FAKULTÄT FÜR !NFORMATIK
Faculty of Informatics

Diplomarbeitspräsentation

Rendering Interactive Maps on Mobile Devices Using Graphics Hardware

Masterstudium:
Visual Computing

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Problem Statement

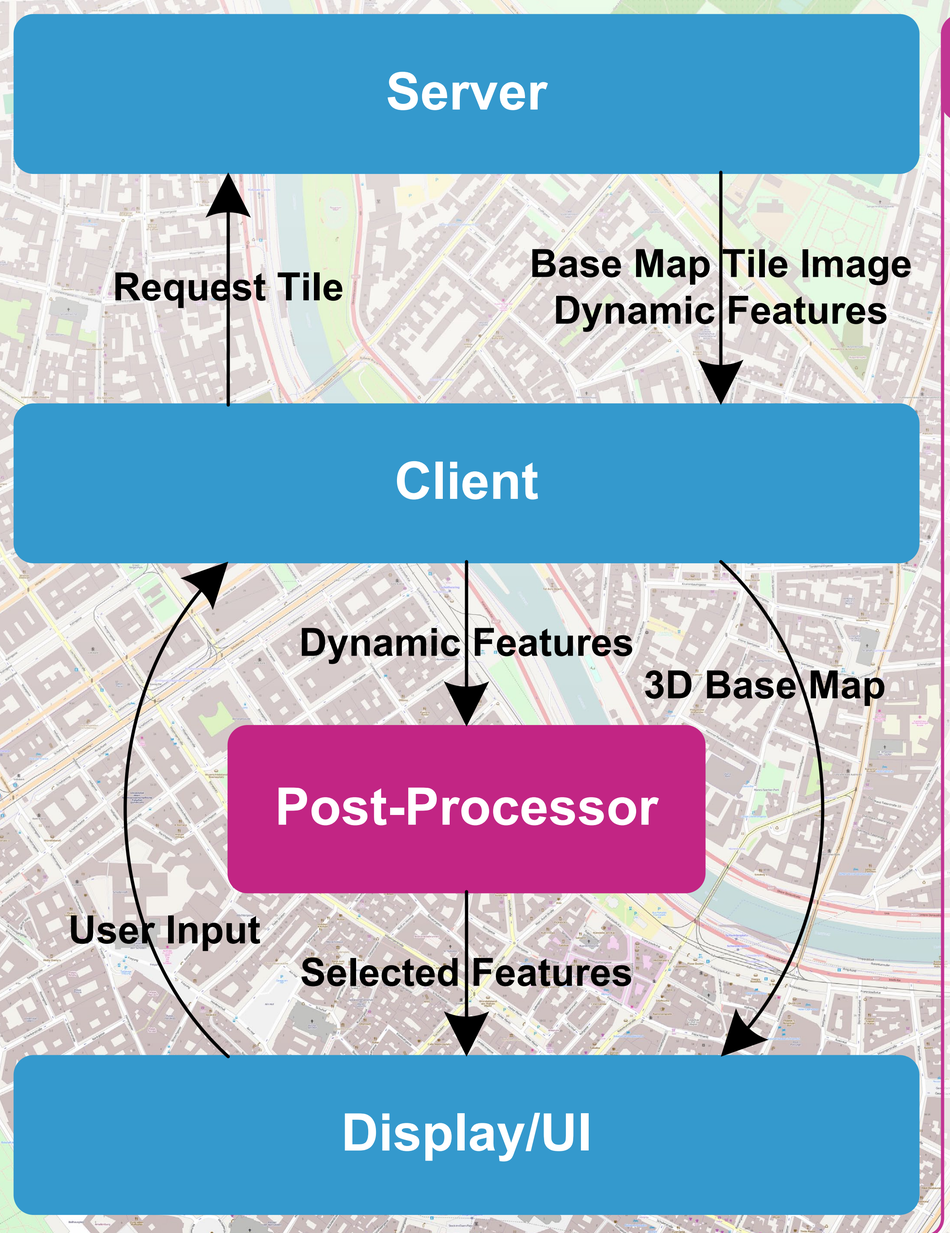
Mapping applications on mobile devices are becoming increasingly popular and storing map data in a **vector format** offers much more possibilities than using pre-rendered map images. OpenGL ES 2.0 is an API to provide hardware accelerated 3D Graphics on mobile devices such as smart phones or tablets.
This thesis was created in **cooperation with Ulmon GmbH** to replace their current CPU-based map renderer. The main task of the presented work was to create a prototype of a hardware accelerated rendering library, offering **vector map rendering with OpenGL ES 2.0**. Outside of the scope of this work, the prototype will be tuned and extended and eventually released as the primary map renderer of the travel apps of Ulmon GmbH.

Contributions

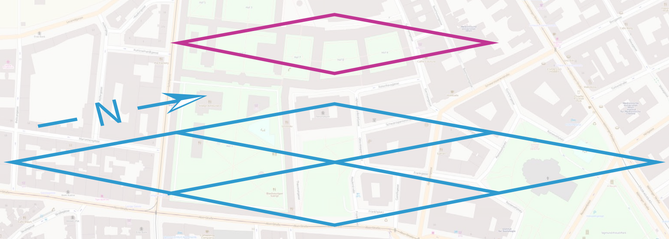
- A **Hybrid Rendering Architecture**, combining the speed of a tile-based renderer with the feature richness of a realtime renderer by rendering certain features in a post-processing step over the base map.
- **Multi-Tiles**, a concept to minimize load latency
- **Line Tessellation and Rendering** with support for lines of arbitrary width, line dashing with a user-defined pattern and three different line cap styles.
- A **Tile Selection Algorithm** using a polygon rasterization technique to determine the visible tiles.
- A **2D Packing Algorithm** to pack many small icons of similar size into a texture atlas.

Hybrid Architecture

The new stage, the Post-Processor, is highlighted in the figure: it renders dynamic data over a base map, so that they stay upright and fronto-parallel.

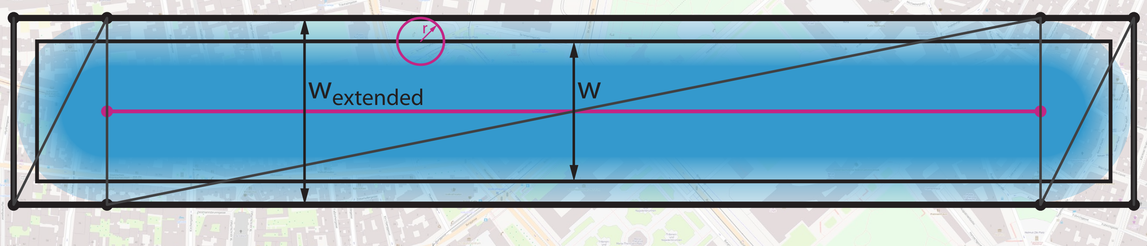


Multi-Tiles



Many features occur duplicated in neighboring tiles. It is more efficient to render tiles at a coarser granularity. Multi-Tiles make this possible while maintaining compatibility to the original tile-based data storage.

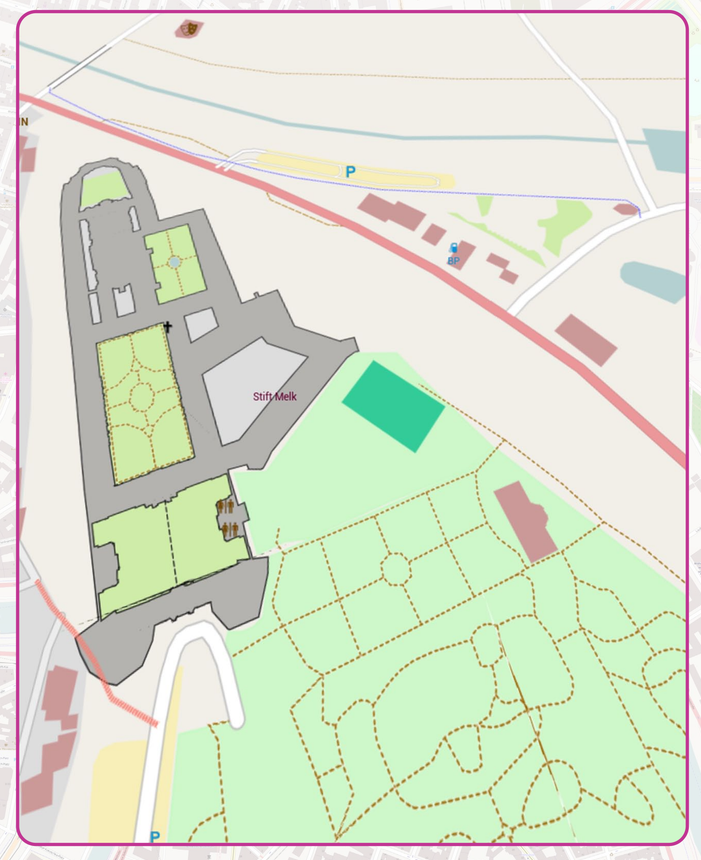
Line Rendering

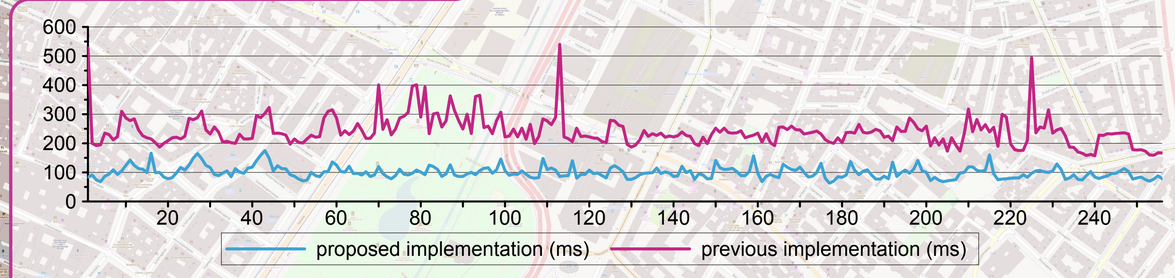


Lines are tesselated as shown in the figure. The line caps are created by evaluating the fragment-line-segment-distance, which is encoded in the texture coordinates. To generate antialiased line dashes, the distance to the closest dash-change is encoded in a special texture.

Results

A new feature of the proposed implementation is the 3D mode where text and icons stay upright, as can be seen in this rendering of Melk Abbey, Lower Austria.





In this figure, it can be seen that the proposed implementation generates 256 tile images on average 2.42 times faster than the previous implementation.

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