Building OSM based web app from scratch

How to find the way through the open source jungle?

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osm-maps.eu

What is my technical background?

- First programming language: ALGOL 60 (late 70's)
- University: MODULA-2, Pascal on DEC PDP/11
- First job: Macro programming Z80
- Software company during 90's
- Sysadmin / DB Admin
- Started in Finance industry
- First GPS device: Garmin GPSmap60CSx
- Contributions to OSM
- OSM based bicycle rental map of Luxembourg (2010)

What is this lecture about?

Programming language

Integrated development environment

Web server

Mapping libraries

Map tile provider

Responsive web design

Data retrieval

Geolocation

Routing

Version Control, Publishing, Collaboration

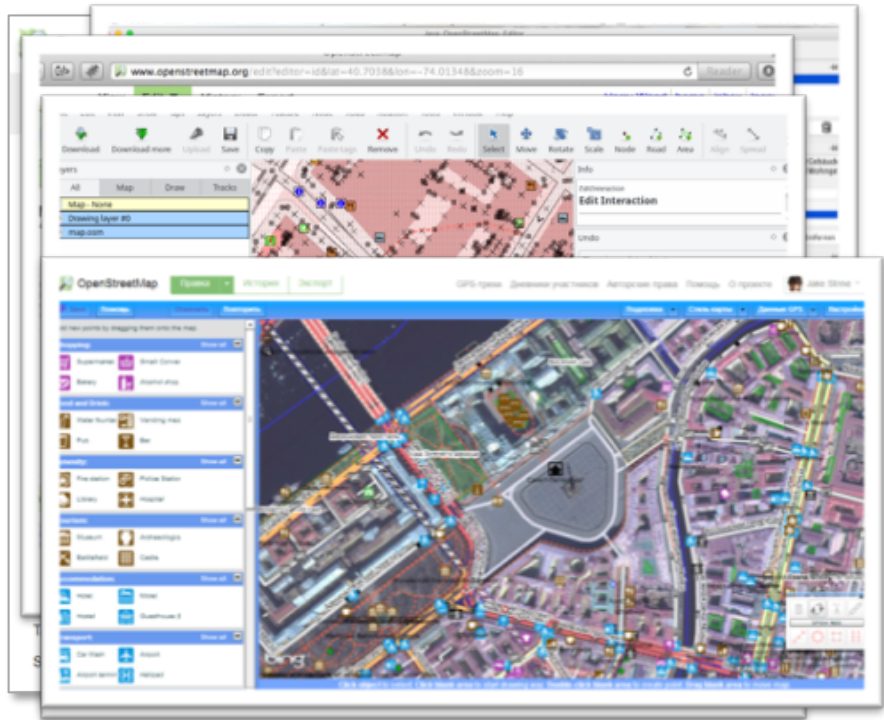# OpenStreetMap – big data as open source

- Worldwide geographic database

- Founded 2004

- Built by volunteers

- Based on surveys and free satellite pictures

- Open source eco system

- 2017: more than 3 mil contributors

Active Contributors per Year

OSM – Editors

How to add or modify data?

- Add data
  - Uploaded gpx tracks
  - Own surveys
  - Public satellite images

- Modify data
  - OSM Editors:
    - JOSM
    - iD
    - Merkaator
    - Potlatch
    - Vespucci

The big data of OSM

- Main database: PostgreSQL
  - 10/2017: about 850 GB

- Contains all data of OSM
  - Nodes, ways, relations

- File extract: *planet.osm*
  - Produced weekly
  - About 40 GB (.pbf)
  - Extracts by country: *geofabrik.de*
  - Formats: .osm (OSM XML), .pbf (compressed OSM XML)
  - Import into database
  - Conversion to JSON file

Get the data out

- Several APIs
  - API (version 0.6):
    - read/write
    - only small areas
    - Mostly for editing
    - RESTful API
    - Basic Authorization
    - OAuth
  - XAPI:
    - Read only
  - Overpass API
    - Complex queries
    - Read only
- Databases
  - PostgreSQL, MySQL
  - SQLite, MongoDB


```
2.2 Changesets
    2.2.1 Bounding box computation
    2.2.2 Create: PUT /api/0.6/changeset/create
```

```xml
<?xml version="1.0" encoding="UTF-8"?>
<osm version="0.6" generator="CGImap 0.0.2">
```

```
/*
This query looks for nodes, ways and relations
with the given key/value combination.
Choose your region and hit the Run button above!
*/
```
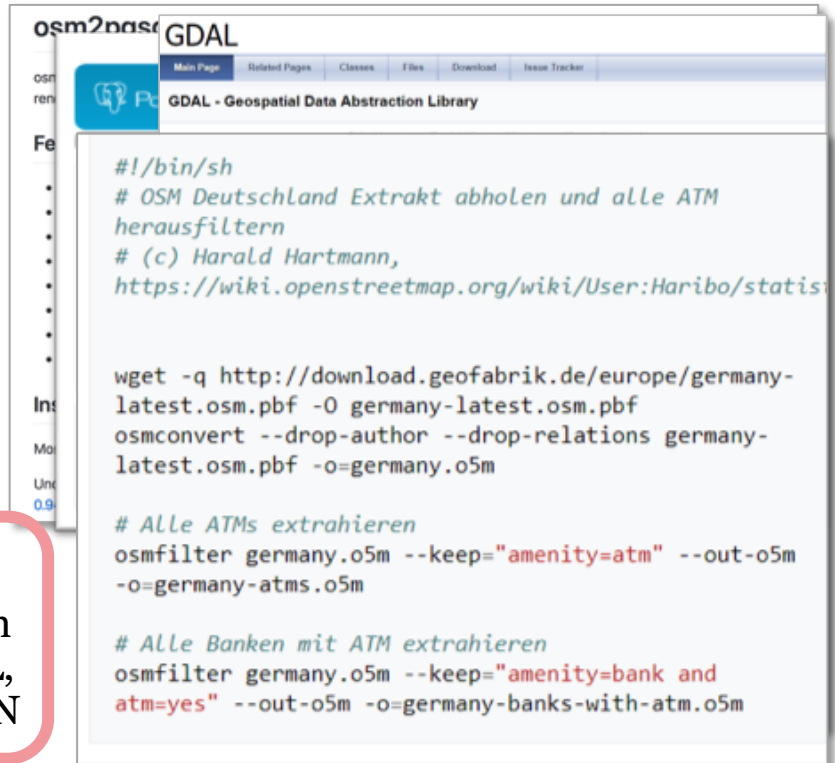
```javascript
3227        });
3228
3229    } else {
3230
3231        // basic authentication
3232        $.ajax ({
3233            url: 'https://api.openstreetmap.org/api/0.6/changeset/create',
3234            type: 'PUT',
3235            beforeSend: function (xhr) {
3236                xhr.setRequestHeader("Authorization", basAuth);
3237            },
3238            options: {
3239                header: {
3240                    'Content-Type': 'text/xml'
3241                }
3242            },
3243            data: xmlString,
3244            success: function (changesetId) {
3245                srvLog('new changeset created, id: ' + changesetId);
3246                callback(changesetId, featureId);
3247            },
3248            error: function (jqXHR, textStatus, errorThrown) {
3249                srvLog('error creating changeset: ' + jqXHR.status + '/' + textStatus + '/' + errorThrown);
3250                showError('Fehler ' + jqXHR.status + ' beim Hochladen zum OSM-Server, bitte wiederholen.');
3251            }
3252        });
3253    }
3254 }
```

```
2.2.8.3 Error codes
2.2.8.4 Notes
```

OSM tools (1)

- Osm2pgsql
  - Import OSM data into PostgreSQL database
  - Needs PostGIS extension

- GDAL/ogr2ogr
  - Data conversion
  - Raster & vector formats

- Osmconvert
  - Conversion between formats (OSM XML, PBF, o5m, GeoJSON


```sh
#!/bin/sh
# OSM Deutschland Extrakt abholen und alle ATM
herausfiltern
# (c) Harald Hartmann,
https://wiki.openstreetmap.org/wiki/User:Haribo/statis


wget -q http://download.geofabrik.de/europe/germany-
latest.osm.pbf -O germany-latest.osm.pbf
osmconvert --drop-author --drop-relations germany-
latest.osm.pbf -o=germany.o5m

# Alle ATMs extrahieren
osmfilter germany.o5m --keep="amenity=atm" --out-o5m
-o=germany-atms.o5m

# Alle Banken mit ATM extrahieren
osmfilter germany.o5m --keep="amenity=bank and
atm=yes" --out-o5m -o=germany-banks-with-atm.o5m
```
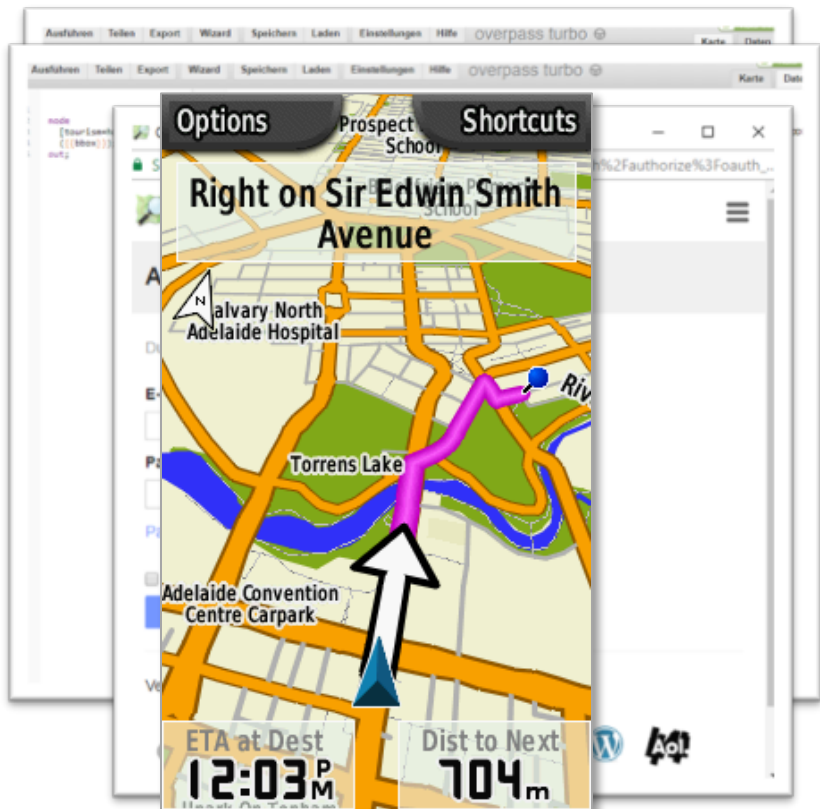
OSM tools (2)

- Overpass turbo
  - Data retrieval
  - Query language
  - Show on map
  - Output as data
- Osmlab/osm-auth
  - Authentication
- OSM Map on Garmin
  - Map creation for Garmin devices
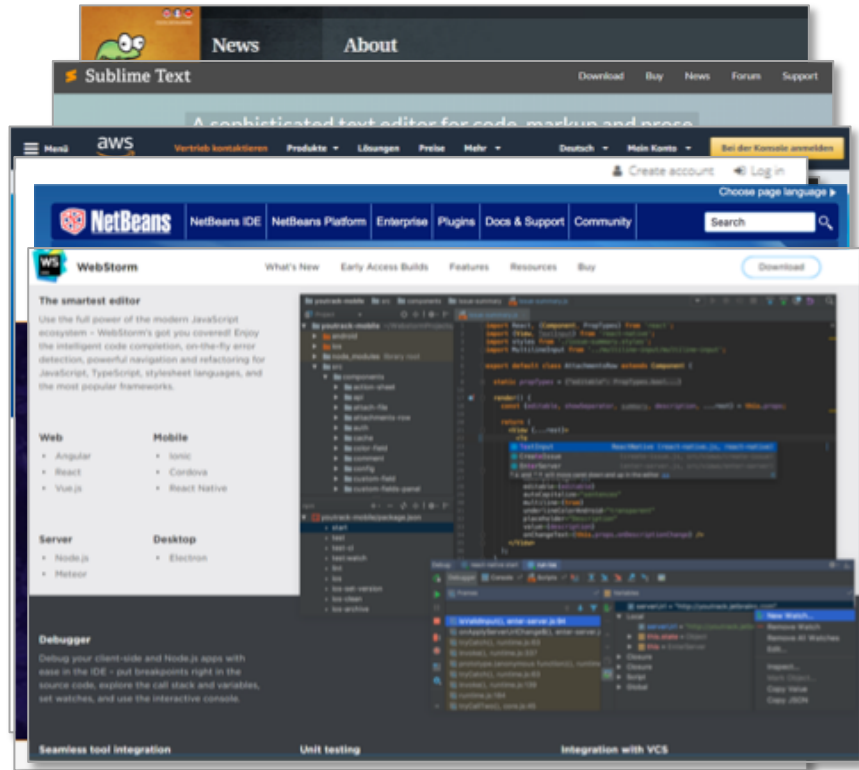 - Makes OSM data usable on Garmin devices

Programming languages

- Client-side: JavaScript
  - Adds dynamic possibilities to web sites
  - Manipulates Document Object Model (DOM)
  - Huge amount of libraries (jQuery)
  - Strong standardization (ECMAscript2015, -2016, -2017)

- Server-side:
  - Java
  - PHP
  - Node.js
  - Python

Software development environment

- Editors:
  - Notepad++
  - Sublime Text 3
- Online Development tools
  - AWS Cloud9
- Integrated development environment (IDE)
  - Aptana Studio 3
  - Eclipse
  - NetBeans
  - WebStorm

WebStorm (IntelliJ)

- Main advantages
    - Smart auto completion
    - Rich framework support (Angular, React, Node...)
    - Powerful search
    - Keyboard centred UI
    - UI 100% cusomizable
    - Debugger inside
    - Console inside
    - Fully VCS integration (Git, SVN, Mercurial and other)

WEB server

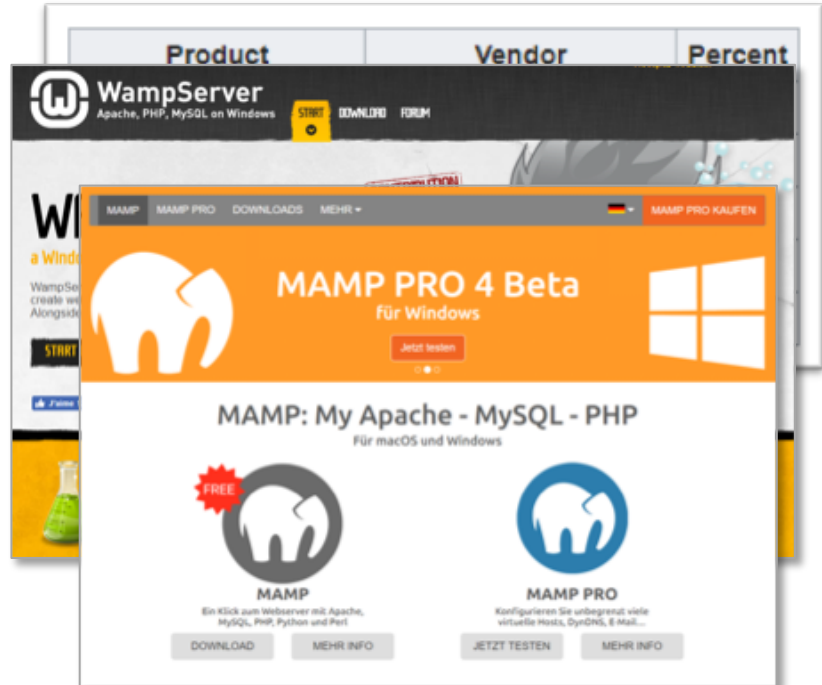HTML Server needed to test dynamic web sites

Mostly used:
- *Apache*
- *nginx*
- *IIS*

Apache Packages
- *LAMP* (Linux, Apache, MySQL, PHP)
- *WAMP*: Windows
- *MAMP*: MacOS
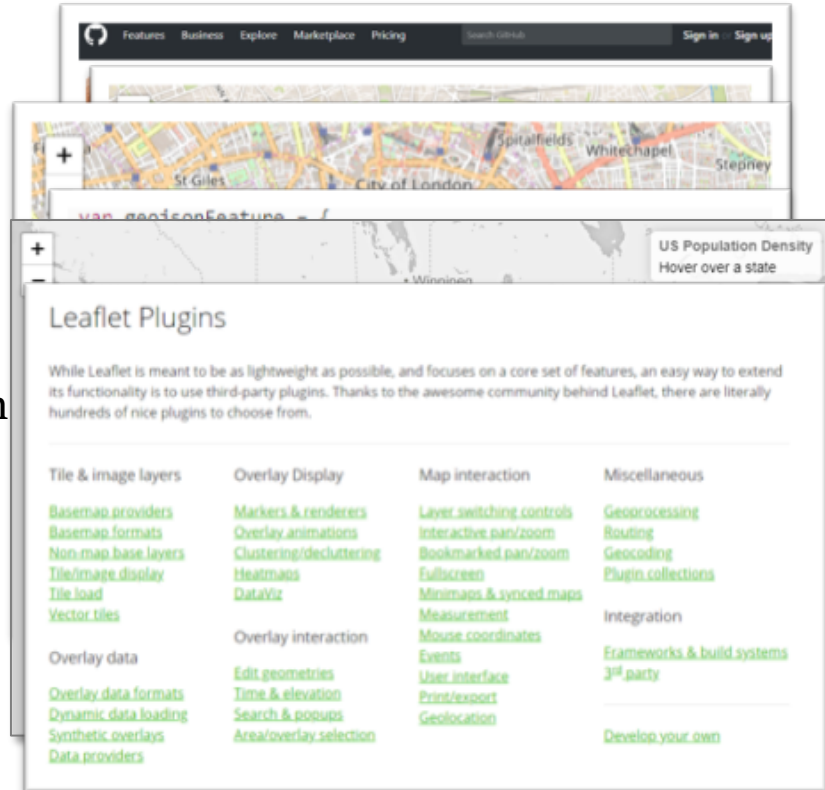
Built-in webserver

JavaScript map libraries

- Why?
    - Background map
    - Markers/lines
    - Popups
    - Legend
    Etc.

- Many libs/plugins
    - Leaflet
    - OpenLayers
    - MapBox
    - Google maps
    - D3
    - GeoExt

Map libraries - Leaflet

- Most popular lightweight mapping library

- Developed by V. Agafonkin

- Pro's:
  - Simple map creation
  - Customized icons
  - Simple GeoJSON processing
  - Choropleth maps
  - Many plugins

Create a map with Leaflet

```html
<!DOCTYPE html>
<html lang="de">
    <head>
        <link rel="stylesheet"
            href="https://cdnjs.cloudflare.com/ajax/libs/leaflet/1.2.0/leaflet.css">
        <script src="https://cdnjs.cloudflare.com/ajax/libs/leaflet/1.2.0/leaflet.js">
        </script>
        <style>
            html, body, #myMap { height: 100%; }
            body { margin: 0; }
        </style>
        <title>My first map with Leaflet</title>
    </head>
    <body>
        <div id="myMap"></div>
        <script type="text/javascript">
            var map = L.map('myMap', {
                center: [50.8120599, 4.3800681],
                zoom:    17
            });
            L.tileLayer(
                'https://{s}.tile.openstreetmap.org/{z}/{x}/{y}.png',
                { maxZoom: 19, detectRetina: true }
            ).addTo(map);
        </script>
    </body>
</html>
```
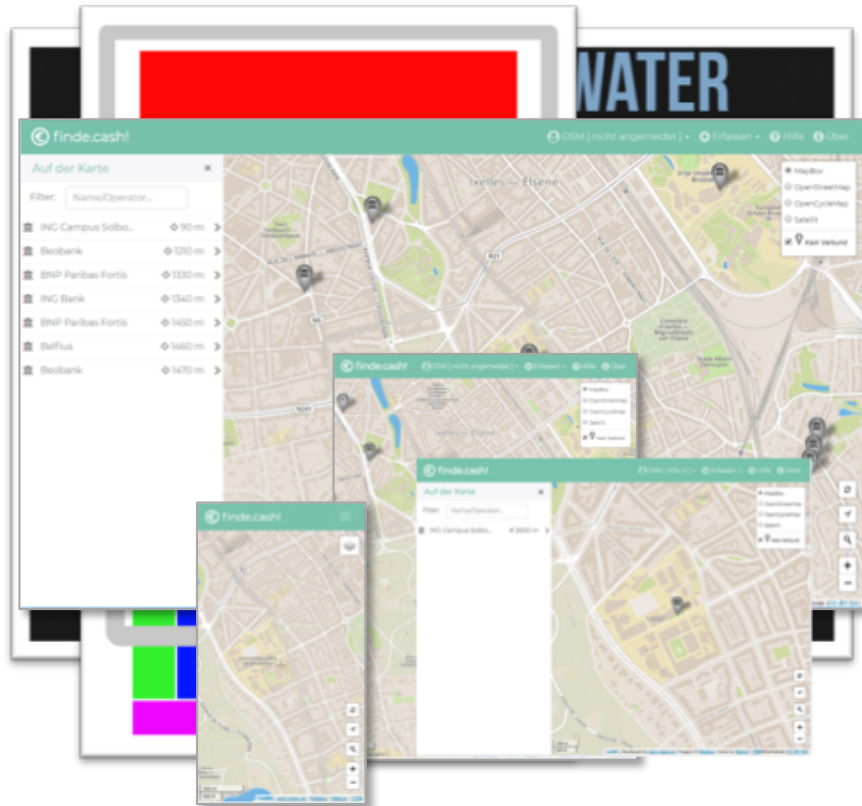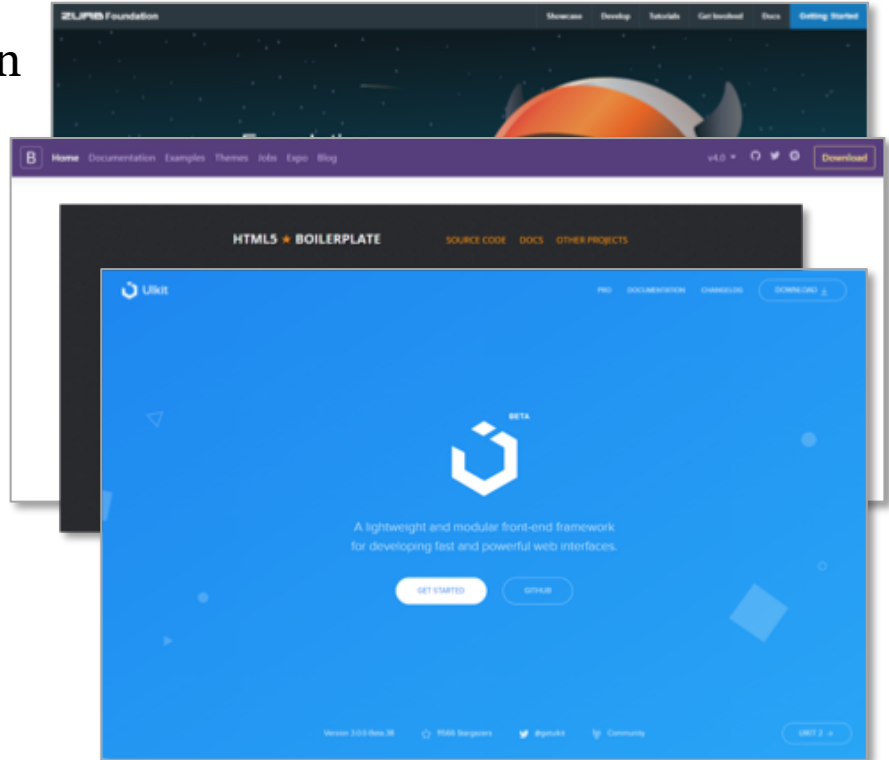
Responsive web design – go mobile!

- What means "responsive"?
- Desktop
- Tablet
- Smartphone
- CSS3 techniques
  - Breakpoints
  - Media Queries
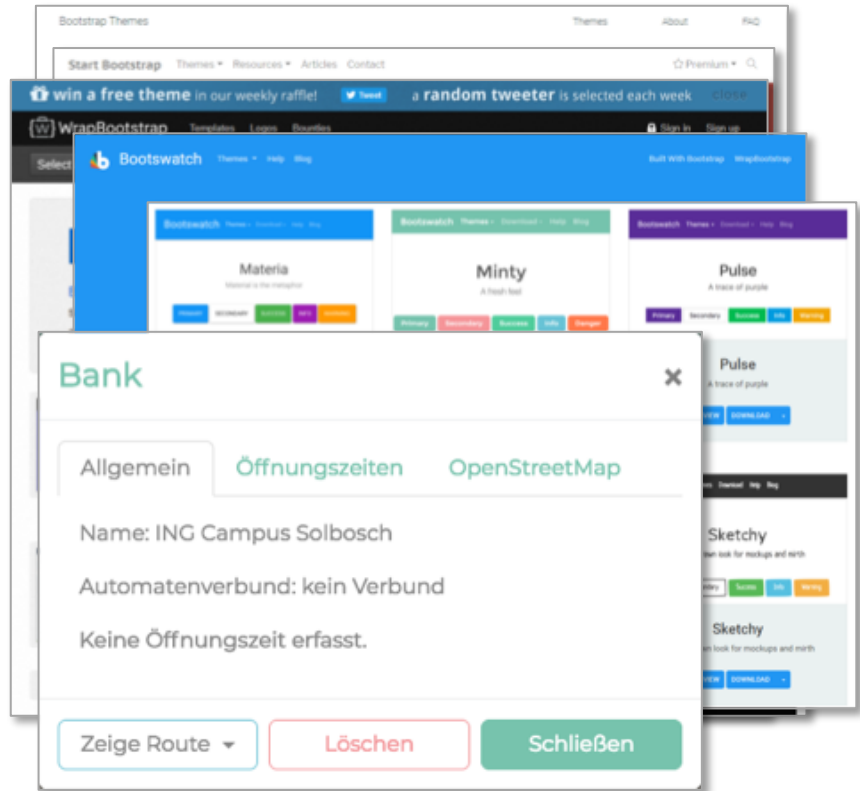- CSS3 Pre-processors (SASS, LESS)

Bootstrap, Foundation and other

- ZURB Foundation
- Bootstrap
- HTML5 Boilerplate
- UIkit
- Many more...

Theming

- *Bootstrap-Themes*
- *Startbootstrap*
- *WrapBootstrap*
- *Bootswatch*
  - Many different colour schemes
  - Actively maintained
  - Open source
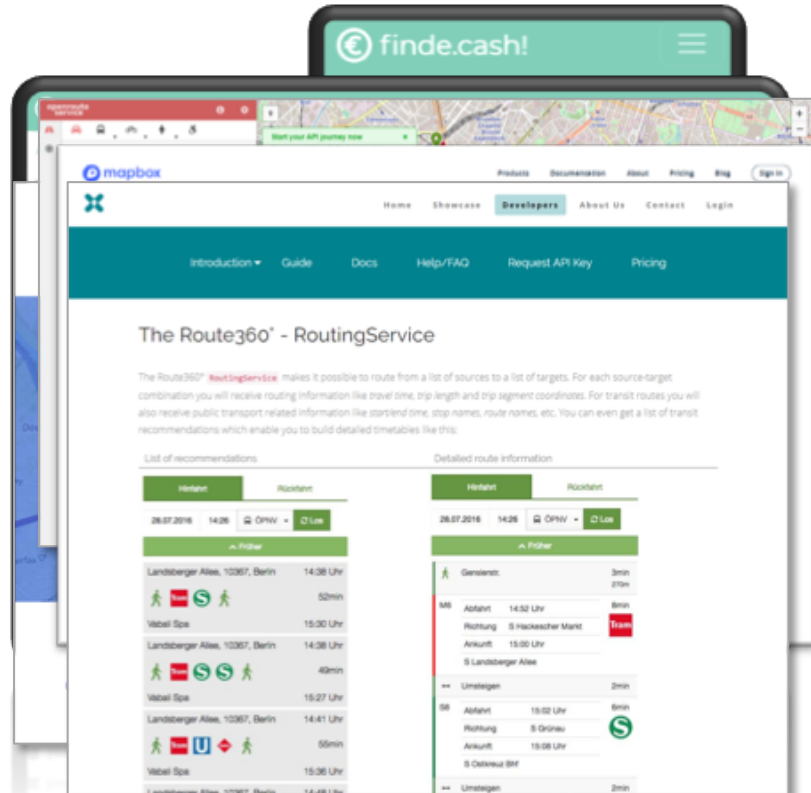 - Easy to integrate
  - Uses SASS

Where am I? – Mobile Geolocation

- Maps on Mobile devices:
  - Geolocation expected
- W3C specification
- Browser API
- Secure HTTP in Chrome > 5.0
- *Leaflet* Locate service
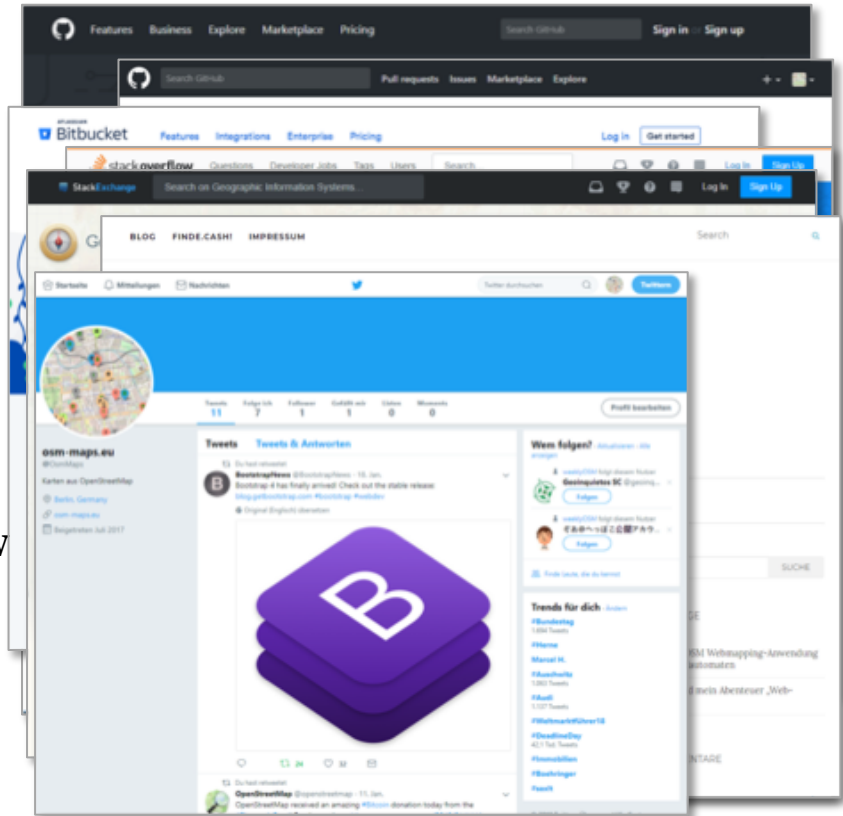- *Leaflet* Plugin for geolocation control

How to find the next ATM?

- Maps on Mobile devices:
  - "Find next item" expected
  - Fast/shortest route
  - Car, walk, bicycle
  - Public transport
- Routing libraries
  - OSRM
  - OpenRouteService
  - MapBox
  - Route360.net
  - ...

Publishing, Collaboration, Social

- Version control
  - *Github (Git)*
    - Versioning
    - Collaboration
    - Communication
  - *Bitbucket (Git, Mercurial)*
- Knowledge base
  - *Stackoverflow*
  - GIS StackOverflow
- Blog
- Twitter

Project finde.cash! (findatm.cash)

- Started beginning 2017
- Full leisure time project
- Regular market scanning
- Learning by doing
- Blog: www.osm-maps.eu
- Learning Resources:
  - YouTube
  - Udemy
  - Stackoverflow

Next steps out of the jungle

Evaluation TypeScript

Modifying OSM objects

Internationalization

Marker clustering

Vector tiles

Evaluation React

And so on and so forth...

Thank you for coming!

Any questions?

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