Hierarchical Software Landscape Visualization for System Comprehension: A Controlled Experiment

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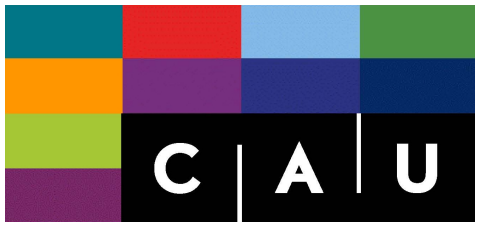

- Landscape visualization to comprehend large software landscapes
- State of the art often provides flat graph-based visualizations
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→ Hierarchical landscape visualization

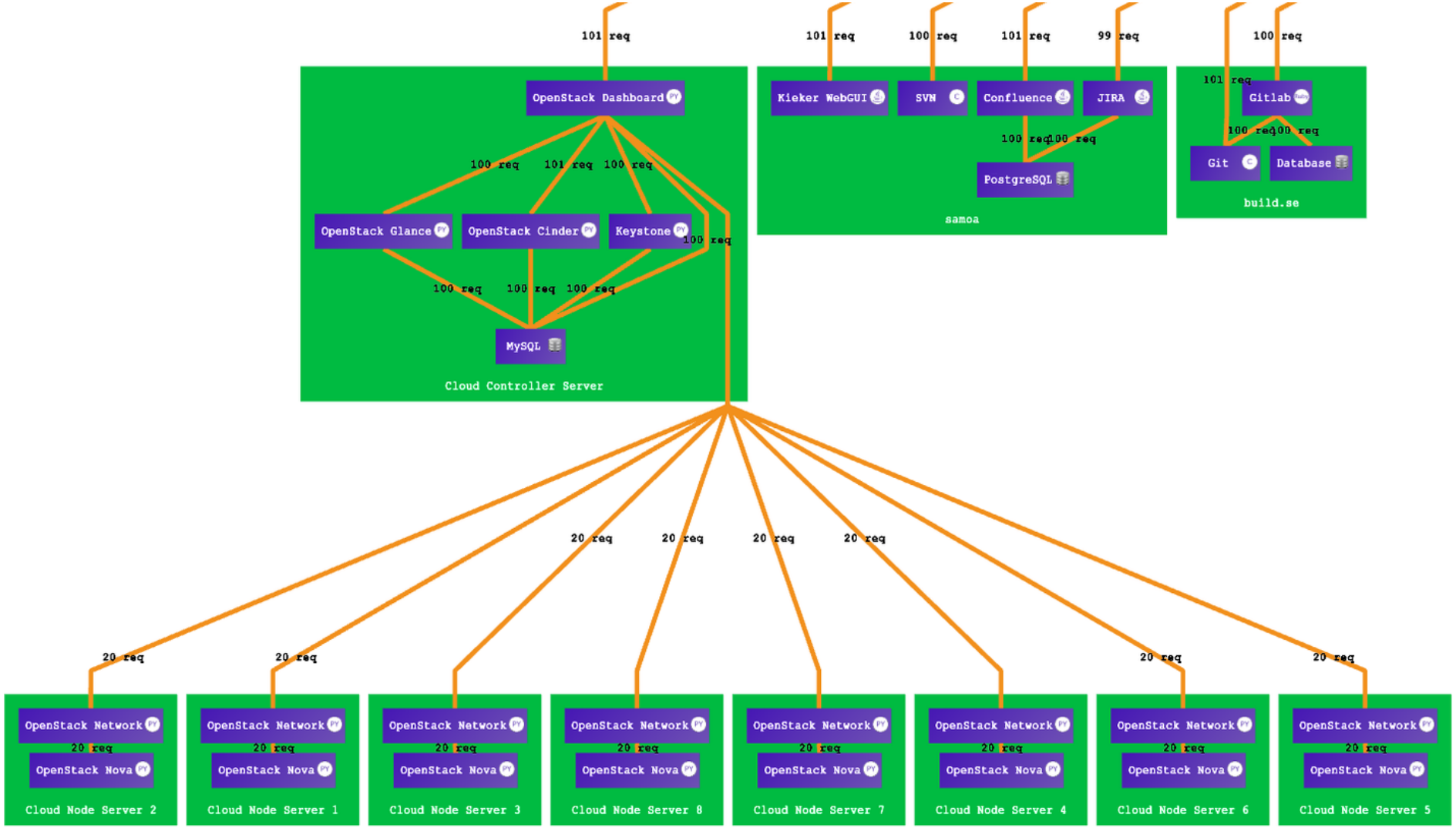
- Controlled experiment to evaluate its effectiveness and efficiency

- Most visualizations in application performance management (APM) tools
- For example: AppDynamics, Foglight, Dynatrace
- Mainly commercial tools

→ Survey and own implementation of a mixture of landscape visualizations

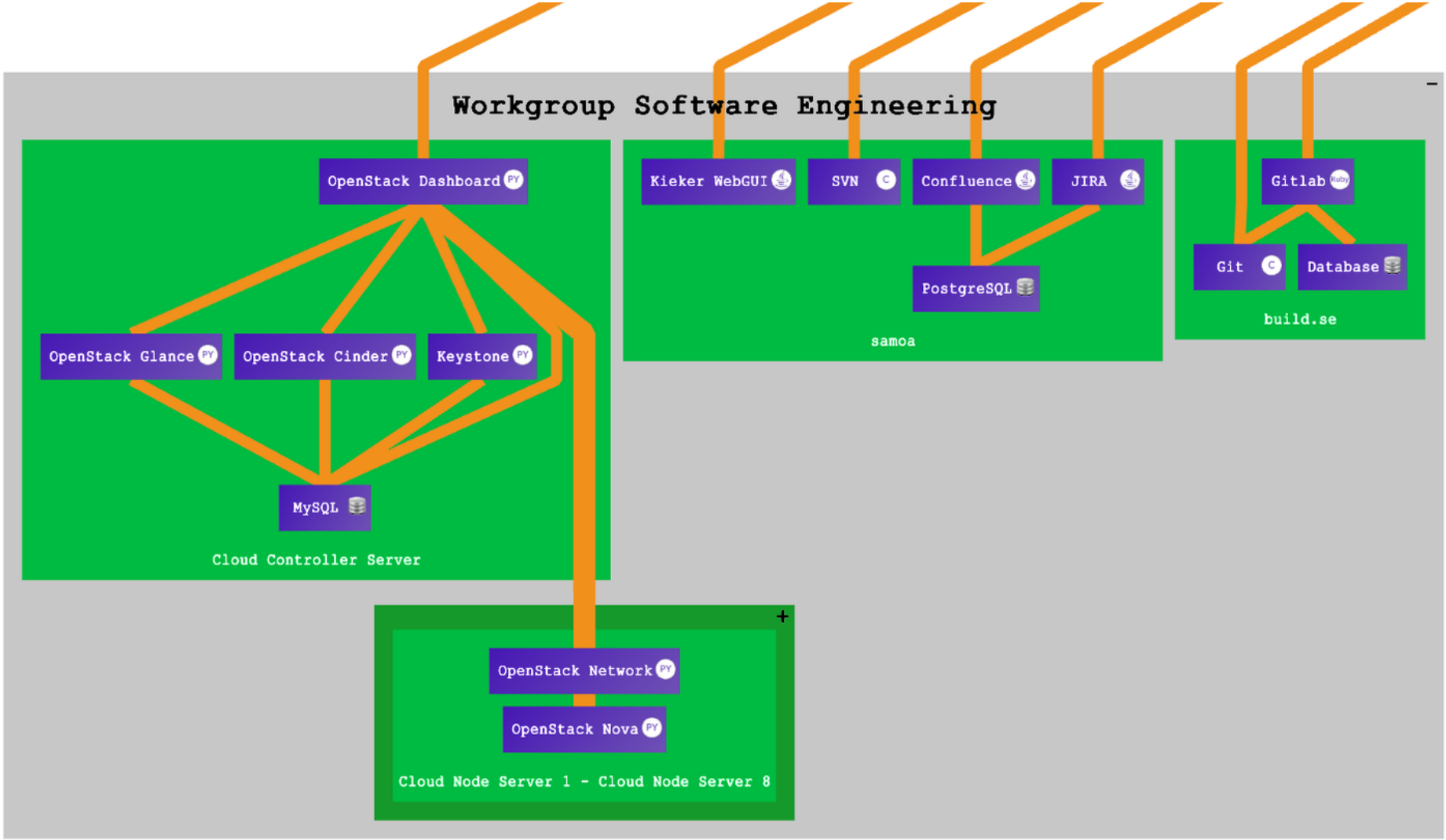
Flat Visualization in ExplorViz

Compared Visualizations



Hierarchical Visualization in ExplorViz

Compared Visualizations

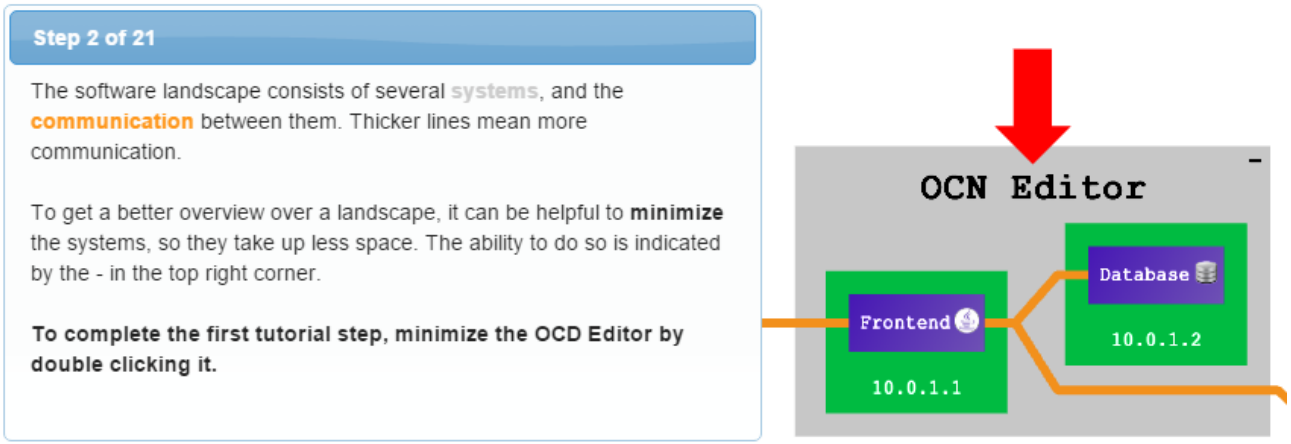


- **H1:** Flat Group and Hierarchical Group require different times for completing typical system comprehension tasks.
- **H2:** The correctness of solutions to typical system comprehension tasks differs between Flat Group and Hierarchical Group.

Christian-Albrechts-Universität zu Kiel
Technische Fakultät

- *Between-subjects* design with random assignment
- Object landscape: Modeled technical IT infrastructure of the Kiel University landscape (**140 applications**)
- 29 students (M.Sc.) from the master course “Software Engineering for Parallel and Distributed Systems”
- 5 system comprehension tasks
- Pilot study

- Automated tutorial



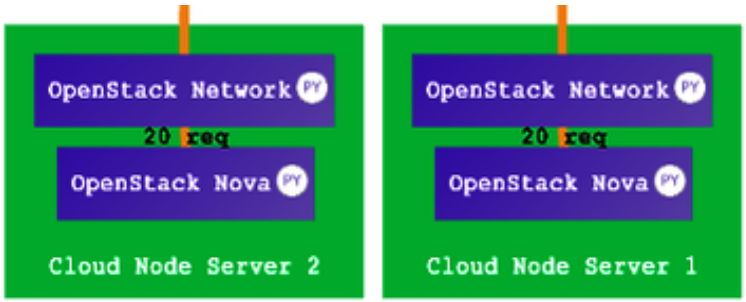
- Electronic questionnaire
- Screen recording

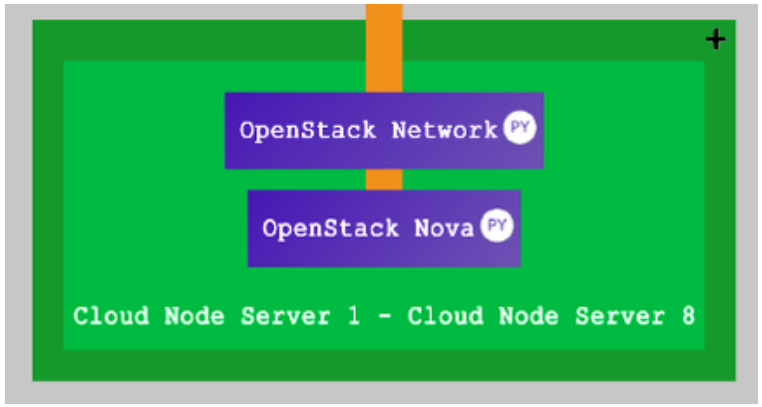
Descriptive Statistics of the Results

	Time Spent		Correctness	
	Flat	Hierarchical	Flat	Hierarchical
mean	23.49	23.45	17.07	19.5
difference		-0.17 %		**+14.24** %
effect size d		0.0093		0.7827
Shapiro-Wilk W	0.9232	0.9605	0.9156	0.7933
Levene F		2.1048		1.2307
Student's t-test				
df		27		27
t		0.0251		-2.4102
p-value		0.9802		**0.02303**

- Flat Visualization Group:
  - Some labels representing the request count overlapped (5 users)
  - Tabular representation for some tasks (2 users)
- Hierarchical Visualization Group:
  - Animations for opening and closing (3 users)
  - Highlight nodes or connections (2 users)

- Distinction between nodes and applications
- Direction of communication
- Finding duplicate applications in hierarchical visualization was harder for the subjects (non-zero learning curve)





Content of Evaluated Artifact

Available online[1]

- Source code and binaries
- Input files
- Tutorial material
- 29 screen recordings
- Raw results
- R scripts

[1] http://dx.doi.org/10.5281/zenodo.18853

- Hierarchical landscape visualization
- +14 % in correctness and no significant time difference
- Open source[2] and replication package provided

ExplorViz

Future Work:

- Replications for higher external validity
- Using metaphors for landscape visualization and compare them

[2] `http://www.explorviz.net`