Live Trace Visualization for System and Program Comprehension in Large Software Landscapes

ZBW Research Colloquium
Kiel University, Software Engineering Group
Motivation

Live trace visualization of large software landscapes for comprehension of systems and applications

Major Challenges:
- Possible huge monitoring data amount (performance/cost efficiency)
- Finding abstractions to understand huge landscapes but also application-level details
- Live visualization of thousands or even millions of traces

[Fittkau et al. 2013a, Fittkau et al. 2015b]
Major Features

- **Live trace visualization** of large software landscapes

- **Scalable monitoring and analysis approach**

- Monitoring approach utilizes a low overhead [Fittkau et al. 2013b, Waller et al. 2014]

- Applying **innovative display and interaction concepts** beyond classical 2D displays and 2D pointing devices
The ExplorViz Approach
The ExplorViz Method

Legend
A1: Monitoring
A2: Preprocessing
A3: Aggregation
A4: Transformation
A5: Navigation

[Fittkau et al. 2013a]
Architecture

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Landscape Meta-Model

Sole representation of landscape information

[Fittkau et al. 2015b]
Landscape Perspective

Landscape-Level Perspective

[Fittkau et al. 2013a, Fittkau et al. 2015b]
Application Perspective

Application-Level Perspective

[Fittkau et al. 2013a]
Selected ExplorViz Features
Step 2 of 32

The software landscape consists of several systems, and the communication between them. Thicker lines mean more communication.

To get a better overview over a landscape, it can be helpful to minimize the systems, so they take up less space. The ability to do so is indicated by the - in the top right corner.

To complete the first tutorial step, minimize the OCD Editor by double clicking it.

[Finke 2014]
Experimentation Mode

Q1: Name three classes (from different packages) that have high fan-in (at least 4 incoming communications) and almost no fan-out (outgoing communication).

Answer

Elapsed time: **3:27** (of 5 minutes)

[Finke 2014]
Trace Replayer

Analyzing Trace 5

Position: 617 of 754
Caller: Registry
Callee: Registry$Segment
Method: new Registry$Segment(…)
Avg. Time: 0.46 ms
Self-Edges: 
Animation: 

1 151 302 452 603 754

Previous  Play  Next
Clustering

[Barzel 2014]
Performance Analysis

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Performance Analysis for Kieker

Show only communications above X msec: 200
Search for a method

[Jähde 2015]
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Arch. Mod. & Conf. Checking

System_A

System_C

System_B


Convergence: Source ➔ Target
Divergence: Source ➔ Target
Absence: Source ➔ Target
Database Monitoring

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Innovative Interaction Concepts
Physical 3D Models

[Fittkau et al. 2015e]
Virtual Reality

[Fittkau et al. 2015f, Krause 2015]
Virtual Reality

[Fittkau et al. 2015f, Krause 2015]
Conclusion & Outlook
Conclusion

• Enables **live trace visualization** of large software landscapes

• Capable of logging and processing a **huge amount** of conducted **method calls** in large software landscapes

• Applies **innovative display and interaction concepts** beyond classical 2D displays and 2D pointing devices
Conclusion

• **Open-source** software
  (Apache License 2.0)

• **Open-access** article in
  “Information and Software Technology”
  [Fittkau et al. 2016]

• All evaluation **results available online**
  • Raw results, R scripts, code, ratings, ...
  • ExplorViz versions used in the experiments
  • All screen and camera recordings about
    160 hours material
  • Long-time archival on Zenodo.org

Collaborative Github project with
more than 32k LOC (without comments and blank)
Future Work

- Major extension towards Database Monitoring

- Redevelopment of the (3D) Application Perspective

- Perform further studies and experiments

- Evaluate other interaction concepts and devices

[Zirkelbach 2015]


[Stelzer 2014] P. Stelzer. Scalable and Live Trace Processing in the Cloud, Bachelor thesis, Kiel University


