maplibre-rs

Cross-platform map rendering using Rust!

Imagine being ableto fly from outer spaceto any place on Earth.

Being able to discover the world through computers was a groundbreaking idea in the 90s.



Disclaimer about myself





I'm NOT an expert in:

- Geoinformatics,
- graphics programming, or
- Rust.

But ... I'm a Software Engineer who has had a lot of free time!

Let's talk about maps!

- 1. What is a vector map?
- 2. maplibre-rs presentation







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Vector Tiles

Pros:

- Smaller data size and therefore lower disk space requirement
- Better user experience-smooth zooming
- Easy and powerful customization

Cons:

• The map is rendering on the client's side and requires more powerful hardware

Raster Tiles

Pros:

- Suitable for raster data like satellite imagery
- Lower requirements for end-users hardware

Cons:

• A bigger size of each tile

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Arrondissement

The World is Huge. Let's divide it up!



The World is Huge. Let's divide it up!

- Projected world is divided into tiles in X, Y and Z (zoom level) direction
- The zoom level influences the extent and details of the world
- Per zoom level the count of tiles increases exponentially: 2°, 21, 22, 23 ...



(Stefan Kühn CC BY-SA 3.0)

Render Loop

- 1. Determine which data to load and draw
- 2. Request data
- 3. Draw data using shaders
- 4. Present new frame
- 5. Goto 1.

- 1. Load requested data
- 2. Tessellate vector data
- 3. Goto 1.



where portability meets performance

Problem

Solution

Most map renderers have multiple code bases

Single Rust codebase for browsers, mobile and desktop

Licensing is often proprietary

Permissive MIT License

State-of-the-art has not changed a lot lately

New project without technical debt

Cross-platform Graphics with WebGPU

- Cross-platform 3D graphics
- Modern API
- Targets the browser and other platforms
- Possible stabilization in ~2024-2026 (WebGL took 5 years)

WebGPU W3C Working Draft, 14 July 2022 More details about this document This version: https://www.w3.org/TR/2022/WD-webgpu-20220714/ Latest published version: https://www.w3.org/TR/webgpu/ Editor's Draft: https://gpuweb.github.io/gpuweb/ Previous Versions: https://www.w3.org/TR/2022/WD-webgpu-20220713/ History: https://www.w3.org/standards/history/webgpu Feedback: public-gpu@w3.org with subject line "[webgpu] ... message topic ..." (archives) GitHub Inline In Spec Editors: Dzmitry Malyshau (Mozilla) Kai Ninomiya (Google) Brandon Jones (Google) Former Editor: Justin Fan (Apple) Participate: File an issue (open issues) Copyright © 2022 W3C® (MIT, ERCIM, Keio, Beihang). W3C liability, trademark and permissive document license rules apply.



Supporting almost 20 Years of Graphics



Technology Stack

Low-level Graphics APIs



Architecture



Why Rust?

- Systems programming language
- Outstanding support for WebAssembly
- Support for atomics, shared-memory and multi-threading on desktop **and** browser
- Major WebGPU implementation is written in **Rust** A

Why WebGPU?

- WebGPU has a modern API.
 - Easily target Apple's Metal API
- WebGPU apps run on Android, iOS, Linux, macOS, Windows and in the browser.

Why is WebGPU a Game Changer?

Classic graphics APIs

2004 OpenGL 2.0



- **2007** OpenGL ES 2.0
- **2011** WebGL 1.0



Low-overhead graphics APIs

2014 Apple's Metal



2015 DirectX 12



2017 WebGL 2.0





Why is WebGPU a Game Changer?

Apple has deprecated the "classical graphics APIs".

It is possible to use a compatibility layer to run OpenGL on Metal.

BUT: This is not an ideal situation. Building on top of "low overhead graphics APIs" is the future proof option.

Why is Web (still) difficult?

- Limited support for:
 - parallelism
 - decoding images
- Constrained environment in terms of processing power.
- Short startup-time is essential.
- Different browsers support different features.

Demo Time



Shoutout to Contributors

Community

- <u>@jackson211</u>
- <u>@ybiletskyi</u>
- <u>@yzsolt</u>
- <u>@dmarcoux</u>
- <u>@iakev</u>
- <u>@neimsaci</u>
- <u>@drwestco</u>
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The Billion Dollar ©ode

The Billion Dollar Code

2021 | 12 | 1 Season | Courtroom TV Programmes

In 1990s Berlin, an artist and a hacker invented a new way to see the world. Years later, they reunite to sue Google for patent infringement on it.

Starring: Mark Waschke, Mišel Matičević, Leonard Scheicher

See you at FOSS4G?

maplibre-rs: toward portable map renderers

Collaboration between
MapLibre and University of Applied Sciences and Arts, Switzerland

Reach out to us and try out maplibre-rs!

Matrix:	matrix.to/#/#ma	plibre:matrix.org

- Github: <u>github.com/maplibre/maplibre-rs</u>
- Slack: <u>osmus-slack.herokuapp.com</u>
- Blog: <u>maplibre.org</u>

Explore the World:

- <u>maplibre-rs-demos.pages.dev/webgl</u>
- <u>maplibre-rs-demos.pages.dev/webgpu</u> (Firefox Nightly or Chrome Canary, worky only sometimes)