Desert Atlas

An Easy Self-Hosted Online Map
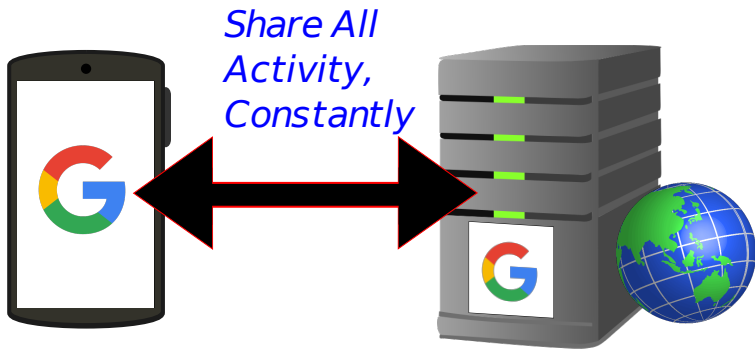

https://danielkrol.com/presentations/desert-atlas-harvard-gis/slides.html

Overview

- Desert Atlas: An Easy Self-Hosted Online Map
  - Self-hosting: motivations
  - OpenStreetMap: challenges
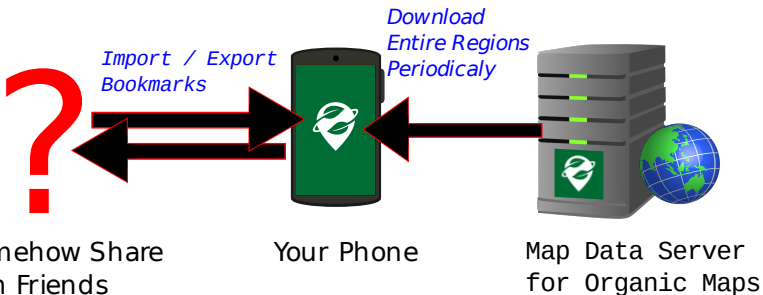 - The Sandstorm platform: bringing self-hosting to the masses

Big Tech Mapping

Share All Activity, Constantly

Your Phone

Google Servers

Google Maps Sees

▶ Where on the map you're looking
▶ Everything you're searching for
▶ What bookmarks you save and share

Private Mapping

Import / Export
Bookmarks

Download
Entire Regions
Periodicaly

Somehow Share
with Friends

Your Phone

Map Data Server
for Organic Maps

Organic Maps (or OSMAnd)

▶ Good: Share coarse data, rarely
▶ Bad: Hard to share or collaborate
   ▶ KML files or geo:// links
   ▶ External website (Google or OSM based)

What is self-hosting

Your Phone   Your Own   Your Friend's
                  Server   Phone
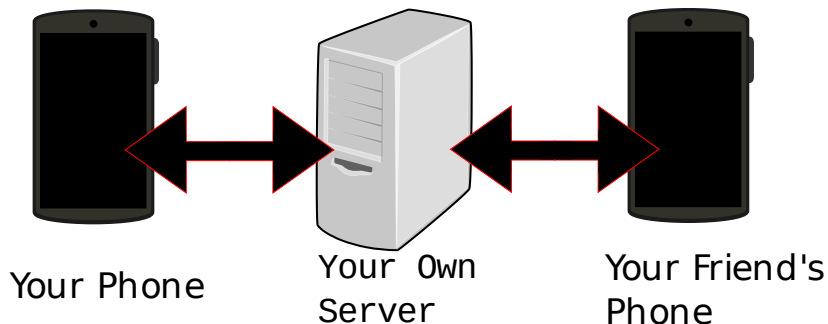
You are the cloud

- ▶ Good: Open source
- ▶ Good: Own hardware (even better)
- ▶ Bad: More Difficult
  - ▶ Sys-admins instead of consumers
  - ▶ Security

What is self-hosting

Platforms

▶ "Sysadmin" (maybe) installs / maintains platform
▶ Aiming for smartphone-like experience for Users
  ▶ Online "App stores"
  ▶ No CLI

Self-Hosted OpenStreetMap

OpenStreetMap Ecosystem

- ▶ World map, open data set
- ▶ Planet "raw" data is 73 GB (as of Feb 2024)
- ▶ Data formats, transformations, applications
- ▶ Vast overlapping options
    - ▶ Sometimes buggy
    - ▶ How do things connect?

Previous self-hosted OSM

Traditional Server Stack

- ▶ Nominatim for search - postgresql
- ▶ PNGs for tiles
    - ▶ apache, mod_tile, renderd, mapnik, osm2pgsql, postgis. . .
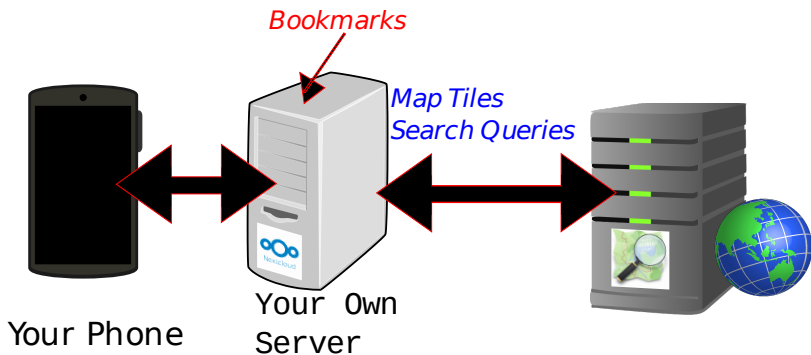   - ▶ Very slow process
    - ▶ PNGs size » raw data size (I think. . .)

Previous self-hosted OSM

Traditional Server Stack

- ▶ Overall:
    - ▶ Complicated to set up (as a developer)
    - ▶ Hard to run on Sandstorm's limitations
    - ▶ Lots of data
    - ▶ Downloaded data is not ready to use

Previous self-hosted OSM
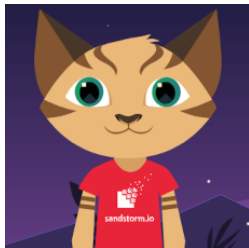

Nextcloud Maps / Yunohost Facilmap

- ▶ Good: Partially self-hosted (bookmarks)
- ▶ Bad: Map data (the hard part) from 3rd parties
- ▶ Map data server knows
  - ▶ Roughly where you are looking
  - ▶ Everything you search for

Previous self-hosted OSM

Headway

- ▶ Traditional stack
- ▶ Full featured (transit)
- ▶ Easier (Docker)
- ▶ Still Slow (processing data)
- ▶ Buggy for me, not 100% "automatic"
- ▶ Limited cities (for the easy options)
- ▶ Conclusion: Not a "consumer app"

What is Sandstorm?

- ▶ Kenton Varda (capnproto, protobuf v2)
- ▶ 2014 Company, 2016 Community Project
- ▶ Apps: office, project organization, games, calendar, etc
- ▶ Easy self-hosting (even for the "sysadmin")
  - ▶ Platform easy to install
  - ▶ Platform auto-updates

What is Sandstorm?
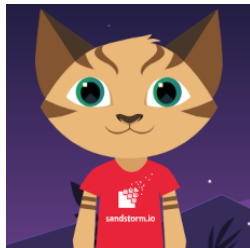
- ▶ Apps point-and-click install
- ▶ Small apps with many "grains" (instances)
  - ▶ Think "single documents"
  - ▶ Apps start ready-to-go, quick initialization
  - ▶ Easier maintenance - broken grains, not broken apps
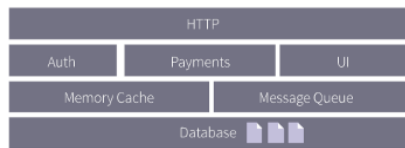
What is Sandstorm?
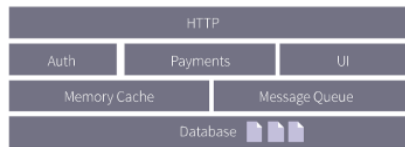
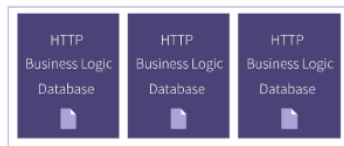Conventional   Sandstorm

Unique Security Model

- ▶ Sandboxing via containers (not Docker)
- ▶ Proxying in - Sandstorm handles user accounts
- ▶ Random URLs
- ▶ Proxying out - Outbound connections only by user permission
- ▶ Client side sandboxing
  - ▶ Block 3rd party js
  - ▶ Disabled by default

What is Sandstorm?

HTTP		
Auth	Payments	UI
Memory Cache		Message Queue
Database		

Conventional

HTTP Business Logic Database	HTTP Business Logic Database	HTTP Business Logic Database

Sandstorm

Facilitated Features

- ▶ Mitigates many otherwise vulnerable apps
- ▶ Exploited grains don't affect other grains
- ▶ Backup / Restore - Download/upload a zip file
- ▶ Sharing - Sandstorm handles access
- ▶ Permissions - Sandstorm handles access, apps implement restrictions

What is Desert Atlas?

Goal: A private online map that's as easy as Organic Maps

What is Desert Atlas?

Like Organic Maps. . .

- ▶ Easy installation (thanks to Sandstorm)
- ▶ Point and click download region (to grain)
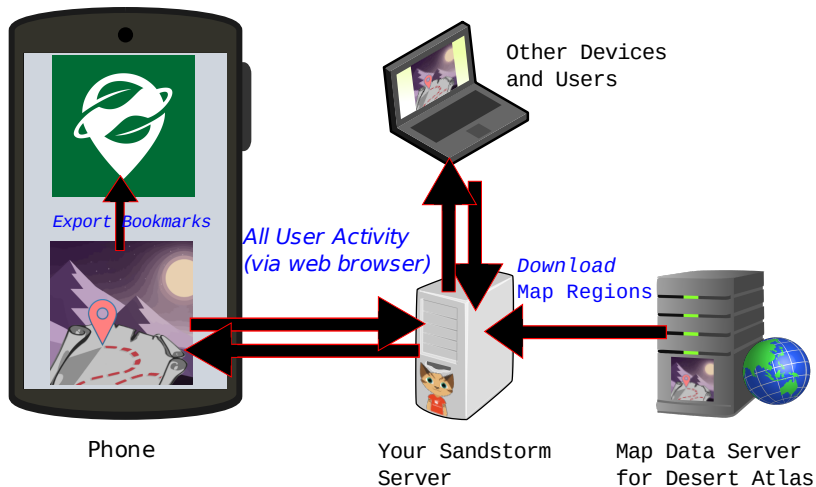- ▶ Add bookmarks

What is Desert Atlas?

But also. . .

- ▶ Share a location with a link
- ▶ Plan trips with friends
- ▶ . . . privately
- ▶ Export bookmarks to Organic Maps / OsmAnd
    - ▶ For private navigation, etc

What is Desert Atlas?

- Your server sees everything that happens
- Public map server sees which regions you request
  - Like Organic Maps

What is Desert Atlas?

Porting OSM for Sandstorm

- ▶ Learning OSM ecosystem
- ▶ Constraints from Sandstorm
  - ▶ Spin up fast (grains)
  - ▶ Single user (Postgresql harder, though turns out possible)
  - ▶ Fewer resources (recommended for Sandstorm, anyway)

What is Desert Atlas?

Downloadable Regions: Convert in-app?

▶ Super slow, no matter what option
▶ Headway does this

What is Desert Atlas?

Downloadable Regions: Pre-render everything?

- ▶ Periodic: raw data -> usable format
- ▶ Provide via a map data service
- ▶ Organic Maps / OsmAnd do this

What is Desert Atlas?

Downloadable Regions: Pre-render everything?

- ► Render PNGs with traditional pipeline?
    - ► Takes up lots of space
    - ► Slow to download

What is Desert Atlas?

Downloadable Regions: Pre-render everything?

- ▶ Protomaps (Vector-based)
    - ▶ Pregenerate: osm.pbf ("raw") -> mbtiles -> pmtiles
    - ▶ User: pmtiles renders via protomaps.js
    - ▶ Reasonable size

What is Desert Atlas?

Downloadable Regions: Pre-render everything?
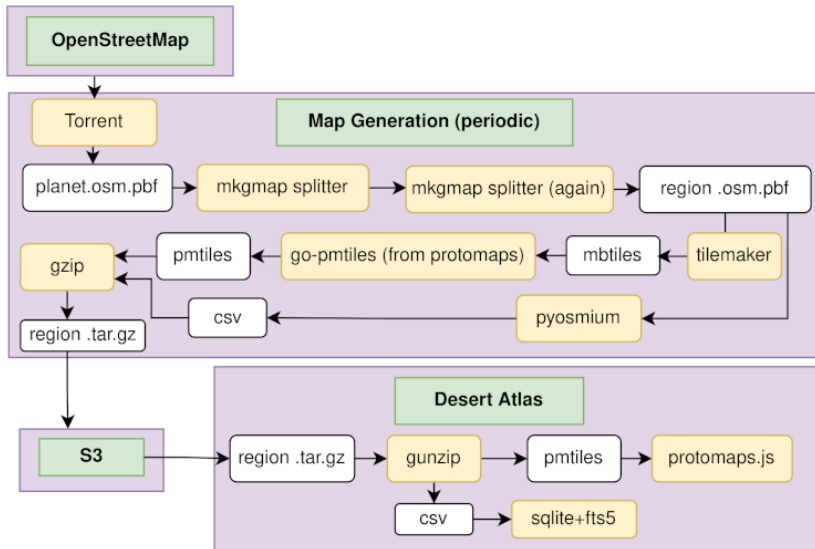
- ▶ Search
  - ▶ Pregenerate: osm.pbf ("raw") -> csv
  - ▶ User: csv -> sqlite3+fts5 on region download
  - ▶ Future: Nominatim Lite is coming

What is Desert Atlas?

Downloadable Regions: Pre-rendered by someone else?

- ▶ Protomaps
    - ▶ No API when I started (as I recall)
    - ▶ Maybe licensing issues?
    - ▶ No customization
    - ▶ Maybe later

What is Desert Atlas?

Demo: Install Sandstorm

See video of installing the Sandstorm platform:

https://danielkrol.com/presentations/desert-atlas-harvard-gis/installation.webm

Demo: Applications

See video of installing a financial application on Sandstorm, and creating a couple grains:

https://danielkrol.com/presentations/desert-atlas-harvard-gis/apps.webm

Demo: Backup / Restore

See video of backing up a Sandstorm grain and restoring it to another account:

https://danielkrol.com/presentations/desert-atlas-harvard-gis/backup-restore.webm

Demo: Desert Atlas

See video of installing Desert Atlas on Sandstorm, creating a map, and creating a share link:

https://danielkrol.com/presentations/desert-atlas-harvard-gis/desert-atlas-desktop.webm

Demo: Desert Atlas

See video of a phone browser using the share link from the previous video to see the created map, and export it to Organic Maps:

https://danielkrol.com/presentations/desert-atlas-harvard-gis/desert-atlas-phone.webm

What can Sandstorm do for you?

- ▶ Academic Apps
  - ▶ Datasette - data visualization and exploration
  - ▶ iPython Notebook - interactive computational environment
  - ▶ ShareLatex - collaborative LaTeX editor
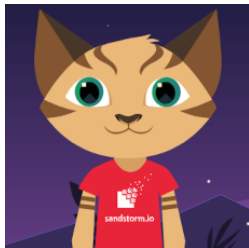
What can Sandstorm do for you?

- ▶ Install apps without IT dept
- ▶ Make custom apps as part of research
- ▶ Assign/submit class assignment as grain
  - ▶ iPython, ShareLaTeX, etc
  - ▶ .zip file or share link
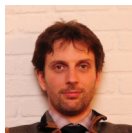
Sandstorm Community Project

- https://sandstorm.org/community
- Kenton handed it off
- Solid foundation, but dependencies getting older
- Technical hurdles to upgrades
- The future: Tempest

Sandstorm Community Project

- https://opencollective.com/sandstormcommunity
    - Fund some of the upgrades
    - Moving to fully community supported project
    - Infrastructure

Thank you

- Python/Go, Functional Programming
- FOSS / Web / API / (GIS?)
- Open for full or part time
- Contact
    - danielkrol.com
    - dan@danielkrol.com
    - https://github.com/orblivion
    - @ill_logic@mastodon.social