Maps on iOS

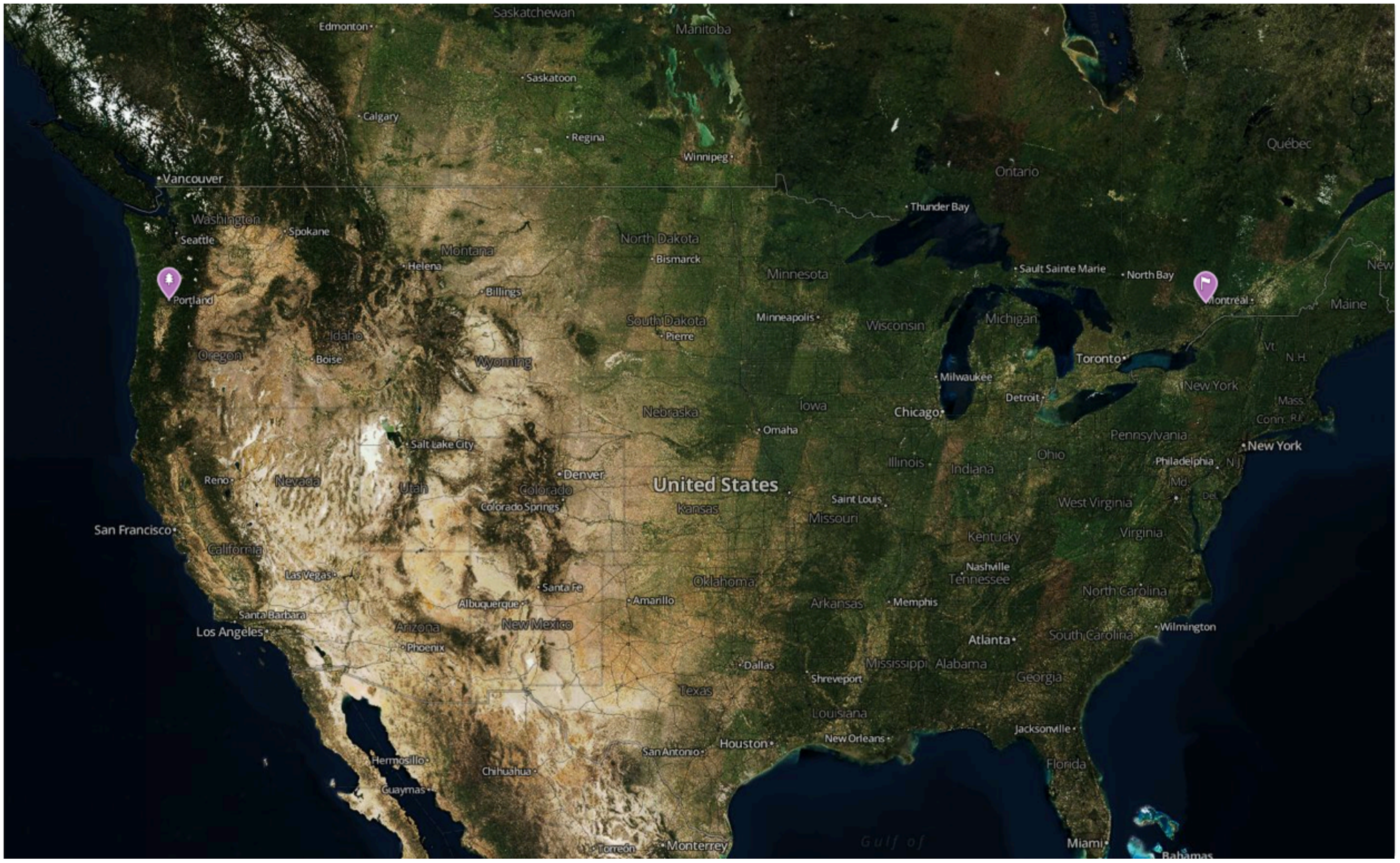
Perhaps You've Heard of Them

Justin Miller • MapBox • NSNorth 2013

I'm not here to rag on Apple, but have you ever paid close attention to the path that this icon is telling you to take?

About Me

- Primarily a software engineer
- Cocoa since 2004
- MapBox since 2011
- Here to show the fun world of maps & lessons learned along the way
- Based remotely in Portland, Oregon

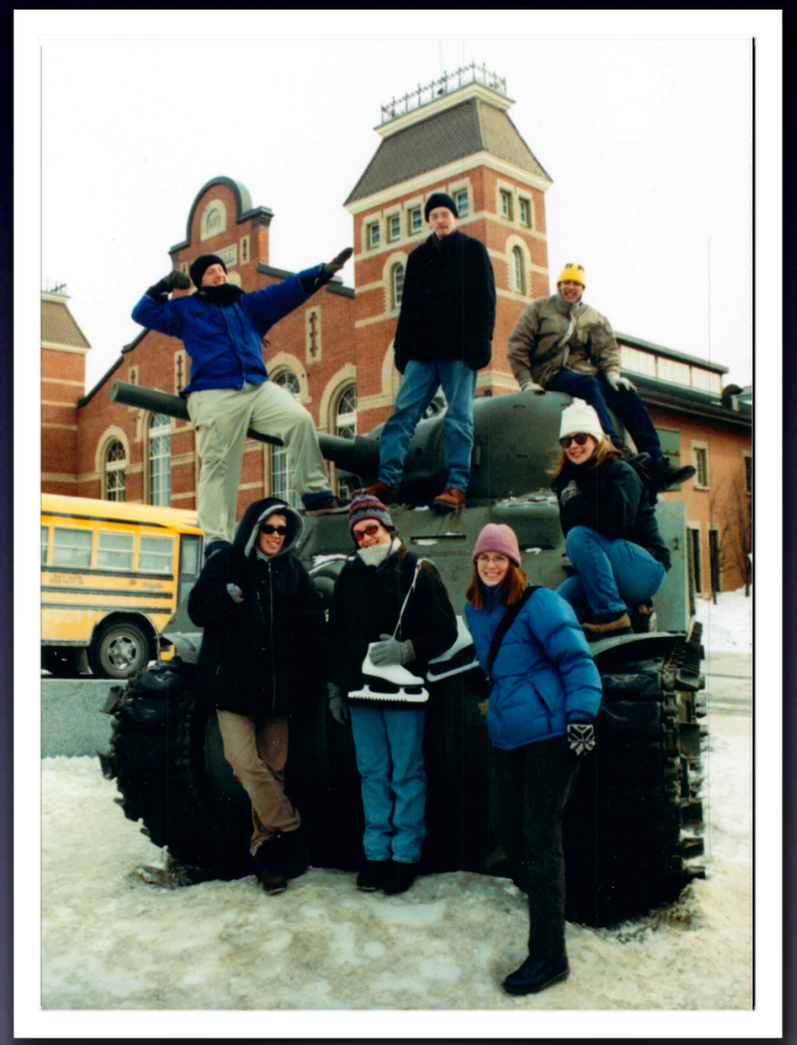


tiles.mapbox.com/justin/map/map-84o69j8c

I traveled (very slightly) south to attend NSNorth.

I <3 Canada

- Haven't been to Ottawa since the 90s
- I'm recently a dual-citizen
- I've stayed in your wonderful prison-hostel
- Thanks for having me!



Your country has a program called "Waking Up Canadian". Amazing.

About MapBox

- Based in Washington, DC
- About 30 folks & bootstrapped
- We're a cloud services company
- All of our software is open source
- Foursquare, Le Monde, Evernote, Hipmunk, NPR, The Canadian Press
  - Check out mapbox.com/showcase

Open Source & Data

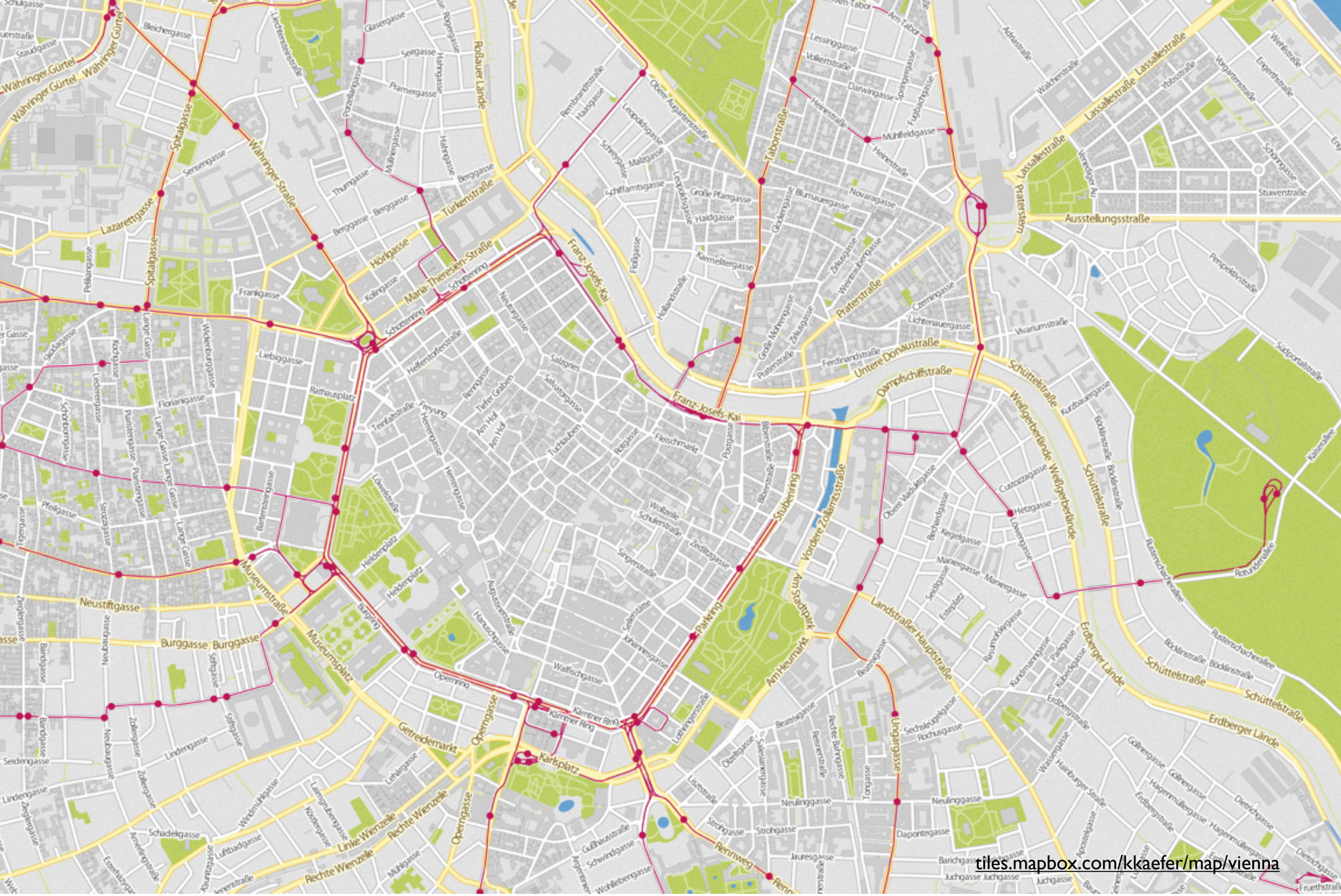
- Competing against Google, Apple, Bing/Nokia, MapQuest, Esri
  - *"Nokia's Maps division operating expenses were €168 million (which were higher than external sales)."*

    (from twitter.com/asymco/status/324834975583174656)
- Leveraging contributors to code & data
  - MIT-licensed code (100+ repositories)
  - OpenStreetMap (1,000,000+ contributors)

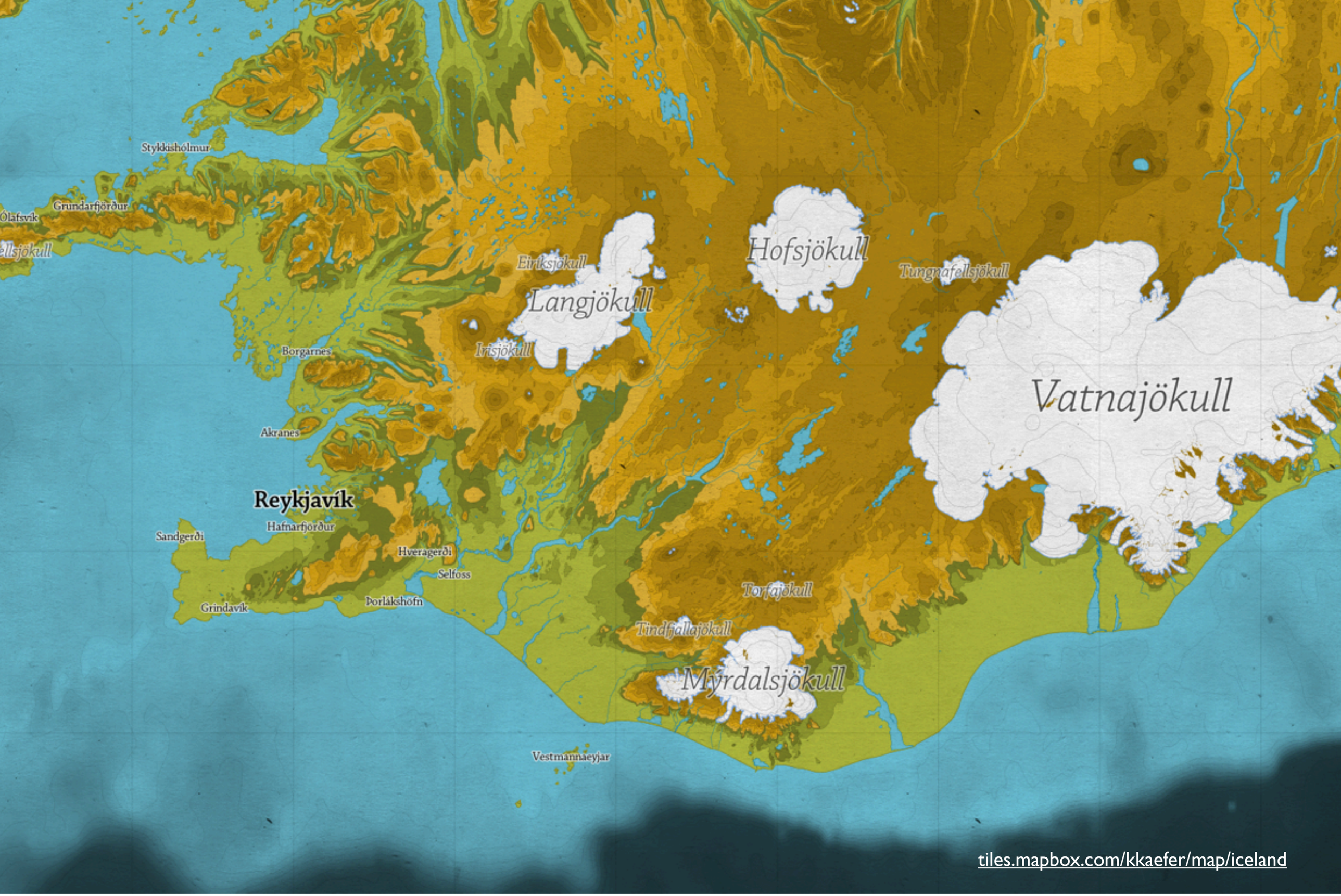
Why Maps?

Maps Look Nice

- mapbox.com/tilemill/gallery
- fantasticmaps.com
- reddit.com/r/mapporn



Vienna


Stykkishólmur
Grundarfjörður
Ólafsvík
ellsjökull
Eiríksjökull
Langjökull
Hofsjökull
Tungnafellsjökull
Irisjökull
Borgarnes
Akranes
Reykjavík
Hafnarfjörður
Sandgerði
Hveragerði
Selfoss
Grindavík
Þorlákshöfn
Torfajökull
Tindfjallajökull
Mýrdalsjökull
Vatnajökull
Vestmannaeyjar
tiles.mapbox.com/kkaefer/map/iceland

Iceland

Maps Tell Stories

tiles.mapbox.com/villeda/map/map-iqzkkag5

Food security

tiles.mapbox.com/villeda/map/map-eeajesvx

Turkey exports to the US for Thanksgiving

Places I’ve been in April

Maps & Mobile

- Pocket computer
- Knows where you are
- Highly personal experience

MapKit

- Released with iOS 3 in 2009
- Originally partnered with Google
- Most of current functionality at debut
  - iOS 4 added shape overlays
  - iOS 5 added user tracking & rotation
  - iOS 6 updated cosmetics & data source

Hitting The Wall

- *"Your neutralness, it's a beige alert!"*
- 80/20 framework rule
- 20% of the time, a framework does only 80% of what you need

MapKit is awful beige.

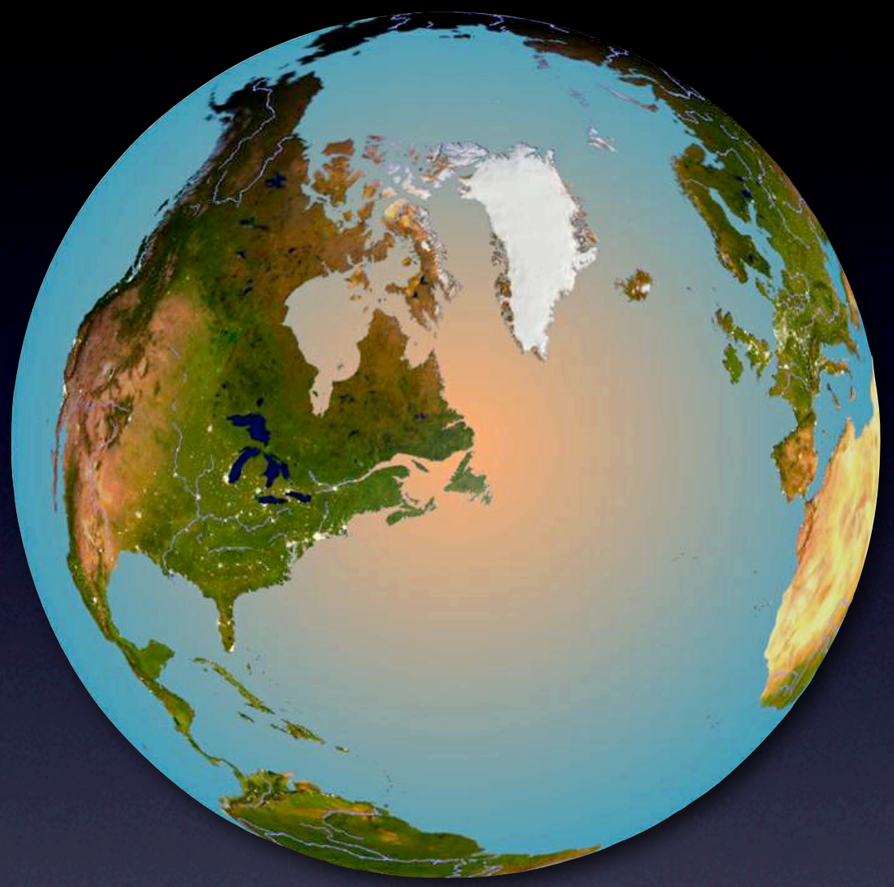
"MapKit? Where we're going, we don't need MapKit..."

MapBox SDK

- Originally based on 2008 Route-Me project
  - Predated original MapKit
  - Refactored in Alpstein fork in 2011
  - Forked into our SDK in early 2012
  - I started hacking on Route-Me in 2010
  - Entirely open source (MIT license)

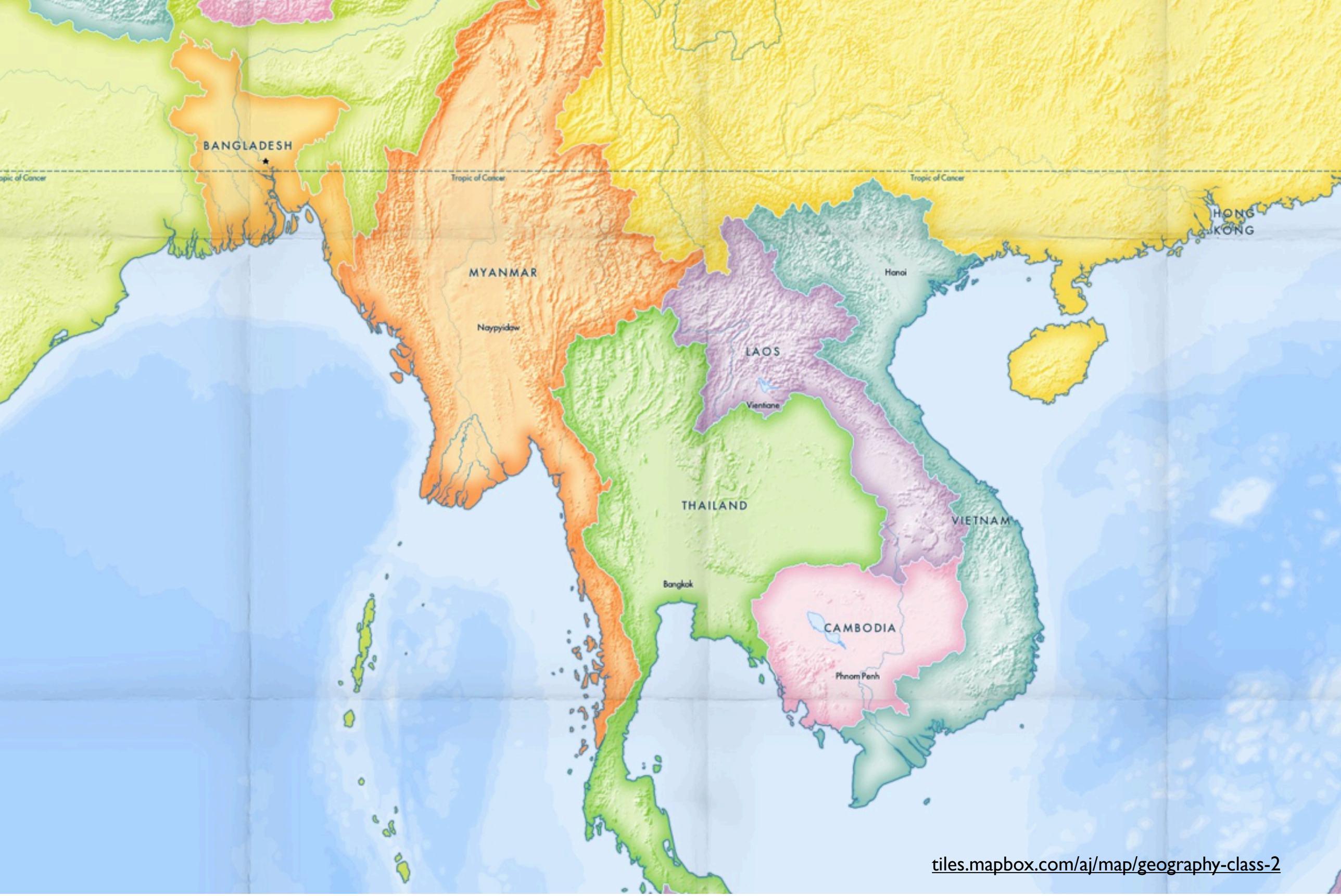
Project Stats

- About 15,000 lines of code
- Our fork has been through 200+ GitHub tickets
- About 130 forks of our project
- About 350 “stars”
- Currently at about 50 classes
  - Many of these are “private”



So, where to next?

Colors & Detail



Geography Class

tiles.mapbox.com/aj/map/map-thxqzg5t

The Bourne Geography

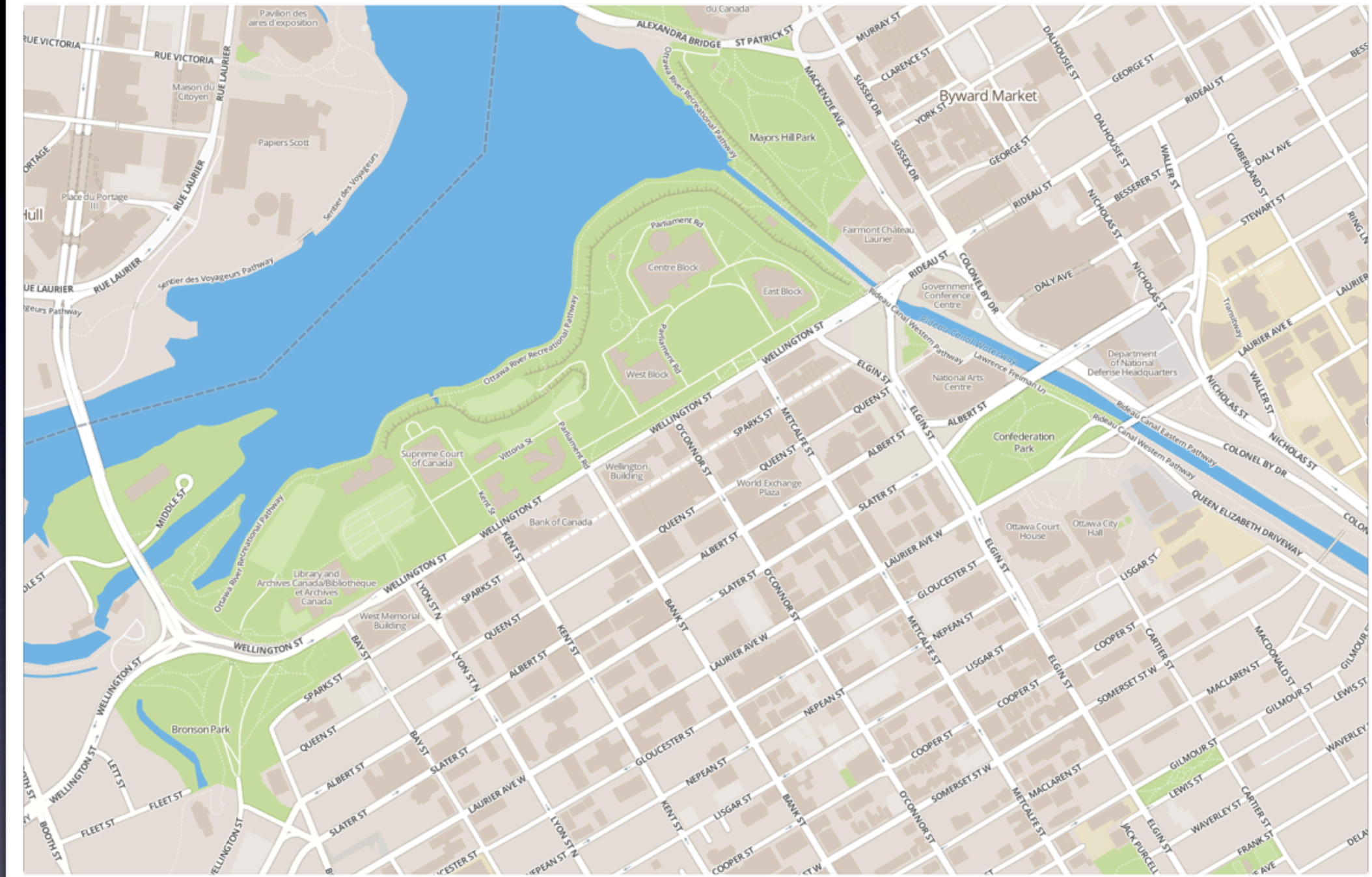
mapofthedead.com

Labels & Languages

lemonde.fr

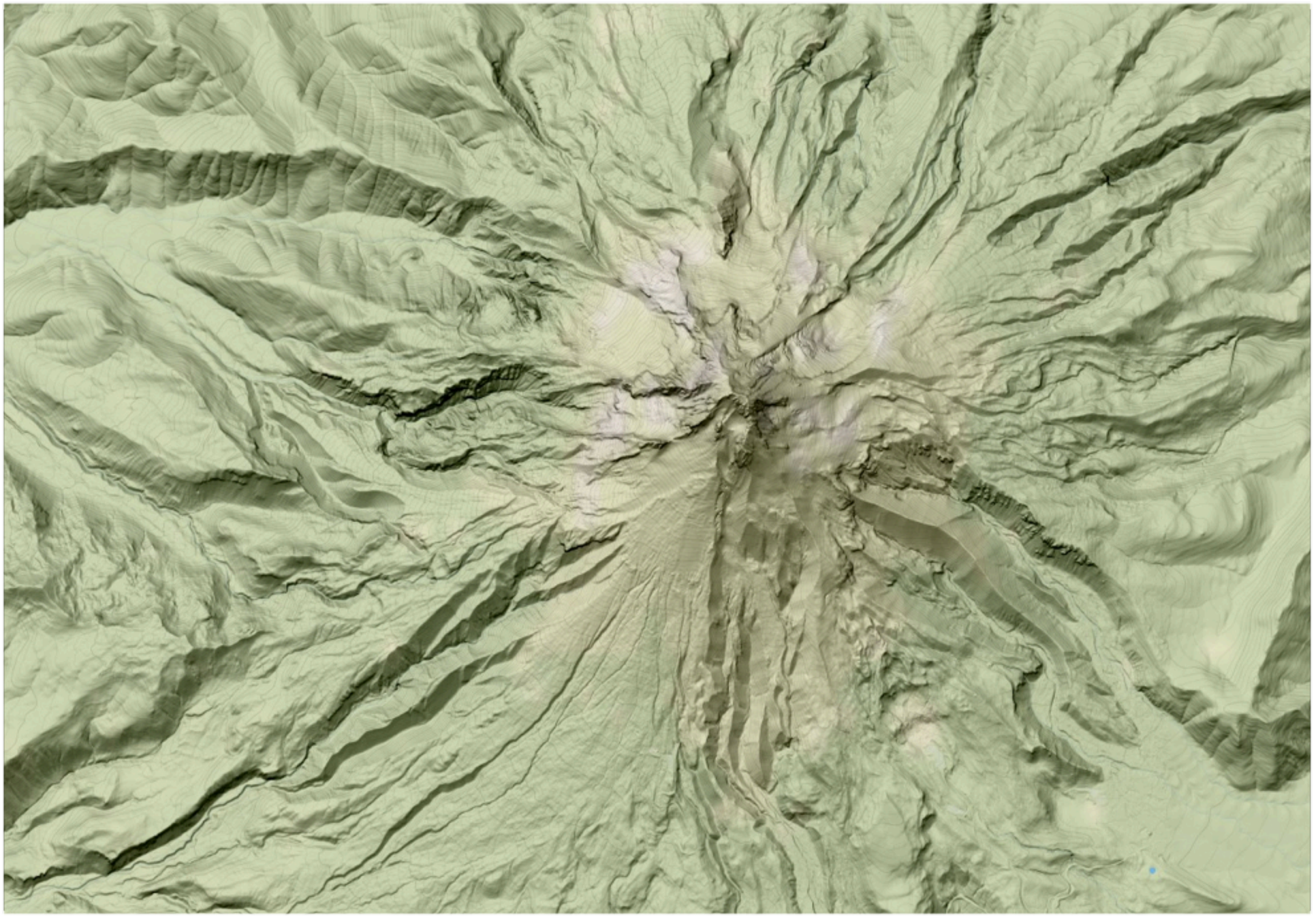
Je sais qu'il y a des Francophones ici aujord'hui. Ça, c'est pour vous!

Just Plain Aesthetics



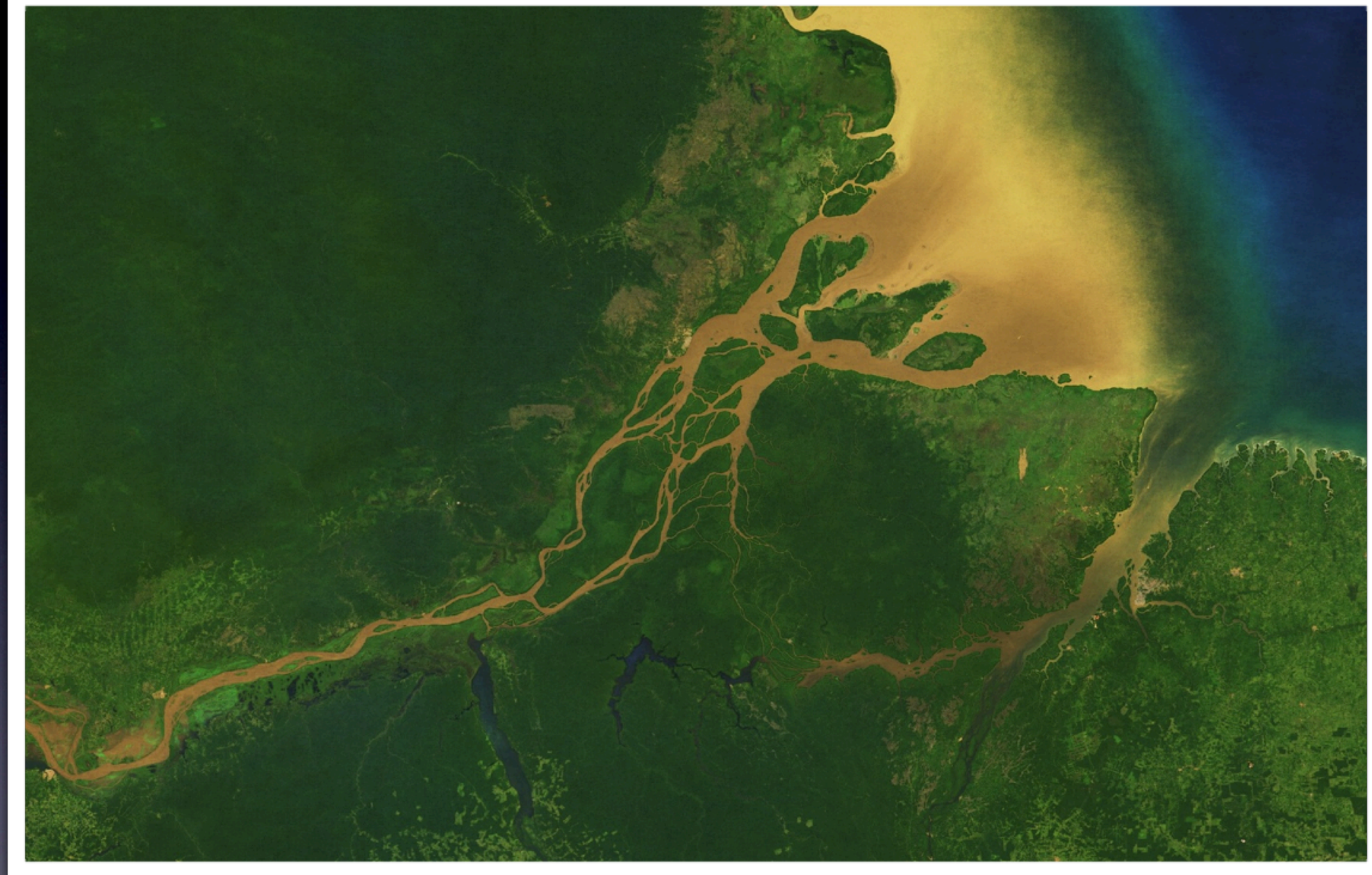
MapBox Streets

Our take on the basic world map.



MapBox Terrain

Our terrain map.



MapBox Cloudless Atlas

Cloud-removed satellite imagery (Amazon delta).

MapBox Cloudless Atlas

New Zealand south island.

Offline Use

- No data plan - traveling, etc.
- Sensitive or difficult environments
- Just for speed

Open Source

- Stack Overflow forum search
  - “custom mapkit”
- Able to tweak behavior
- Can learn from the code

Bring Your Own Data

- Kind of beyond the scope of this talk
- Use GeoJSON, Shapefiles, KML, etc.
- But you can do it - we do all the time

- Also open source
- Desktop app (Mac, Windows, and Linux)
  - Hybrid Node.js & Cocoa (web view)
- Map design studio
- Export for web or native

TileMill | Fast and beautiful maps

mapbox.com/tilemill/

Justin Miller

TileMill
an open source project by MapBox

MAP GALLERY CHANGELOG HELP

Make beautiful interactive maps

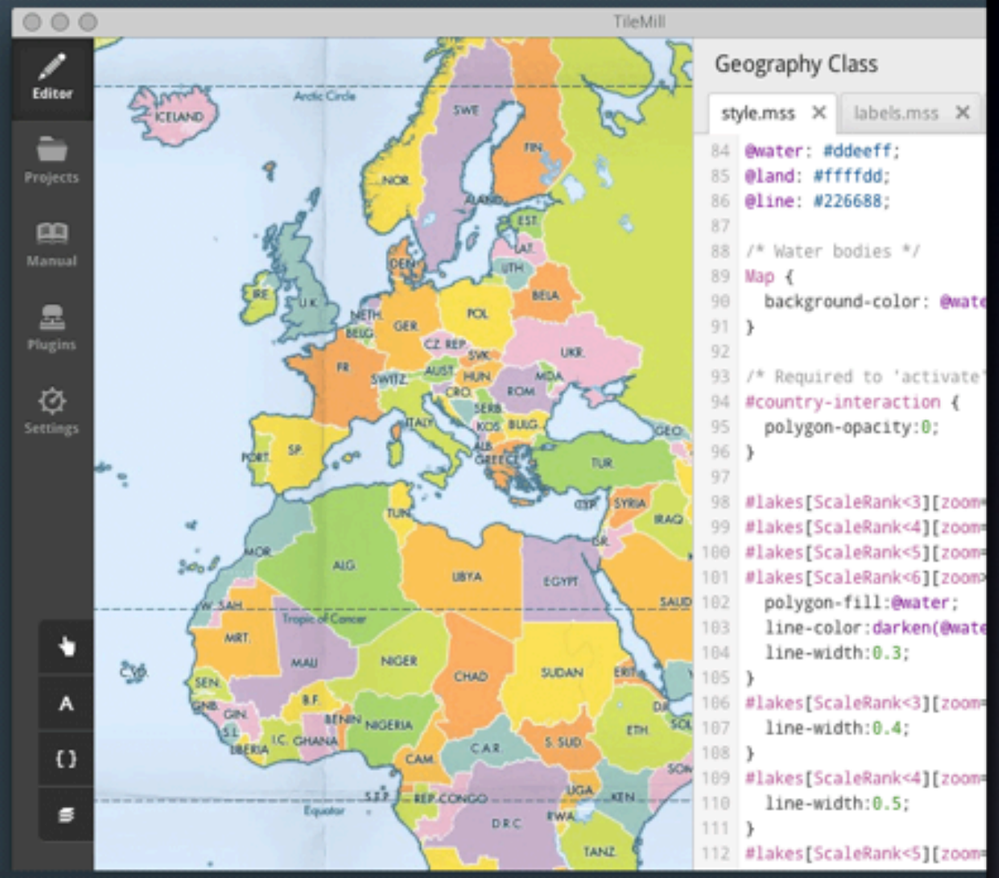
Whether you're a journalist, web designer, researcher, or seasoned cartographer, TileMill is the design studio you need to create stunning interactive maps.

Mac OS X | Ubuntu | Windows

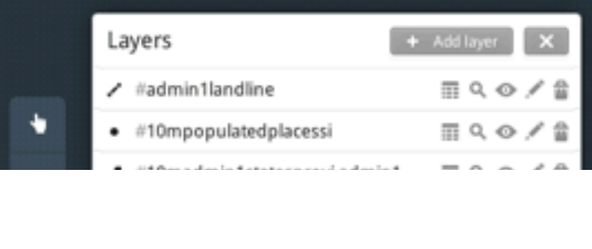
Mac OS X
DOWNLOAD

TileMill-0.10.1.zip
58.9 MB

Upgrade notes | Changelog | More install details



MANAGE DATA



Load data from a wide range of sources

Compatible datasources include ESRI Shapefile, KML, GeoJSON, GeoTIFF, PostGIS, CSV, and SQLite. Inspect, order, and layer your sources to build complex maps.

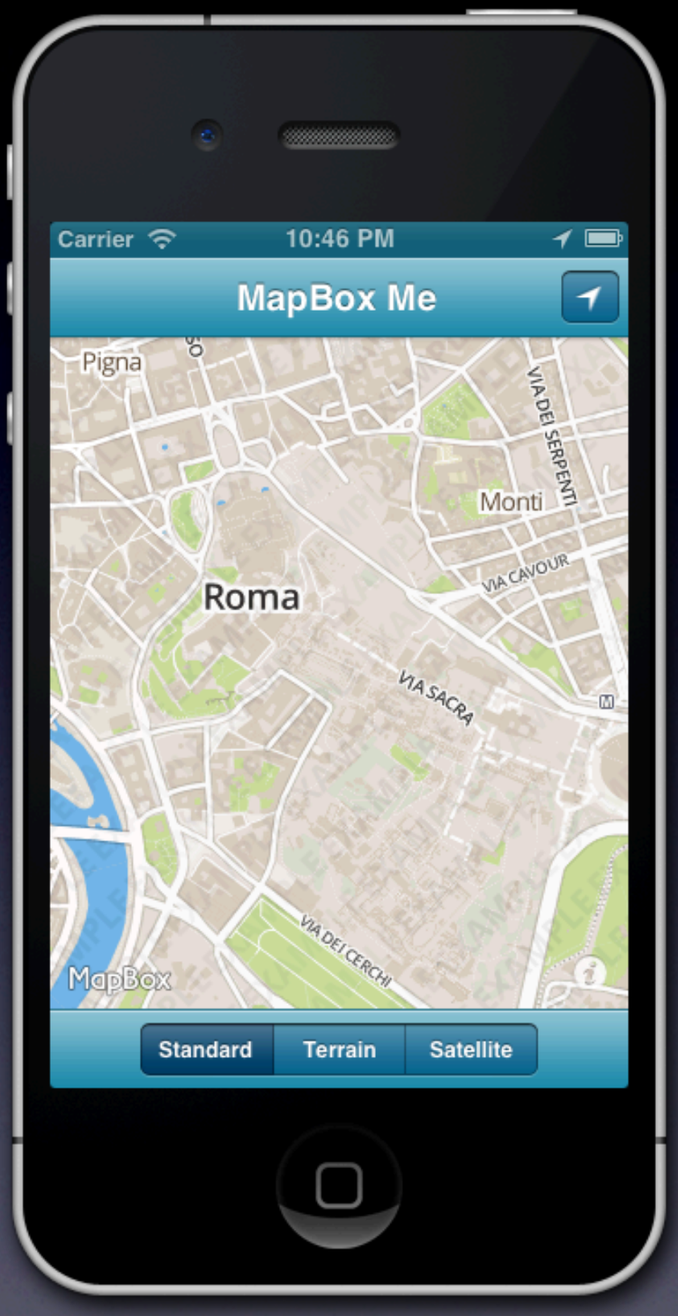
1. Code-Level Stuff

Map UI components have many layers.

The Moving Parts

- Map view
- Annotations (points and shapes)
- User location services
- Offline capability

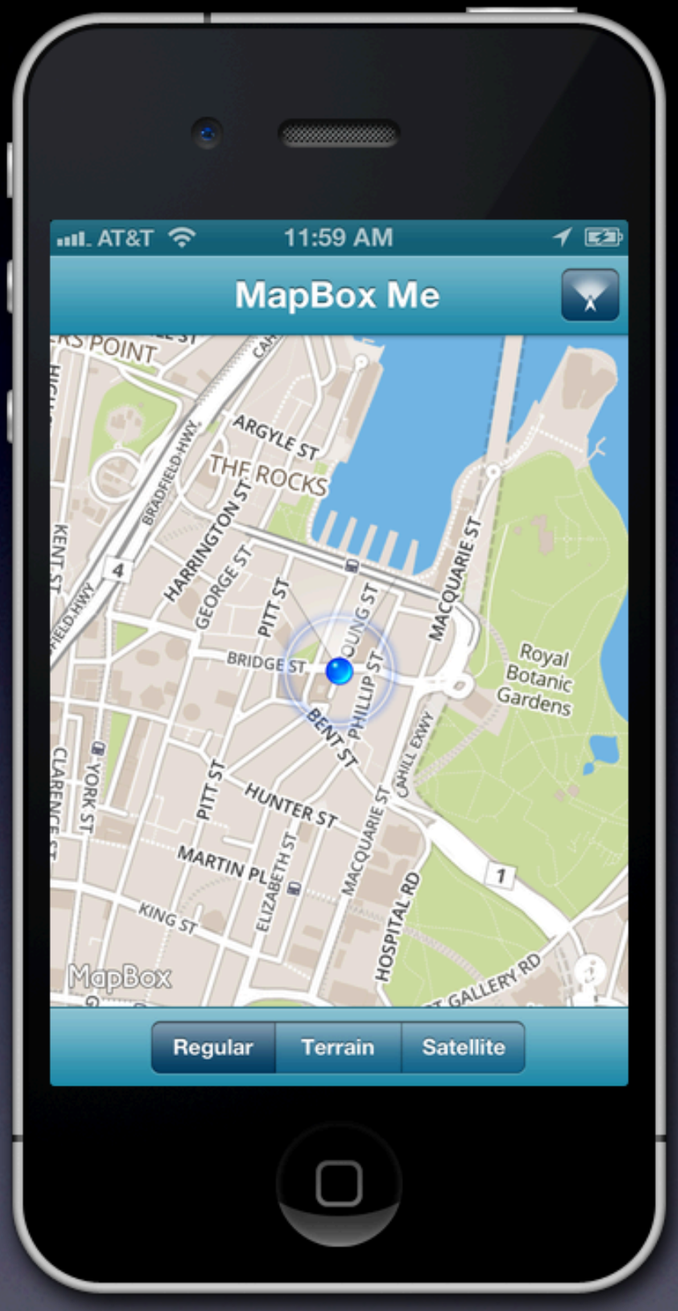
A. Map View


Carrier
10:46 PM
MapBox Me
Pigna
Monti
Roma
VIA DEI SERPENTI
VIA CAVOUR
VIA SACRA
VIA DEI CERCHI
MapBox
Standard
Terrain
Satellite

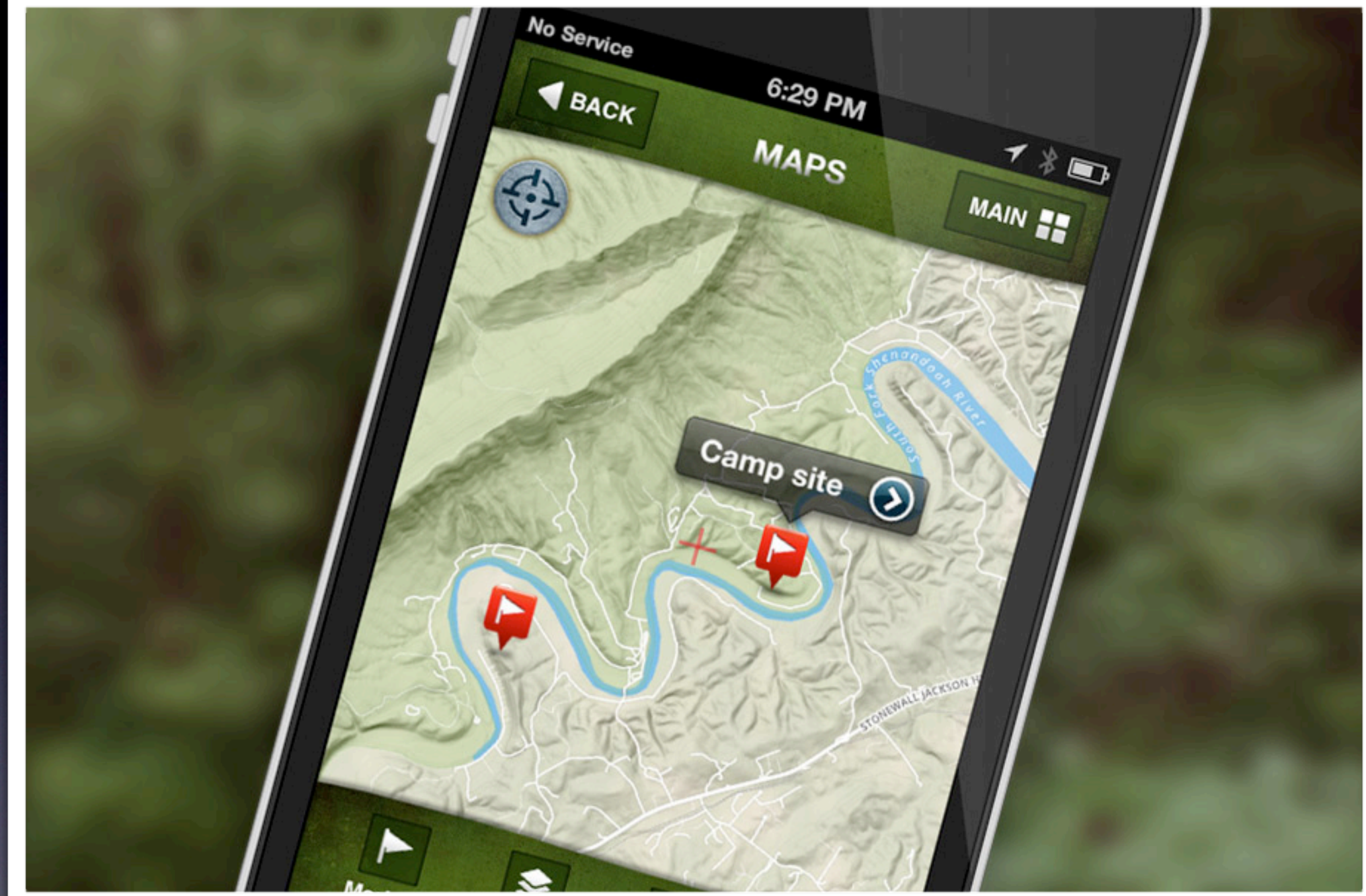
B. Annotations

Carrier
10:20 AM
DC Weekend Picks
Capital Pride Parade
Chevy Chase Section Three
Chevy Chase Village
Takoma Park
Chillum Station
Brentwood Village
West End
Washington
Alcova Heights
Douglass Park
Congress Heights
MapBox

C. User Location Services

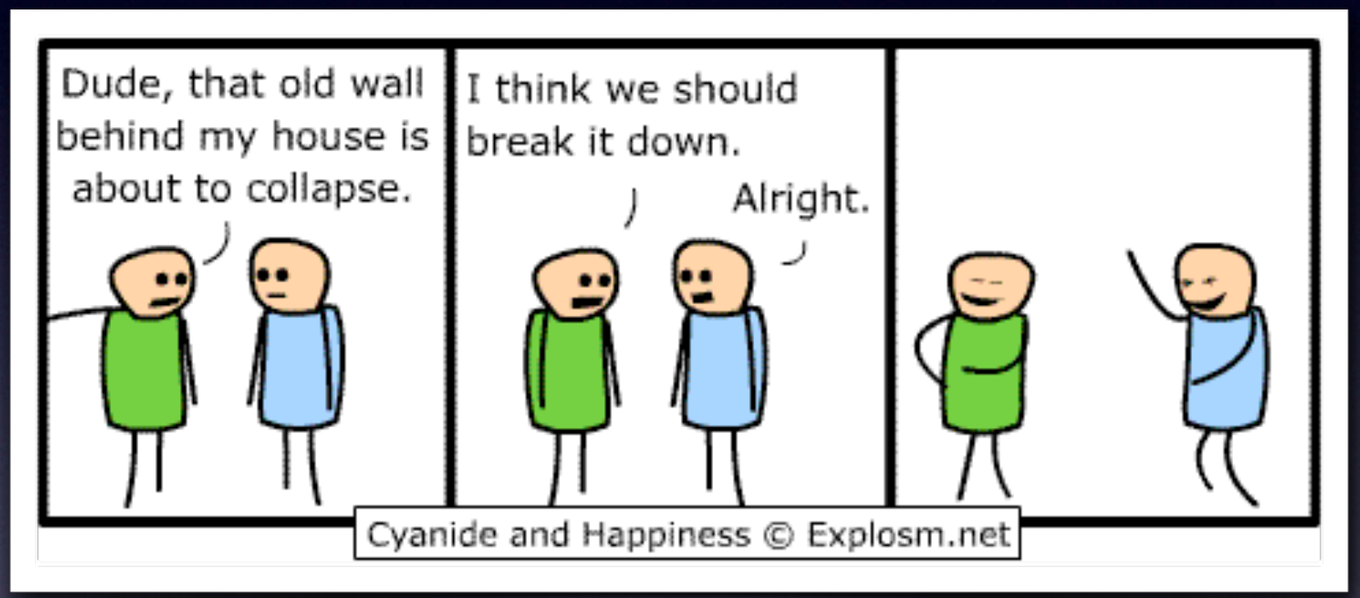

AT&T
11:59 AM
MapBox Me
ARGYLE ST
THE ROCKS
BRADFIELD HWY
HARRINGTON ST
GEORGE ST
PITT ST
MACQUARIE ST
BRIDGE ST
PHILLIP ST
BENT ST
Royal Botanic Gardens
CAHILL EXWY
YORK ST
HUNTER ST
MARTIN PL
ELIZABETH ST
KING ST
HOSPITAL RD
GALLERY RD
MapBox
Regular
Terrain
Satellite

D. Offline Capability



bassproshopsgames.com

Break It Down



Last frame here is animated. Keynote does animated GIFs!

A. Map View

- Parent `UIScrollView`
- Tiled layer-backed subviews
- Gesture handlers
- Geo translation layer

Animated demo of how a scroll view works.

Map Zoom Levels

- Zoom 0
  - One tile covers the whole world
  - Content view is 256px on a side
- Zoom Z
  - 4^Z tiles cover the whole world
  - Content view is $2^Z * 256$px on a side

CATiledLayer Use

- Every `UIView` has a `CALayer`
- Override `+[UIView layerClass]`
  - Return `[CATiledLayer class]`
- `-drawLayer:inContext:` method
  - Delegate is the owning view

CATiledLayer Drawing

- Context is your “drawing scratch space”
- Query the context for offset & bounds
- Combine this with the zoom scale
- Fetch & draw a tile to the context

Map Gestures

- Pan & zoom handled by `UIScrollView`
- Extra gestures handled individually
  - Single- and double-tap
  - Two-finger single-tap
  - Additional pan for marker dragging
    - With hit testing before failing

Geo Translation

- Relatively straightforward
- Uses *Proj4* - treat it like a black box
- `CGPoint` ↔ `CLLocationCoordinate2D`

B. Annotations

- Overlay parent - `CAScrollLayer`
- Points
  - Sublayers with image `contents`
  - Auto-correct position during zooms
- Shapes
  - Sublayers with `CAShapeLayer`
  - Also auto-correct scale during zooms

Managing Annotations

- Works just like MapKit
- Layers (or views) provided by delegate
- Hidden layers set to `nil` to save memory

C. User Location Services

- "Blue dot"
- Compass-based rotation

The Blue Dot

- Actually several layers
  - Dot itself is an image
    - github.com/0xced/UIKit-Artwork-Extractor
  - Pulsing halo animation (see also Sam's)
  - Accuracy circle
- Core Location position

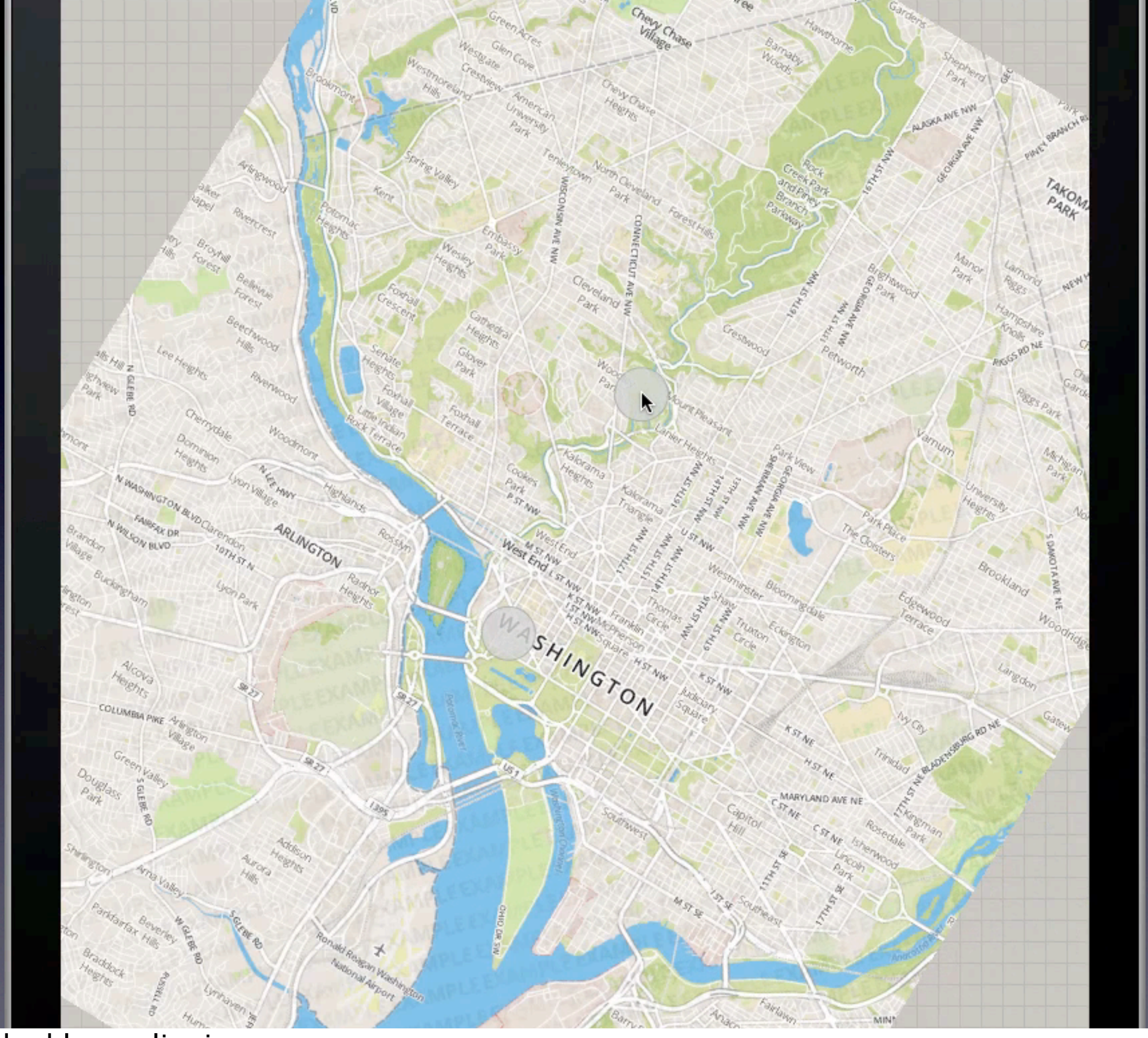
Compass Rotation

- Core Location heading
- Rotate map view
- Simple, right?
  - Lots of subtleties here

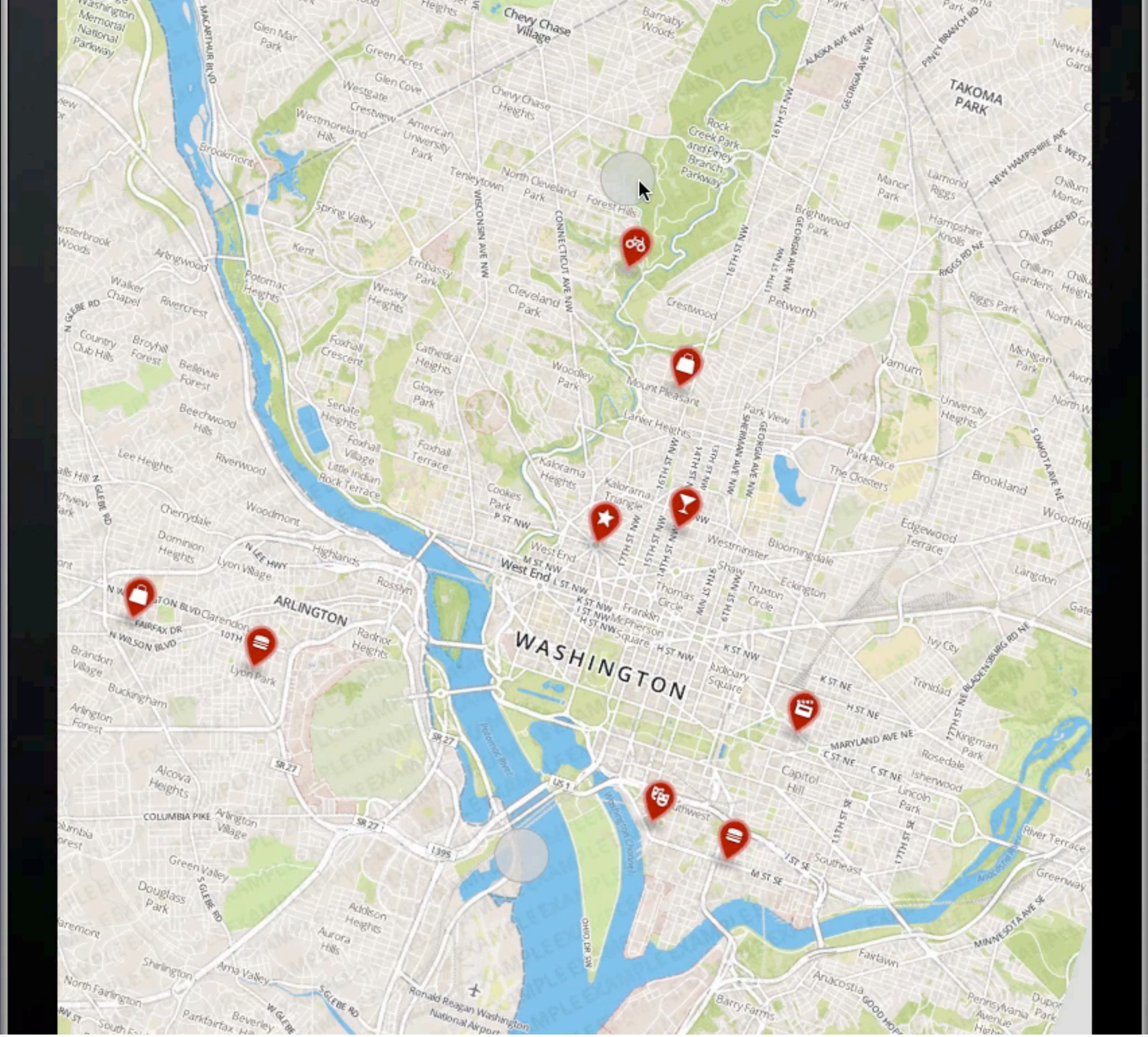
Nothing ever takes “just an hour”.

Complexity

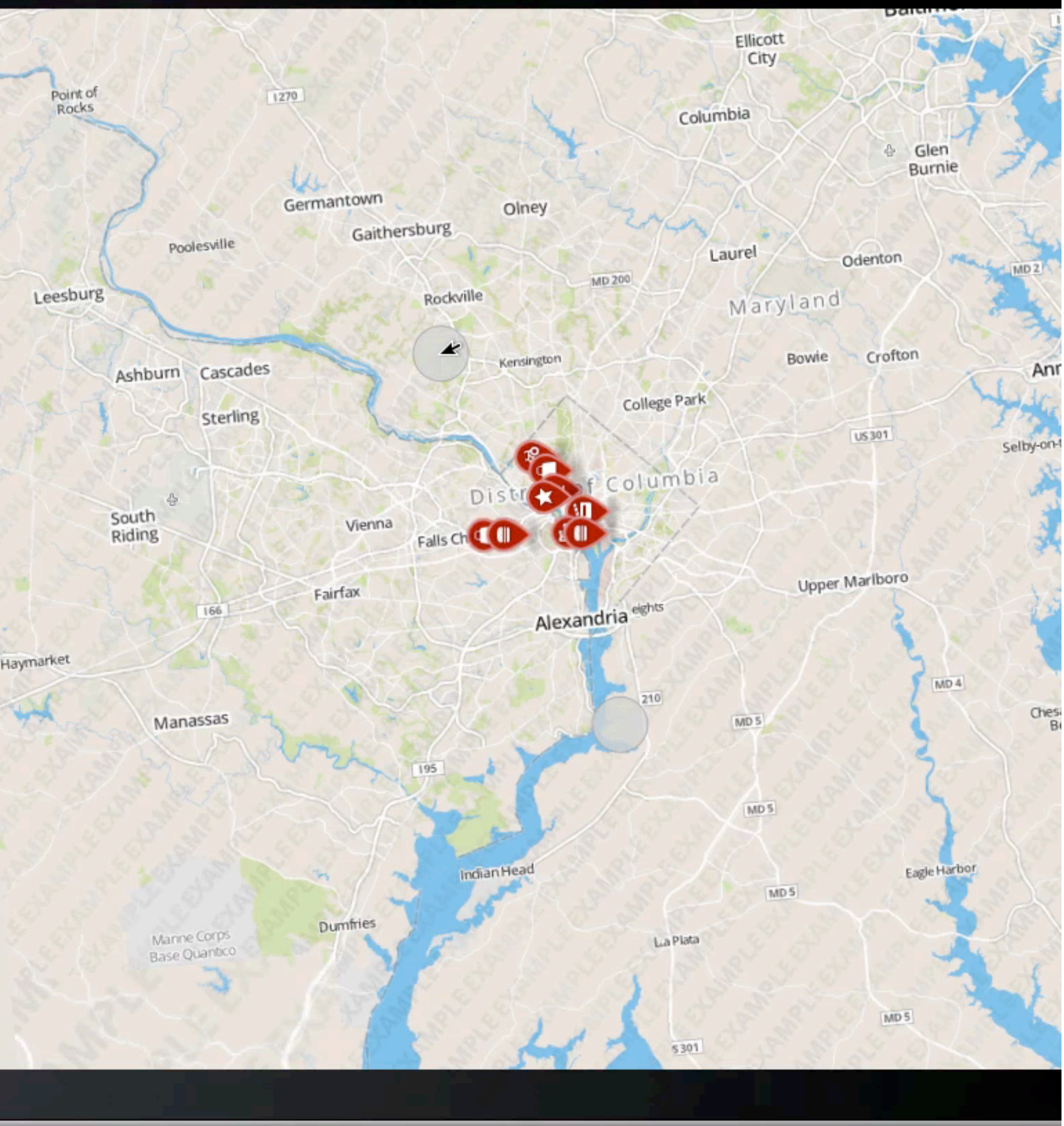
- Rotate transformation seems simple
- ... but that affects tile rendering
- ...and it affects annotation orientation
- ...which then affects layer occlusion



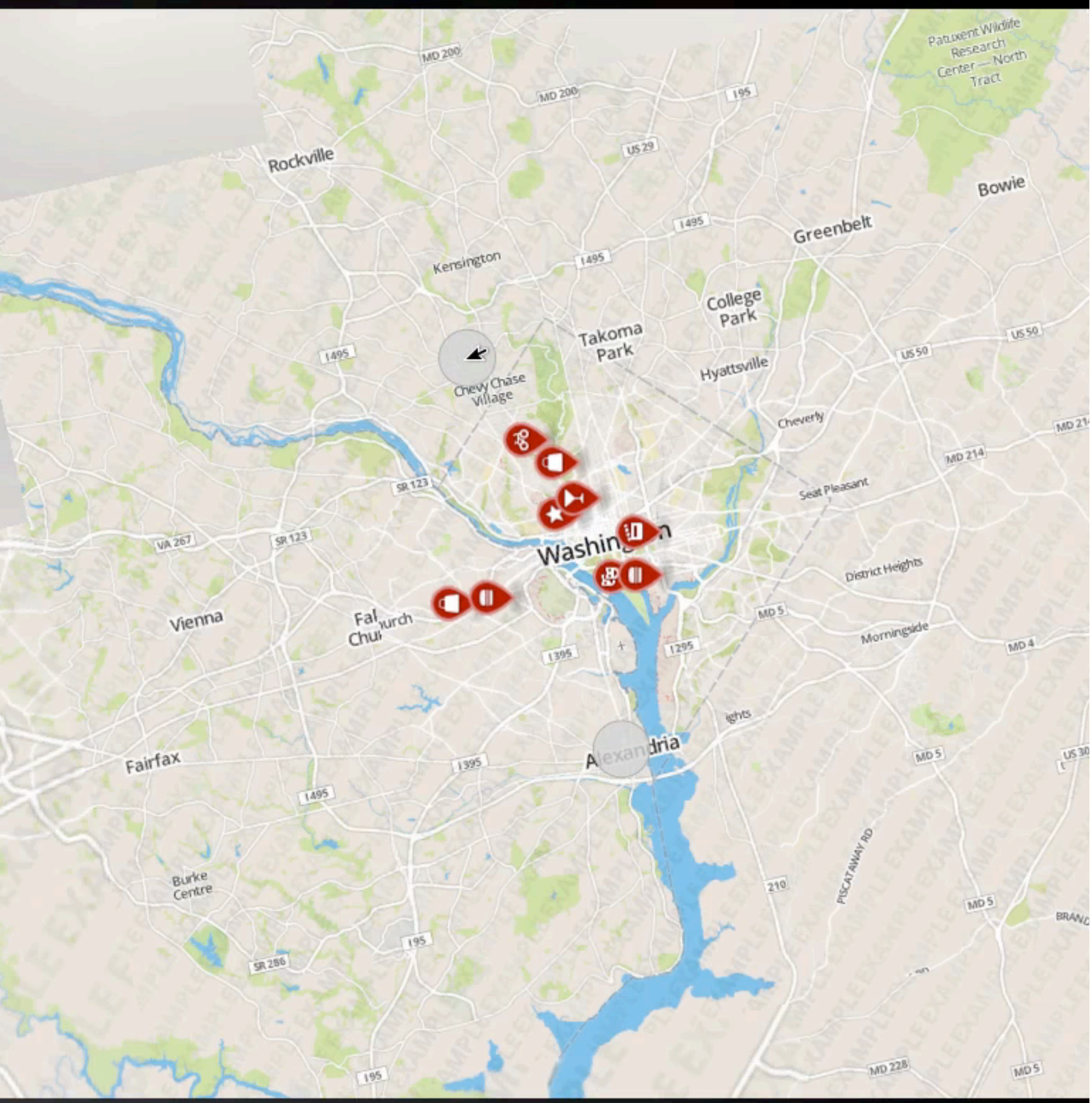
Animation of bad layer clipping.



Animation of improperly rotated annotations.



Annotation of improper z-ordering of annotations.



Animation of final, correct result.

4. Offline Capability

- Two approaches
  - Reactive
    - Just give complete cache control
    - Liberal caching policies
  - Proactive
    - Pre-loading geographic areas

MBTiles

- SQLite (uses *FMDB*)
- Simple, four-column database
  - Tiles are `z/x/y` triads
  - Plus blobs of the tile data
- Allows further de-duping & compression

Why store more than one blue ocean tile when they're all the same?

MBTiles Benefits

- Easy to transport
- Easy to checksum
- Easy to enumerate
  - In-app purchase capability
  - App data files management in iTunes

2. Ecosystem Stuff

- Documentation
- Code & support management
- Code examples
- Product page & sales
- Install methods

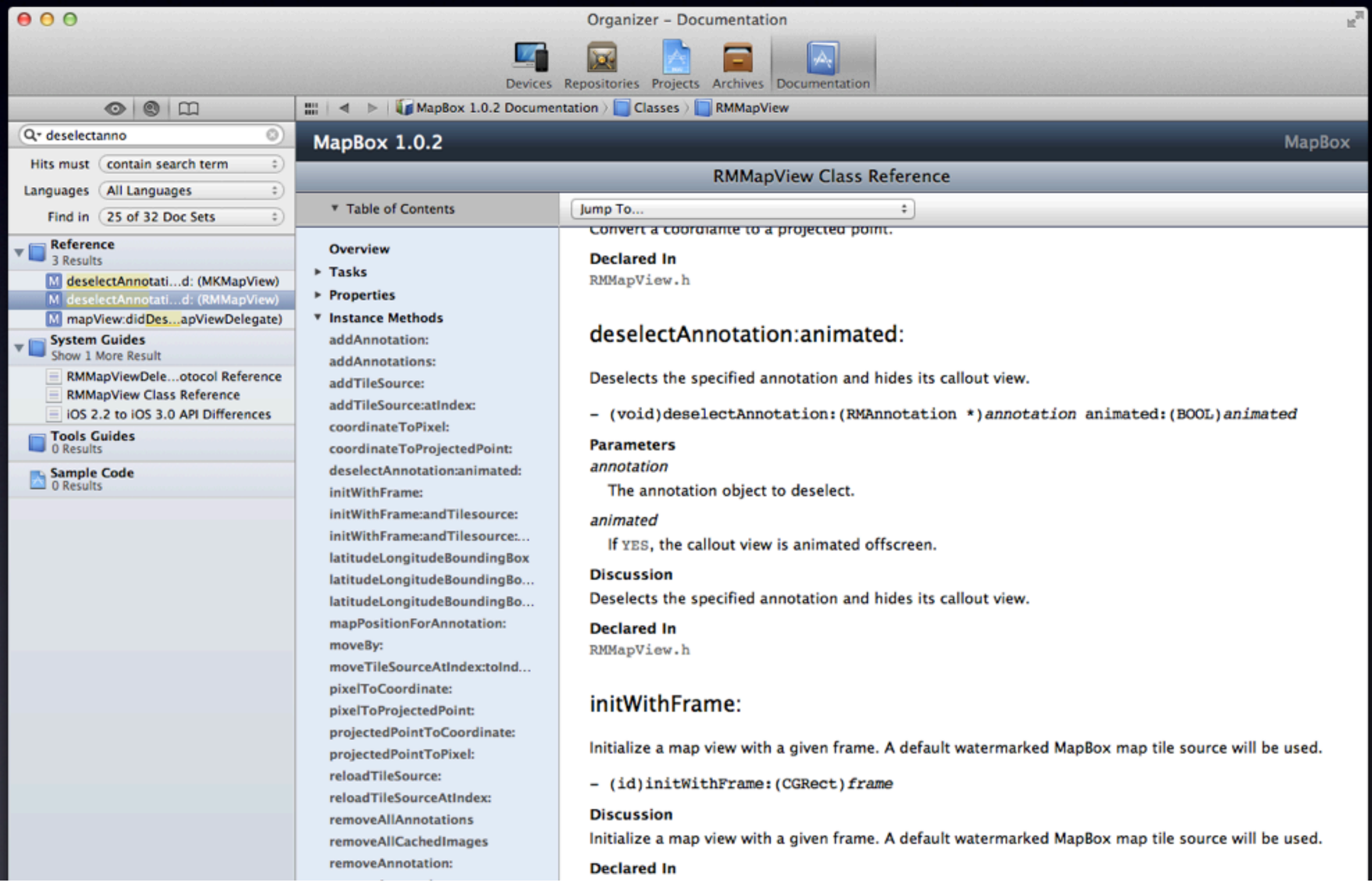
Documentation

- Clear winner: *appledoc*
- Based on header comments
- Creates Apple-like HTML pages
- Installs in Xcode
- Allows for Atom-based update feed

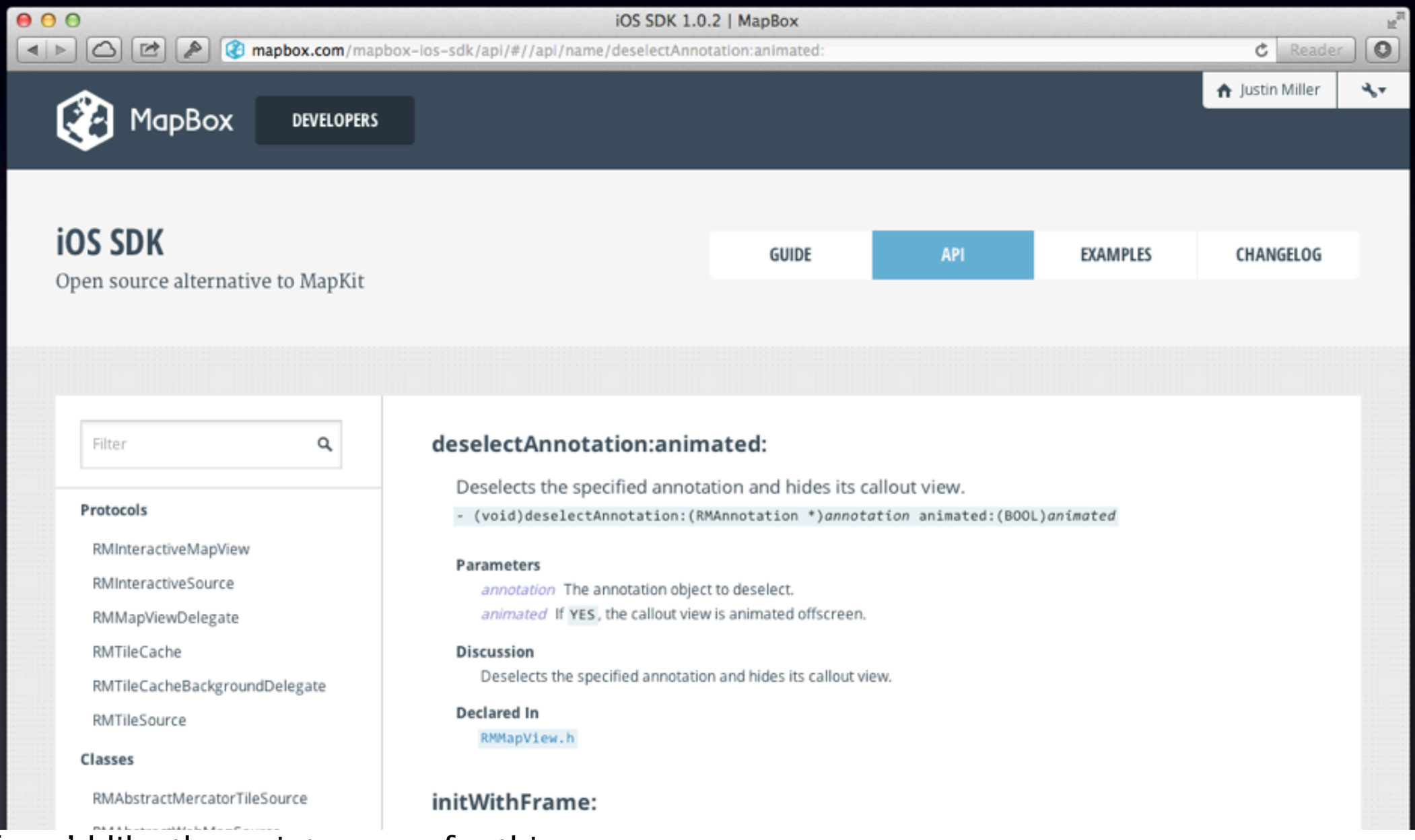
Comment Format

```
336 - (void)selectAnnotation:(RMAnnotation *)annotation animated:(BOOL)animated;
337
338 /** Deselects the specified annotation and hides its callout view.
339 *   @param annotation The annotation object to deselect.
340 *   @param animated If `YES`, the callout view is animated offscreen. */
341 - (void)deselectAnnotation:(RMAnnotation *)annotation animated:(BOOL)animated;
342
343 /** The annotation that is currently selected. */
```

Final Result



Post-Processing



Ask me if you'd like the script we use for this.

Code & Support

- We use GitHub for code hosting
  - Externally **and** internally
  - Bit of a monster
  - But a neat way to work
- We use Tender for support
  - Great email & GitHub integration

GitHub benefits include API, mobile apps, Markdown, and notifications.

Code Examples

- Great way to quickly get the point across
- We use snippets & whole apps
- Sometimes hard to keep up to date
- TestFlight for internal, tags for external

Product Page & Sales

- Know when to call a designer
- This speaks to decision makers, not coders
- Especially important for *alternatives*

Install Methods

- At first: Xcode sub-project/target
  - i.e., the Way of Pain
- Then: drop-in binary “framework”
  - Actually a static library
  - But helps smooth resources & headers
- Ultimate: CocoaPods

Ask me if you’d like the framework build scripts that I made for this.

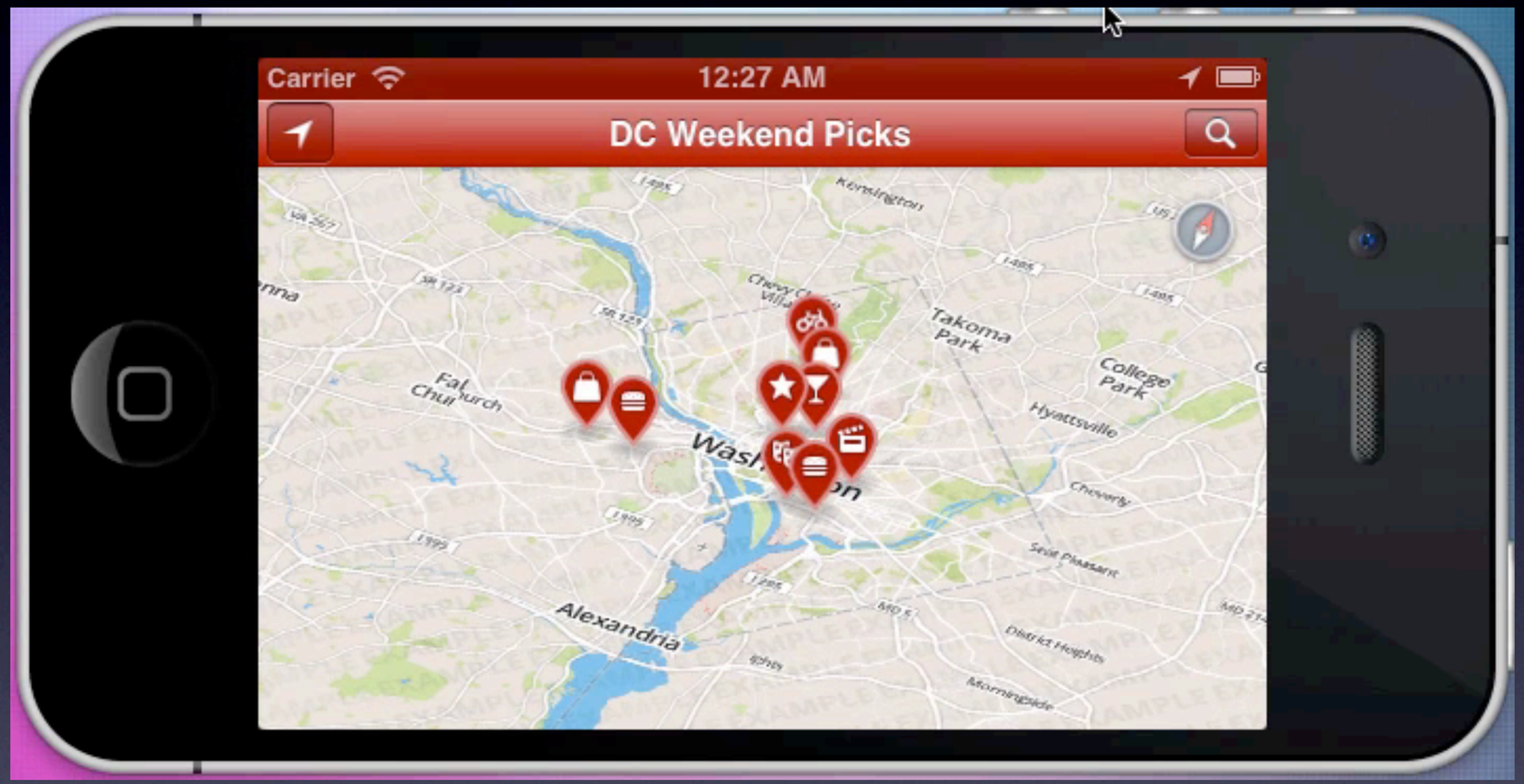
Example Podfile

```
platform :ios, '5.0'
pod 'AFNetworking'
pod 'MapBox'
pod 'MBProgressHUD'
```

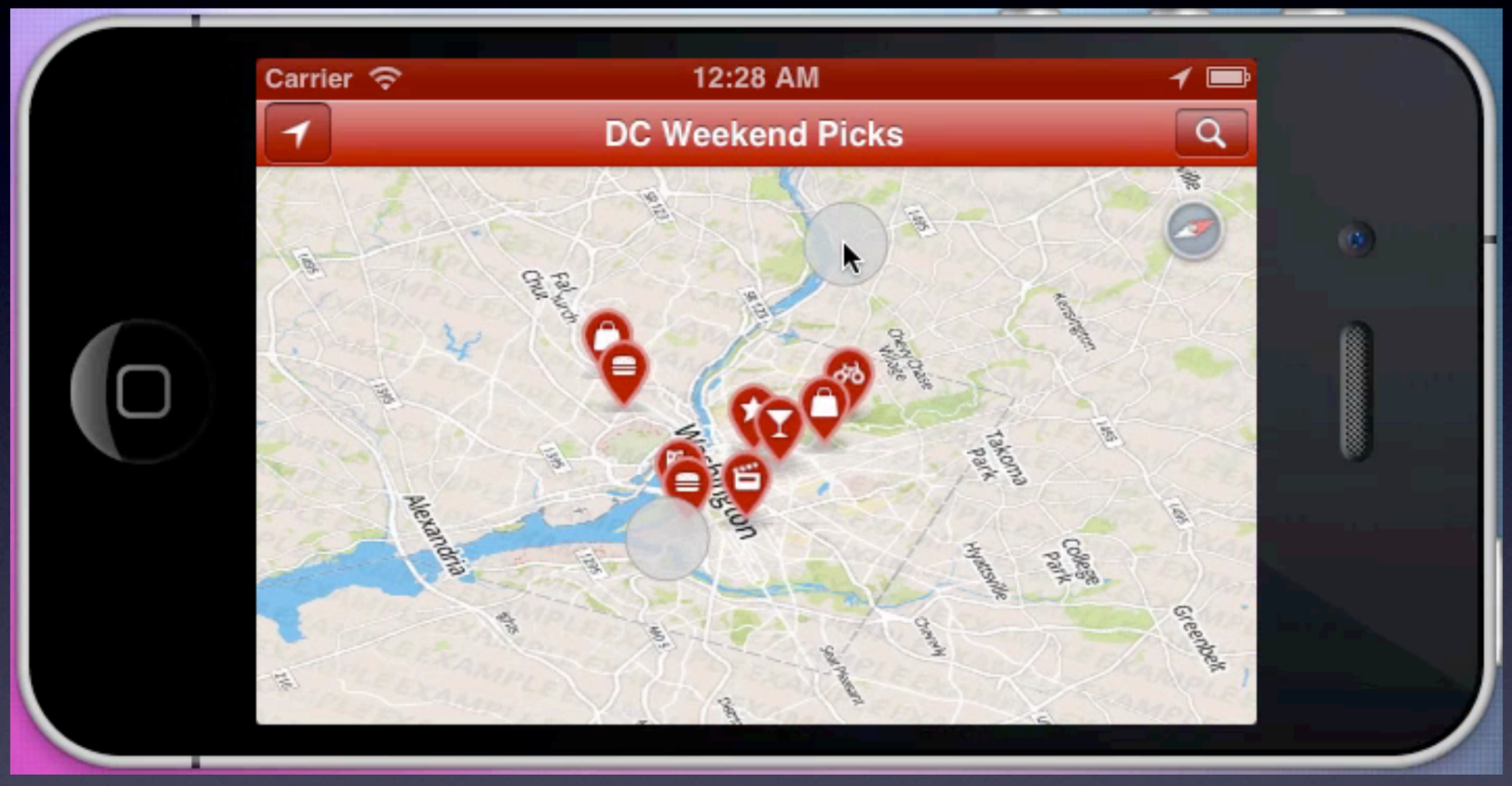
3. The Future

- What comes next?
- 3D maps
- True vector rendering

3D Maps



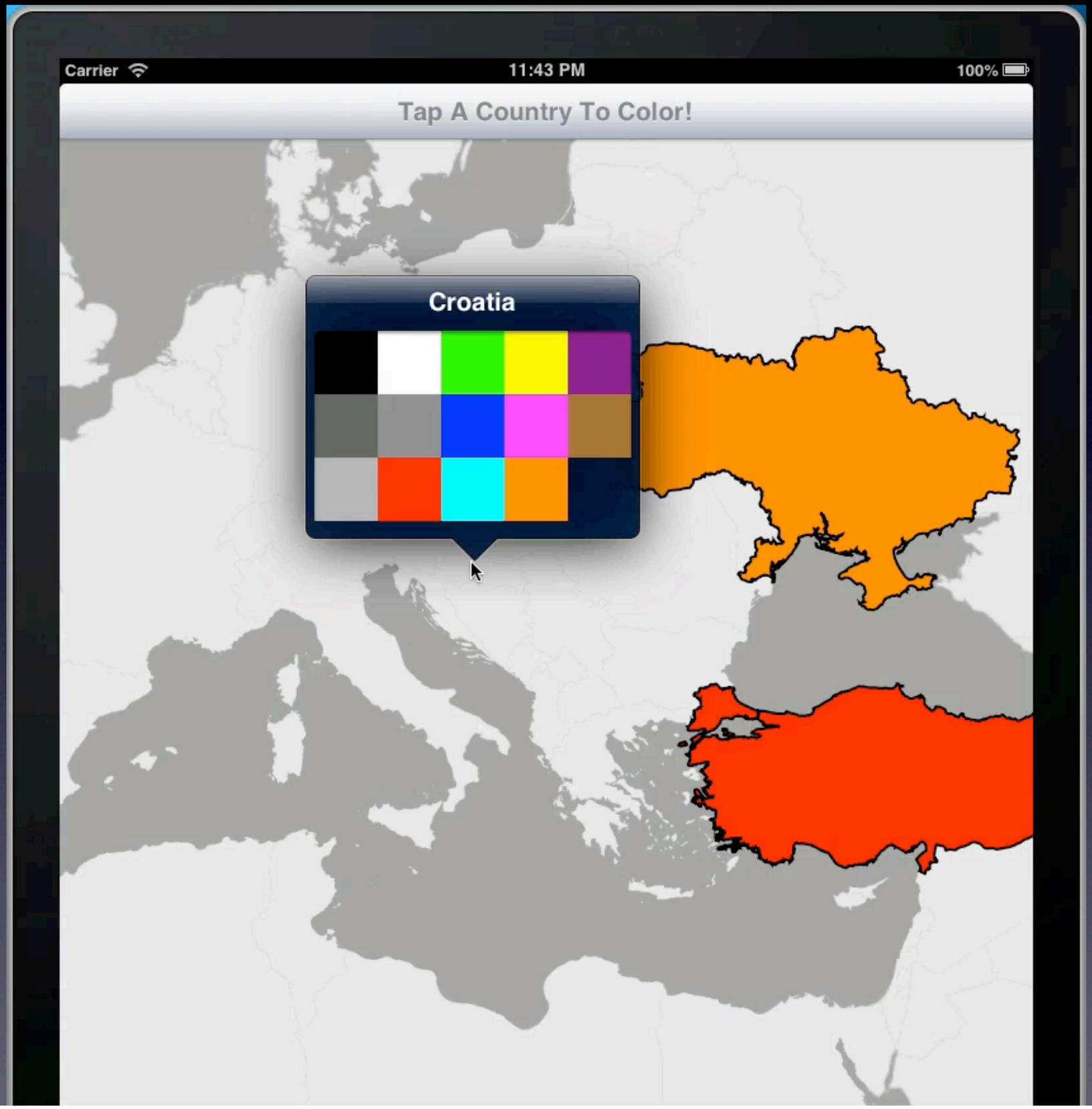
Map 3D tilt animation.



Tilted map 3D rotate animation.

True Vector

- As with all maps, it starts with data
- Then comes client-side rendering
- Lastly, full vector
  - Labels independent of features
  - As shown earlier, can remove labels



Animation of simple vector region identification and coloring.

Summary

1. Code-level stuff
    - Map view, annotations, user location services, and offline maps
2. Ecosystem stuff
    - Documentation, code & support hosting, example code, product sales, and install methods
3. The Future

Thank You!

- Twitter/ADN: @*incanus77*
- mapbox.com & mapbox.com/blog
- codesorcery.net & mallornimagery.com