

Bachelor's Thesis

Synchronized Timeline View for Memory Cities

Student: Kaan Baylan

Advisor: Dipl.-Ing. Dr. Markus Weninger, BSc

Start date: March 2022

Dipl.-Ing. Dr.

Markus Weninger, BSc

Institute for System Software

P +43-732-2468-4361

F +43-732-2468-4345

markus.weninger@jku.at

The software city visualization metaphor is used in a wide range of visualization applications such as visualizing the development history of a software system, its memory consumption, or the communication between its various components. The core idea of this metaphor is to depict given software entities (for example classes) as individually sized buildings (for example based on line count and method count) and arranging these buildings hierarchically in districts (for example based on their packages).

While some approaches only visualize the state of the software system at one point in time, a number of city visualizations enable users to step through time (*time-traveling*) to inspect the system's development over time. Yet, changes from one point in time to the next are often minimal, making it hard to detect general (growth) trends in the city without performing a larger number of steps and carefully inspecting the resulting visual changes.

In the past, we have developed *Memory Cities*, a technique to *visualize an application's heap memory evolution over time* using the software city metaphor. In this tool, heap objects can be grouped by multiple properties such as their types or their allocation sites. The resulting object groups are visualized as buildings arranged in districts, where the size of a building corresponds to the number of heap objects or bytes it represents. Time-travelling through the different states of the heap, i.e., watching the city evolve, can be used to detect and analyze memory leaks by searching for suspicious growth behavior.

The goal of this work is to introduce a *synchronized timeline view* for memory cities. Such a timeline outlines the evolution of the system over time by depicting the city in multiple thumbnails that are placed in juxtaposition, i.e., side by side. These thumbnails show the city at the current point in time, as well as a number of times in the future and the past. They are synchronized with the main view, i.e., if the city is rotated or zoomed, all thumbnails are rotated and zoomed at the same time as well.

This approach should provide easier insights into trends over time, as the user can inspect the city at the current point in time from different angles and at the same time can see their respective past and future forms without the need to step through time.

Modalities:

The progress of the project should be discussed at least every three weeks with the advisor. A time schedule and a milestone plan must be set up within the first 3 weeks and discussed with the advisor. It should be continuously refined and monitored to make sure that the thesis will be completed in time. The final version of the thesis must be submitted not later than 31.09.2022.