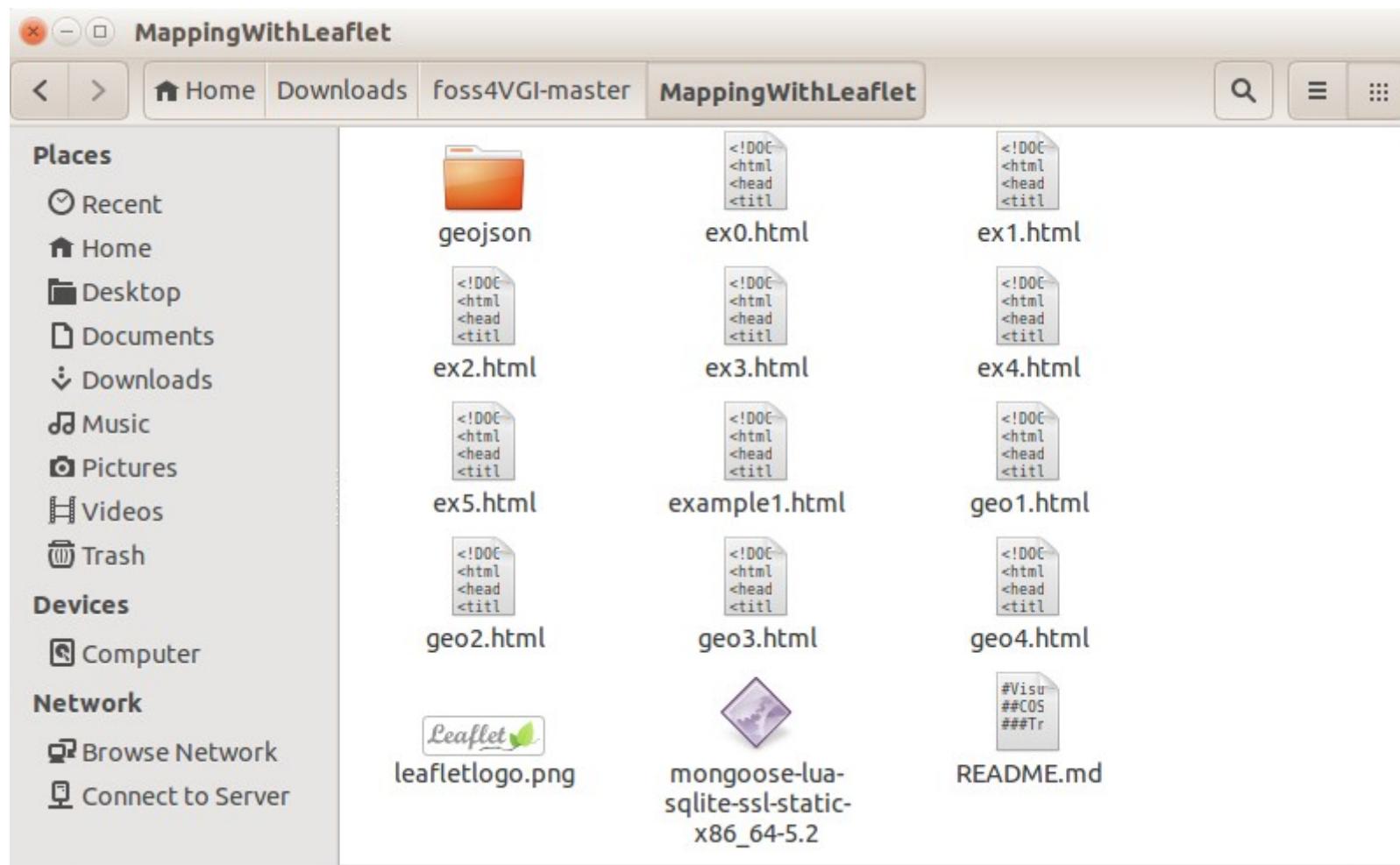
Getting our material together

- We will need to download all of the materials from MOODLE (look at today's topic)
- You will unzip these materials into a folder on your computer.
- You then need to copy the Mongoose executable into this folder. **[LATER ON]**
- DO NOT CHANGE the names of any files or folders within this new folder.

The Unzipped Files in a Folder



And look – there is the Mongoose Executable Included now!



Every webpage in the world has the same structure regardless of what the webpage actually does



A webpage at its most fundamental has a `<head>` and has a `<body>`

The `<body>` is what you see in your web-browser. The `<head>` helps to support the technical details of how the `<body>` is managed and displayed.

Unfortunately – we do not have enough time to go into the deeper details of web page development

- So we are going to take a few things for granted and make some assumptions.
- In our examples – the <HEAD> of our pages WILL NOT CHANGE except for the <TITLE>
- In our examples – the <BODY> of our pages will change but we are not trying to design very fancy beautiful webpages.
- **The focus today is on DISPLAYING MAPS WITH GEODATA in a webpage and NOT webpage development.**

Let's open ex0.html in your text editor which you installed

- We are going to step through this very carefully so we can see the <HEAD> and the <TITLE> and the <BODY>

The <HEAD> of our Web Pages

```
2 <html>
3   <head>
4     <title>FOSS4VGI - Leaflet Lectures - Example 0</title>
5     <!-- This part of our web page should hardly change over the course of lecture today -->
6     <!-- This part of the web-page tells the web-browser it will need certain functionality
7       to make the page display/function as the programmer intended -->
8     <!-- There should be no need for you to change any of the links below -->
9
10    <meta charset="utf-8" />
11    <meta name="viewport" content="width=device-width, initial-scale=1">
12
13    <!-- Bootstrap CSS -->
14    <link rel="stylesheet" href=
15      "https://maxcdn.bootstrapcdn.com/bootstrap/3.3.5/css/bootstrap.min.css">
16
17    <!-- Bootstrap Optional theme -->
18    <link rel="stylesheet" href=
19      "https://maxcdn.bootstrapcdn.com/bootstrap/3.3.5/css/bootstrap-theme.min.css">
20
21    <!-- JQuery - which is needed by Bootstrap and Leaflet -->
22    <script src="https://code.jquery.com/jquery-1.11.3.min.js"></script>
23
24    <!-- Latest compiled and minified JavaScript for Bootstrap -->
25    <script src="https://maxcdn.bootstrapcdn.com/bootstrap/3.3.5/js/bootstrap.min.js"></script>
26
27    <!-- Include Leaflet -->
28    <script src="http://cdnjs.cloudflare.com/ajax/libs/leaflet/0.7.3/leaflet.js"></script>
29    <link rel="stylesheet" href=
30      "http://cdnjs.cloudflare.com/ajax/libs/leaflet/0.7.3/leaflet.css" />
31
32  </head>
```

The <BODY> of our Web Pages

```
<body>
<div class="container">
    <!-- start the row of content -->
<div class="row">
    <h1>This is Example 0</h1> <!-- We can change this piece of text each time -->
    <div id="map" style="width: 100%; height: 600px"></div>
</div><!-- close the row of content-->

<script><!-- This is where our mapping code starts -->
// This is our base layer - you should not need to change this in many examples
var OpenStreetMap_Mapnik = L.tileLayer('http://{s}.tile.openstreetmap.org/{z}/{x}/{y}.png',
{maxZoom: 19, attribution: '&copy; <a href="http://www.openstreetmap.org/copyright">OpenStreetMap</a>'});

// Notice how the MAP is centered at a particular point - notice the ZOOM level
var map = L.map('map', {center: [45.81288, 9.07454], zoom: 19, layers: [OpenStreetMap_Mapnik]});

var baseMaps = {"OpenStreetMap_Mapnik": OpenStreetMap_Mapnik};

var overlayMaps = { };

L.control.layers(baseMaps, overlayMaps).addTo(map);

// This is a marker pin on a particular spot. It does not have to be the center
L.marker([45.81288, 9.07454]).addTo(map).bindPopup("<b>Hello Everyone</b><br/>This is the
Cube Cafe in Como.").openPopup();

</script><!-- This is where our mapping code ends -->
</div><!-- close the container -->
</body>
</html>
```

Exercise A: Let's put a marker pin on our own house/appartment

- Copy the file ex0.html and rename the file exerciseA.html (*stay in the same folder*)
- Open exerciseA.html in your text editor.
- Using the 'get lat long' web page – find the lat/longitude of your home – change the code in your file so that the marker pin is changed.
- Change also the <TITLE> and the <h1> text
- **SAVE** the file and then look at **exerciseA.html**

Let's look at Ex1.html in your text editor – multiple markers

- You can have multiple markers on your map – it's no problem. You can actually have hundreds of marker icons on your map if you need.
- **Decision 1:** When you have more than one marker – you will need to decide where to center the map
- **Decision 2:** You will also need to decide upon the appropriate zoom level
- **Decision 3:** You might need to use a different LAT/LONG for your center

The code for adding more markers to your map is very simple

```
42 // Notice how the MAP is centered at a particular point - notice the ZOOM level
43 var map = L.map('map', {center: [45.80880, 9.08367], zoom: 15, layers: [OpenStreetMap_Mapnik]});
44
45 var baseMaps = {"OpenStreetMap_Mapnik": OpenStreetMap_Mapnik};
46
47 var overlayMaps = { };
48
49 L.control.layers(baseMaps, overlayMaps).addTo(map);
50
51
52 // This is a marker pin on a particular spot. It does not have to be the center
53 L.marker([45.81288, 9.07454]).addTo(map).bindPopup("<b>Hello Everyone</b><br/>This is the Cube Cafe in Como.");
54
55 L.marker([45.81413, 9.08407]).addTo(map).bindPopup("<b>Hello Train Users</b><br/>This is the Como Lago Nord train
station.");
56
57 L.marker([45.80168, 9.08913]).addTo(map).bindPopup("<b>Hello Shoppers</b><br/>This is the Carrefour Supermarket in
the south of Como city.");
58
59
```

NOTICE that the CENTER of the map is different to the locations of the 3 markers which we have added

Exercise B: Let's put multiple marker pins on a map using our own data

- Copy the file ex1.html and rename the file exerciseB.html (*stay in the same folder*)
- Open exerciseB.html in your text editor
- Use Get Lat Long to find the locations of FOUR TRAIN STATIONS close to YOUR HOME
- You will need to also test and find an appropriate center for your map.
- You will need to fina an appropriate zoom
- **Result at exerciseB.html**

Changing the Background Layer

- In the previous examples we have used the default OpenStreetMap MAPNIK layer
- BUT the great thing about Leaflet is that we can easily change the background layer

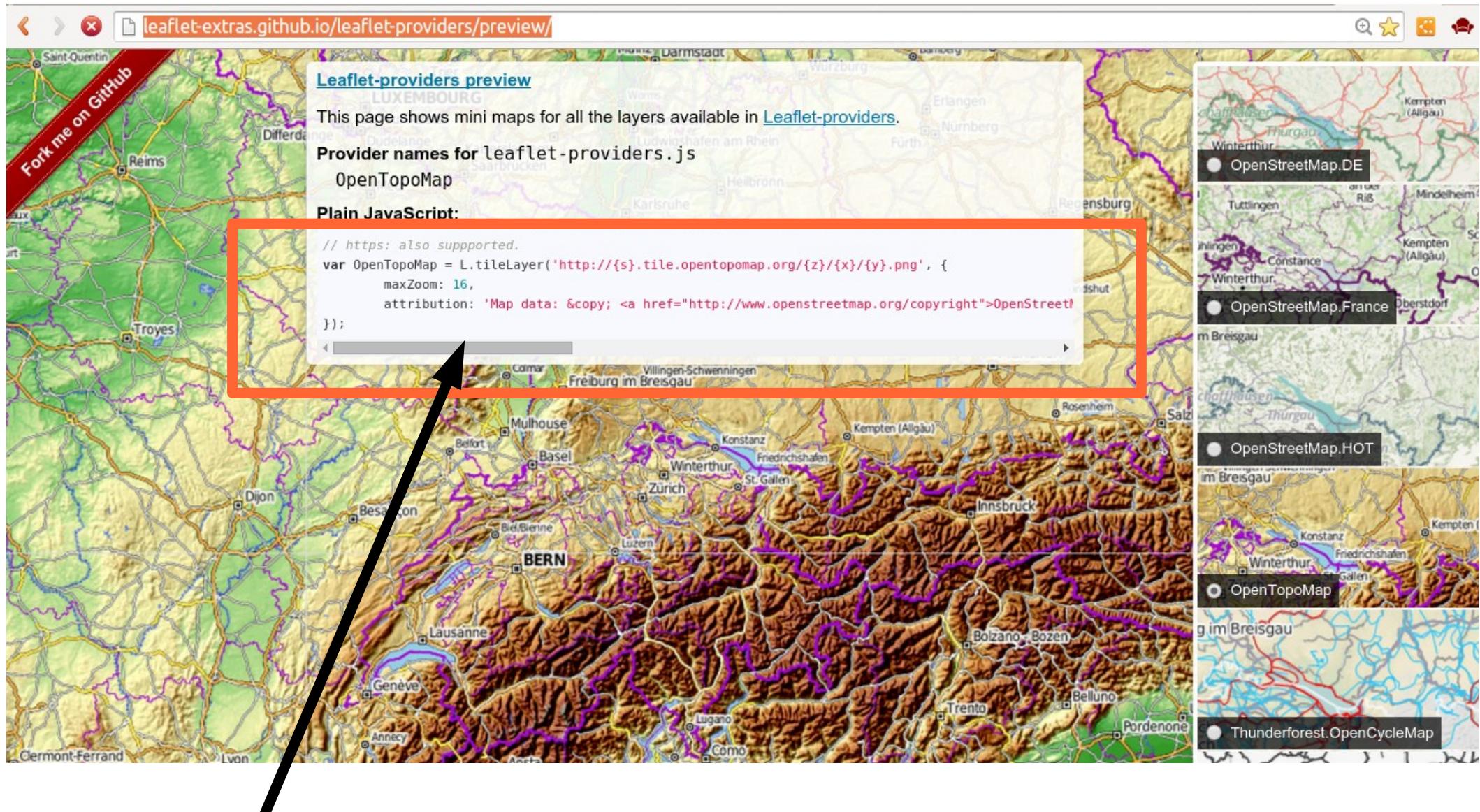
You will need to change 4 pieces of information

```
1 <script><!-- This is where our mapping code starts -->  
2 // This is our base layer - you should not need to change this in many examples  
3 var OpenStreetMap_Mapnik = L.tileLayer('http://{s}.tile.openstreetmap.org/{z}/{x}/{y}.png', {maxZoom:  
4 19, attribution: '&copy; OpenStreetMap'});  
  
// Notice how the MAP is centered at a particular point - notice the ZOOM level!  
var map = L.map('map', {center: [45.80880, 9.08367], zoom: 15, layers: [OpenStreetMap_Mapnik]});  
  
var baseMaps = {"OpenStreetMa2_Mapnik": OpenStreetMap_Mapnik};  
var overlayMaps = { };  
  
L.control.layers(baseMaps, overlayMaps).addTo(map);
```

Choosing a background layer

- We are going to look at some choices of background layers
- REMEMBER
- You will choose a layer which is appropriate to your data – you need to make sure that your users can easily understand the data and understand the significance of the background layer
- GO TO
<http://leaflet-extras.github.io/leaflet-providers/preview/>

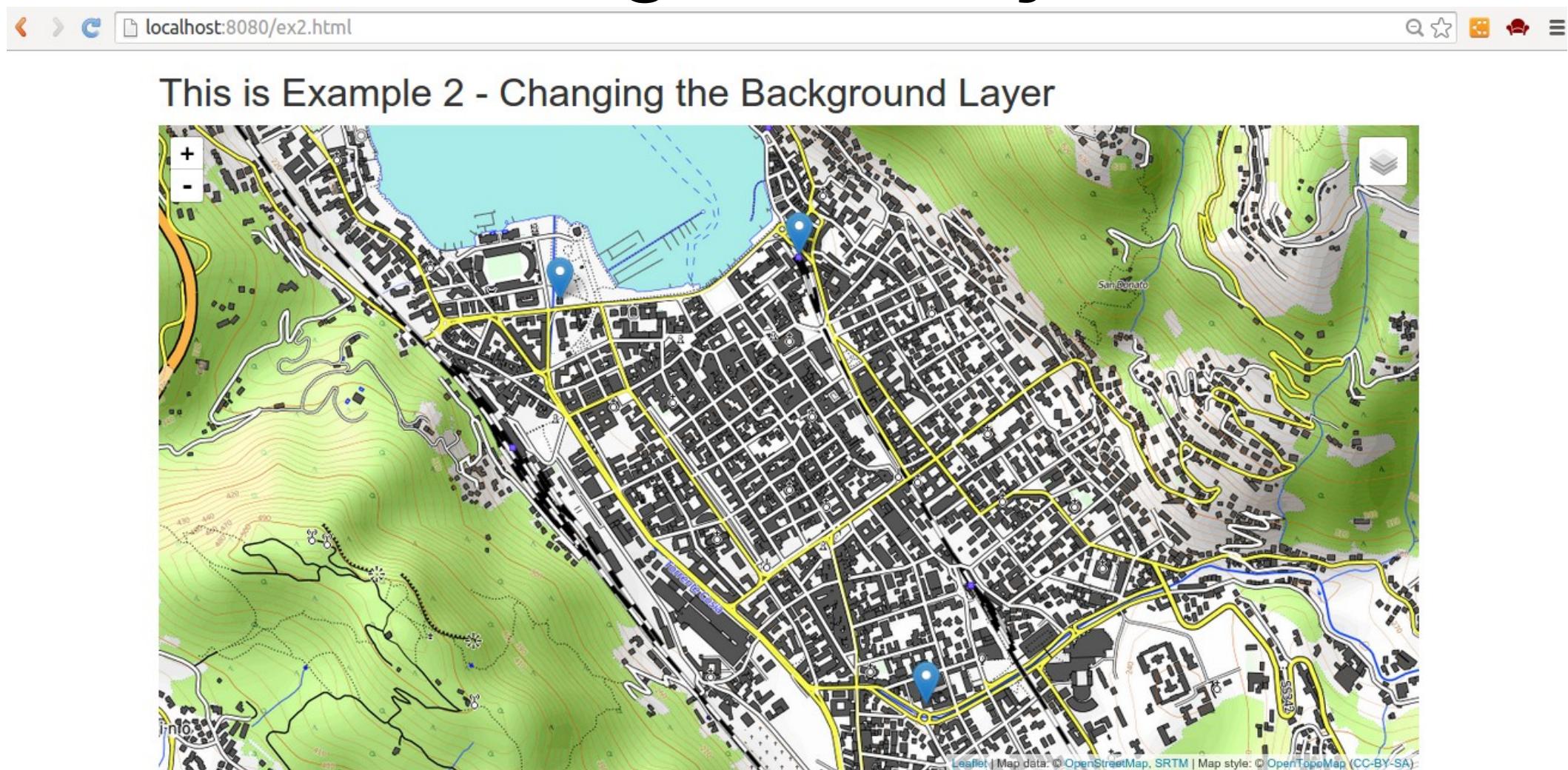
Leaflet Layer Providers



Exercise C: Changing the background layer in Leaflet

- Copy the file exerciseB.html and rename the file exerciseC.html (*stay in the same folder*)
- Open exerciseC.html in your text editor
- Pick your favourite layer from the Leaflet Layer Providers page
- Copy this code and REPLACE the Mapnik Definition. You will also need to change the line containing 'var baseMaps'

This is one example of a different background layer



Exercise D – Having Multiple Background Layers

- It's possible to have several different background layers which the user can easily switch between.
- Let's look at ex3.html in your text editor
- We just use Leaflet Layer Providers to get the code for our new layer
- Let's look and see where the new code fits in and then we'll test it.

Exercise D: Having Multiple Background Layers

```
<script><!-- This is where our mapping code starts --&gt;
// This is our base layer - you should not need to change this in many examples
var OpenTopoMap = L.tileLayer('http://{s}.tile.opentopomap.org/{z}/{x}/{y}.png', {
  maxZoom: 16,
  attribution: 'Map data © &lt;a href="http://www.openstreetmap.org/copyright"&gt;OpenStreetMap&lt;/a&gt;, &lt;a href="http://viewfinderpanoramas.org"&gt;SRTM&lt;/a&gt; | Map style: © &lt;a href="https://opentopomap.org"&gt;OpenTopoMap&lt;/a&gt; (&lt;a href="https://creativecommons.org/licenses/by-sa/3.0/"&gt;CC-BY-SA&lt;/a&gt;)'
});

var Stamen_Toner = L.tileLayer('http://stamen-tiles-{s}.a.ssl.fastly.net/toner/{z}/{x}/{y}.png', {
  attribution: 'Map tiles by &lt;a href="http://stamen.com"&gt;Stamen Design&lt;/a&gt;, &lt;a href="https://creativecommons.org/licenses/by/3.0"&gt;CC-BY 3.0&lt;/a&gt; — Map data © &lt;a href="http://www.openstreetmap.org/copyright"&gt;OpenStreetMap&lt;/a&gt;',
  subdomains: 'abcd',
  minZoom: 0,
  maxZoom: 20,
  ext: 'png'
});

// Notice how the MAP is centered at a particular point - notice the Z0 Level
var map = L.map('map', {center: [5.80880, 9.08367], zoom: 15, layers: [OpenTopoMap,Stamen_Toner]});

var baseMaps = {"OpenTopoMap": OpenTopoMap,"Nice Stamen Toner Map": Stamen_Toner};</pre>
```

Exercise D: Making a map with THREE background layers

- Copy the file ex3.html and rename the file exerciseD.html (*stay in the same folder*)
- Open exerciseD.html in your text editor
- Use Leaflet Map Providers page to choose THREE different background layers.
- BE CAREFUL – You will need to make the changes to your code as shown
- Look at the result in your browser at **exerciseD.html**

Adding Polygons to Leaflet

It is easy to add polygons to Leaflet using similar code to that of points

```
var polygon1 = L.polygon([
  [51.509, -0.08],
  [51.503, -0.06],
  [51.502, -0.05],
  [51.51, -0.047],
  [51.509, -0.08]
]).addTo(map);
```

REMEMBER: A polygon is a closed object – so the start and end nodes must be the same!

Ex4: Adding a polygon

- We can use a tool such as 'Get Lat Long' to help us get the points we need to make up a polygon. Look at ex4.html in your text editor

```
// Notice how the MAP is centered at a particular point - notice the ZOOM level
var map = L.map('map', {center: [45.80880, 9.08367], zoom: 15, layers: [OpenStreetMap_BlackAndWhite,MapQuestOpen_OSM]}); 

var baseMaps = {"OSM BW": OpenStreetMap_BlackAndWhite, "MapQuest OSM": 
var overlayMaps = { };

L.control.layers(baseMaps, overlayMaps).addTo(map);

var polygon1 = L.polygon([
[45.81424, 9.07097],
[45.81460, 9.07350],
[45.81339, 9.07386],
[45.81307, 9.07144],
[45.81374, 9.07068],
[45.81424, 9.07097]
]).addTo(map);
polygon1.bindPopup("I am a polygon showing the outline polygon for the Stadio Giuseppe Sinigaglia in Como");
```



Exercise E: Adding more Polygons

- Copy ex4.html and rename it as exerciseE.html
- **AIM:**
- Use 'Get Lat Long' to help create TWO NEW POLYGONS (you can fully delete the polygon which is already in ex4.html)
- The TWO NEW POLYGONS will represent TWO Educational facilities in your town, city or Region. You will need to find an appropriate center for the map. You will need to provide text for the popup windows.

**OK! Let's take a break from
Polygons for a moment**

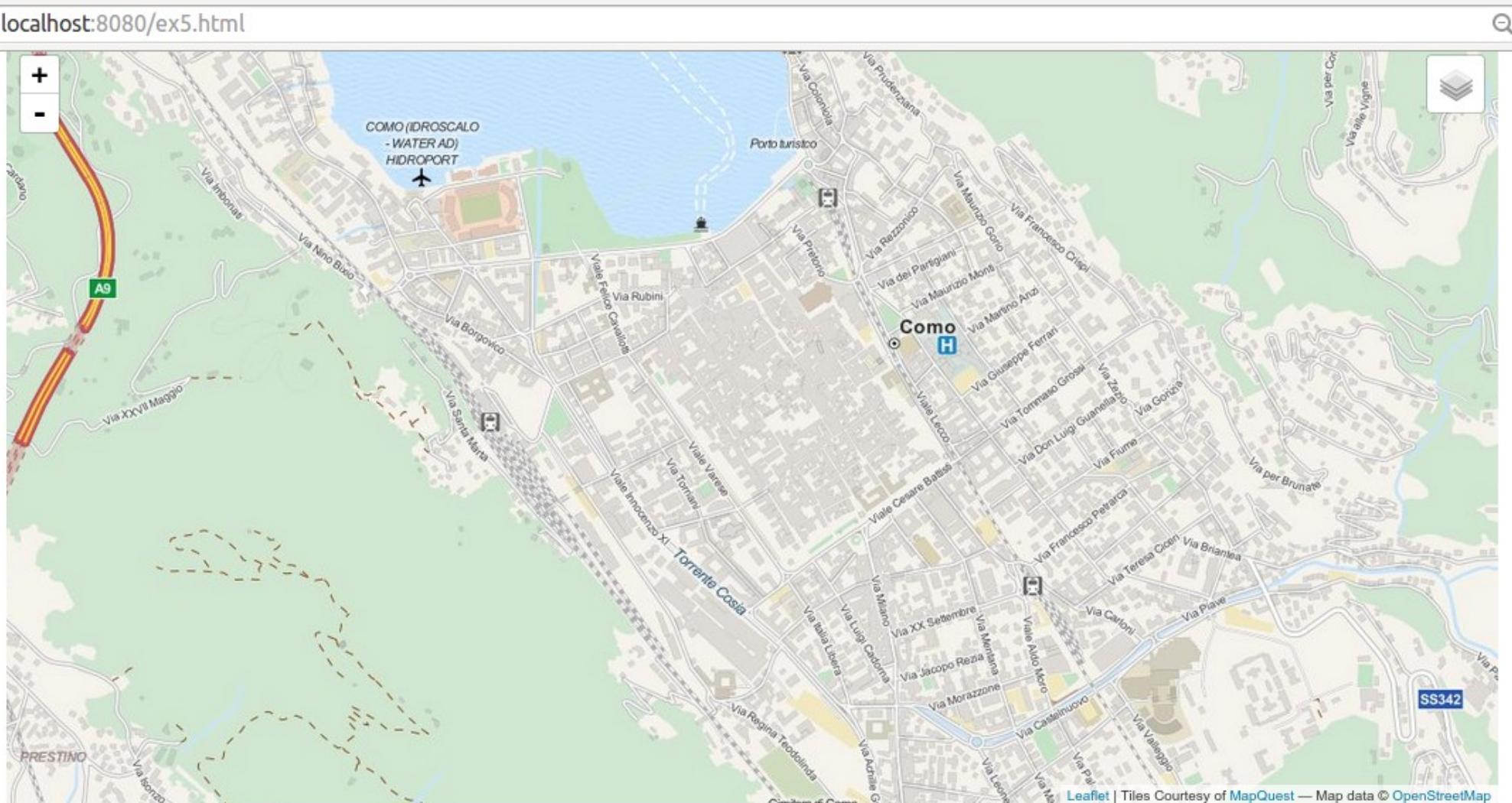
**Let's create our very own simple
version of Get Lat Long for
ourselves**

Ex5.html – Open this file in your text editor and view it in the browser

- Open Ex5.html in your text editor
- Check out ex5.html in the browser
- **We have added some code – but it is a really useful piece of code**

```
56
57 // This is the where Javascript is connected to the map when you 'click' on the map
58 map.on('click', onMapClick);
59
60 // THIS IS NEW. This is a special FUNCTION from Javascript.
61 // Leaflet has lots of functionality that we can use. This is very useful to display information about
62 // the map
63 function onMapClick(e) {
64     var theDateAndTime = new Date();
65     var mapCenter = map.getCenter();
66     $("#mycoordinates").html("<p class = 'lead'>MyGetLatLong Says:<br/> At " + theDateAndTime +
67     "<br/>You clicked the map at Coordinates " + "(Lat, Lon) = " + e.latlng.lat + "," + e.latlng.lng +
68     "<br/>Also the map is at Zoom level " + map.getZoom() + "<br/>The CENTER of the map is currently at
69     Coordinates " + "(Lat,Lon) = " + mapCenter.lat + "," + mapCenter.lng + "</p>");
70 }
```

This is the output from Ex5.html



MyGetLatLong Says:

At Mon Jul 13 2015 17:10:54 GMT+0100 (IST)

You clicked the map at Coordinates (Lat, Lon) = 45.808823378560895,9.085154533313471

Also the map is at Zoom level 15

The CENTER of the map is currently at Coordinates (Lat,Lon) = 45.808803435510455,9.081478118932864

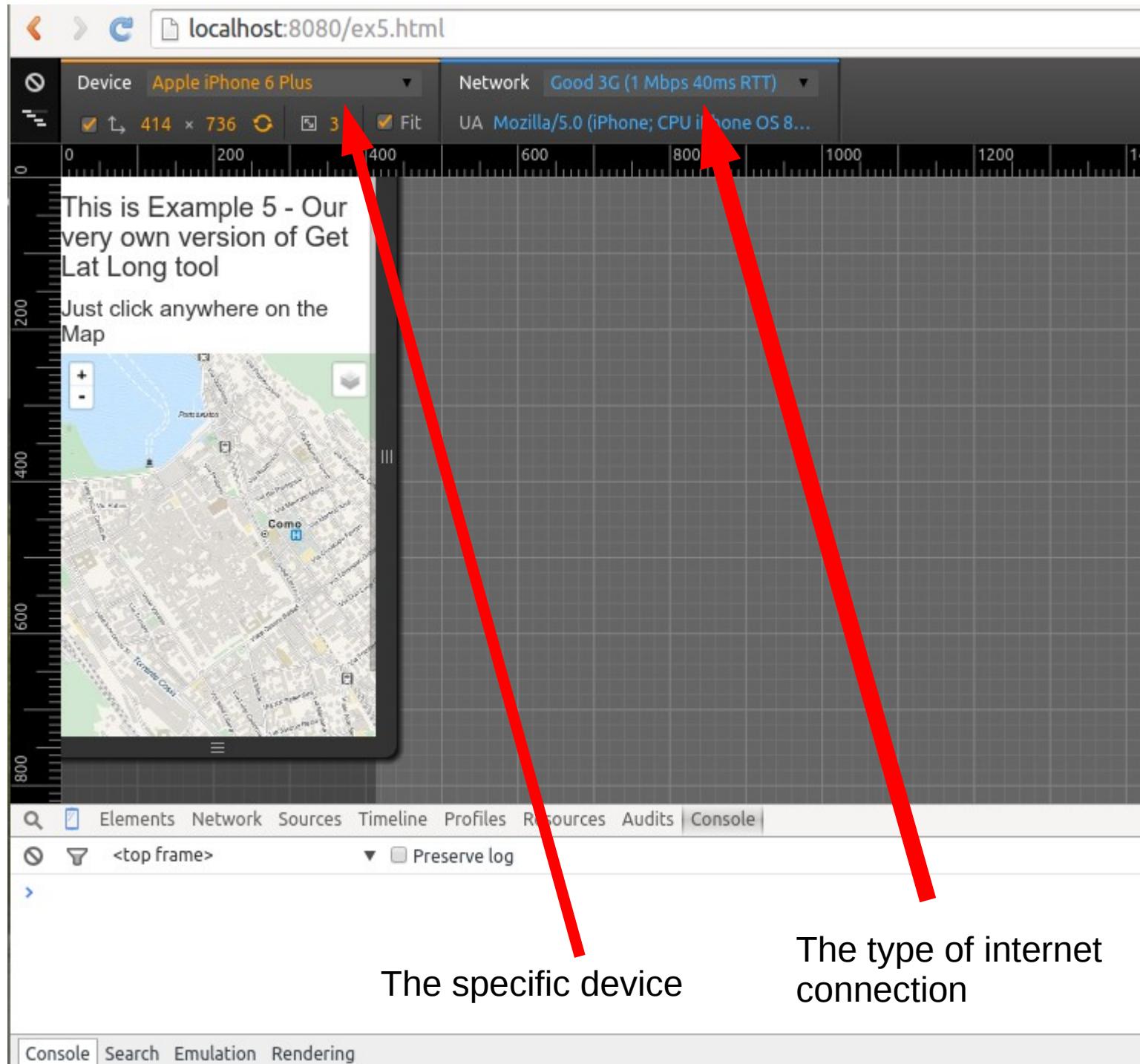
How does all this look on your mobile phone?

Can we test how this will all look on your smartphone or tablet?



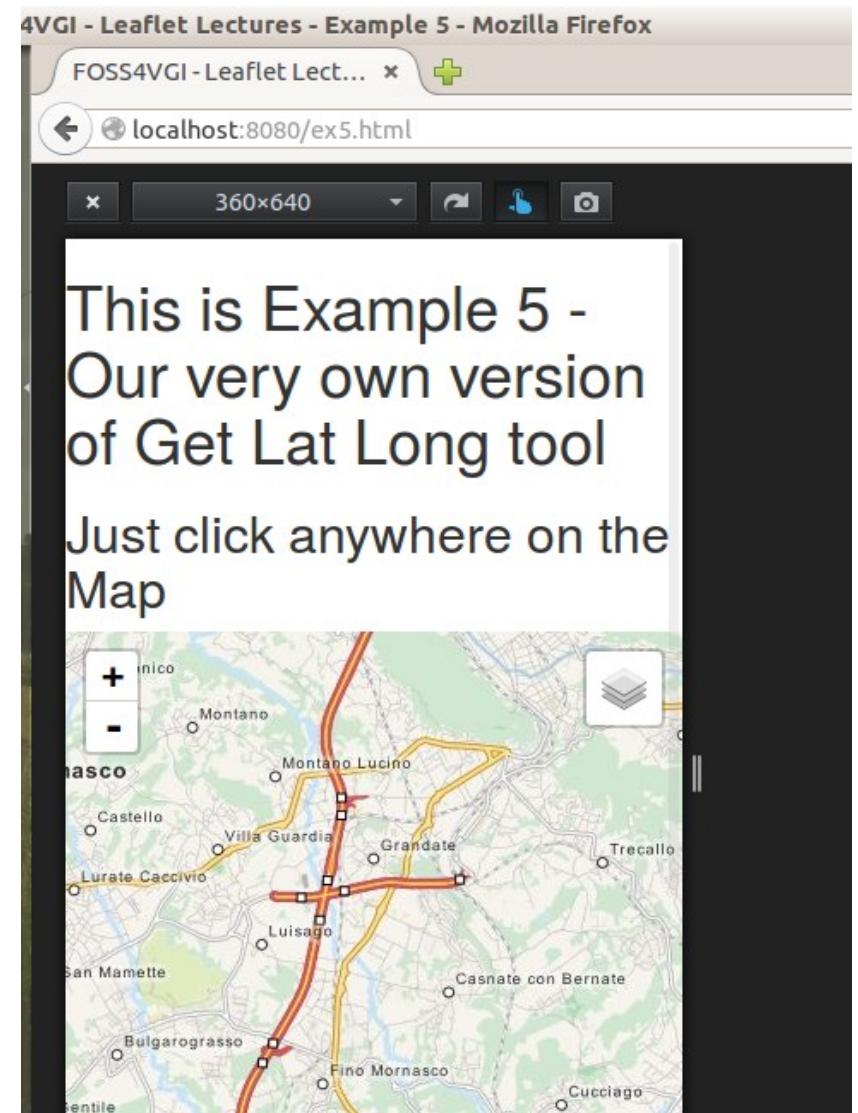
If you are using Google Chrome

- Open up ex5.html in your Google Chrome
- Go to the options menu
- Then go to More Tools
- Then go to Developer Tools
- Click on the little smartphone icon in the left hand corner.



If you are using Firefox

- Go to options
- Go to Developer
- Go to 'Responsive Design View"

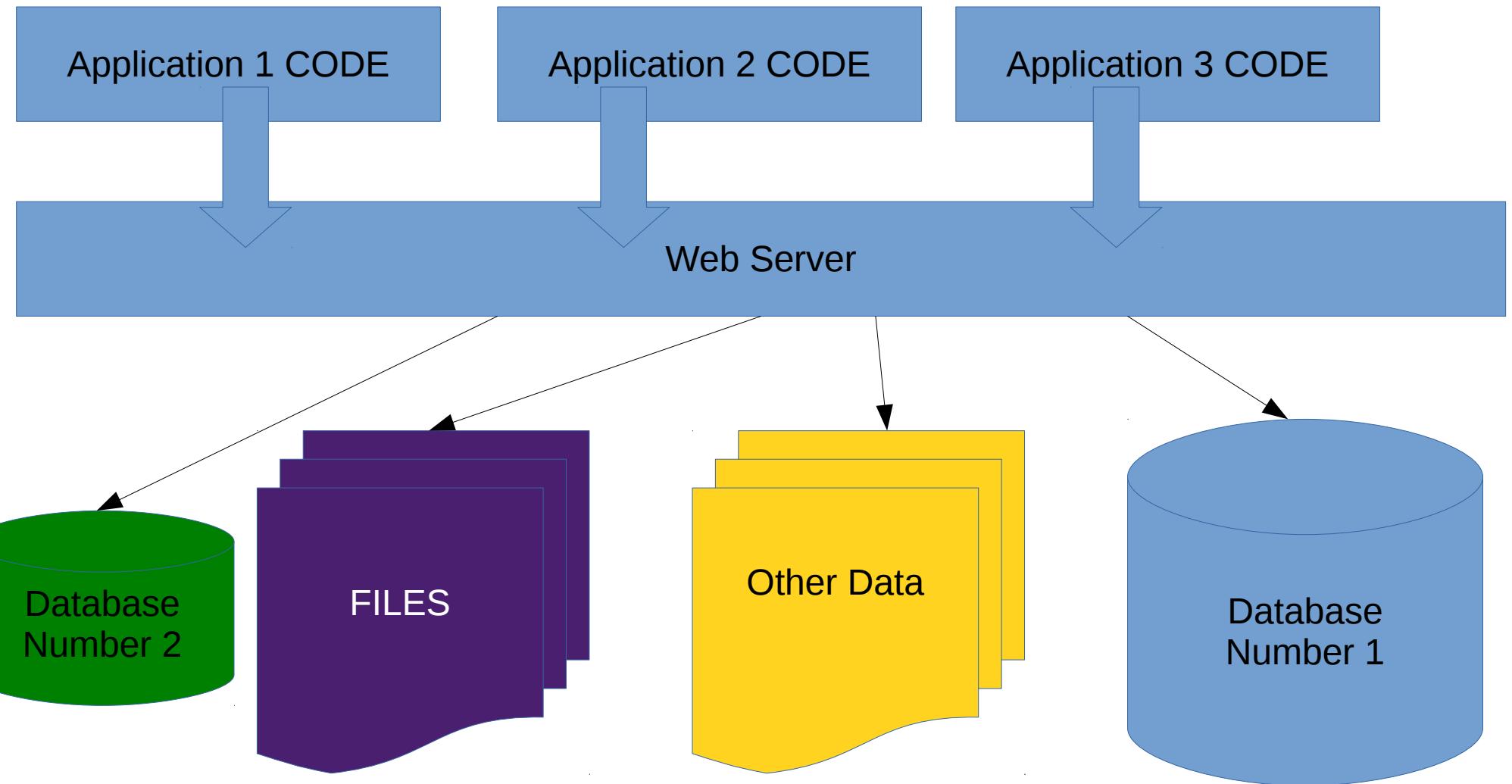


WEB SERVERS

We are going to need to have a web-server to run some of the examples today

- A web server is a special piece of software which provides the software technology to make data and content available on the Internet
- There are millions of web servers running around the world but very often we don't even think about them or what they do!

A very simplistic view of what a web-server actually does



**Installing a webserver
for this lecture**

We will need a web server for some of the more advanced examples

- There are LOTS of choices for this.
- The BEST solution (in my opinion) would be to use Apache Server
- It is probably the best web-server available (and it is Open Source)
- But it can be tricky to install when we are dealing with lots of different machines and operating systems.

Download Mongoose Free

N4100 × M Inbox (1,8 × nō How did y × 47595359! × Deleting f × petermoo × Webtext - × Karlsruhe × overpass l × Cesanta S ×

https://cesanta.com/mongoose.shtml

129825 downloads since 2014-03-05

Download Mongoose Free Edition

- Stable and mature: over 1 million downloads since 2004
- Cross-platform: works on Mac, Windows, UNIX/Linux
- No installation or configuration required: runs in one click
- IP-based ACL (deny access to certain IP addresses)
- File blacklist (hide certain files from serving)
- Resumed download support

-- download for free --

[Windows Executable](#)
[Windows Mongoose+PHP Package](#)
[Windows Mongoose+Lua Package](#)
[MacOS Installer](#)
[Linux x86_64 Executable](#)

-- download for free --

Download Mongoose Pro Edition

- All features of the Free edition, plus:
- [CGI](#) (ability to run sites written in PHP, Ruby or any other scripting language)
- [Server Side Includes](#) (include one HTML page into another)
- [WebDAV](#) (attach shared directory as a remote drive)
- Pre-packaged, ready-to-go Mongoose + [PHP](#) bundle for Windows (start PHP project in seconds)

Life-time software updates

personal and Commercial use. Distribution not allowed.

[Accept Mongoose EULA](#)

Download Mongoose Dev Edition

- All features of the Pro edition, plus:
- Ability to view and analyze all incoming and outgoing network packets



Experimental HTTPS security (TLS1.2) support

For personal and Commercial use. Distribution not allowed.

I accept [Mongoose EULA](#)

-- buy for \$8 --

I accept [Mongoose EULA](#)

-- buy for \$15 (with SSL) --

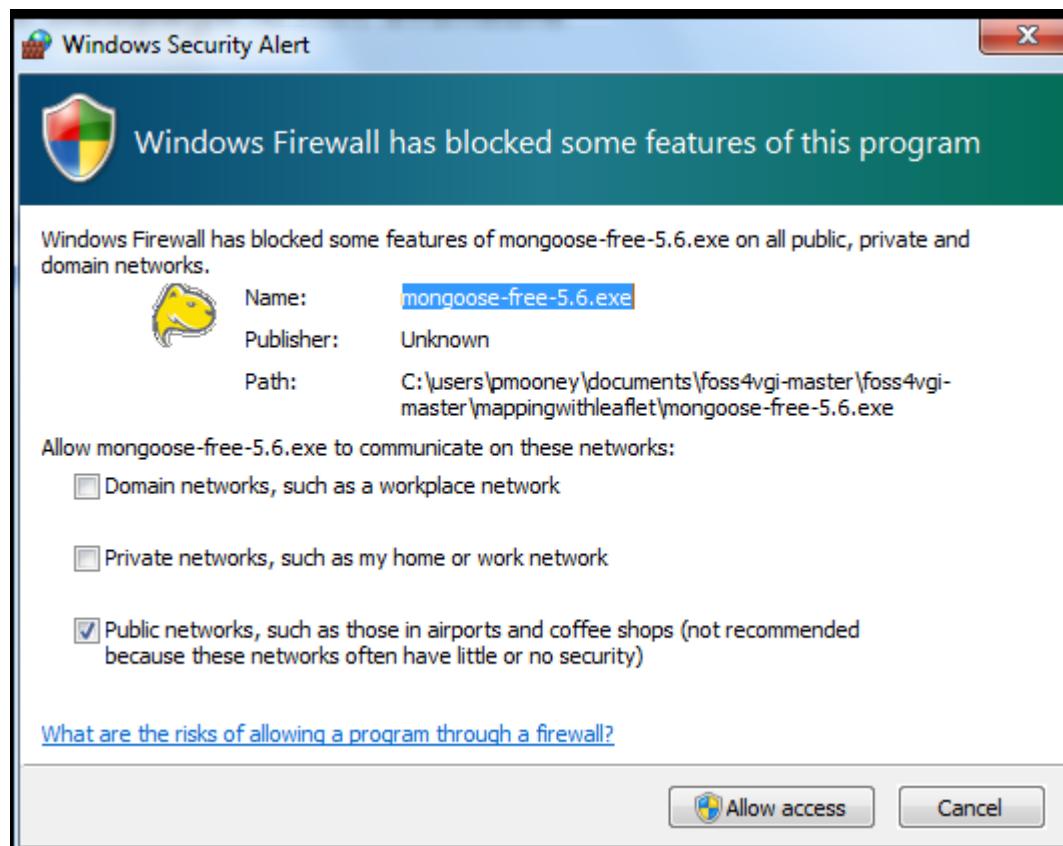
Documentation Licensing

We've made both Windows
and Linux executables
available for download in the
Moodle ZIP download

Mongoose – Windows Users

- Download the EXE file
- Move the EXE file to a new folder anywhere on your computer (*call the folder www or public_html*)
- Ensure that when you run the file that you do so as administrator (check that Windows has not prevented you from running it)
- Check in your browser that the URL
<http://127.0.0.1:8080> or **<http://localhost:8080>** work

Mongoose Windows Users



When Mongoose starts up you should see something like this



The screenshot shows a web browser window with the URL `149.157.243.132:8080` in the address bar. The page title is "Index of /". Below the title is a table listing files and their details.

Name	Modified	Size
geojson/	09-Nov-2015 12:33	[DIRECTORY]
README.md	09-Nov-2015 12:29	1.8k
Visualizing_VGI_With_Leaflet_PeterMooney.pdf	09-Nov-2015 12:29	5.1M
access_not_allowed.PNG	09-Nov-2015 12:42	50.1k
ex0.html	09-Nov-2015 12:29	2.5k
ex1.html	09-Nov-2015 12:29	2.7k
ex2.html	09-Nov-2015 12:29	2.9k
ex3.html	09-Nov-2015 12:29	3.4k
ex4.html	09-Nov-2015 12:29	2.9k
ex5.html	09-Nov-2015 12:29	3.2k
example1.html	09-Nov-2015 12:29	3.1k
example1.html~	09-Nov-2015 12:29	3.1k
geo1.html	09-Nov-2015 12:29	3.5k
geo2.html	09-Nov-2015 12:29	4.8k
geo3.html	09-Nov-2015 12:29	4.8k
geo4.html	09-Nov-2015 12:29	5.0k
leafletlogo.png	09-Nov-2015 12:29	41.6k
mongoose-free-5.6.exe	09-Nov-2015 12:39	220.1k
mongoose_in_windows_explorer.PNG	09-Nov-2015 12:43	182.7k

Mongoose – Linux Users (1)

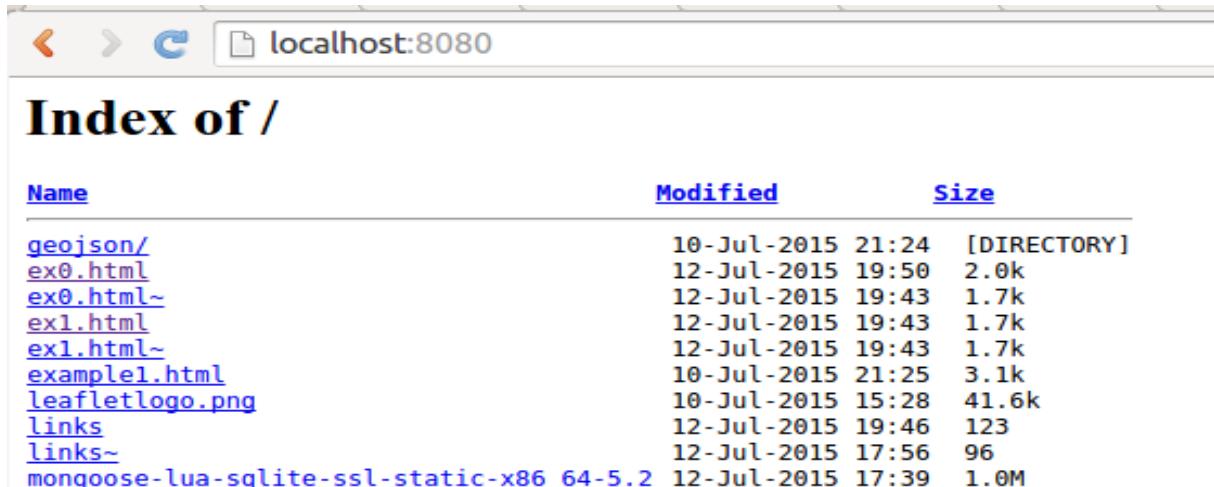
- Download the Linux executable
- Move this file to a new folder within your workspace – call the folder www or public_html
- You will need to make this file executable
- You will need to type the command
sudo chmod ugo+x mongoose-lua-sqlite-ssl-static-x86_64-5.2 in a terminal window
- Click on the file to run it
- Check in your browser that the URL **http://127.0.0.1:8080** or **http://localhost:8080** work

Windows and Linux Users

- DO NOT DELETE the Mongoose file
- As this is just a TEST ENVIRONMENT it is OK here – but this technique should not be used in a production environment
- However that's a different set of lecture notes!

We have a special web address now that Mongoose is operational

- We can now type in the address
<http://127.0.0.1:8080> or <http://localhost:8080>
into your browser
- You should be given a list of the files in the folder.
- Just click on “ex0.html” and wait for the lecture slides to catch up



A screenshot of a web browser window displaying a file directory listing. The address bar shows "localhost:8080". The page title is "Index of /". The table lists files and directories:

Name	Modified	Size
geojson/	10-Jul-2015 21:24	[DIRECTORY]
ex0.html	12-Jul-2015 19:50	2.0k
ex0.html~	12-Jul-2015 19:43	1.7k
ex1.html	12-Jul-2015 19:43	1.7k
ex1.html~	12-Jul-2015 19:43	1.7k
example1.html	10-Jul-2015 21:25	3.1k
leafletlogo.png	10-Jul-2015 15:28	41.6k
links	12-Jul-2015 19:46	123
links~	12-Jul-2015 17:56	96
mongoose-lua-sqlite-ssl-static-x86_64-5.2	12-Jul-2015 17:39	1.0M

We cannot proceed beyond this point unless you have Mongoose running successfully!



Download from
Dreamstime.com

This watermarked comp image is for previewing purposes only.



ID 33352709

© Mila Gligoric | Dreamstime.com

Starting with GeoJSON and Leaflet

GeoJSON and Leaflet are made for each other :-)



- **Leaflet is able to process, manipulate and display GeoJSON data**
- So it is in our best interests (because it is very efficient) to try to format our spatial data in GeoJSON format so that Leaflet can display it for us on a web map

Remember: Every GeoJSON file is a dataset in its own right

- This is an important consideration.
- We cannot just “throw” the GeoJSON file at Leaflet and expect Leaflet to display the file.
- **We will have to understand what the data contents of our GeoJSON file is in order to generate the best way to display our data**
- We shall start off with a GeoJSON file from the web and then proceed to OpenStreetMap data

geo1.html – US Geological Survey EarthQuake Data

- <http://earthquake.usgs.gov/earthquakes/feed/v1.0/geojson.php>

The screenshot shows a web browser displaying the USGS Earthquake Hazards Program website. The URL in the address bar is <http://earthquake.usgs.gov/earthquakes/feed/v1.0/geojson.php>. The page title is "GeoJSON Summary Format". On the left, there's a sidebar with "Real-time Feeds" (ATOM, KML, Spreadsheet, QuakeML) and "Real-time Notifications" (Earthquake Notification Service, Tweet Earthquake). The main content area has sections for "Description" (explaining GeoJSON), "Usage" (GeoJSON as a programmatic interface), and "Output" (GeoJSON format). On the right, there are "Feeds" for "Past Hour" (updated every 5 minutes) and "Past Day" (updated every 5 minutes), each with a list of links: "Significant Earthquakes", "M4.5+ Earthquakes", "M2.5+ Earthquakes", "M1.0+ Earthquakes", and "All Earthquakes".

earthquake.usgs.gov/earthquakes/feed/v1.0/geojson.php

USGS science for a changing world

Earthquake Hazards Program

Feeds & Notifications

Real-time Feeds

- ATOM
- KML
- Spreadsheet
- QuakeML

Real-time Notifications

- Earthquake Notification Service
- Tweet Earthquake

GeoJSON Summary Format

Description

GeoJSON is a format for encoding a variety of geographic data structures. A GeoJSON object may represent a geometry, a feature, or a collection of features. GeoJSON uses the [JSON standard](#). The GeoJSONP feed uses the same JSON response, but the GeoJSONP response is wrapped inside the function call, eqfeed_callback. See the [GeoJSON site](#) for more information.

This feed adheres to the USGS Earthquakes [Feed Life Cycle Policy](#).

Usage

GeoJSON is intended to be used as a programmatic interface for applications.

Output

Feeds

Past Hour

Updated every 5 minutes.

- [Significant Earthquakes](#)
- [M4.5+ Earthquakes](#)
- [M2.5+ Earthquakes](#)
- [M1.0+ Earthquakes](#)
- [All Earthquakes](#)

Past Day

Updated every 5 minutes.

geo1.html – please scroll to the bottom of this page and download the Past 7 Days 'All Earthquakes'

For Developers

- API Documentation - EQ Catalog
- GeoJSON Summary
- GeoJSON Detail
- Developers Corner
- Glossary
- Change Log
- Feed Lifecycle Policy
- Mailing List-Announcements
- Mailing List-Forum/Questions

Earthquakes

Hazards

Data

earthquake.usgs.gov/earthquakes/feed/v1.0/geojson.php

```
type: "FeatureCollection",
metadata: {
    generated: Long Integer,
    url: String,
    title: String,
    api: String,
    count: Integer,
    status: Integer
},
bbox: [
    minimum_longitude,
    minimum_latitude,
    minimum_depth,
    maximum_longitude,
    maximum_latitude,
    maximum_depth
],
features: [
{
    type: "Feature",
    properties: {
        mag: Decimal,
        place: String,
        time: Long Integer,
        updated: Long Integer,
        title: String
    }
}
]
```

Download this geojson file into the folder/directory you are using for all of these examples. Do not change the filename or extension

Past 7 Days
Updated every 5 minutes.

- [M2.5+ Earthquakes](#)
- [M1.0+ Earthquakes](#)
- [All Earthquakes](#)

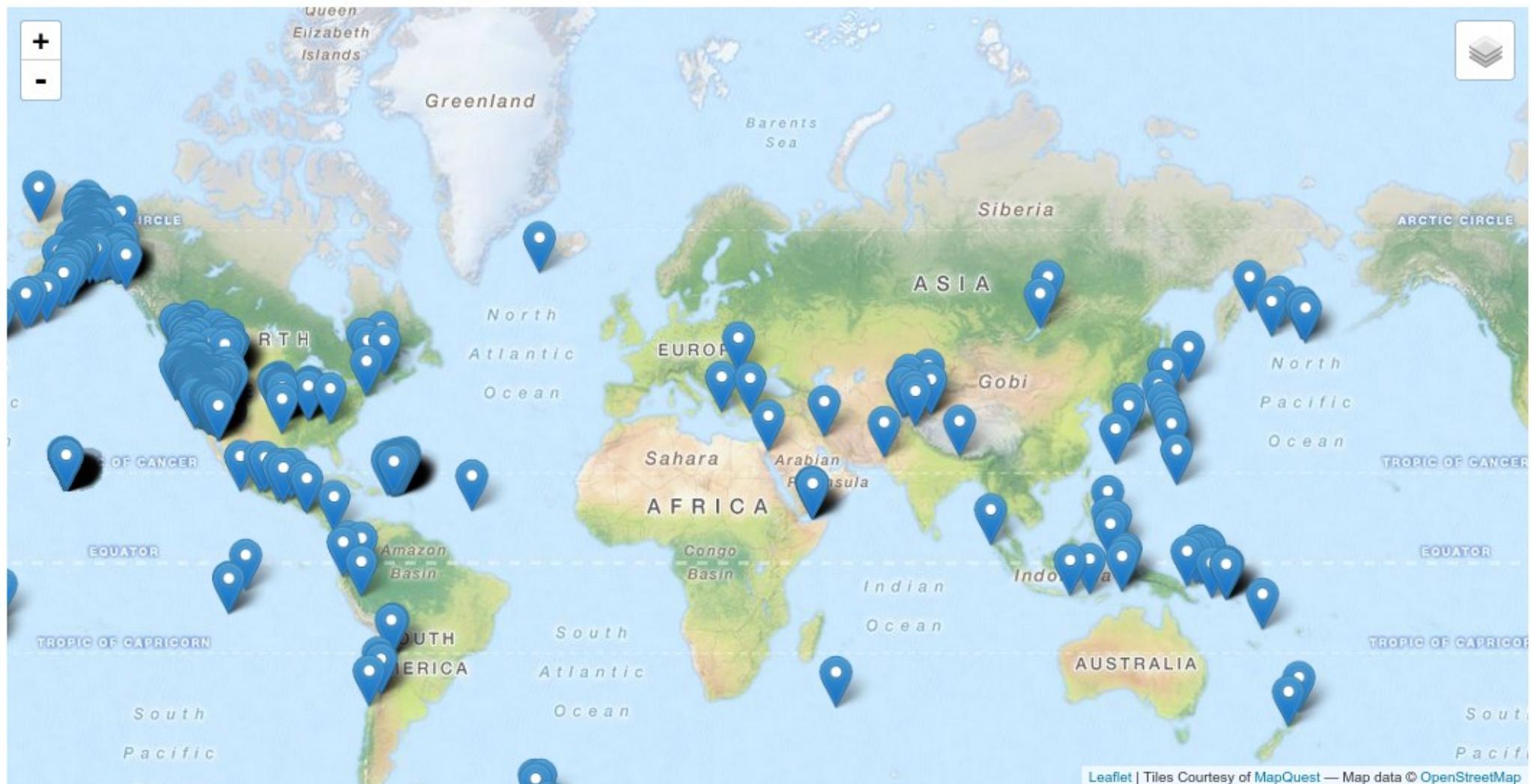
Past 30 Days
Updated every 15 minutes.

- [Significant Earthquakes](#)
- [M4.5+ Earthquakes](#)
- [M2.5+ Earthquakes](#)
- [M1.0+ Earthquakes](#)
- [All Earthquakes](#)

[All Earthquakes](#)

If you downloaded the data correctly – the link <http://localhost:8080/geo1.html> should look like this

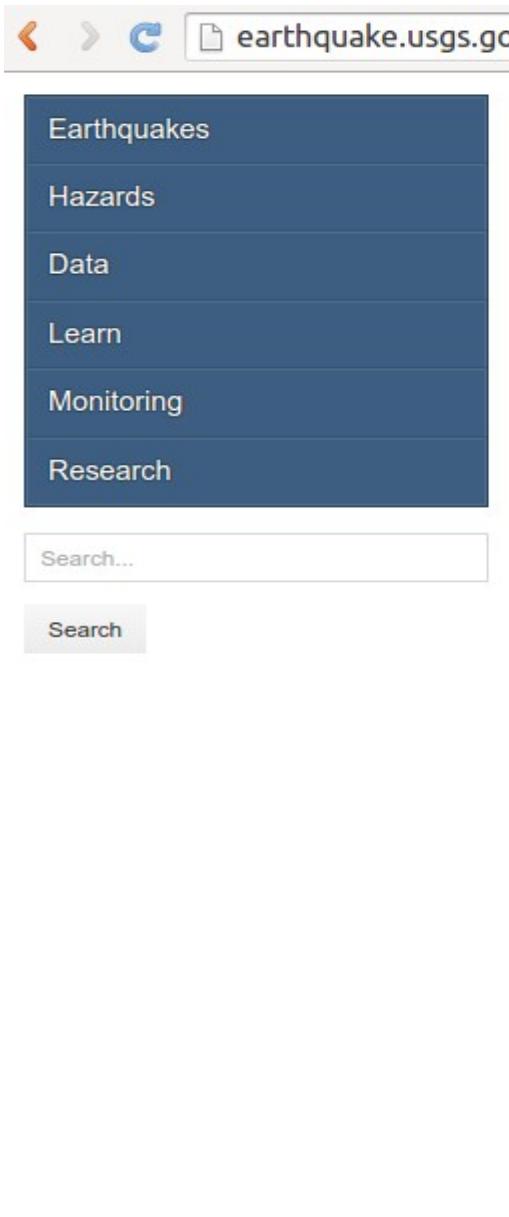
US Geological Survey - Past 7 Days Earthquakes



Unfortunately there is one major problem with the map we have created

- If you look at the map – it is just a bunch of pins or markers
- YES – We state on the page that it is a USGS dataset
- We need to make those pins or markers 'clickable'
- We need to display some information about each pin.
- **We need to revisit the specification for the GeoJSON file on the USGS Website first.**

Here is the specification of the PROPERTIES of the GeoJSON data



```
features: [
  {
    type: "Feature",
    properties: {
      mag: Decimal,
      place: String,
      time: Long Integer,
      updated: Long Integer,
      tz: Integer,
      url: String,
      detail: String,
      felt: Integer,
      cdi: Decimal,
      mmi: Decimal,
      alert: String,
      status: String,
      tsunami: Integer,
      sig: Integer,
      net: String,
      code: String,
      ids: String,
      sources: String,
      types: String,
      nst: Integer,
      dmin: Decimal,
      rms: Decimal,
      gap: Decimal,
      magType: String,
      type: String
    },
  }
],
```

There are four very useful properties

They are:

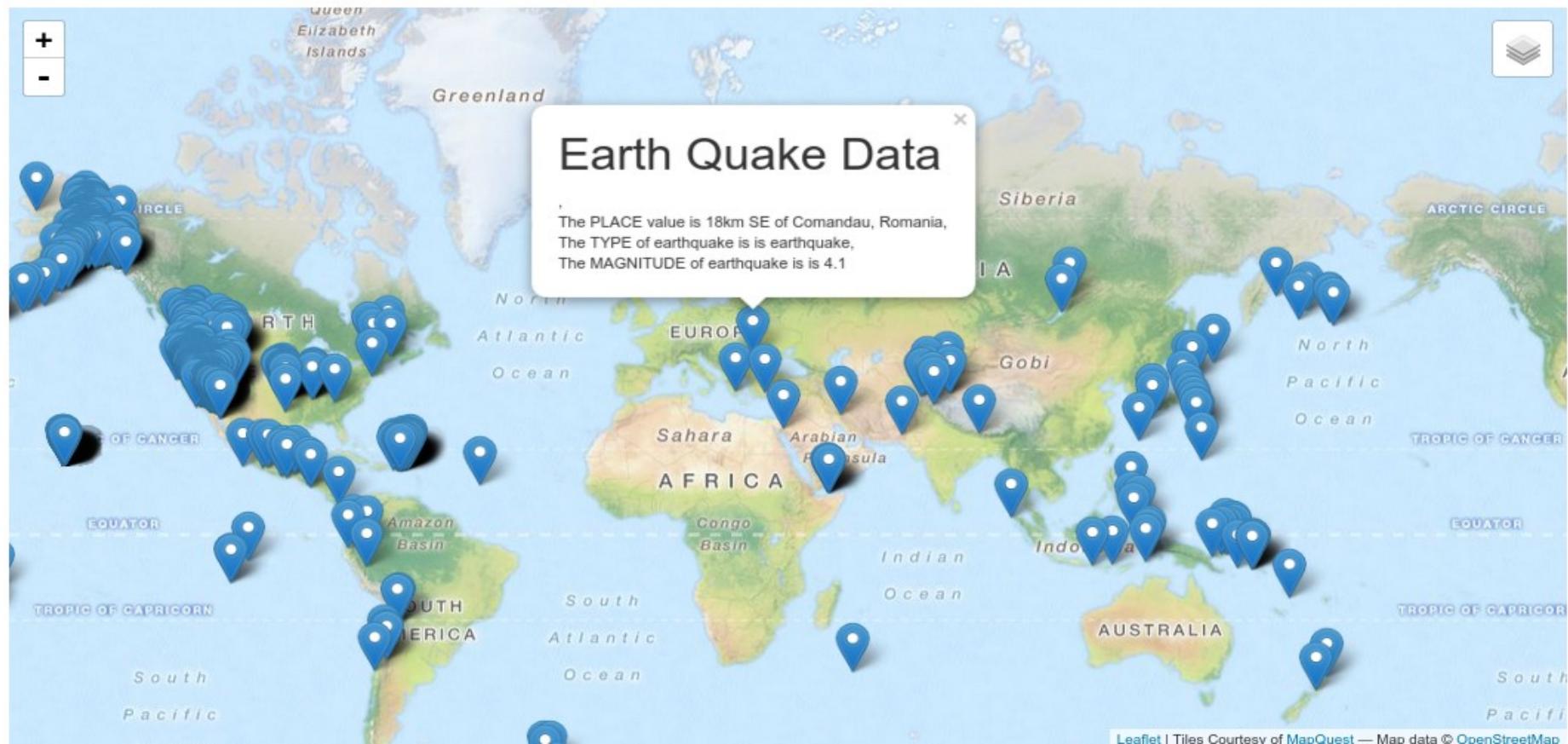
- = place
- = type
- = mag

Let's try to display these as a popup with each pin or marker on our map

Let's open up geo2.html in your text editor and look at it in the browser

- REMEMBER to view it at
<http://localhost:8080/geo2.html>

US Geological Survey - Past 7 Days Earthquakes - This time with clickable icons with information!



It's very important for you to understand the link between the Javascript in Leaflet and the PROPERTIES in the GeoJSON

- There is a VERY IMPORTANT new piece of code in the Javascript. We will REUSE this for all of our GeoJSON examples in the future!

```
// This is where Leaflet will go if you click on any of the objects which are in the
// GeoJSON file
function action_To_Perform_When_Marker_Is_Clicked_On_The_Map(feature, layer) {

    // does this clicked feature have any properties in its GeoJSON?
    if (feature.properties)
    {
        // the text for the Popup
        var PopupText = [];

        PopupText.push("<h1>Earth Quake Data</h1>");
        |
        if (feature.properties.place) // if this is a property called place
            PopupText.push("<br/>The PLACE value is " + feature.properties.place)

        if (feature.properties.type) // if this is a property called type
            PopupText.push("<br/>The TYPE of earthquake is " + feature.properties.type)

        if (feature.properties.mag) // if this is a property called type
            PopupText.push("<br/>The MAGNITUDE of earthquake is " + feature.properties.mag)

        // Join all the text to make the Popup
        layer.bindPopup("<p>" + PopupText.join() + "</p>");

    } // end if
} // end of function
```

Look at the PROPERTIES here
- these appear EXACTLY as they are typed in the GeoJSON file

= place
= type
= mag

Attribute information on Geographical Objects in OpenStreetMap

Tagging in OpenStreetMap

- Tagging is one of the most important aspects of OpenStreetMap
- It also provokes the most debate, conversation, chat, discussion, disagreement, etc
- Tagging in OpenStreetMap is very flexible
- It is very different to the type of tagging (or ontology) that one would find in databases such as those used by National Mapping Agencies

The “Map Features” Page – one of the cornerstones of OSM

http://wiki.openstreetmap.org/wiki/Map_Features



Main Page
The map
Map Features
Contributors
Help
Blogs
Shop
Donations
Recent changes

Tools
What links here
Related changes
Special pages
Printable version
Permanent link
Page information
Cite this page

A あ English Create account Log in

Page Discussion Read View source View history Search

We hit our fundraising target. Thank you! (You can still donate)

Map Features

Available languages — Map Features

- azərbaycanca • Bahasa Indonesia • bosanski • català • čeština • dansk • Deutsch • eesti • English • español • français • hrvatski • íslenska • italiano • latviešu • lietuvių • magyar • Nederlands • norsk bokmål • polski • português • português do Brasil • română • shqip • slovenčina • slovenščina • suomi • svenska • Tiếng Việt • Türkçe • српски / srpski • български • македонски • русский • українська • ქართული • தமிழ் • 한국어 • 日本語 • 中文 (简体) • 中文 (繁體) • فارسی • العربية • עברית

Other languages — Help us translate this wiki

- Afrikaans • Alemannisch • asturianu • Bahasa Melayu • Bân-lâm-gú • Basa Jawa • Baso Minangkabau • brezhoneg • corsu • Esperanto • euskara • Frysk • Gaeilge • Gàidhlig • galego • Hausa • Igbo • interlingua • Interlingue • isiXhosa • isiZulu • Kiswahili • Kreyòl ayisyen • Kréyòl gwadloupéyen • Kurdî • Lëtzebuergesch • Malagasy • Malti • Nedersaksies • norsk nynorsk • occitan • Oromoo • o'zbekcha • Plattdüütsch • Soomaaliga • Vahcuengh • Wolof • Yorùbá • Zazaki • беларуская • қазақша • монгол • тоҷикӣ • Ελληνικά • Հայերեն • ନେପାଳୀ • ମରାଠୀ • ହିନ୍ଦୀ • ଅଞ୍ଚିତା • ଗାଁତା • ପଞ୍ଜାਬୀ • ଗୁଜରାତୀ • ଓଡ଼ିଆ • ଶଲଗୁ • କଣ୍ଠଜ୍ଞ • ମଧ୍ୟାଳ୍ପିନୀ • ପିହାଳୀ • ତୈଥାରୀ • ମୁଖର୍ଜିଯା • ଗାନ୍ଧାରୀ

OpenStreetMap represents physical **features** on the ground (e.g., roads or buildings) using **tags** attached to its basic data structures (its **nodes**, **ways**, and **relations**). Each tag describes a geographic attribute of the feature being shown by that specific node, way or relation.

OpenStreetMap's free tagging system allows the map to include an unlimited number of attributes describing each feature. The community agrees on certain key and value combinations for the most commonly used tags, which act as informal standards. However, users can create new tags to improve the style of the map or to support analyses that rely on previously unmapped attributes of the features. Short descriptions of tags that relate to particular topics or interests can be found using the [feature pages](#).

Most features can be described using only a small number of tags, such as a path with a classification tag such as `highway=footway`, and perhaps also a name using `name=*`. But, since this is a worldwide, inclusive map, there can be many different feature types in OpenStreetMap, almost all of them

Tags can be considered as the attributes of an object

- An object can have at minimum 1 attribute (tag)
 - and there is no upper limit.
- There are no strict rules on how many attributes any object should have
- This flexibility means that you must use your own judgement in regards to how many attributes you provide

Let's look at the OSM tag for restaurants



Main Page
The map
Map Features
Contributors
Help
Blogs
Shop
Donations
Recent changes

Tools
What links here
Related changes
Special pages
Printable version
Permanent link
Page information
Cite this page

We hit our fundraising target. Thank you! (You can still donate [↗](#))

Tag:amenity=restaurant

Available languages — **Tag:amenity=restaurant** [Help](#) [show](#)

- Deutsch • English • español • français • italiano • português do Brasil • русский • 日本語

Other languages — [Help us translate this wiki](#)

amenity=restaurant is for a generally formal place with sit-down facilities selling full meals served by waiters and often licensed (where allowed) to sell alcoholic drinks.

Contents [hide]

- 1 How to Map
- 2 Examples
- 3 Rendering
- 4 See Also

Description
Is for a generally formal place with sit-down facilities selling full meals served by waiters and often licensed (where allowed) to sell alcoholic drinks.

How to Map

Add a node at the centre of the building and add **amenity=restaurant** to it. You can name it with **name=***. If the whole building is used for this feature and its footprint is present in OSM, you can apply the tags on the area if you prefer.

Optionally, you can further classify it using the **cuisine=*** tag with a value suitable for your nation's environment

We use the amenity = restaurant tag and others where applicable

Amenity = restaurant

Name = Peter's Italian Place

Cuisine = Italian

Smoking = no

internet_access = wlan

In OSM we try to supply an appropriate number of tags to an object/feature

- We try to use the tags to supply as much accurate and timely attribute information about the object/feature as we can
- **ALWAYS USE MAP FEATURES FOR GUIDANCE WHEN USING TAGS**
- In the case of many tags there are suggested accompanying tags you should use

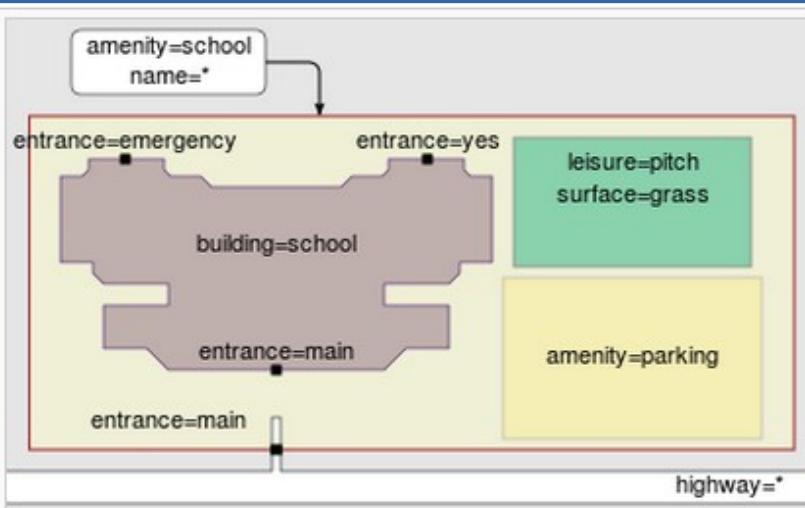
Example: Amenity = School

How to map

Mark the boundary of the school using an [Area](#) or place a [Node](#) in the middle of the site if you are in a hurry (or don't have access to information about the boundary and it is not obvious from aerial imagery).

This area should envelop the full grounds of the school including all the buildings, sports facilities and grounds. For schools with multiple sites the [multipolygon](#) relation can be used. Tag the element with [amenity=school](#) and [name=*](#) for the name of school. Suggested additional tags include:

- [operator=*](#) - Name of operator, often the local education authority.
- [addr=*](#) - Address details
- [capacity=*](#), for the number of pupils taught at the school
- [isced:level=*](#), for the educational level (proposed tags)
- [fee=yes](#) if the school makes a direct charge for core services.
- [religion=*](#), if the school is associated with a particular religion (also [denomination=*](#))
- [wikipedia=*](#), for a link to a Wikipedia article about the school
- [ref=*](#), if schools are numbered
- [contact=*](#), for contact details including the schools website, email and phone number



School buildings should be tagged with [building=school](#) where they are used generally, and optional also with details of use with appropriate additional tags, for example [amenity=swimming_pool](#).

Consider adding [entrance=*](#) and if appropriate [barrier=gate](#) to the points where roads, paths or other access routes into the school grounds cross the boundary of the school (which is tagged with [amenity=school](#)).



Description

Institution designed for learning under the supervision of teachers.

Group: Education features

Used on these elements



Useful combination

- [name=*](#)
- [operator=*](#)
- [isced:level=*](#)

Status: Approved

[taginfo](#) [More...]

<input type="radio"/>	334 305	6.60 %
<input checked="" type="checkbox"/>	315 360	10.11 %
<input checked="" type="checkbox"/>	8 017	21.19 %

Tools for this tag

- [taginfo](#), [fr](#), [uk](#), [ie](#), [us](#)
- [overpass-turbo](#)

Choosing the correct tags is not an easy task

- Choosing the correct tags requires you to think about the object/feature you are mapping
- As you get more experienced with mapping you will become more familiar with tagging
- **Remember** – you should always use tags which you can **VERIFY**
- **Remember** – you should use the Map Features guidance on the popular combinations of tags

**Let's get some OSM GeoJSON
data from OVERPASS**

Suppose we are feeling crazy and decide to drive our car into central London

The screenshot shows the overpass-turbo web application interface. At the top, there is a navigation bar with buttons for Run, Share, Export, Wizard, Save, Load, Settings, and Help. To the right of the navigation bar, the text "overpass turbo" is displayed, followed by "Map" and "Data" buttons. On the left side of the interface, there is a code editor window containing the following Overpass query:

```
1 node
2   [amenity=parking]
3   (around:3000,51.507343,-0.127656);
4 out body;
```

An arrow points from the "Export" button in the navigation bar to the code editor window.

Below the code editor, the URL <http://overpass-turbo.eu/> is shown.

On the right side of the interface, a map of central London is displayed, showing numerous parking locations marked by blue circles. A callout box with a black border contains the following text:

**Export and SAVE as GeoJSON
in the folder called geojson –
remember to give the file a
sensible name – no spaces**

At the bottom of the map interface, there is a status bar with the following information:

Loaded – nodes: 84, ways: 0, relations: 0
Displayed – pois: 84, lines: 0, polygons: 0

When downloaded and in correct folder – let's open it in a text editor

```
},
{
  "type": "Feature",
  "id": "node/368044118",
  "properties": {
    "@id": "node/368044118",
    "amenity": "parking",
    "capacity": "233",
    "capacity:disabled": "5",
    "covered": "yes",
    "fee": "yes",
    "name": "Baynard House",
    "operator": "Corporation of London",
    "website":
    "http://www.cityoflondon.gov.uk/services/transport-and-streets/parking/where-to-park/car-parks/Pages/Baynar d-House-car-park.aspx"
  },
  "geometry": {
    "type": "Point",
    "coordinates": [
      -0.1000953,
      51.5118468
    ]
  }
}
```

**Look CAREFULLY at the properties of each Feature/Object/Node
Notice – each node has a different number of tags**

Let's choose three: **name** **operator** **capacity**

Check Map Features if you need more information

Open the file geo3.html in your text editor AND your browser

- You'll need to check out one very important detail
- You will need to change the filename of the geojson file to the name you used
- You will then save the file and refresh the page in your browser
- Otherwise you won't see any car parks!!!

This is what <http://localhost:8080/geo3.html> should look like!

PARKING PLACES in Central London, UK. GeoJSON data from the Overpass Turbo service



Look VERY carefully at the action_To_Perform_When_Marker_Is_Clicked_On_The_Map function

```
// This is where Leaflet will go if you click on any of the objects which are in the
// GeoJSON file
function action_To_Perform_When_Marker_Is_Clicked_On_The_Map(feature, layer) {

    // does this clicked feature have any properties in its GeoJSON?
    if (feature.properties)
    {
        // the text for the Popup
        var PopupText = [];

        PopupText.push("<h3>Car Park Info</h3>");

        if (feature.properties.name) // if this is a property called name
            PopupText.push("<br/>The NAME of the car park is " + feature.properties.name)

        if (feature.properties.type) // if this is a property called operator
            PopupText.push("<br/>The OPERATOR of the car park is " + feature.properties.operator)

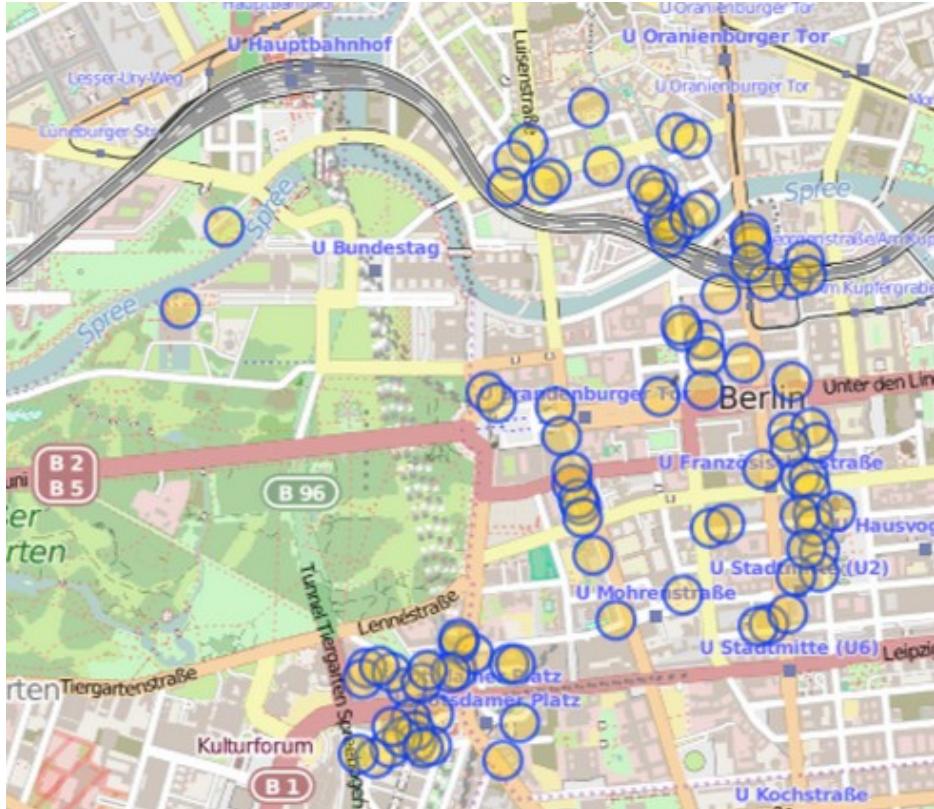
        if (feature.properties.capacity) // if this is a property called capacity
            PopupText.push("<br/>The Capacity of the Car Park is " + feature.properties.capacity)

        // Join all the text to make the Popup
        layer.bindPopup("<p>" + PopupText.join() + "</p>");
    } // end if
} // end of function
```

NOTICE – How we had to change very little – we just change the text a little and we put in our own properties which we picked out a few minutes ago

GeoJSON Exercise on your own!

Exercise: Map of places to eat in Berlin, Germany



- Using the Overpass API generate GeoJSON representing all amenity=restaurant around 1000m radius of the Brandenburg Gate in Berlin
- Use name, cuisine, opening_hours, wheelchair as properties
- Center and zoom the map appropriately
- You can use geo3.html as your starting point

Colors for Polygons and other features in Javascript

Visibone Color Lab is very useful

The screenshot shows a web browser window for the Visibone Color Lab at <https://www.visibone.com/colorlab/>. The main interface features a circular "The 216-Color Webmaster's Palette" with various colored hexagons. A specific color, "Light Dull Magenta" with the hex code CC66CC, is highlighted in purple. To the right of the color swatch, its CMYK values are listed: 204=R, 40=G, 0=Y, 20=K. Below this, a row of six color swatches shows the color in different color models: LSG (99FF66), Y (FFFF00), R (FF0000), LSG (FF3300), Y (CC66CC), R (LSG). At the bottom of the page, there is a multilingual instruction: "Click on another color..." followed by translations in French, German, Spanish, Norwegian, Dutch, Swedish, Italian, Czech, Danish, Indonesian, Portuguese, Polish, Japanese, and Russian.

CC66CC
LDM
Light Dull Magenta

204=R 40=G 0=Y
102=G 0=Y 20=K
204=B

99FF66 LSG	FFFF00 Y	FF0000 R	FF3300 LSG	CC66CC LDM
Y R RRO X LDM	LSG R RRO X LDM	LSG Y RRO X LDM	Y R RRO X LDM	Y R RRO X LDM

Click on another color...
Cliquer une autre couleur...
Klicken Sie auf eine andere Farbe...
Haga clic en otro color...
Klikk på en annen farge...
Probeer nog een andere kleur...
Klicka på en annan färg...
Cliccare su un altro colore...
Klikněte na jinou barvu...
Klik på en anden farve...
klik pada warna lainnya...
Clique em outra cor...
Kliknij inny kolor...
再選一個顏色...
他の色をクリックしてください...
Нажмите на другой цвет...

It is very good practice to always specify colors using their HEX value – all browsers and Javascript understand HEX

The screenshot shows a web browser window displaying the VisiBone color palette. The URL in the address bar is <https://www.visibone.com/colorlab/>. The main interface features a large, colorful hexagonal color wheel on the left and a detailed color palette grid on the right. A specific color, Light Dull Magenta (CC66CC), is highlighted in purple on both the wheel and the grid. The grid shows the color's RGB values (204=R, 102=G, 0=B) and CMYK values (0=C, 40=M, 0=Y, 20=K). Below the grid, there is a message in multiple languages: "Click on another color...". A large gray arrow points from the highlighted color area towards the bottom right corner of the screen. In the bottom right corner, the hex code "#CC66CC" is displayed.

VisiBone

The 216-Color Webmaster's Palette

CC66CC
LDM
Light Dull Magenta

204=R 0=C
102=G 40=M
0=B 0=Y
0=C 20=K

99FF66	FFFF00	FF0000	FF3300	CC66CC
LSG	Y	R	Q	LDM
Y	LSG	Y	Y	Y
R	R	RR	R	R
RRO	RRO	RRO	RRO	RRO
X	LDM	X	LDM	X

Click on another color...
Cliquer une autre couleur...
Klicken Sie auf eine andere Farbe...
Haga clic en otro color...
Klikk på en annen farge...
Probeer nog een andere kleur...
Klicka på en annan färg...
Cliccare su un altro colore...
Klikněte na jinou barvu...
Klik på en anden farve...
klik pada warna lainnya...
Clique em outra cor...
Kliknij inny kolor...
再選一個顏色...
他の色をクリックしてください...
Нажмите на другой цвет...

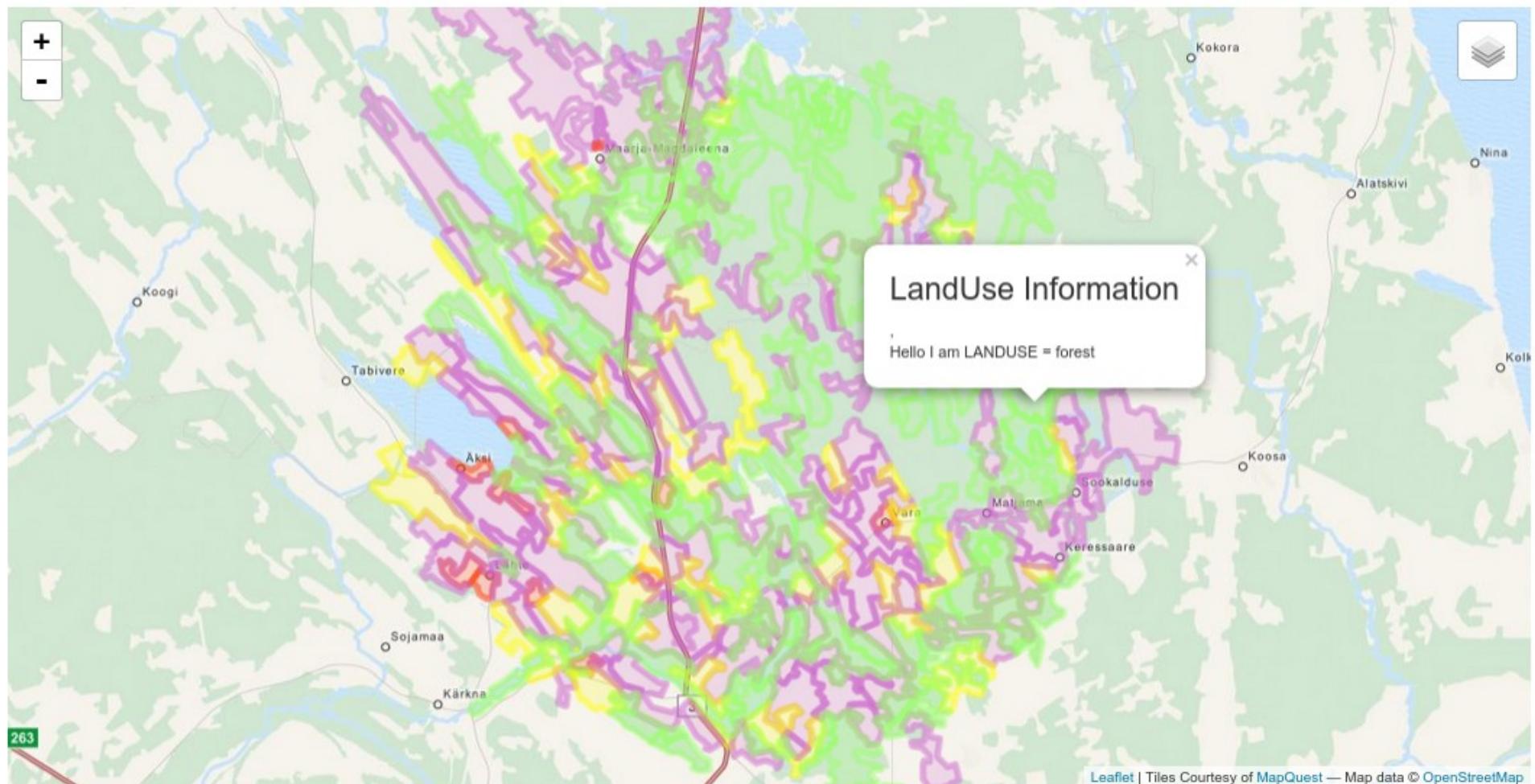
#CC66CC

Colouring/Styling Landuse Polygons in Estonia

- Open up geo4.html in your text editor and in your browser at <http://localhost:8080/geo4.html>
- This is an example where we have POLYGONS and not points.
- To make a map a bit more interesting we have decided to give the polygons a different colour depending on the value of the tag
- We are looking at LANDUSE tags only

The geo4.html web map should look something like this in your browser

Styling Land Cover Maps (Polygons) from Estonian OpenStreetMap

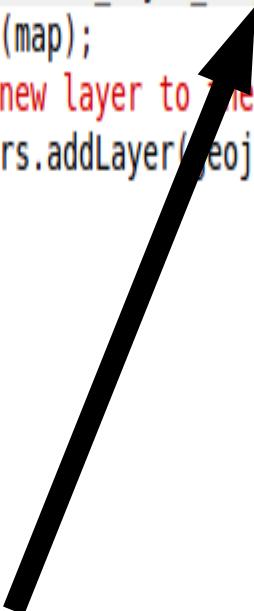


There are a few VERY important changes to our Javascript

- 1 – We tell LEAFLET that we want to put a specific STYLE on the polygons
- 2 – We must have code to tell LEAFLET what the colours in the specific STYLE actually are
- 3 – We must also adapt our code for when someone clicks on one of the polygons – in this case we just show the landcover tag

We tell LEAFLET that we want to put a specific STYLE on the polygons

```
$getJSON("./geojson/estoniaLanduse.geojson",
  function(data) {
    // tell Leaflet to go to the function action_To_Perform_When_Marker_Is_Clicked_On_The_Map
    // when someone clicks on one of the objects in the GeoJSON layer
    var geojson = L.geoJson(data, {onEachFeature: action_To_Perform_When_Marker_Is_Clicked_On_The_Map,
      style: specific_style_for_ways});
    geojson.addTo(map);
    <!-- add our new layer to the group of top layers -->
    myGeoJSONLayers.addLayer(geojson);
  }
);
```



We must have code to tell LEAFLET what the colours in the specific STYLE actually are

```
// This is a VERY important function. This is where we say which colors will be
// displayed for specific values of the landuse tag
function specific_style_for_ways(feature) {
    switch (feature.properties.landuse) {
        case 'meadow': return {color: "#FFFF00"};
        case 'forest':  return {color: "#99FF66"};
        case 'farm':   return {color: "#CC66CC"};
        default: return {color: "#FF3300"}; // this is when we don't know the property value
                                         // or it is different to the ones above
    }
}
```

We must also adapt our code for when someone clicks on one of the polygons – in this case we just show the landcover tag

```
// This is where Leaflet will go if you click on any of the objects which are in the
// GeoJSON file
function action_To_Perform_When_Marker_Is_Clicked_On_The_Map(feature, layer) {

    // does this clicked feature have any properties in its GeoJSON?
    if (feature.properties)
    {
        // the text for the Popup
        var PopupText = [];

        PopupText.push("<h3>LandUse Information</h3>");

        if (feature.properties.landuse) // if this is a property called landuse
            PopupText.push("<br/>Hello I am LANDUSE = " + feature.properties.landuse)

        // Join all the text to make the Popup
        layer.bindPopup("<p>" + PopupText.join() + "</p>");
    } // end if
} // end of function
```

Just a very simple popup for this example

Optional Exercise on Polygons

Visualising Amenity polygons in Cork

- Go to the Moodle page for today's lecture
- Copy the final piece of OVERPASS code into overpass online
- This is for amenity objects in Cork
- Save the output as GeoJSON into your geoJSON folder
-
- **NOTE: I've made this geoJSON file available in the download ZIP file to save time. There is a similar file for Geneva and Denver**

Exercise – Colouring amenity objects in Cork or Geneva

- Copy the geo4.html file and rename as geo5.html
- Make the necessary changes to center, zoom and name of geoJSON file
- Color all Amenity = School (#009246)
- Color all Amenity = Parking (#CE2B37)
- Color everything else (White #FFFFFF)
- **In the POPUP information just give the AMENITY type as text**

So now you can develop your own
web-based maps using Open
Source Software AND Open Data



**What if we want to have TWO or
more geoJSON layers?**

Our Javascript code to add ONE layer of GeoJSON

```
58 | <!-- We are going to make a group for our 'top layers' -->
59 | var myGeoJSONLayers = L.layerGroup(); ←
60 | <!-- we use JQUERY to access our GeoJSON -->
61 | <!-- Remember our GeoJSON is stored in a subfolder - so we need to make sure we get the file
location correct-->
62 | <!-- This will become a new layer -->
63 |
64 | $.getJSON("./geojson/estoniaLanduse.geojson",
65 |   function(data) {
66 |     // tell Leaflet to go to the function action_To_Perform_When_Marker_Is_Clicked_On_The_Map
67 |     // when someone clicks on one of the objects in the GeoJSON layer
68 |     var geojson = L.geoJson(data, {onEachFeature:
69 |       action_To_Perform_When_Marker_Is_Clicked_On_The_Map,
70 |       style: specific_style_for_ways});
71 |     geojson.addTo(map);
72 |     <!-- add our new layer to the group of top layers -->
73 |     myGeoJSONLayers.addLayer(geojson); ←
74 |   }
75 |
76 | // Notice that we have made a change here also.
77 | // We have added the myGeoJSONLayers variable so that Leaflet knows that you
78 | // want to include the GeoJSON as a layer on the map
79 | // Notice that we also make a place where we can switch on/off the layer
80 | var overlayMaps = {"Estonian Landuse": myGeoJSONLayers}; ←
81 | L.control.layers(baseMaps, overlayMaps, myGeoJSONLayers).addTo(map);
82 |
```

To add a second GeoJSON layer we just need to add some new variables to our code

Check out [double.html](#)

Step 1: Add a new layer group

```
<!-- This is where we are going to get Javascript to gather the GeoJSON and make it available-->
<!-- so that Leaflet can display it -->
<!-- We need to make a special LAYER for our GeoJson -->
<!-- We are going to make a group for our 'top layers' -->
var myGeoJSONLayers = L.layerGroup();
var myGenevaLayers = L.layerGroup(); // NEW ADDITIONAL SECOND GEOJSON LAYER
```

Step 2: Add your geoJSON Javascript (with layerGroup changed)

```
78 |
79 |     $.getJSON("./geojson/Amenity_Geneva.geojson",
80 |         function(data) {
81 |             // tell Leaflet to go to the function action_To_Perform_When_Marker_Is_Clicked_On_The_Map
82 |             // when someone clicks on one of the objects in the GeoJSON layer
83 |             var geojson = L.geoJson(data,{onEachFeature:
84 |                 action_To_Perform_When_Marker_Is_Clicked_On_The_Map,
85 |                 style: specific_style_for_ways});
86 |             geojson.addTo(map);
87 |             <!-- add our new layer to the group of top layers -->
88 |             myGenevaLayers.addLayer(geojson); // NEW LAYER GROUP NAME HERE
89 |         }
90 |     );

```

Step 3: Add your new geoJSON layer to the layer control for the map

```
92 // Notice that we have made a change here also.  
93 // We have added the myGeoJSONLayers variable so that Leaflet knows that you  
94 // want to include the GeoJSON as a layer on the map  
95 // Notice that we also make a place where we can switch on/off the layer  
96 var overlayMaps = {"Estonian Landuse": myGeoJSONLayers, "Geneva Layer": myGenevaLayers};  
97  
98 // Notice how we add our second layer to our overlay container!  
99 L.control.layers(baseMaps, overlayMaps,myGeoJSONLayers,myGenevaLayers).addTo(map);  
100  
101  
102
```

You can easily make your own
GeoJSON

Go to GeoJSON.io

The screenshot shows a map of the Maynooth University campus area in Ireland. The map includes labels for 'North Campus', 'Arts Building', 'Science Building', 'Post Primary School Maynooth', 'South Campus', 'Maynooth Castle', 'Royal Canal Way', 'Carton Ave', 'DUBLIN RD', 'LEINSTER PK', 'MAIN ST', 'PARSON ST', 'KILCOCK RD', 'Laraghbryam', 'THE STEEPLE', 'MOYGLARE RD', 'LARE HALL', 'THE PARK', 'THE WALK', and 'Rivertyreen'. A large dark grey polygon highlights the North Campus area. The right side of the interface displays the corresponding GeoJSON code:

```
1 {  
2   "type": "FeatureCollection",  
3   "features": [  
4     {  
5       "type": "Feature",  
6       "properties": {"name": "Maynooth University"},  
7       "geometry": {  
8         "type": "Polygon",  
9         "coordinates": [  
10            [  
11              [-6.605830192565918,  
12                53.387346941404545  
13              ],  
14              [-6.6031694412231445,  
15                53.387654077940816  
16              ],  
17              [-6.59879207611084,  
18                53.38668147130748  
19              ],  
20              [-6.595573425292969,  
21                53.385606459176216  
22              ],  
23              [-6.605830192565918,  
24                53.387346941404545  
25              ]  
26            ]  
27          ]  
28        }  
29      }  
30    ]  
31  }  
32 }  
33 }
```

You can make really nice GeoJSON datasets here

- Remember PROPERTIES – the name of the property and the value MUST always have double quotes
- For example “population”: “200,000”
- You can have a mixture of polylines, polygons and points

You can easily SAVE the data you create as GeoJSON

The screenshot shows a map of Maynooth University campus and its surroundings. A polygon is drawn over the university campus buildings. The 'Save' menu is open, with 'GeoJSON' selected. The right panel shows the corresponding GeoJSON code.

```
{
  "type": "FeatureCollection",
  "features": [
    {
      "type": "Feature",
      "properties": {"name": "Maynooth University"},
      "geometry": {
        "type": "Polygon",
        "coordinates": [
          [
            [
              [
                [
                  [
                    -6.605830192565918,
                    53.387346941404545
                  ],
                  [
                    [
                      -6.6031694412231445,
                      53.387654077940816
                    ],
                    [
                      [
                        -6.59879207611084,
                        53.38668147130748
                      ],
                      [
                        [
                          -6.595573425292969,
                          53.385606459176216
                        ],
                        [
                          [
                            -6.595573425292969,
                            53.385606459176216
                          ]
                        ]
                      ]
                    ]
                  ]
                ]
              ]
            ]
          ]
        ]
      }
    }
  ]
}
```

The final exercise.....



Exercise – on your own

- Create a simple GeoJSON dataset on [GeoJSON.io](#)
- Give each feature one or two PROPERTIES (remember the double quotes)
- Use the code you have written for LEAFLET today to make a web-based map of the data you have created.
- In particular geo2.html, geo3.html and geo4.html will be of help! (if you are adventurous)

Getting GeoJSON Polygon Data for OSM

<https://mapzen.com/data/metro-extracts>

[PROJECTS](#)[DATA](#)[DOCUMENTATION](#)[BLOG](#)[◀ DATA](#)

metro extracts

City-sized portions of OpenStreetMap, served weekly





PROJECTS

DATA

DOCUMENTATION

BLOG

DEVELOPERS

Dubai, Abu Dhabi

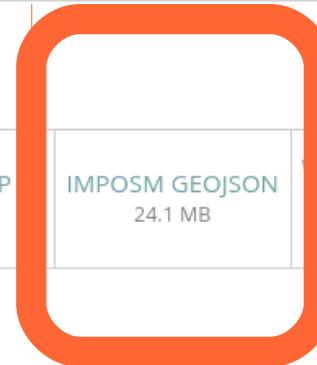
OSM PBF 13.9 MB	OSM XML 22.6 MB	OSM2PGSQL SHP 27.4 MB	OSM2PGSQL GEOJSON 18.3 MB	IMPOSM SHP 23.0 MB	IMPOSM GEOJSON 28.7 MB	WATER COASTLINE SHP 1.7 MB	LAND COASTLINE SHP 1.5 MB
--------------------	--------------------	--------------------------	---------------------------------	-----------------------	---------------------------	----------------------------------	---------------------------------

Dublin, Ireland

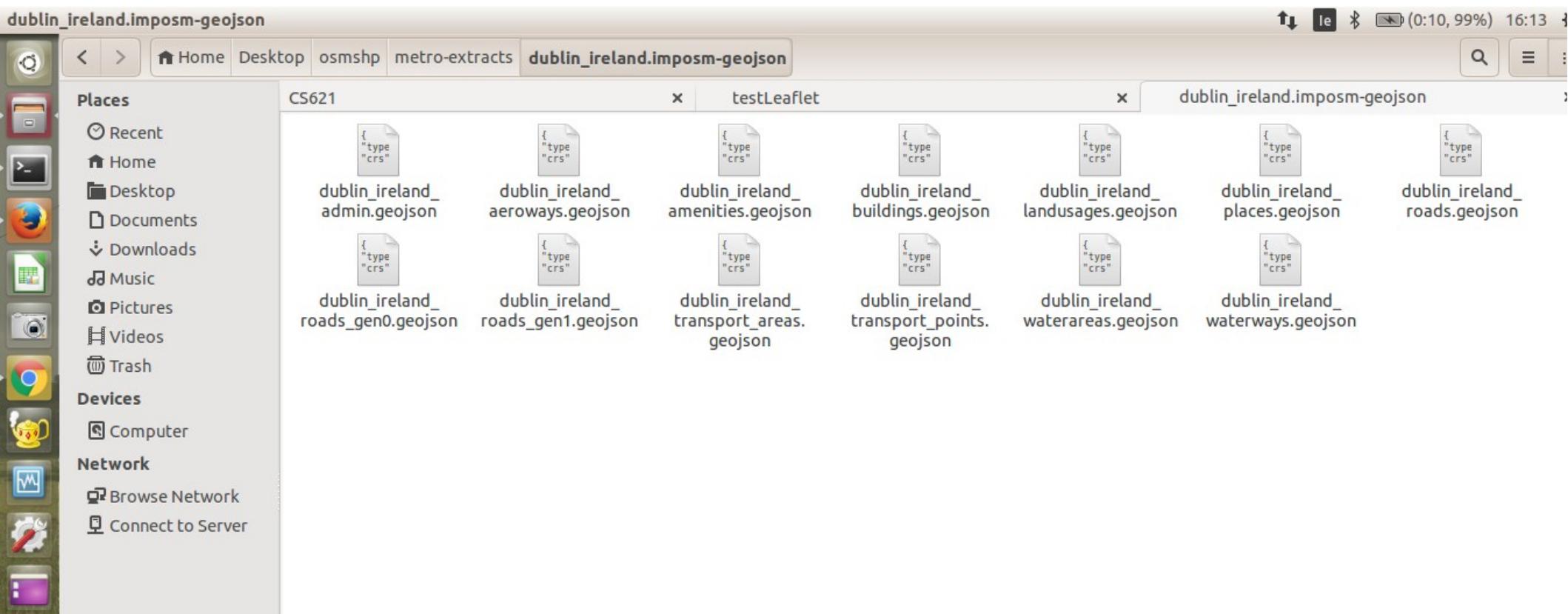
OSM PBF 11.6 MB	OSM XML 18.2 MB	OSM2PGSQL SHP 29.6 MB	OSM2PGSQL GEOJSON 20.9 MB	IMPOSM SHP 19.0 MB	IMPOSM GEOJSON 24.1 MB	WATER COASTLINE SHP 193 KB	LAND COASTLINE SHP 78 KB
--------------------	--------------------	--------------------------	---------------------------------	-----------------------	---------------------------	----------------------------------	--------------------------------

Duesseldorf, Germany

OSM PBF 26.8 MB	OSM XML 43.1 MB	OSM2PGSQL SHP 64.5 MB	OSM2PGSQL GEOJSON 45.9 MB	IMPOSM SHP 41.7 MB	IMPOSM GEOJSON 52.9 MB
--------------------	--------------------	--------------------------	------------------------------	-----------------------	---------------------------



When you UNZIP the file



Some of these geoJSON files can
be very large.... choose wisely!

Assignment is on Moodle

I'm happy to help with questions at
peter.mooney@nuim.ie

