

Model-based Feedback for Software Performance Improvement

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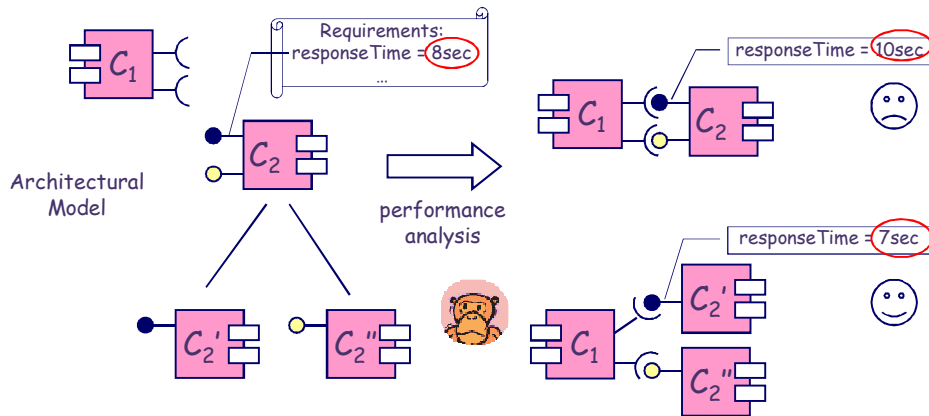
Roadmap

- » Problem statement and motivation
- » Related works
- » A vision of the approach
- » Future works and open issues



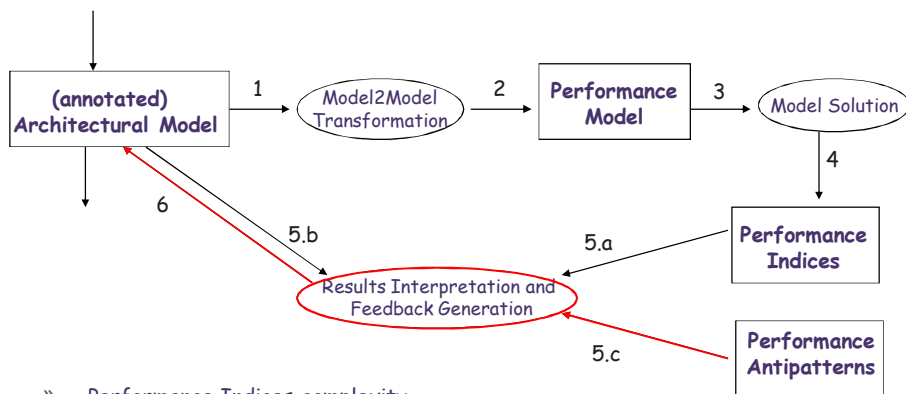
Problem statement and motivation

» What to change to improve the software design?



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Software Performance Analysis Process



- » Performance Indices complexity
- Numbers to be interpreted
 - Different levels of granularity
 - Cross-checking of software system characteristics

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(Performance) Antipatterns

- » W.J.Brown, R.C. Malveau, H.W. Mc Cornich III, and T.J. Mowbray. "Antipatterns: Refactoring Software, Architectures, and Project in Crisis", 1998.
- » C. U. Smith and L. G. Williams. "More new software performance antipatterns: Even more ways to shoot yourself in the foot", 2003

-Look at negative features of a software system:

> The definition includes common mistakes (i.e. "Bad practice") in software development as well as their solutions



Antipattern	Problem	Solution
...

- » **What to avoid and how to solve (performance) problems!**

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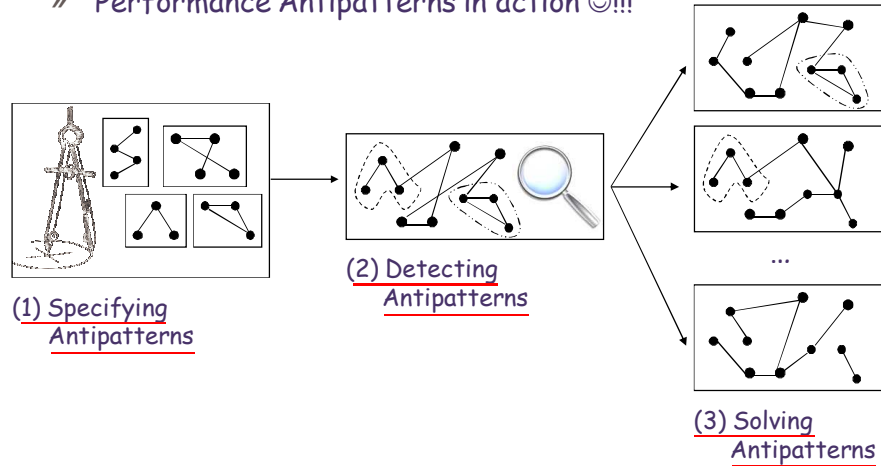
Related works

- » V.Cortellessa, L.Frittella, "A framework for automated generation of feedback from software performance analysis", 2007.
 - Informal interpretation matrices from the analysis of Layered Queueing Networks (LQNs)
- » T.Parsons, J.Murphy, "Detecting Performance Antipatterns in component-based enterprise systems", 2008.
 - Performance antipattern detection (PAD) tool for Enterprise Java Bean (EJB) applications
- » J.Xu, "Rule-based automatic software performance diagnosis and improvement", 2008.
 - Analysis of LQNs performance model for bottlenecks and long paths
- » A. Martens, H. Koziolk, S. Becker, and R. Reussner, "Automatic, model-based software performance improvement for component-based software designs", 2009.
 - Exploring design space with meta-heuristics techniques

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A vision of the approach: a Framework

» Performance Antipatterns in action ☺!!!

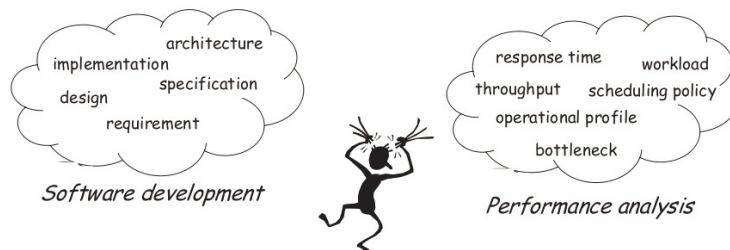


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Framework activities (1/6)

» Specifying antipatterns

- Select the minimum amount of the system model properties that are able to express the antipatterns specification

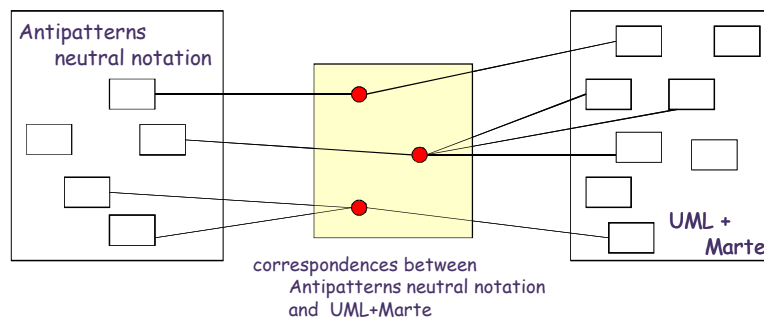


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Framework activities (2/6)

» Embedding antipatterns

- Translate the system model properties into concrete modeling notations (e.g. UML + Marte, Aemilia, etc.)

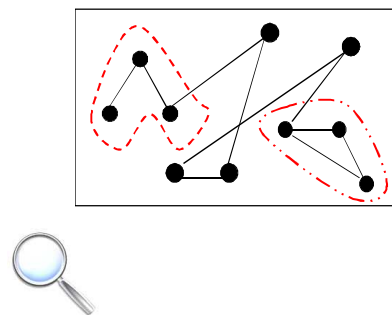


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Framework activities (3/6)

» Detecting antipatterns

- Look for performance antipatterns properties in the system model in order to locate performance issues

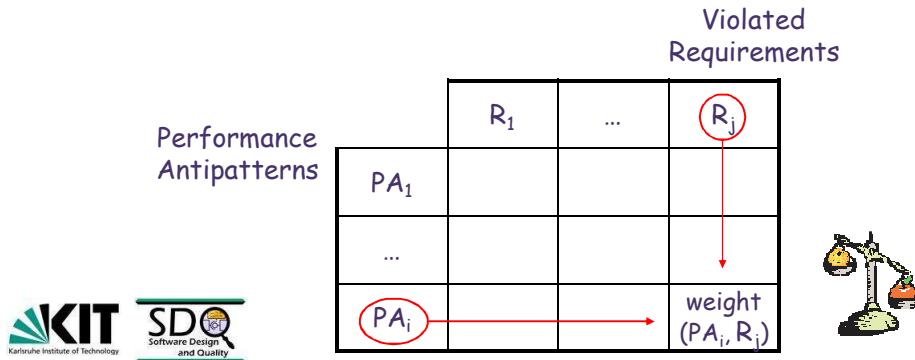


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Framework activities (4/6)

» Rating antipatterns

- Estimate how much a Performance Antipattern PA_i is important for the Violated Requirement R_j

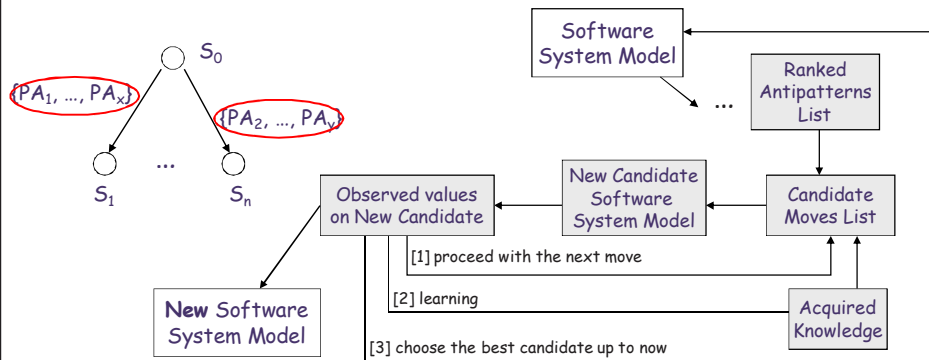


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Framework activities (5/6)

» Combining antipatterns

- Estimate how much a simultaneous set of antipatterns solutions (i.e. a "move") is important for performance improvements

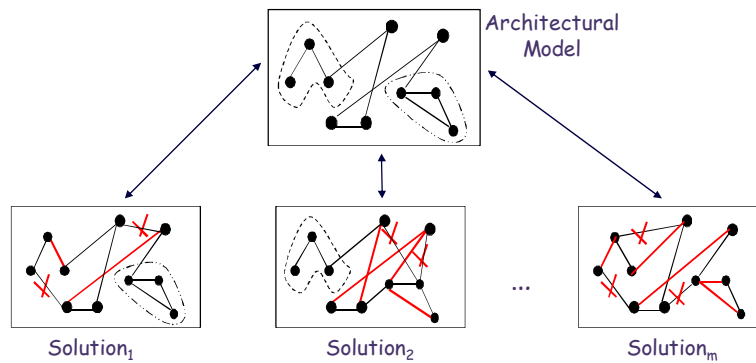


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Framework activities (6/6)

» Solving antipatterns

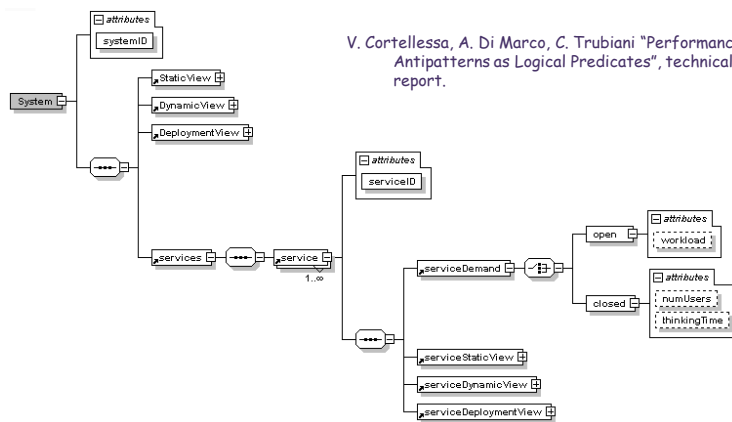
- Change the system model applying performance antipatterns solutions thus to obtain performance improvements



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Experimentation (1/2)

» XML-based Approach



V. Cortellessa, A. Di Marco, C. Trubiani "Performance Antipatterns as Logical Predicates", technical report.

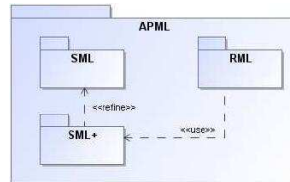
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Experimentation (2/2)

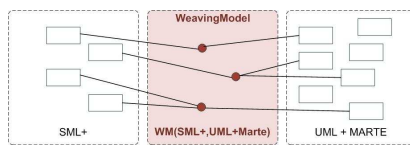
» Model-driven Approach

V. Cortellessa, A. Di Marco, R. Eramo, A. Pierantonio, C. Trubiani, "Approaching the model-driven generation of feedback to remove software performance flaws", EUROMICRO 2009

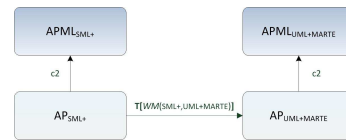
Metamodel



APML: AntiPattern Modeling Language
SML: System Modeling Language
SML+: enrichment of SML including performance parameters
RML: Refactoring Modeling Language



Weaving models

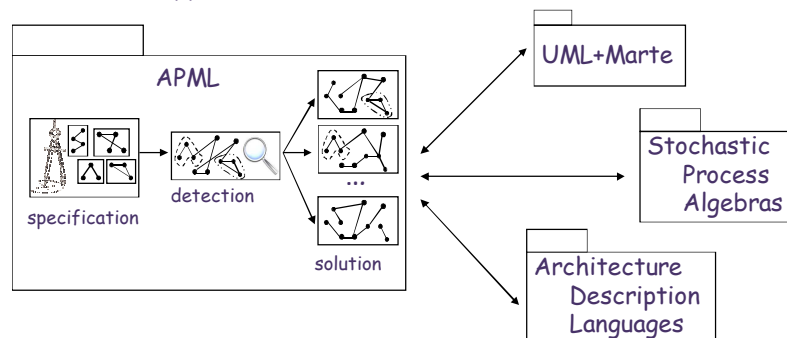


High-order transformations

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Future works

- » Validate the scope of the whole approach across languages, to assess the independence of any concrete notation.
- » Real case studies to analyse the usability and the scalability of the approach.



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Open issues

- » Requirements issues
 - Functional requirement
 - > Legacy components cannot be split or re-deployed
 - Non-Functional requirement
 - > Budget limitations
- » Coherency issues
 - Incoherences among antipattern solutions
- » Maintenance issues
 - What happens if the design and the architectural changes are performed at run-time (e.g. pervasive systems)? How do the performance antipatterns change across the run-time reconfigurations of the system?
- » Further issues
 - Can an antipattern solution introduce another antipattern? How do the workload and the operational profile affect the antipatterns identified?



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Questions?



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