

Mobile, Offline Mapping Using Open Tools & Data

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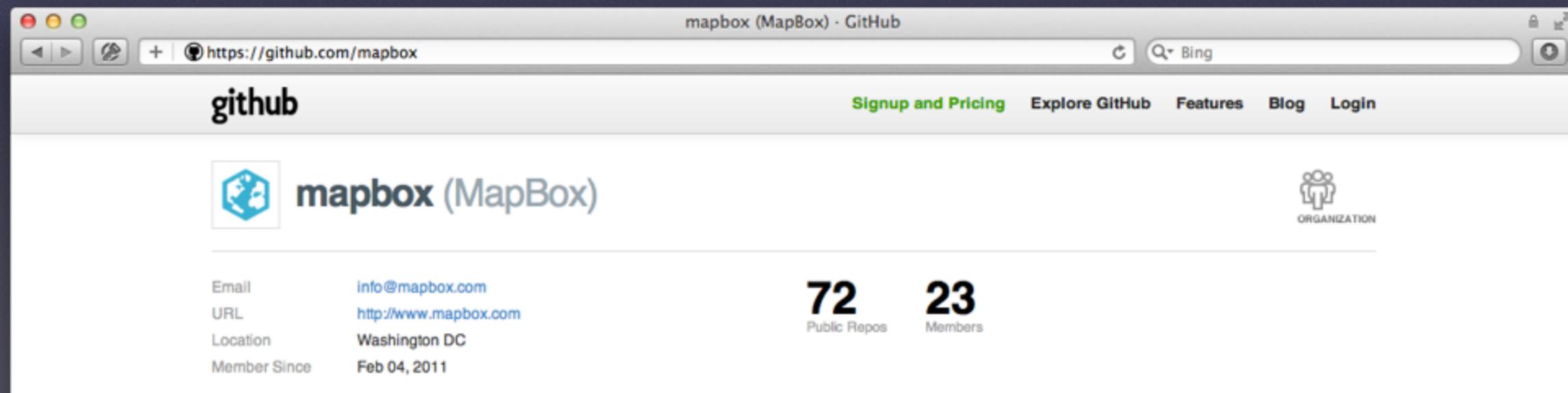


Your Host

- Work for Development Seed
- I don't have a traditional GIS background
- Mostly iOS dev these days
- ~12 years contributing to open source

MapBox

- Bootstrapped project of Development Seed
- Ecosystem around fast, beautiful maps
- Charge for cloud hosting (high availability)
- Produce lots of open source code



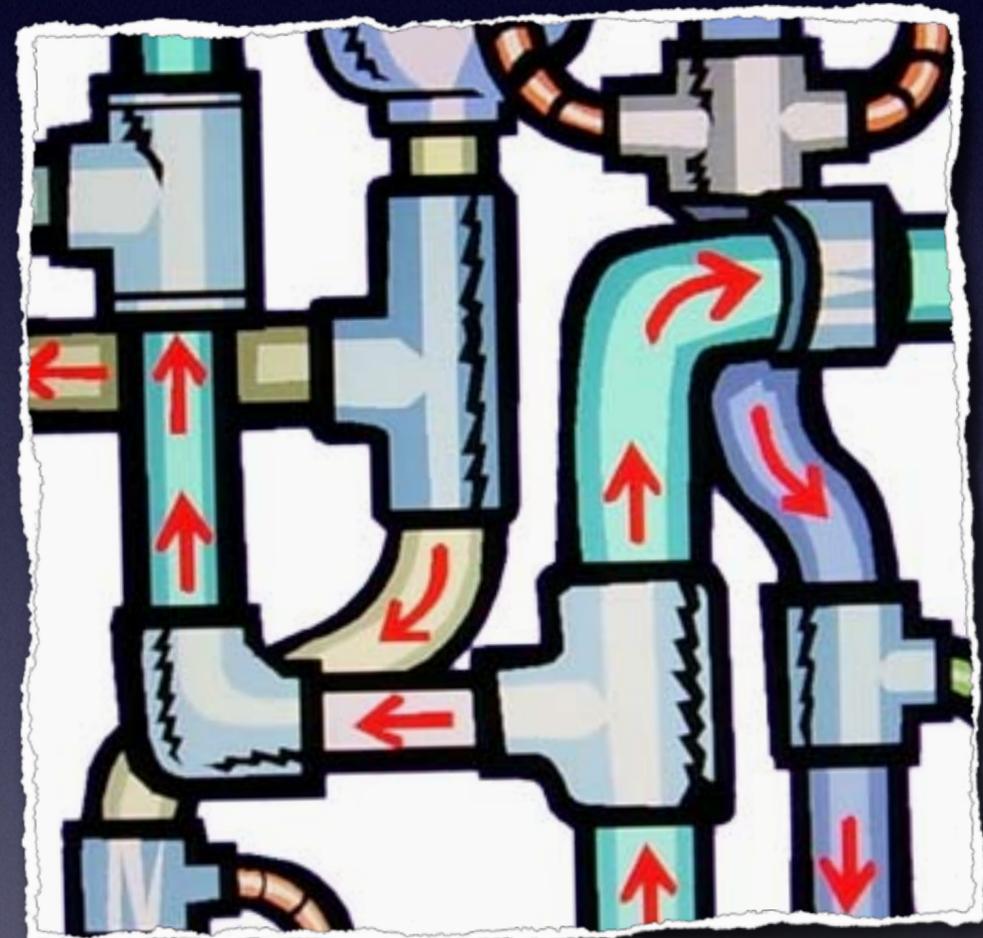
Today's Goal: Sample App

- Portland food carts
 - Over 500 licensed
 - Carts, streets, transit, ATMs, highlights
- Mobile
- Interactive
- Offline-capable



Workflow Overview

- Acquire data
- Process data
- Create map
- Engage data
- Package & distribute data
- Attribute data
- Use data in a mobile app



Types of Geo Data

- Shapefile - vector, proprietary, common
- GeoJSON - simple text
- KML - XML, somewhat sprawling
- Rasters/GeoTIFF (pixel data)
- OpenStreetMap (XML & PBF)
- SQLite (not necessary geo)
- PostGIS (geo-focused RDBMS)

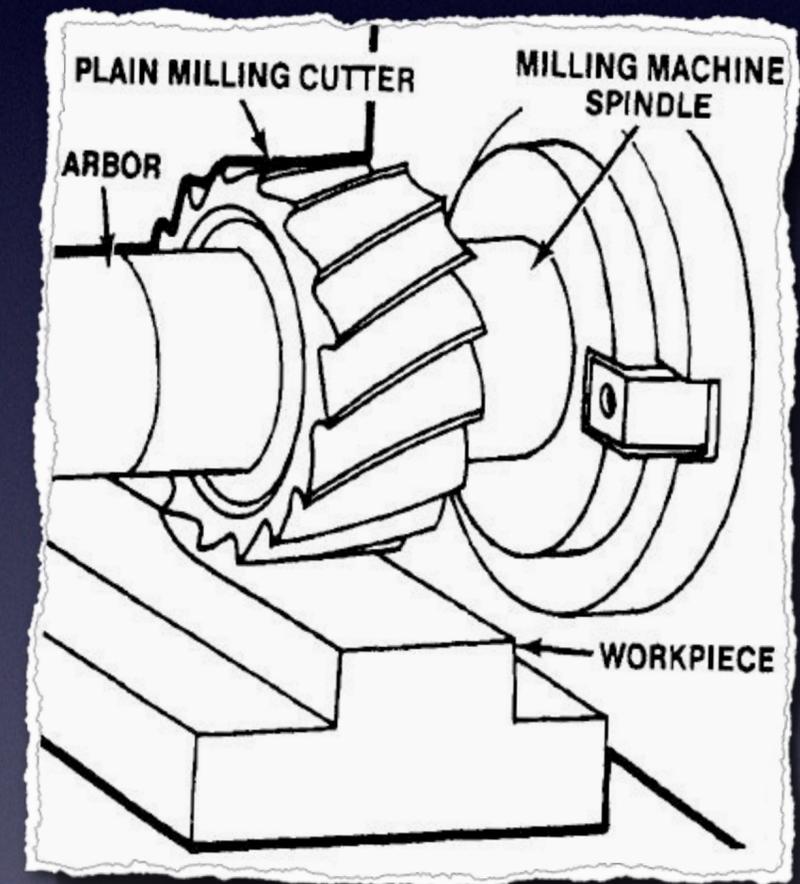


Acquire Data

- Open government - *civicapps.org, developer.trimet.org*
- Create your own
 - GeoJSON
 - KML (XML)
- Cart data: *foodcartsportland.com* map (KML export)

Process Data

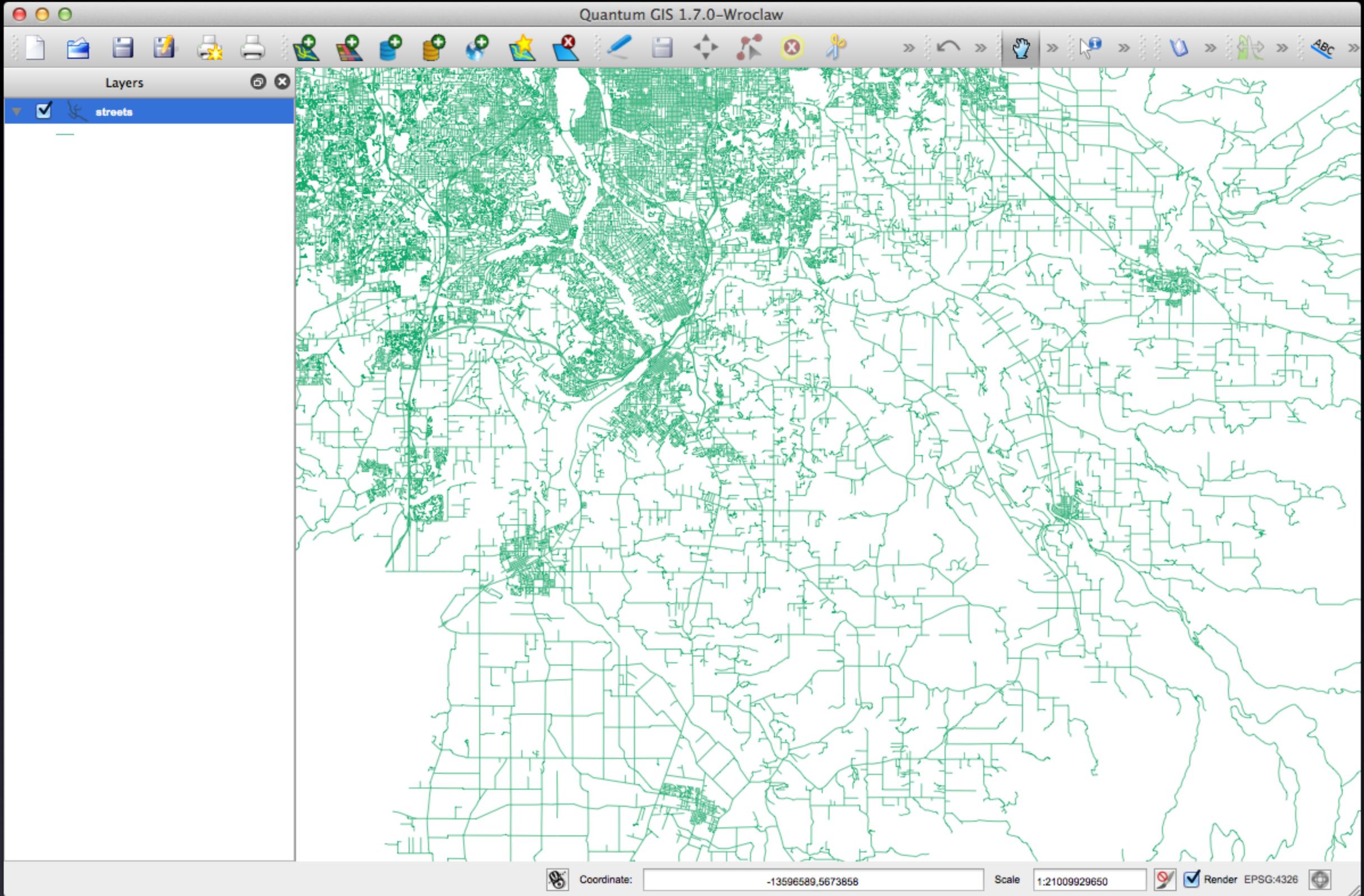
- Need a way to visualize
- Need a way to combine sources
- Need a way to style data in realtime



Geo Utilities

- GDAL - gdal.org
 - MIT-licensed open source
 - Command-line tools & C++ libraries
- Quantum GIS- qgis.org
 - GPL-licensed open source
 - “GIS system”





Quantum GIS 1.7.0-Wroclaw

Layers

streets

Coordinate: -13596589,5673858 Scale 1:21009929650 Render EPSG:4326

Create A Map

- Need a way to render
- Perform a usability test run
- Manage a project over time



TileMill

- Geographic design studio
- BSD-licensed open source
- Made of Node.js (yes, on the desktop)
- Runs on Linux, Mac, and Windows
- *mapbox.com/tilemill*



TileMill

Editor

Projects

Manual

Plugins

Settings

ZOOM 4

CHINA, SOUTH KOREA, JAPAN, PHILIPPINES, TAIWAN, HONG KONG, MACAU, HANOI, VIETNAM, THAILAND, CAMBODIA, MYANMAR, BANGLADESH, INDIA, SRI LANKA, MALAYSIA, BRUNEI, SINGAPORE, INDONESIA, EAST TIMOR, AUSTRALIA, PAPUA NEW GUINEA, MELEKEOK PALAU, MANILA, JAKARTA, BANDAR SERI BEGAWAN, TROPIC OF CANCER, TROPIC OF CAPRICORN, NEW DELHI, NEPAL, BHUTAN, MALE MALDIVES

★ country capital city

Layers

- #country-interaction
- #paper
- #cities
- #country-name
- #geo-lines
- #glacier
- #admin-0-line-land.border.country
- #admin-0-line-disputed.border.disputed

Geography Class

style.mss x labels.mss x rainbow.mss x +

```

1 /*****
2
3 This file is responsible for assigning colors to each country. Color
4 assignment is mostly manual. Not taking advantage of Natural Earth's
5 'MAP_COLOR' field because it did not exist when I started, and at any
6 rate I want a smaller palette :)
7
8 *****/
9
10 @white: #F0F8FF; /* blue-tinted, for Antarctica */
11 @red: #fdaf6b;
12 @orange: #fdc663;
13 @yellow: #fae364;
14 @green: #d3e46f;
15 @turquoise: #aadb78;
16 @blue: #a3cec5;
17 @purple: #ceb5cf;
18 @pink: #f3c1d3;
19 @f00: #f00;
20
21 /* Coastlines */
22 #country::land-glow-inner[zoom>=0] {
23   line-color:@line;
24   line-opacity:0.8;
25   line-join:round;
26   [zoom=0] { line-width:1.2; }
27   [zoom=1] { line-width:1.6; }
28   [zoom=2] { line-width:2; }
29   [zoom>2] { line-width:2.4; }
30 }
31
32 #country::land-glow-outer[zoom>1] {
33   line-color:@line;
34   line-width:5;
35   line-opacity:0.1;
36   line-join:round;
37 }
38
39 #country::fill[zoom>=0] {
40   [ADM0_A3='ABW'] { polygon-fill:@purple; }
41   [ADM0_A3='AFG'] { polygon-fill:@red; }
42   [ADM0_A3='AGO'] { polygon-fill:@yellow; }
43   [ADM0_A3='AIA'] { polygon-fill:@blue; }
44   [ADM0_A3='ALB'] { polygon-fill:@purple; }

```

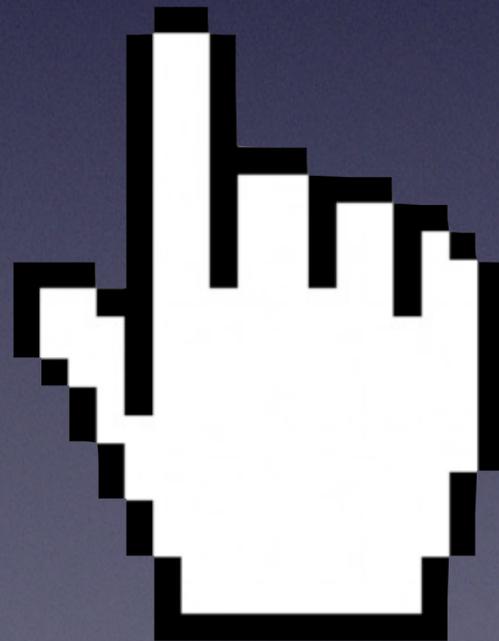
CartoCSS

- It's like, well, CSS
- Reference at mapbox.com/carto
- Allows for realtime editing of features

```
15 #streets {
16   line-width:1.0;
17   line-color:gray;
18   line-opacity: 0.5;
19
20   [zoom >= 17] {
21     line-width: 10.0;
22     text-name: "[STREETNAME]";
23     text-face-name: "Verdana Regular";
24     text-fill: white;
25     text-opacity: 0.5;
26     text-min-distance: 200.0;
27     text-placement: line;
28   }
29
30   [zoom = 18] {
31     line-width: 20.0;
32   }
33
34   [zoom >= 19] {
35     line-width: 30.0;
36   }
37 }
```

Engage Data

- We're talking about interactivity
- Allow mouseovers & clicks/taps & other gestures

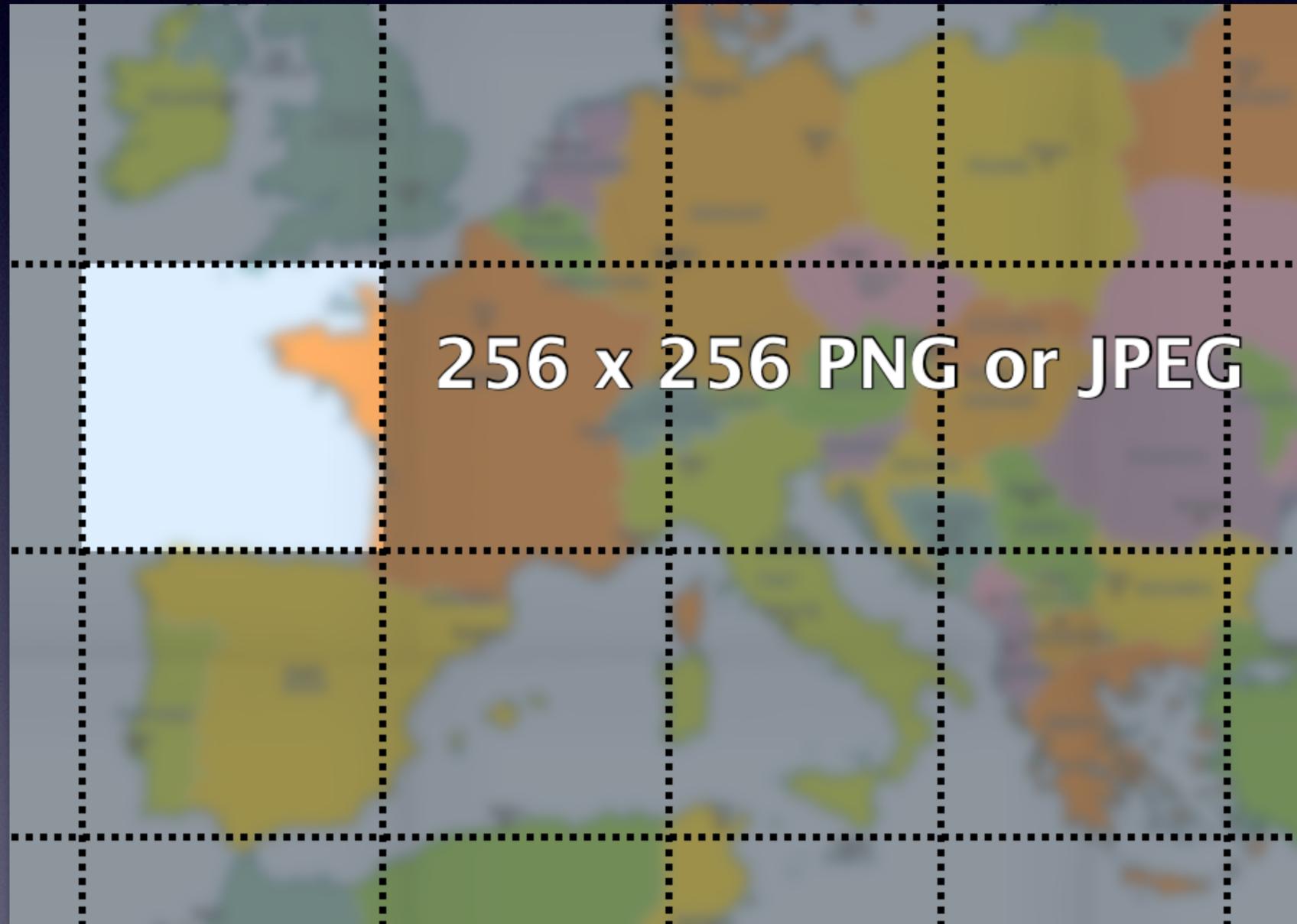


Package & Distribute Data

- Size
- Ease of transfer
- Robustness
- Cross-platform capability

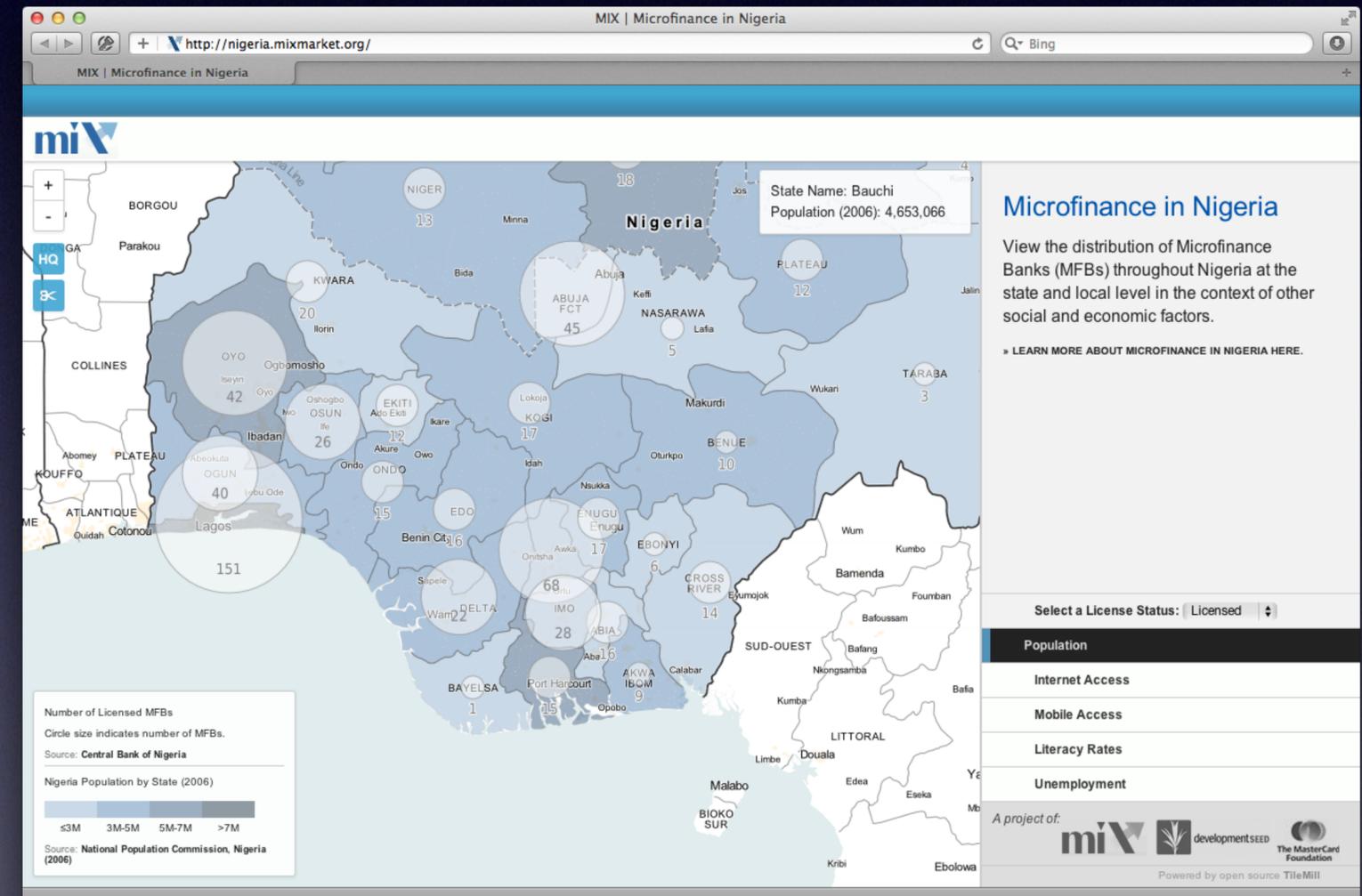


Map Tiles



“Baking In” Data

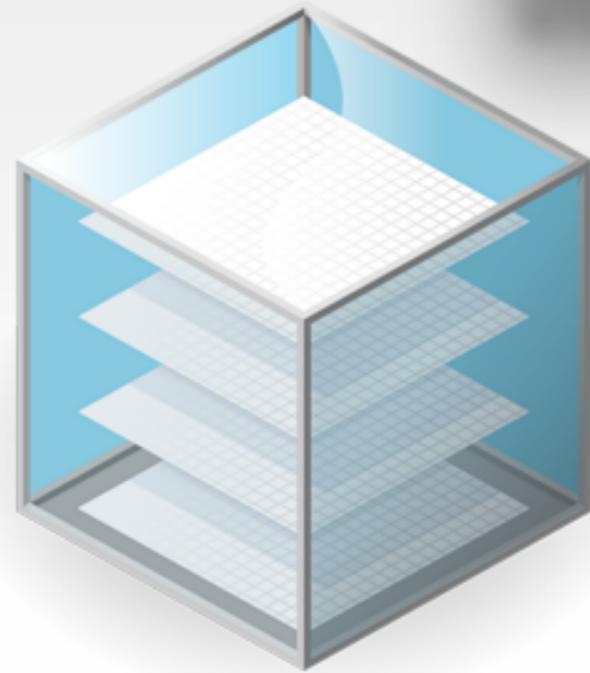
- Vectors are expensive
- Draw data on tiles



The Problem With Tiles

- Can easily number in the millions
- Zoom level 0
 - One 256x256 tile (4^0)
- Zoom level 17
 - 17,179,869,184 tiles (4^{17})
- Difficult to transfer reliably

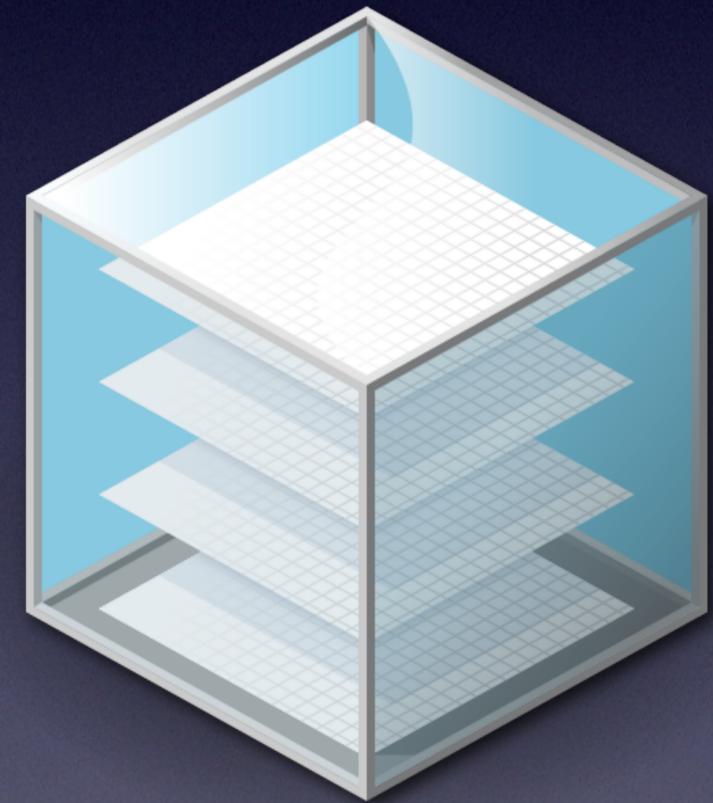


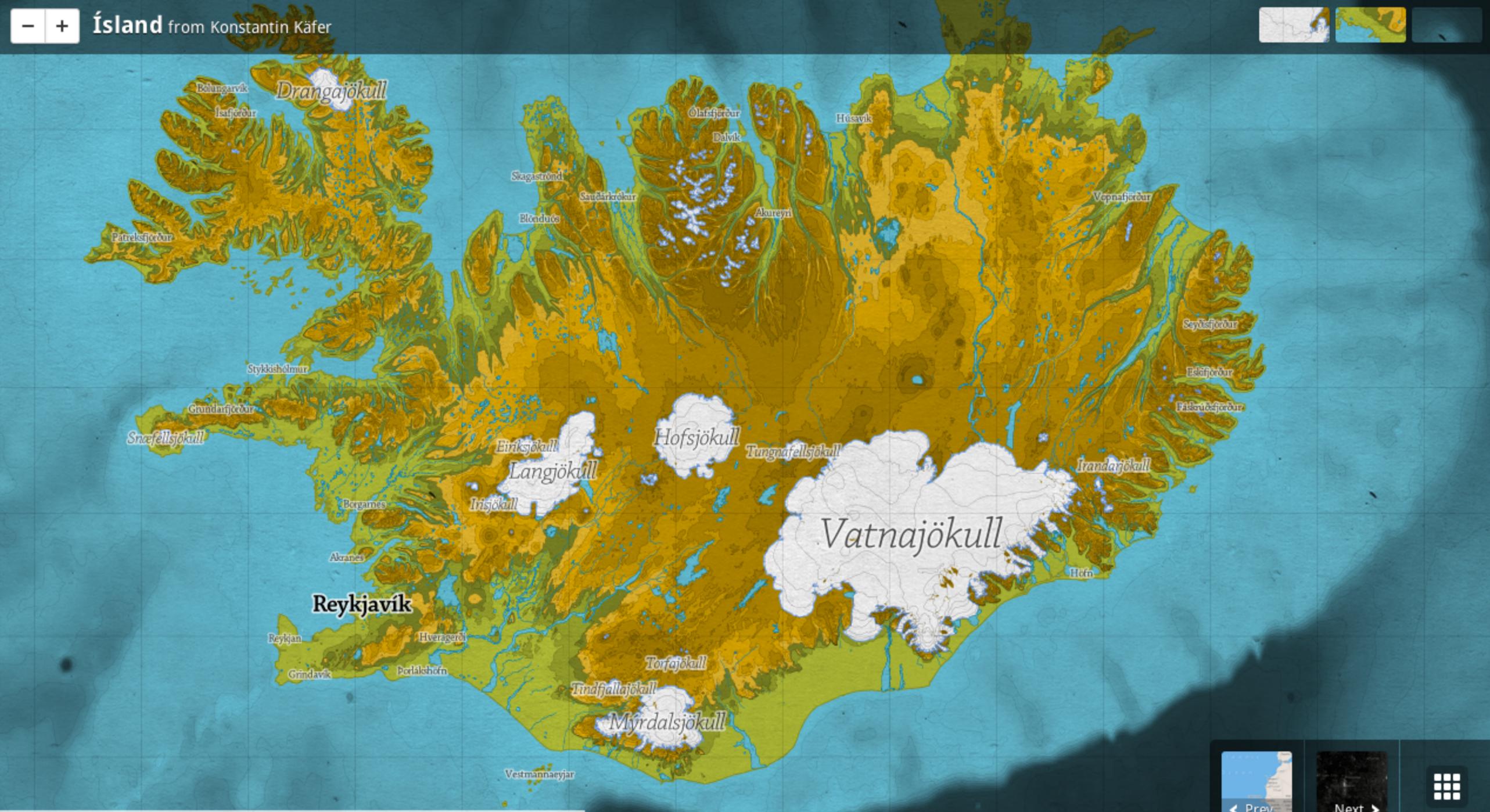


MBTILES

What is MBTiles?

- Originated from this scale problem
 - Especially on mobile (USB & net)
- Essentially just SQLite with blobs
 - Index by tile $z/x/y$
- Add metadata, optimizations





Mobile Use

- MBTiles works for tile serving
 - MapBox cloud hosting, TileStache
- But: we're here for offline use
 - MBTiles can be used directly!
 - MapBox iOS SDK (BSD-licensed)
- Other implementations at mbtiles.org



```
NSURL          *localURL = [NSURL URLWithString:@"..."];
RMMBTilesSource *offlineSource;
RMMMapView     *mapView;

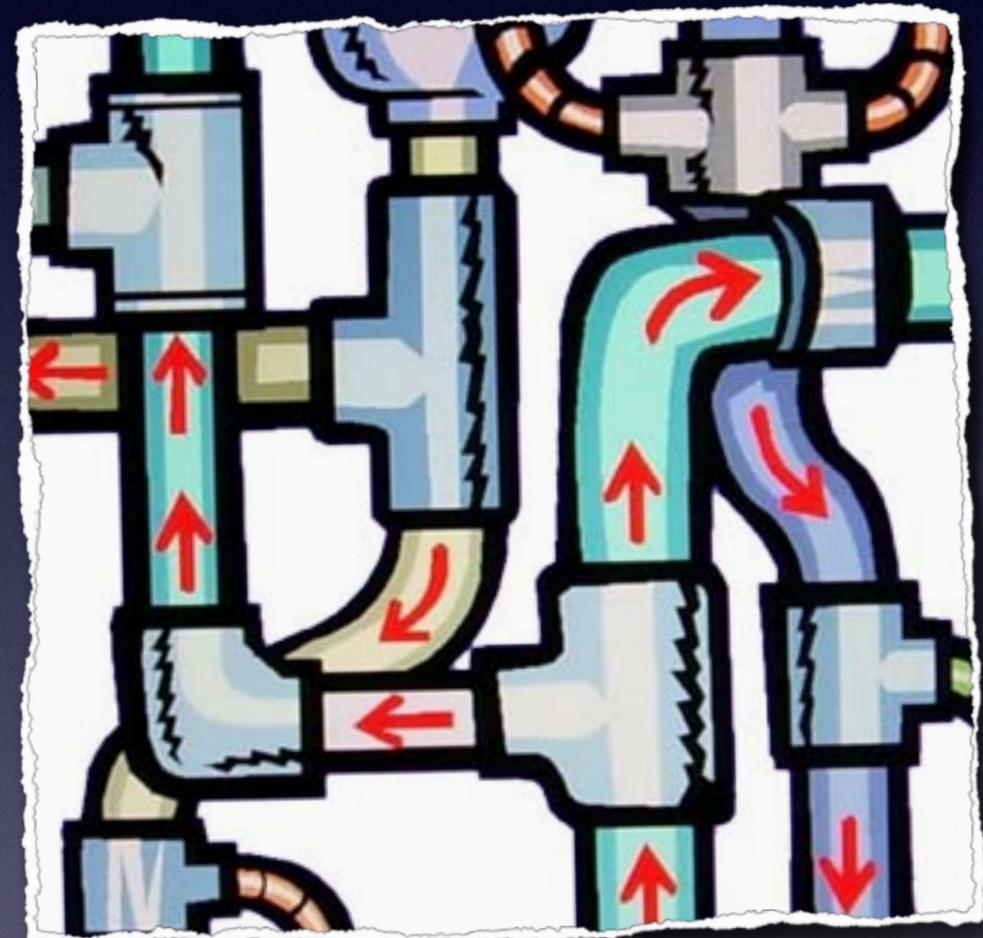
offlineSource = [[RMMBTilesSource alloc] initWithTileSetURL:localURL];

mapView = [[RMMMapView alloc] initWithFrame:self.view.bounds
                                             andTilesSource:source];

[self.view addSubview:mapView];
```

Workflow Review

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Demo

Conclusion

- The open source toolchain is there
- Portability problems have been solved
- The democratization of maps is at hand!
- Also: maps are fun



Thanks!

- Reach me: justin@mapbox.com and [@incanus77](https://twitter.com/incanus77)
- MapBox: mapbox.com and [@mapbox](https://twitter.com/mapbox)
- Slides will go up at ds.io/JMOSCON2012
- Check out the PDX OS GIS monthly meeting tonight!
 - groups.google.com/group/pdx-osgis

