In-Test Adaptation of Workload in Enterprise Application Performance Testing

Maciej Kaczmarski

April 23, 2017
Agenda

1. Motivation & Research Objective
2. Proposed Approach
3. Experimental Evaluation
4. Conclusions & Future work
Motivation

- A considerable number of the performance issues which occur in the software systems are **dependent** on the input workloads.

- Traditional Techniques are **ineffective** because:
  - rely on **static workloads**,
  - it is common to use **time-consuming** and complex iterative test methods,
  - heavily rely on **human expert knowledge**.

- They could cause:
  - the **complexity** escalation,
  - the **risk** of potentially overlooking performance issues.
Research Objective

- Automated approach to **dynamically adapt** the workload used by a testing tool
- Based on a set of **diagnostic metrics**, evaluated in **real-time**, to determine if any test workload adjustments are required for the tested application

**Traditional Performance Testing**

![Flowchart diagram showing the process of traditional performance testing.

1. Tester
   - Input Workload
   - Execute Test Run
   - Analyse Results
   - Was workload appropriate?
     - Yes → Release Results
     - No → Manually adjust workload

**In-test Workload Adaptation**

- Monitor Results
- Adjust Workload
Proposed Approach

[Diagram showing the proposed approach with stages: Pre-Test Initialisation, Test Execution, Post-Test Closure. Stages include actions like setting input parameters, initializing diagnosis and adjustment policies, waiting for sampling interval, checking if test is still executing, evaluating diagnosis policy, and concluding with an END.]
Experimental Set-up

**Testbed**
- Two independent VMs located on a 24-core, 64GB RAM server:
  - **Server** (2 core, 4GB RAM):
    - JPetstore, NMon, WAIT data collector
  - **Test Controller** (2 cores, 4GB RAM):
    - JMeter, Controlling tool (Java)

**Tests execution**
- **Static:**
  - Run a range of workloads in order to establish Static Base Line; to be compared with our solution
- **Dynamic:**
  - Tests run with our solution (prototype)

**Analyzed parameters:** # Bugs, Transaction Response Time, Throughput, Error rate, CPU and Memory utilisations
Results

Bugs detection

- Bugs classification (frequency occurrence based):
  - major (more than 5%)

- Comparable number of detected bugs w.r.t. the best static workload
Results

Execution time

- Reduction in the duration of the performance testing activities of 94%
- Workload decision taken out from a tester hands
Results

Resource utilisation

- More CPU efficient than static workload
- Marginally more memory-intensive due to monitoring the workload behaviour
Conclusions

- Automated approach to dynamically adapt the workload so that issues (e.g. bottlenecks) can be identified more quickly, as well as with less effort and expertise
- Reduction in the duration of the performance testing activities of 94%
- The approach is able to identify almost as many relevant bugs as the best test run (from the tests using static workloads)
- Introducing a moderate level of overhead in memory (i.e., 5% increment) utilisation in the JMeter machine.
Future work

➢ Improve experimental validation of our approach:
   — by diversifying the tested applications,
   — the diagnosis tools used to identify the bugs,
   — the size and composition of the test environment,
   — test duration.

➢ Keep investigating how best to extend our technique (i.e., by exploring the idea of using different workloads, per transaction type).
Thank you for your attention.

Questions?