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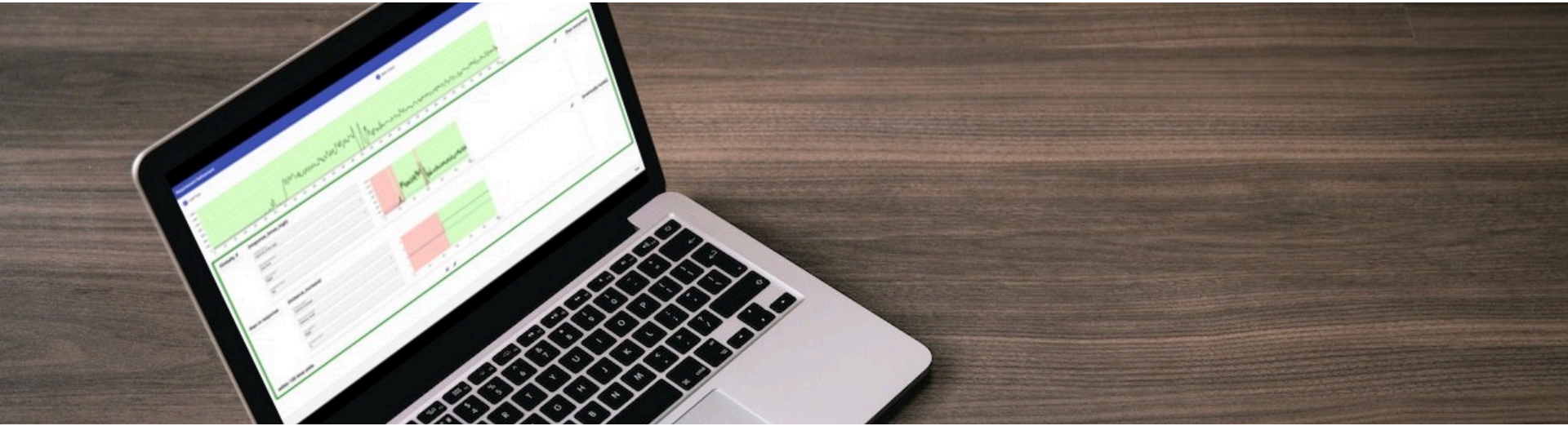

SEBASTIAN FRANK, JULIAN BROTT, ALIREZA HAKAMIAN, ANDRÉ VAN HOORN

TQPROPREFINER: HOW TO INTERACTIVELY COMPREHEND AND REFINE SPECIFICATIONS ON TRANSIENT SOFTWARE QUALITY PROPERTIES?

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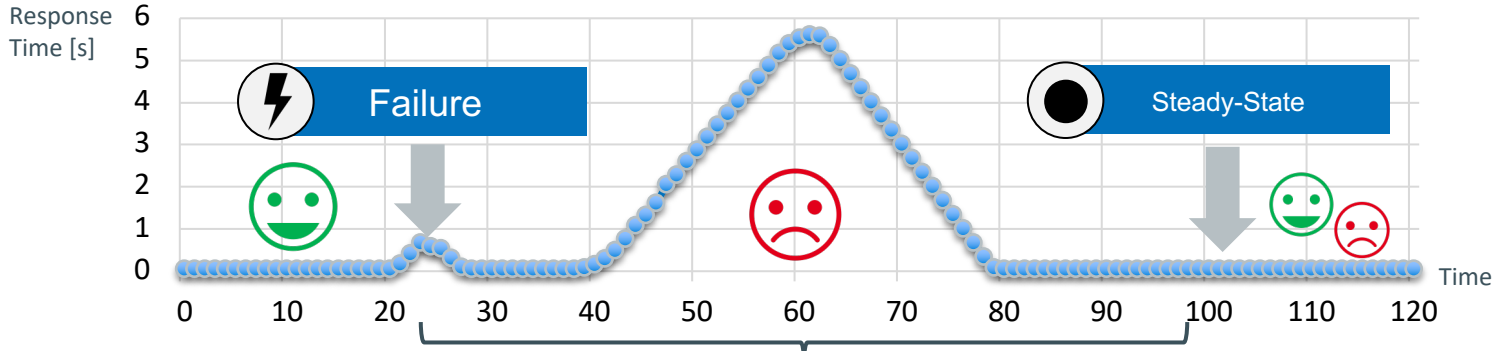
[1] Beck, Samuel, et al. "How is Transient Behavior Addressed in Practice? Insights from a Series of Expert Interviews." *Companion of the 2022 ACM/SPEC International Conference on Performance Engineering*. 2022.

TRANSIENT BEHAVIOR



Transient Behavior

- Comprehension of transient behavior
- Providing exact (testable) specifications
- Insufficient tooling [1]

"Complete failure in the DATEV data center renders up to 40,000 tax offices unable to work"

https://t3n.de/news/komplettausfall-datev-1425705/ (translated)

"People who have a negative experience on mobile are 62% less likely to purchase from that brand in the future"

Google/Purchased, U.S. "How Brand Experiences Inspire Consumer Action," n=2,010 U.S. smartphone owners 18+, brand experiences=17,726, April 2017.

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GOALS

Develop and design a **structured, interactive approach** that helps software architects to…

…**comprehend** transient behavior

…**refine** specifications on transient software quality properties

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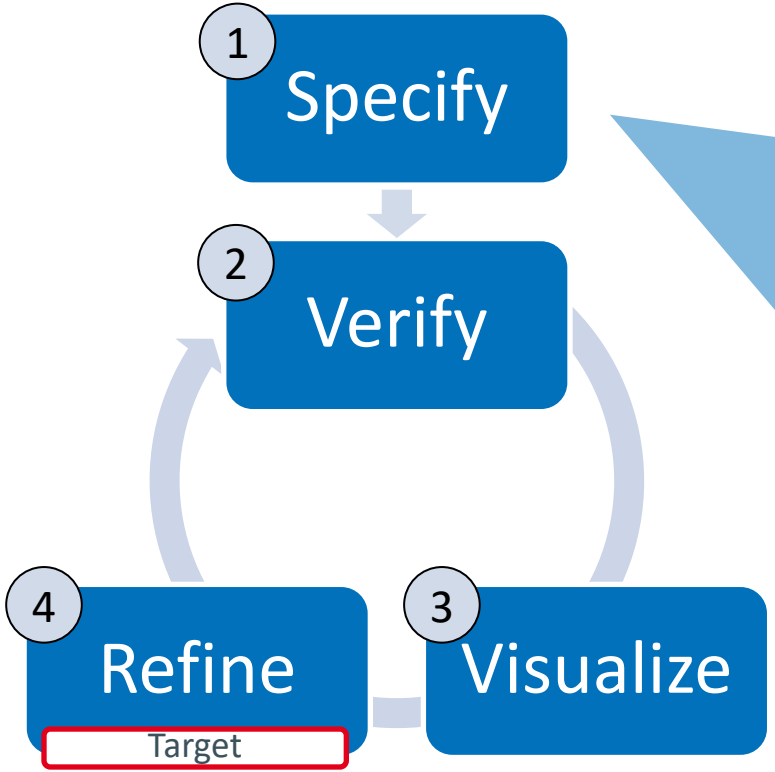
[2] Autili, Marco, et al. "Aligning qualitative, real-time, and probabilistic property specification patterns using a structured english grammar." *IEEE Transactions on Software Engineering* 41.7 (2015): 620-638.

APPROACH IDEA



PSP [2]

Scope	**Global**
Category	**Order**
Pattern	**Response**
Time Constraint	**within 150 time units**

SEG

Globally, if {*response time high*} [has occurred] then in response {*instance increase*} [eventually holds] within 150 time units.

MTL

$\square((\textit{response time high}) \rightarrow \Diamond_{[0,150]} (\textit{instance increase}))$

Predicates

- ***response time high***: response times > 100 time units
- ***instance increase***: instance count > 2

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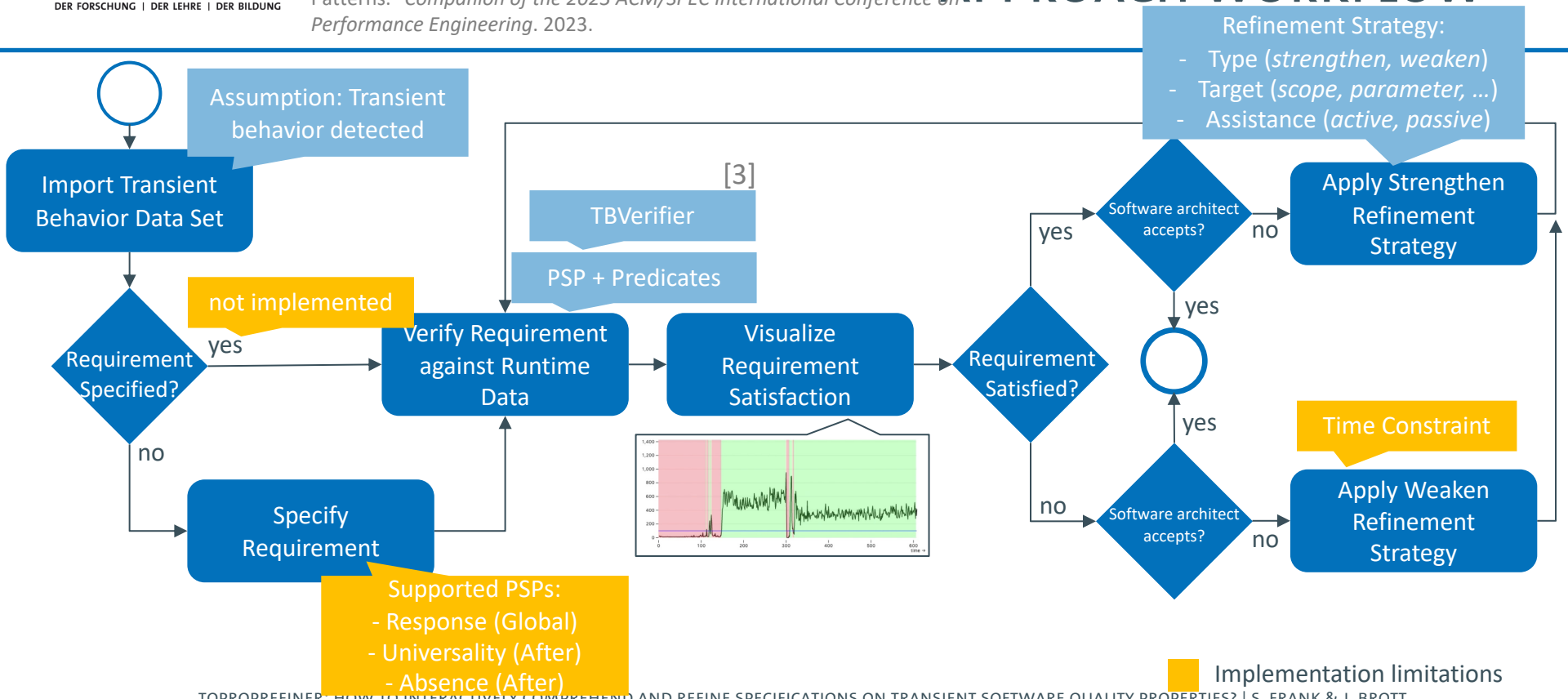
[3] Frank, Sebastian, et al. "Verifying Transient Behavior Specifications in Chaos Engineering Using Metric Temporal Logic and Property Specification Patterns." *Companion of the 2023 ACM/SPEC International Conference on Performance Engineering*. 2023.

APPROACH WORKFLOW



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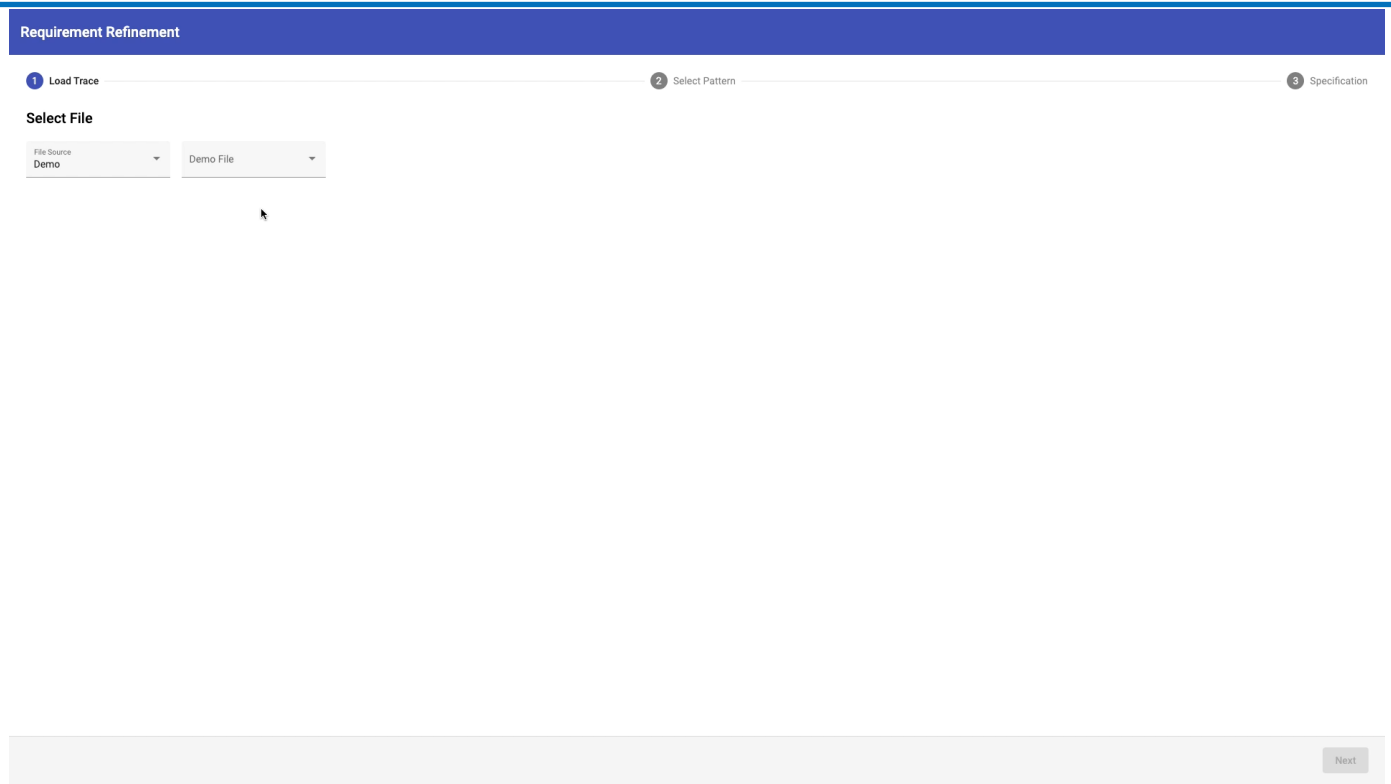
DEMO

https://www.youtube.com/watch?v=OjZPbsXNw1g



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[4] Frank, Sebastian, et al. "Verifying Transient Behavior Specifications in Chaos Engineering Using Metric Temporal Logic and Property Specification Patterns." *Companion of the 2023 ACM/SPEC International Conference on Performance Engineering*. 2023.

QUALITATIVE USER STUDY

Research Questions

- **RQ1**: Facilitate **comprehension** of transient behavior?
- **RQ2**: Assist in requirements **refinement**?
- **RQ3**: **Improve** regarding practical challenges?

Methodology / Setting

- **5 industry experts**
- Online Sessions - **60min**
- **Questionnaire**
  - 7 demographic questions
  - 2 tasks
  - 20 RQ-related questions
    - 10 usability (SUS)
- **Interview** & Discussion

Tasks

- **Two Tasks** [4]
  - **T1:** Service Failure
  - **T2:** Load Peak
- **Provided Information**
  - SLO, PSP, Question
- **Structure**
  - Select Data Set
  - Select Pattern
  - Enter Specification
  - Answer Question

PSP: Globally, if {response times exceed 100 time units} then in response {the instance count increases to 3}.
How long did the system take to scale to 3 service instances?

T2

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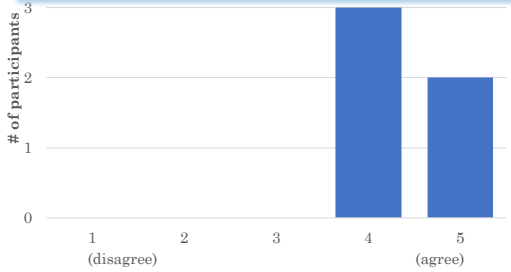
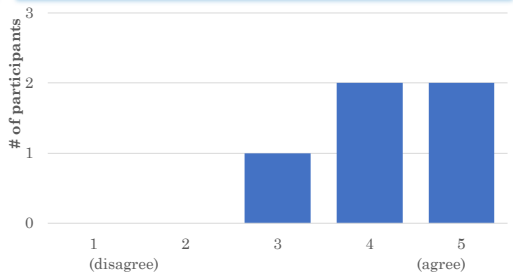
EVALUATION RESULTS

It was easy to interpret the initial …

… evaluation of a **single predicate**.



… **property** evaluation



RQ1: Comprehension

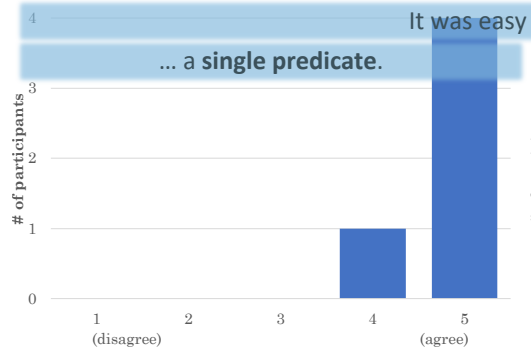
Task 1 solved **correctly** by 5/5

Task 2 solved **correctly** by 4/5

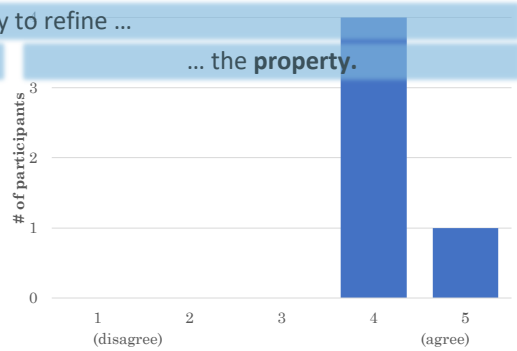
mixed self-assessment whether tasks could have been **solved without tool**

It was easy to refine …

… a **single predicate**.



… the **property**.



RQ2: Refinement

easy to refine predicates & properties

Time Constraint requires **more explanation**

RQ3: Improvements

Alignment of graphs

Save and load specifications

API integration of monitoring systems for **trace import**

Improve explanation of **color coding**

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[5] https://github.com/Cambio-Project/transient-behavior-requirement-refiner
[6] https://doi.org/10.5281/zenodo.8125612

CONCLUSION

1. Specify
2. Verify
3. Visualize
4. Refine

SCAN ME

[5]

Qualitative User Study [6]

Comprehension ✓ | Refinement ✓ | Improvements

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FUTURE WORK