DECLARE: Declarative Performance Engineering

André van Hoorn, Samuel Kounev
Dušan Okanović, Jürgen Walter

Renewal Kickoff Workshop of the DFG Priority Programme 1593
Hannover, January 14 – 15, 2016
Working Group

Project PIs
- Dr.-Ing. André van Hoorn (Prof.-Vertr.), University of Stuttgart
- Prof. Dr.-Ing. Samuel Kounev, University of Würzburg

Members
- Dr.-Ing. Dušan Okanović, University of Stuttgart
- Dipl.-Inform. Jürgen Walter, University of Würzburg

Associated Partners
- Capgemini Deutschland GmbH, Stuttgart, Germany

Collaborators
- Research Group of the Standard Performance Evaluation Corporation (SPEC RG)
Research Context: Software Performance Engineering

- Performance = timing behavior + resource usage

- Software Performance Engineering (SPE)

“the entire collection of software engineering activities and related analyses used throughout the software development cycle, which are directed to meeting performance requirements.”

Performance-Relevant Concerns Spanning the Software Lifecycle

- Response time of service S?
- Utilization of server N?
- Most suitable architecture?
- Performance anti-patterns?
- Performance regressions?
- SLAs satisfied?
- What if changes?
- Performance Analyst
Extensive Body of SPE Knowledge Exists

Problem Statement: Various Decisions to Apply SPE Correctly

- Which modeling language?
- Which modeling granularity?
- Granularity of instrumentation?
- Analytical solution? Simulation?
- How to reconfigure?
- Workload intensity?
- Ramp-up time? Duration?

Problem Statement: Various Decisions to Apply SPE Correctly

Performance Concerns

System

Software Performance Engineering

Challenges

- Choice of approach
- Parametrization of approach
- Result filtering and interpretation

Established Methods, Techniques, Tools

- Measurement-based
- Model-based

Performance Analyst
Vision: Declarative Performance Engineering

Performance Concerns

Software Performance Engineering

Established Methods, Techniques, and Tools

Asking “What?“, Automating the “How?“

Declarative Performance Engineering (DPE)

What would be the response times of services X, Y and Z if the workload intensity doubles over the next week? Rough estimation is sufficient.

The resulting response times are ...

Service X: 4ms
Service Y: 5ms
Service Z: 9ms
Resource A: 20%
Resource B: 50%

Results

Software Performance Engineering

Architectural Performance Model

Analysis Model and Solution Approach

Declarative Performance Engineering (DPE)
## Work Programme

### WP1: Declarative Performance Language
- **Basic queries**
- **Complex queries**
- **Goals**
- **Tradeoffs**

### WP2: Capability Model for Performance Evaluation Methods, Techniques, Tools
- **Survey**
- **Capability meta-model**
- **Capability models (instances)**

### WP3: Decision Engine for Solution Methods and Techniques
- **Decision engine**
- **Constraint support**
- **Robustness**
- **Hybrid solutions**

### WP4: Language and Statement Processing Algorithms
- **Query mappings**
- **Goals → actions**

### WP5: DECLARE Platform
- **Design**
- **Implementation**

### WP6: Validation and Evaluation
- **Lab studies**
- **Industrial case study**

---

Preliminary Work

- **University of Stuttgart**
  - Monitoring, dynamic software analysis (e.g., Kieker)
  - Model-based software analysis and capacity management (e.g., MAMBA, SLAStic)
  - Workload modeling, extraction, generation (e.g., WESSBAS)

- **University of Würzburg**
  - Model-based performance prediction and management (e.g., QPN, DML)
  - DSL for performance queries (e.g., DQL)
  - Comparison of performance modeling approaches

- **Joint Work**
  - DSL for runtime adaptation (S/T/A)
Project and Case Study Collaborations within SPP 1593

- Exchange of performance models and analyses
- Load testing environment (usage profile, driver, …)
- New DevOps scenario and environment
  - Microservice-based version
  - Continuous deployment pipeline
- Many common topics (collaboration ongoing), e.g. DSLs, performance models and evaluation, and evaluation scenarios
- Co-evolution of performance models
- Knowledge transfer MDSD
- (Incremental) performance evaluation

- Additional collaborations to be discussed here in Hannover …
Publications on Preliminary Work


Publications on Preliminary Work (Cont’d)


- Kounev, S., Brosig, F., Huber, N. The Descartes Modeling Language. Technical report, Department of Computer Science, University of Wuerzburg, 2014