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Adaptive Tracing: Problematic Area Localization

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Introduction

Large scale tracing challenges

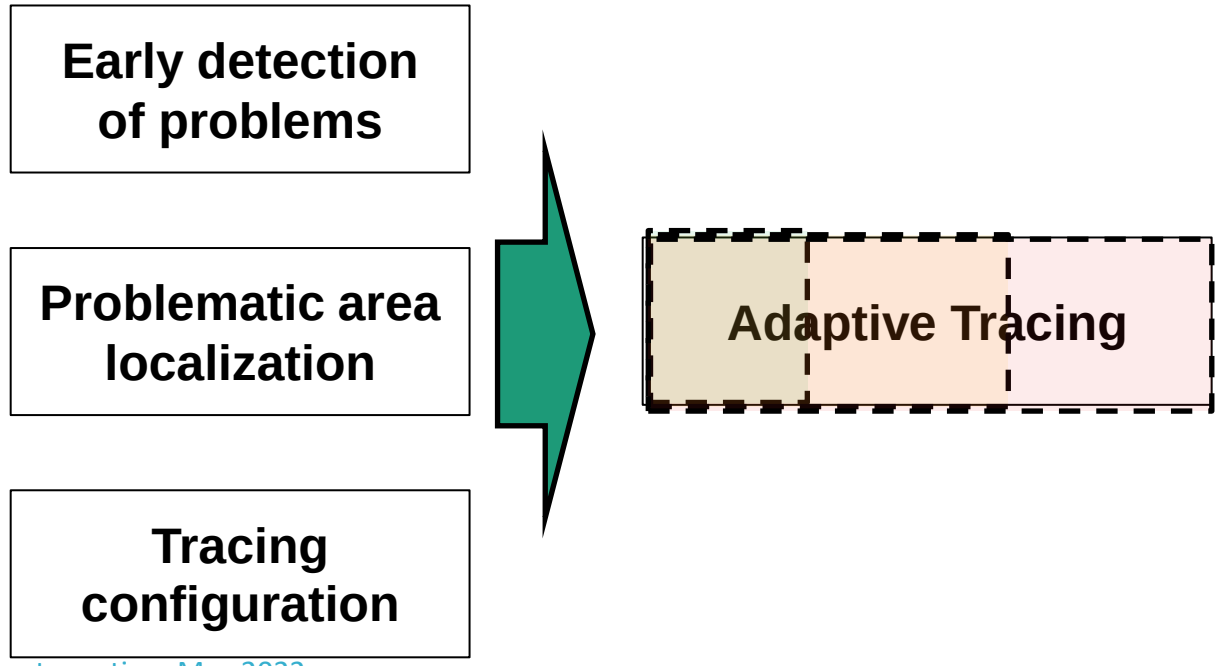
- Huge number of requests results in enormous traces
- Puts overhead in trace collection, storage, and analysis
- Not much intelligence in collecting traces

To improve tracing effectiveness,
tracing focus should adjust and adapt to collecting relevant events around the issues.

Research question

1. Can we increase the tracing effectiveness using trace adjustment methods at runtime, so that tracing is more focused on collecting events around the issues?

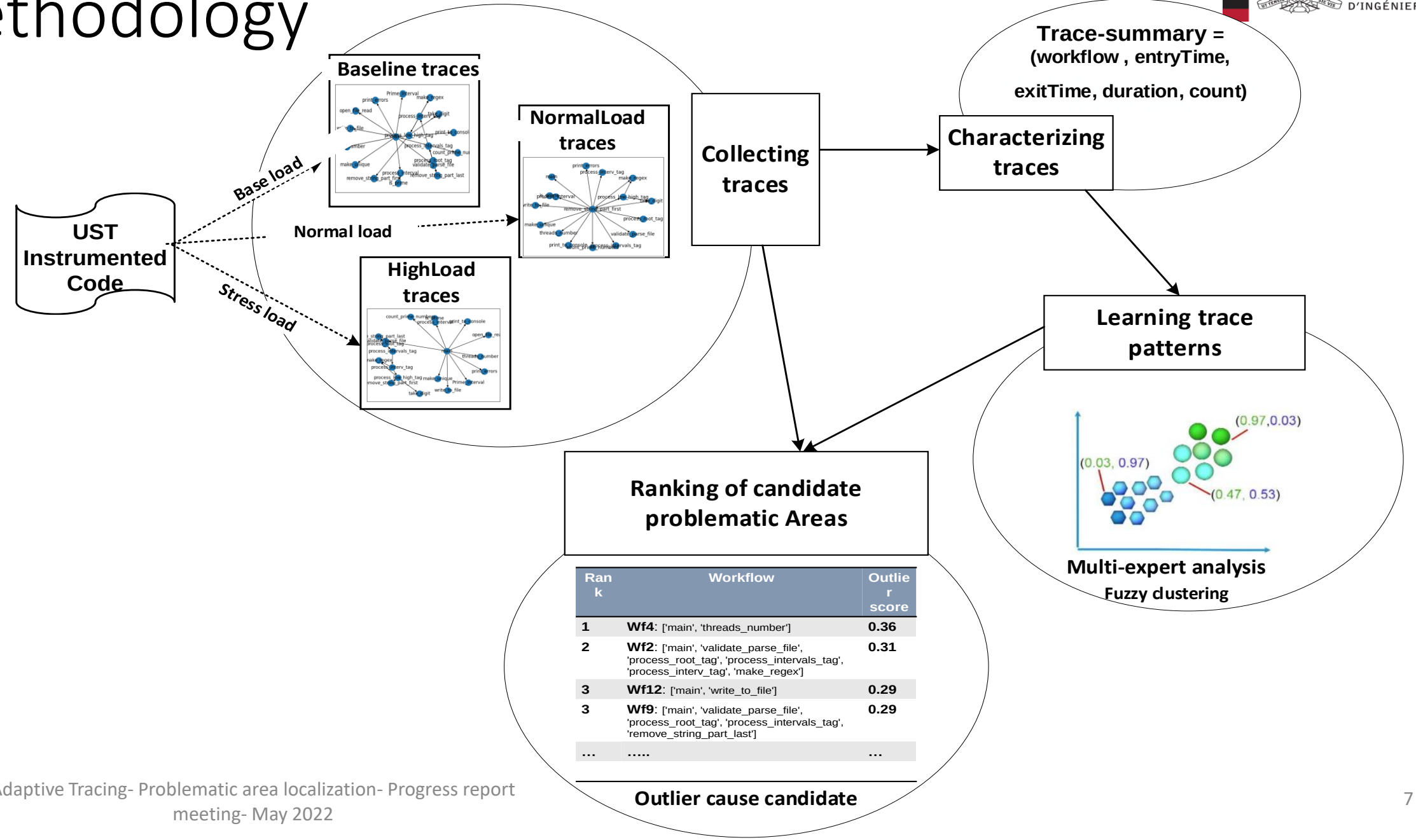
2. Can we identify the possible problematic areas by analyzing workload and resource metrics?



Similar workflows should perform similarly!

Preliminary results

Methodology



Rank	Workflow	Outlier score
1	**Wf4**: ['main', 'threads_number']	0.36
2	**Wf2**: ['main', 'validate_parse_file', 'process_root_tag', 'process_intervals_tag', 'process_interv_tag', 'make_regex']	0.31
3	**Wf12**: ['main', 'write_to_file']	0.29
3	**Wf9**: ['main', 'validate_parse_file', 'process_root_tag', 'process_intervals_tag', 'remove_string_part_last']	0.29
…	…..	…

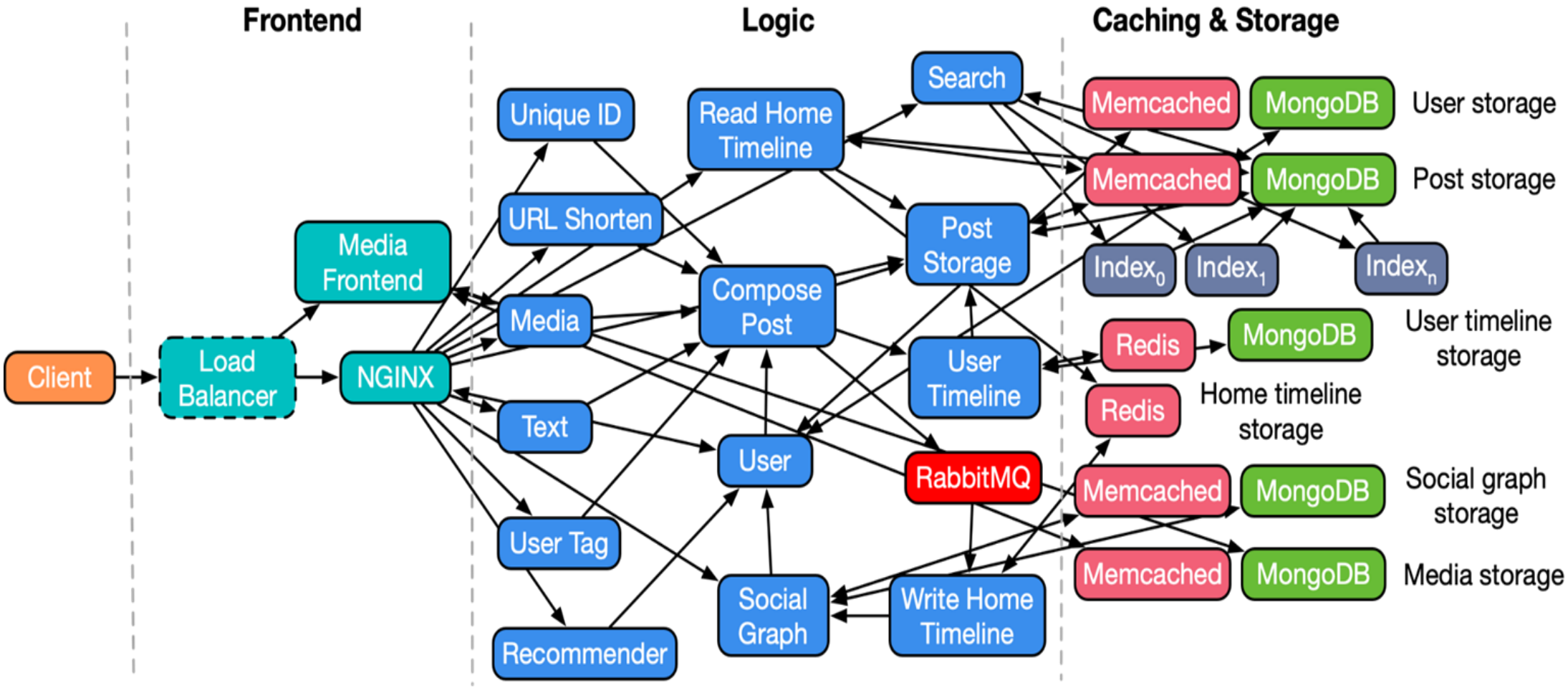
Analysis results

- Always slow workflows
  - Candidates for problematic areas. Should check code for the functions included in the workflows
- Slow workflows in high loads
  - Candidates for scalability issues. Should check in combination with resource usage
- Always freq. workflows
  - If performing well good candidates for trace sampling less frequently
- High load freq. workflow
  - Good candidates to check in-combination with workflows that are slow in high loads
- Less frequent workflows
  - If performing well good candidates to disable tracing

Demo

Evaluation setup

DeathStarBench (SocialNetwork)- test setup



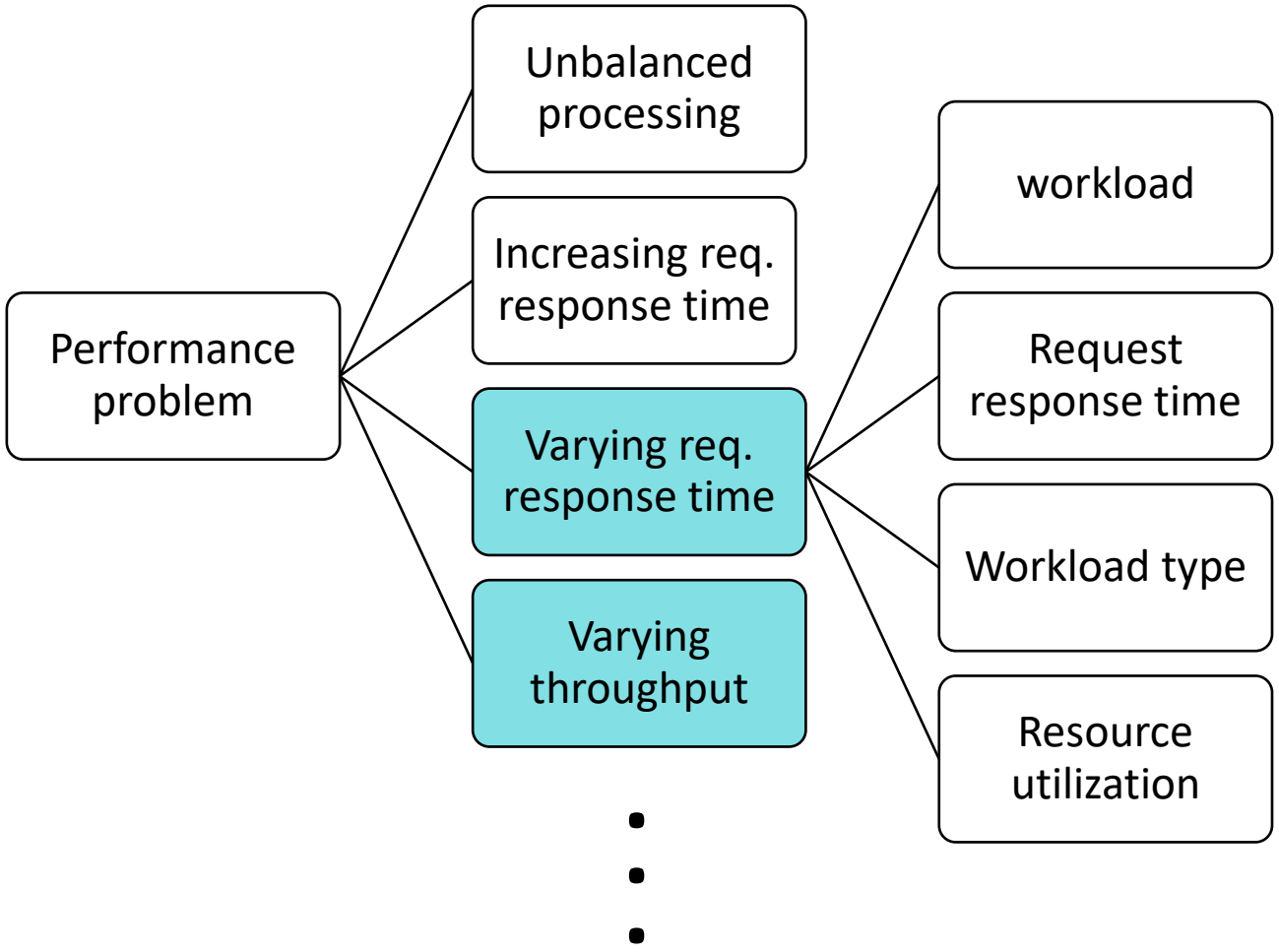
Characteristics of DeathstarBench- Social Network Service

- Supported actions in DeathStarBench
  - Create text post (optional media: image, video, shortened URL, user tag)
  - Read post
  - Read entire user timeline
  - Receive recommendations on which users to follow
  - Search database for user or post
  - Register/Login using user credentials
  - Follow/Unfollow user

Service	Total LoCs	Communication Protocol	Unique Microservices	Pre-language LoC breakdown
Social Network	**68061**	**RPC**	**36**	**34% C, 23% C++, 18% Java, 7% node.js, 6% Python, 5% Scala, 3% PHP, 2% Javascript, 2% Go**

Code Composition

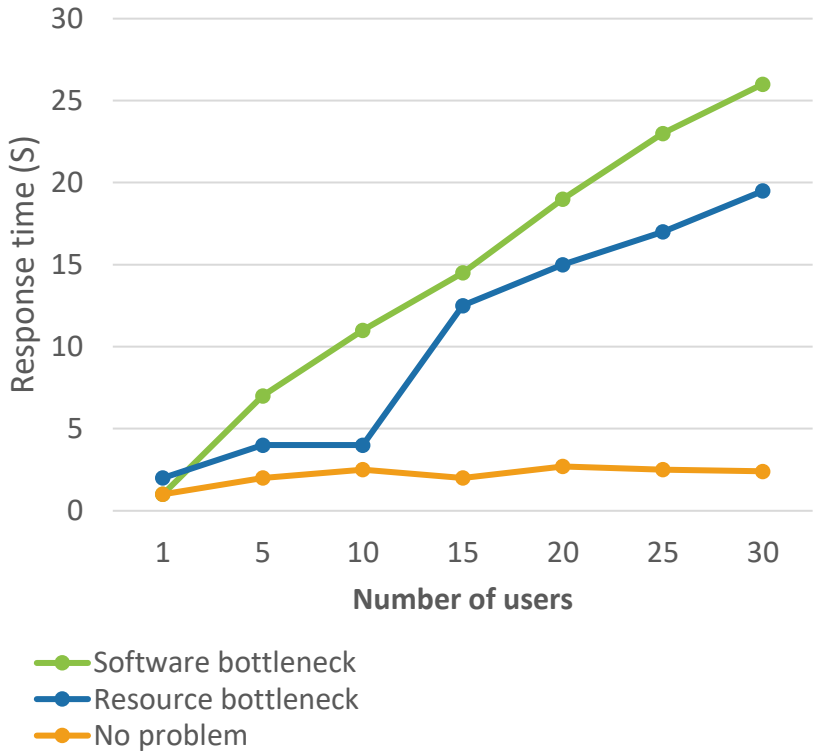
Problematic area localization

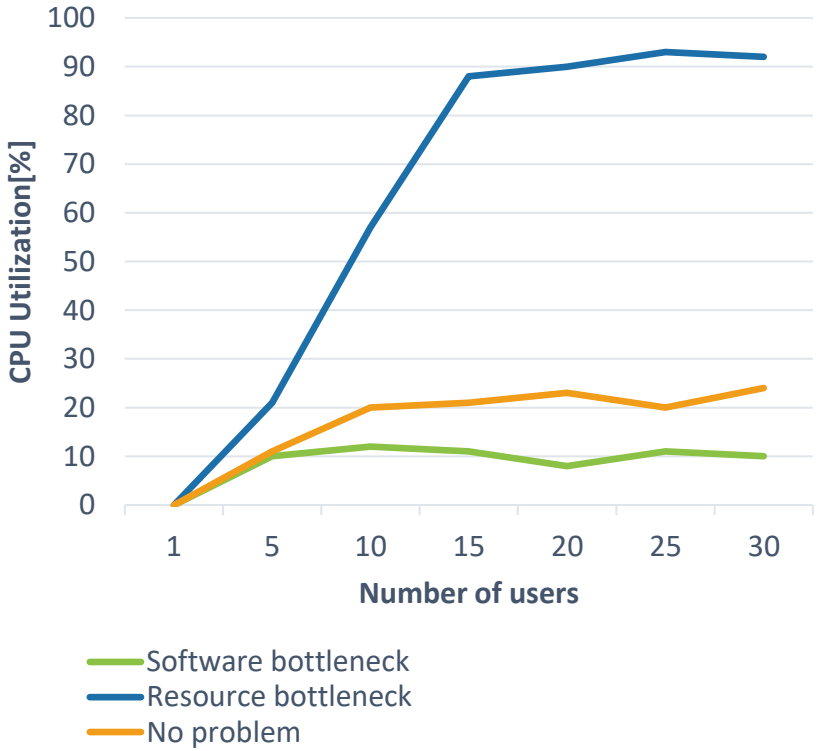


Performance problem:

- Scalability problem
  - Software bottleneck
    - Synchronization
    - External call bottleneck
  - Resource bottleneck
  - …..

Example: Software Bottleneck





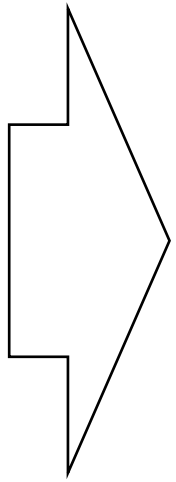
Checking software bottleneck detection

Software bottleneck possible causes:

- Synchronization points
- Database locks
- Pools
- ….

+

Related functions contain DB queries



Iinject DB Lock bottleneck in source-code

The way forward - update from the last meeting

- Automate the pipeline for the presented method
  - done
- Test and extend the method for more complex applications with longer execution paths
  - in-progress
- Investigate other methods to model frequency and duration metrics
  - working on fuzzy methods like fuzzy clustering
- Apply the same concept to other metrics like resource-related metrics modeling in combination with UST trace metrics
  - planned
- Improve performance of the code
  - in-progress

Github address for source code and test data:

https://github.com/mnourollahi/UST_adaptiveTracing

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