Automated Scalability Assessment in DevOps Environments

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ABSTRACT

In this extended abstract, we provide an outline of the presentation planned for WOSP-C 2020. The goal of the presentation is to provide an overview of the challenges and approaches for automated scalability assessment in the context of DevOps and microservices. The focus of this presentation is on approaches that employ automated identification of performance problems because these approaches can leverage performance anti-pattern [5] detection technology. In addition, we envision extending the approach to recommend component refactoring.

In our previous work [1, 2], we have designed a methodology and associated tool support for the automated scalability assessment of micro-service architectures, which included the automation of all the steps required for scalability assessment.

The presentation starts with an introduction to dependability, operational Profile Data, and DevOps. Specifically, we provide an overview of the state of the art in continuous performance monitoring technologies [4] that are used for obtaining operational profile data using APM tools.

We then present an overview of selected approaches for production and performance testing based on the application monitoring tool (PPTAM) as introduced in [1, 2].

The presentation concludes by outlining a vision for automated performance anti-pattern [5] detection. Specifically, we present the approach introduced for automated anti-pattern detection based on load testing results and profiling introduced in [6] and provide recommendations for future research.

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APPROACH

The PPTAM tool [1, 2] implements a methodology for automated scalability assessment in DevOps environments, which uses a partition of the input domain [7] based on operational profile data and scalability testing results for the assessment of architecture deployment alternatives.

The PPTAM tool methodology for automated scalability assessment implements the following steps: (i) operational profile data analysis and steady state probability estimation, (ii) automated load test execution for each architecture alternative to be assessed, (iii) automated definition of the scalability requirement and automated fail/pass assessment.

The approach introduced in [6] employed a Java profiler to create Java snapshots during load testing execution. Automated performance antipattern detection was implemented by applying heuristics based on defined thresholds. For example, for the Circuitous Treasure Hunt (CTH) performance anti-pattern, thresholds on the rate of method calls and hardware devices utilization were used. In contrast, for the Extensive Processing (EP) performance anti-pattern, thresholds on the number of blocked threads and on the methods execution time were employed.

As a topic for future research, we would like to propose the application of systematic statistical characterization performance anti-patterns using performance signatures [3]. Specifically, we would like to define approaches for measurements and modeling with the objective of identifying the performance signatures of specific anti-patterns. Variables of interest could include response time, CPU utilization, memory usage, and database usage.

CONCLUSIONS

The ubiquity of CI/CD and DevOps processes have created new challenges for the application of scalability assessment approaches that are based on operational profile specifications [7]. In addition, once scalability issues are uncovered, there is a need to identify the failed component(s) and provide recommendations for scalability improvements.

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