A Journey to comprehensible User Behavior Models

SSP 2020, Online

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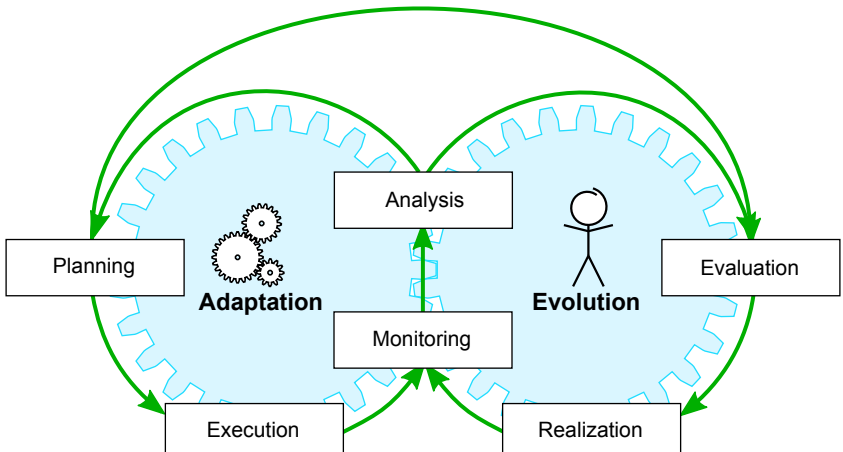
Kieker

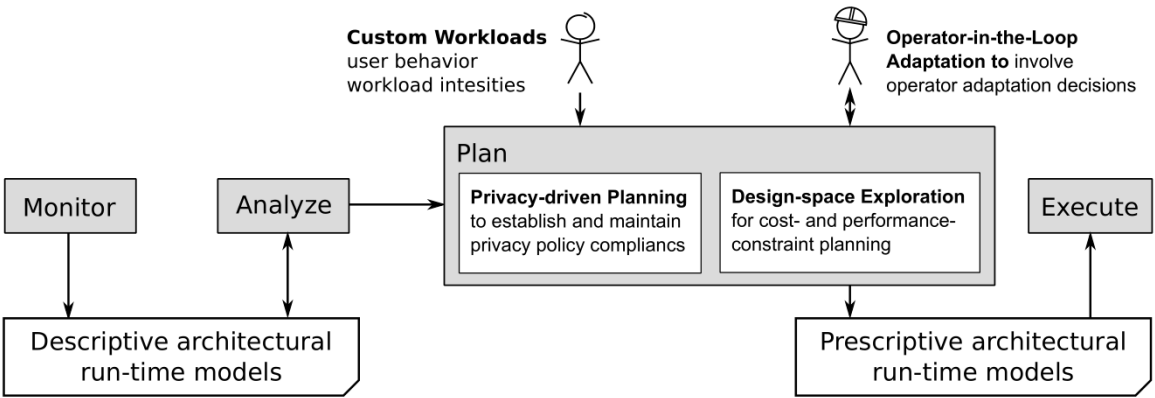
iObserve

iObserve - Overview

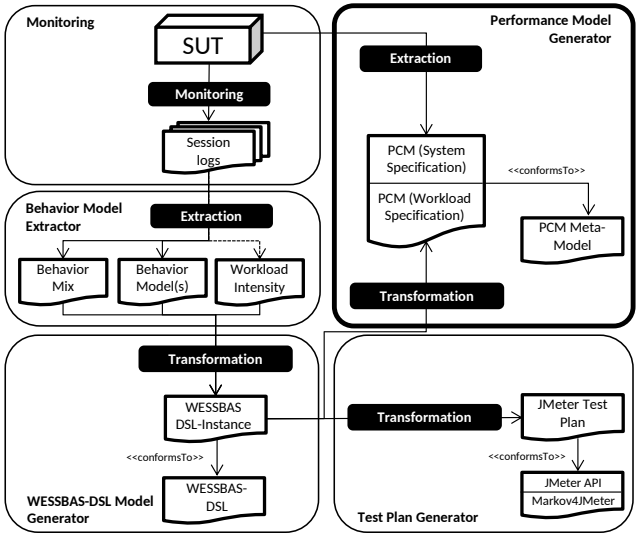


[Heinrich et al. 2015]

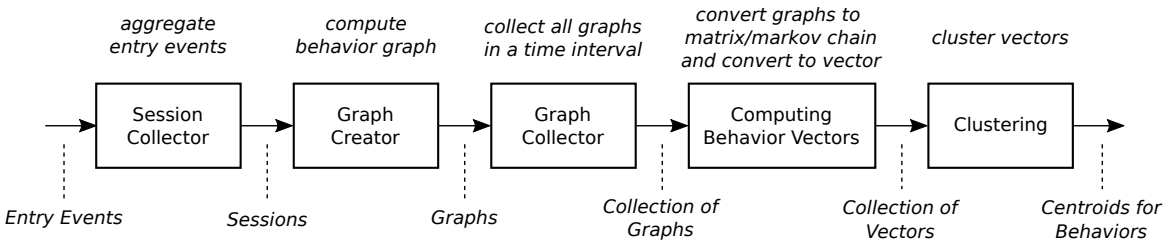
Operator in the Loop



What we wanted to do?

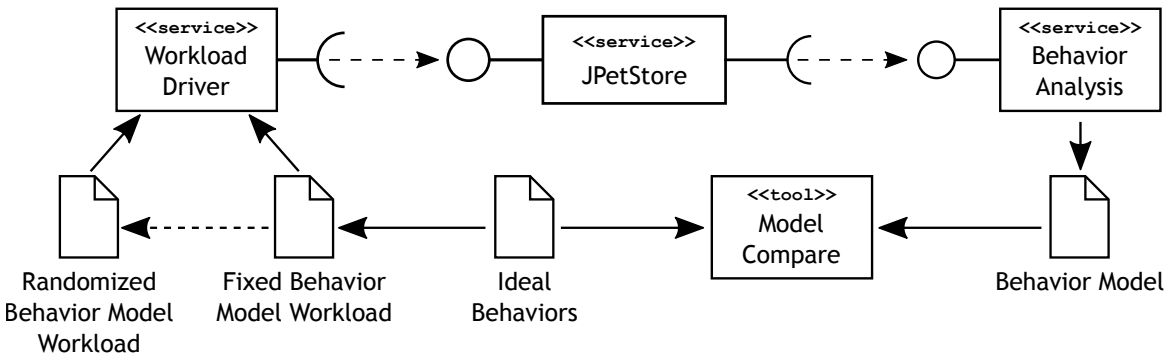


[Vögele et al. 2018]

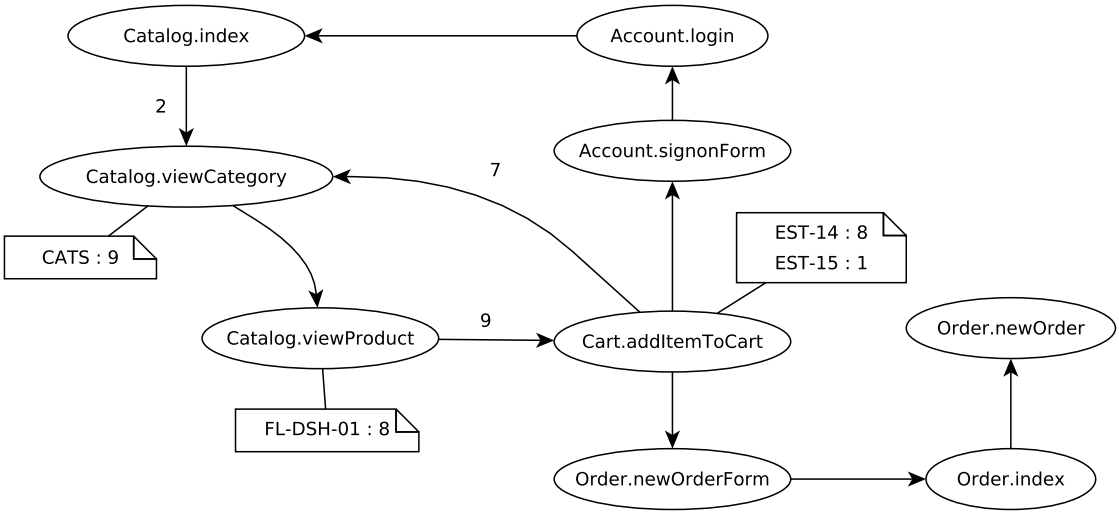


[Jung et al. 2017]

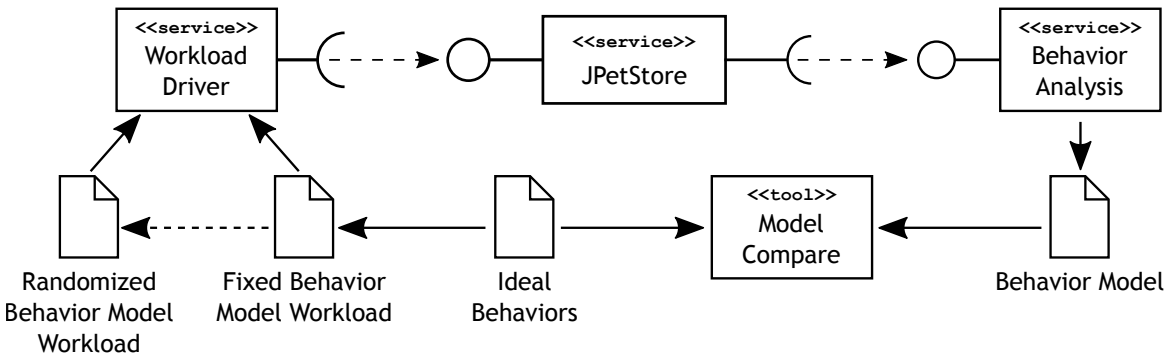
Experiment Setup



Page and Transition Graph



Experiment Execution



C | A | U

Clustering matrices did not work

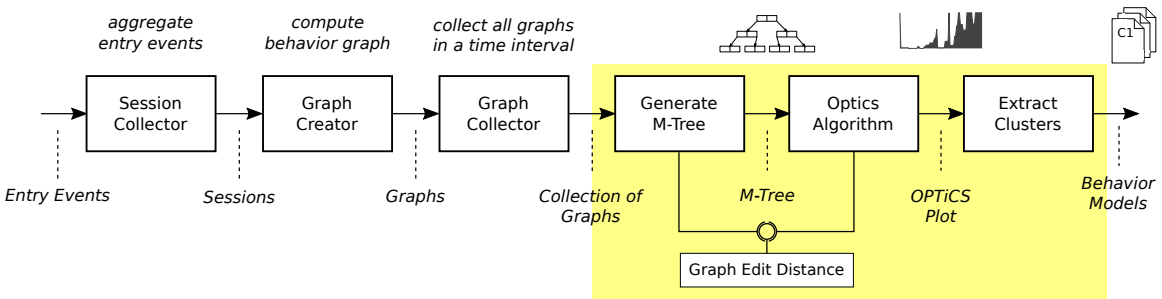
- X-Means
- EM
- Hierarchical clustering
- Similarity of matrices *somewhat better*

Why does it not work?

- Too many dimensions: $dimensions = node^2$
- Other attributes cannot be included
- Also: Attributes at nodes insufficient

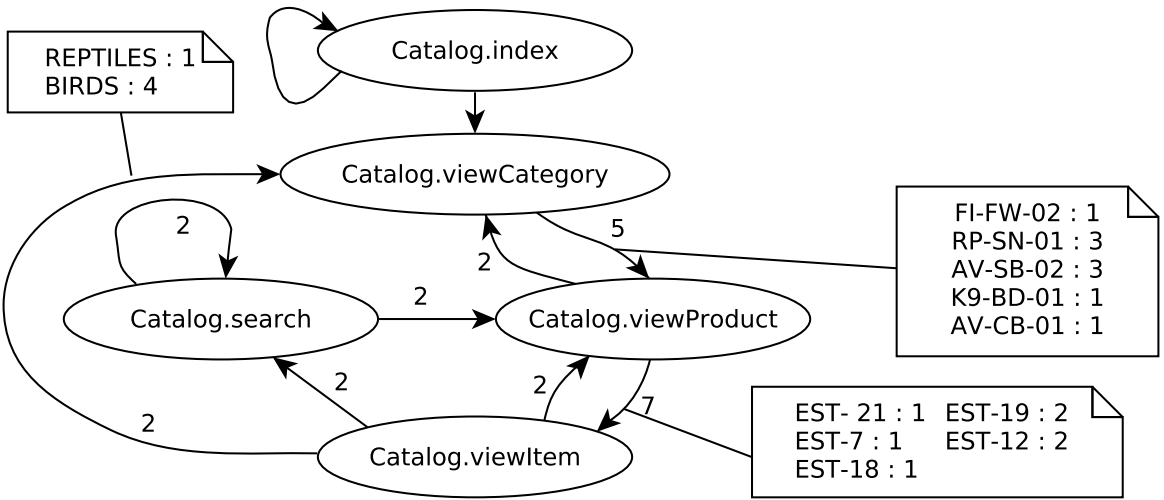
Now What?

New Approach

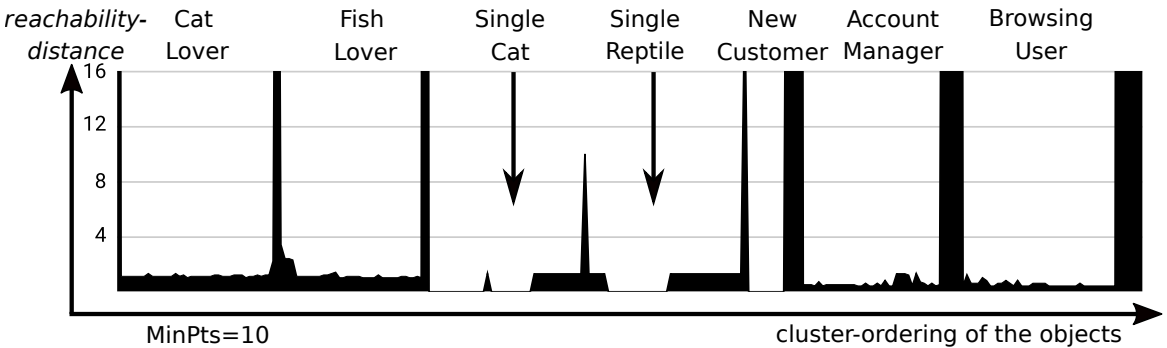


[Jürgensen 2019]

New Graph Model



Graph Edit Distance - Results



[Jürgensen 2019]

Issues

1. Issue memory exhausted
2. Some race condition errors
3. Huge user behavior graphs

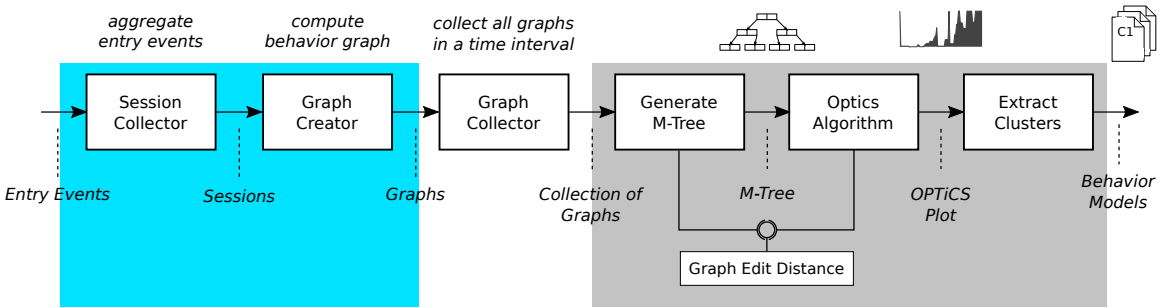
What went wrong?

- **Shop System (JPetStore)**
  - User pursue single tasks
  - Short sessions
- **Ticket System (JIRA)**
  - User perform multiple tasks
  - Long sessions

Issues

1. Issue memory exhausted
2. Some race condition errors
3. Huge user behavior graphs

What went wrong?



Conclusion

Summary

- **Graph Edit Distance** + **OPTICS** works
- **Attributes for edges** works
- **User sessions** are not a good idea

Potential Solutions

- Mark nodes as **end of an action**
- Split user sessions with graph pattern analysis

What will happen next

- Implement different pattern approaches
- Tune graph clustering
- Move more results to Kieker

JIRA Monitoring Data

DOI 10.5281/zenodo.3648094

DOI 10.5281/zenodo.3648240

DOI 10.5281/zenodo.3648228

DOI 10.5281/zenodo.3648269

JPetStore Experiment Setup

DOI 10.5281/zenodo.883083

iObserve Code Repository

`https://github.com/research-iobserve/iobserve-analysis`

Bibliography I

Heinrich, Robert et al. (Sept. 2015). "Architectural Run-Time Models for Operator-in-the-Loop Adaptation of Cloud Applications." In: *MESOCA*. IEEE Computer Society, pp. 36–40.

Jung, Reiner et al. (Nov. 2017). "Towards Extracting Realistic User Behavior Models." In: *STT* 37.3, pp. 11–13.

Jürgensen, Lars (Nov. 2019). "Clustering and Analysis of User Behaviors utilizing a Graph Edit Distance Metric." Bachelorarbeit. Kiel University. URL: http://eprints.uni-kiel.de/48216/.

Vögele, Christian et al. (May 2018). "WESSBAS: extraction of probabilistic workload specifications for load testing and performance prediction—a model-driven approach for session-based application systems." In: *SoSyM*, pp. 443–477. DOI: 10.1007/s10270-016-0566-5.