Cost-Based Prevention of Violations of Service Level Agreements in Composed Services Using Self-Adaptation

Philipp Leitner

W. Hummer, S. Dustdar (Vienna University of Technology)
B. Wetzstein, F. Leymann (University of Stuttgart)
TALK OUTLINE
Outline

- Motivation
- Approach Overview
- Cost-Based Optimization
- Conclusions
Motivation – Service Level Agreements

- **Service Level Agreements (SLA)**
  - Essential concept in service-based environments

- Contractual agreements about client-perceived quality
  - Violating SLAs is **expensive** (penalty payments!)
  - Hence: providers want to prevent SLA violations at runtime

- **Questions:**
  - How should a service provider decide if he should adapt?
  - How should the provider decide, which actions to use?
  - Is it even economically beneficial to adapt?
APPROACH OVERVIEW
COST-BASED OPTIMIZATION
Cost-Based Optimization – Problem Formulation

Minimize the predicted total costs (TC) for the service provider:

\[ TC(A^*) \approx v(A^*) + \sum_{s_x \in S} e^i_{s_x} + \sum_{a_x \in A^*} c(a_x) \rightarrow \min! \]

Three terms:
- Estimated costs of SLA violations
- Costs of adaptation
- Penalty term if incompatible actions should be applied
Cost-Based Optimization –
Algorithms

- Deterministic Algorithms:
  - Branch and Bound
  - Does not scale to larger optimization problems

- Heuristic Algorithms:
  - Greedy Randomized Adaptive Search Procedure (GRASP)
    - Local optimization with ‘smartly’ selected start solutions
  - Genetic Algorithms
  - Memetic Algorithms
    - Combination of Genetic Algorithm and local optimization
Taxonomy of Adaptation Actions

Adaptations

Data Manipulation

Service Rebinding

Structural

Without Interface Mediation

With Interface Mediation

Substitution with Subflow

Parameterization

Environmental

Freeform
CONCLUSIONS
Conclusions

- Summarizing …
  - Autonomic computing approach to self-optimizing compositions
  - Automatically attempts to predict and prevent SLA violations
    - But only if it is cost-optimal to do so

- Current caveats:
  - Only instance-level SLOs (no aggregated SLOs)
  - No environmental adaptation
  - Some implicit cost factors (e.g., customer satisfaction) not considered
Acknowledgements

The research leading to these results has received funding from the European Community’s Seventh Framework Programme [FP7/2007-2013] under grant agreement 215483 (S-Cube).