T-rex, a vector tile server for your own data

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Vector Tiles
Vector tile demo

https://www.mapbox.com/maps/
Vector tile demo

https://www.mapbox.com/maps/
Mapbox Vector Tiles

https://github.com/mapbox/vector-tile-spec

- Protocol buffer format (PBF, binary, Streamable)
- Geometry in screen pixel coordinates (Integers, ZigZag encoded)
- Multipoint/Multiline/Multipolygon
- Non-spatial attributes (optional Feature-ID)
- Multiple layers per tile
Mapbox Vector Tiles

T-rex, a vector tile server for your own data
Vector tile size

- **OSM data set:**
  - Boston: 24 MB
  - USA: 7.2 GB
  - Planet: 55 GB

- **Offline maps!**

- **Download & Build-Tools:**
  - http://osm2vectortiles.org/
  - https://openmaptiles.org/
WMS -> WMTS -> Vector tiles

- **WMS**
  - No tiling problems (labels, etc.)
  - Printing

- **WMTS**
  - Scalability
  - Caching (server and client)

- **Vector Tiles**
  - Scalability
  - Caching (server and client)
  - Interactivity
  - Flexible styling (client-side rendering)
  - Hi-DPI
Creating vector tiles
Vector tile stack for custom data

Client
Mapbox GL, OpenLayers

Styling
Mapbox Styles

Webserver

PBF

PBF

PBF

Tile Server

PostGIS Database

Files
gpkg, etc.
Styling / viewer

- Mapbox Styles (JSON)
  - Viewer:
    - Mapbox GL JS
    - OpenLayers 3/4
    - Style Editor (OSS)
    - Maputnik

- Mapzen Tangram Styles (YAML)
  - Viewer:
    - Tangram
    - Style Editor (OSS)
    - Tangram Play
Vector tile creation

» Read geodata within tiles borders

» Clip geometries

» Simplify geometries
  » Polygons: e.g. SnapToGrid
  » Lines: e.g. Douglas-Peucker
  » Points: clustering

» Generate label points

» Deliver MVT (Protobuf) format

» Serve live or seed cache (parallelization!)
Vector tile stack for custom data (PG)

- node-mapnik (Kartotherian, tessera)
- Tilezen tileserver
- Tegola
- t-rex
- GeoServer
- PostGIS ST_AsMVT

https://github.com/mapbox/awesome-vector-tiles
t-rex
t-rex

- Multiple datasources (PostGIS + GDAL/OGR)
- Auto-detection of layers in PostGIS database
- Built-in viewers for data display and inspection
- Tile generation command with simple parallelization
- Automatic reprojection to grid CRS
- Support for custom tile grids
- Single executable
Rust

- New programming language from Mozilla
- Next Firefox rendering engine
- Systems programming (like C, C++)
- Zero-cost abstractions
- Guaranteed memory safety
- https://www.rust-lang.org/
Workflow with t-rex (1)

- Installation:
  - http://t-rex.tileservr.ch/

- Start server:
  
t_rex serve --dbconn postgresql://user@host/database
  or
  t_rex serve --datasource <file_or_gdal_ds>
OGR/GDAL examples (t-rex >0.8)

- natural_earth.gpkg
- ne_110m_coastline.shp
- placemarks.kml
- route.gpx
- osm.pbf
- https://earthquake.usgs.gov/earthquakes/feed/v1.0/summary/all_week.geojson
- spreadsheet.vrt (Spreadsheet with lat/lon columns)
- dm01avch24d.itf, inspire.gml, OCI, ...
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Built-in viewer

Tileset: admin_0_countries

Layers:
- admin_0_countries (POLYGON)

Endpoints:
- Tiles: http://127.0.0.1:6767/admin_0_countries/{z}/{x}/{y}.pbf
- Style JSON: http://127.0.0.1:6767/admin_0_countries.style.json
- TileJSON: http://127.0.0.1:6767/admin_0_countries.json
- Style map with Maputnik

Snippets:
- MapBox GL JS
- OpenLayers

```html
<html>
<head>
  <meta charset='utf-8' />
  <title></title>
  <meta name='viewport' content='initial-scale=1,maximum-scale=1,user-scalable=no' />
  <script src='https://api.tiles.mapbox.com/mapbox-gl-js/v0.38.0/mapbox-gl.js'></script>
  <link href='https://api.tiles.mapbox.com/mapbox-gl-js/v0.38.0/mapbox-gl.css' rel='stylesheet'/>

<style>
  body { margin:0; padding:0; }
  #map { position:absolute; top:0; bottom:0; width:100%; }
</style>
</head>
```
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X-Ray viewer

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Create styles with Maputnik

Kickstarter financed OSS editor by Lukas Martinelli

Integrated in t-rex backend
Workflow with t-rex (3)

› Generate a configuration template:

```
t_rex genconfig --dbconn postgresql://user@host/database
```

› Run with configuration file:

```
t_rex serve --config myconfig.cfg
```
Workflow with t-rex (4)

- Generate tile cache:
  
t_rex generate --config myconfig.cfg

- Create MBTiles File:
  
mb-util --image_format=pbf /tmp/mvtcache/ne ne.mbtiles
Create and serve your own vector tiles

Serve vector tiles

- Live tiles from PostGIS geodata
- Zero-configuration mode
- Embedded webserver
- Visual styling with Maputnik

Generate vector tiles

- Tile generation command with simple parallelization
Roadmap

- Release of 0.8 with OGR/GDAL support
- Clipping & Simplification for OGR/GDAL layers
- More cache output formats (S3, etc.)
- Performance optimizations for big geometries
- More to come - driven by customer needs or contributions
- ST_AsMVT integration?
Questions? Thank you!

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