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

ICSA 2017 Tutorial
Runtime Modeling and Visualization

Software Engineering Group, Kiel University
Christian Zirkelbach — April 04, 2017
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<td>09:00 – 09:10</td>
<td>Welcome and General Introduction</td>
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<td>09:10 – 09:40</td>
<td>Study Foundations</td>
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<tr>
<td>09:40 – 10:00</td>
<td>Model-based Software Application Monitoring</td>
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<td>10:00 – 10:30</td>
<td>Runtime Architecture Modeling and Visualization</td>
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<td>10:30 – 11:00</td>
<td>Coffee Break</td>
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<td>11:00 – 12:15</td>
<td><strong>Introduction to the ExplorViz, Palladio, and iObserve Approaches</strong></td>
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<td>with following Tool / Visualization Demos</td>
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<td>12:15 – 12:30</td>
<td>Study Setup</td>
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<td>12:30 – 14:00</td>
<td>Lunch</td>
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<td>14:00 – 15:30</td>
<td>Comprehensibility Study</td>
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<td>15:30 – 16:00</td>
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<td>16:00 – 16:30</td>
<td>Live Database Trace Visualization in Large Software Landscapes</td>
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<td>16:30 – 17:00</td>
<td>Feedback and Open Discussion</td>
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Motivation

Selected 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

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

[Fittkau et al. 2013a, Fittkau et al. 2015b]
- Enabling **live trace visualization** of large software landscapes

- Providing a **monitoring** and **analysis approach** capable of logging and processing the huge amount of conducted method calls in large software landscapes

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

- Applying **innovative display** and **interaction concepts** for the software city metaphor 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

Monitored Server

Monitored Application

Monitoring

Trace Processing Server

<<component>>

Analysis

Record Receiver

Visualization Server

<<executionEnvironment>>

Application Server

Visualization Provider

<<component>>

Analysis

<<component>>

Repository

Record Receiver

Client PC

<<component>>

Web Browser

Web Interface

[Fittkau 2015]
Landscape Meta-Model

Sole representation of landscape information

[Fittkau et al. 2015b]
[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**

Enter Answer
Enter Answer
Enter Answer
Enter Answer

Elapsed time: 3:27 (of 5 minutes)

[Finke 2014]
Clustering

[Barzel 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
Performance Analysis

[Jähde 2015]
Live Demo

https://www.explorviz.net/demo.php
Conclusions & Outlook
Conclusions

Live trace visualization for large software landscapes available as **open-source software** (Apache License 2.0)

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

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


Bibliography (cont’d)


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


