Architecture Model Reconstruction
Towards Change Scenario Evaluation
Introduction
Software Quality Prediction

Goals for ABB

- Understand consequences that system changes have on quality attributes
  - Without costly try-and-error
  - Including existing/legacy software
- Understand trade-offs between quality attributes during evolution
Introduction: Q-ImPrESS¹

Software Quality Prediction

Performance: Response time
Reliability: Prob. of failure
Maintainability: Cost

¹Quality Impact Prediction for Evolving Service-oriented Software
Q-ImPrESS Meta Model – Sample Models

Static

Behaviour

Resources

Annotations

Allocation

Usage

<<Service>>
aService

Database

doA

doB

Database Server

Application Server

doSth

cpuTimeDemand=5ms
hddTimeDemand=10ms
repetions=10

<<allocate>>
aService

Application Server

<<User>>
callService

ABB
Problem:

- Suitable abstraction of the code base
- Suited for quality predictions
- Higher level components not explicit in the code
Model Extraction
SoMoX Overview

- Underlying component concept:
  - Explicit interfaces
  - Composite components
- Target model defined within the Q-ImPrESS meta-model
SoMoX
Component Identification

Identify initial components

Create candidate composites

Classes with their required and provided interfaces

Based on OO metrics, compute score for candidates

[done]
SoMoX
Candidate Composites

OO Metrics used to evaluate candidates
- Distance from the main sequence
- Coupling and
  - Name resemblance
  - Interface violation
- + X

Metrics are combined

Metrics are weighted
- System/technology specific

Metrics are computed pair wise
- Subsequent clustering
## Case studies
### Overview

<table>
<thead>
<tr>
<th>Java</th>
<th>LoC</th>
<th># Files</th>
<th>Total file size</th>
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<tbody>
<tr>
<td>CoCoME</td>
<td>5k</td>
<td>125</td>
<td>600kB</td>
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<tr>
<td>Ant</td>
<td>200k</td>
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<tr>
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<td>15</td>
<td>150 KB</td>
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<td>Industrial II</td>
<td>50k</td>
<td>58</td>
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<tr>
<td>Industrial III</td>
<td>150k</td>
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<td>2.4 MB</td>
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Java: CoCoME

Examplary implementation of a SOA

Stats

<table>
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<tr>
<th>Source</th>
<th>Details</th>
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<tr>
<td>Sources</td>
<td>600kB, 5kLoC, 58 files</td>
</tr>
<tr>
<td>GAST</td>
<td>6MB (30s)</td>
</tr>
<tr>
<td>SAM Rep.</td>
<td>6kB (5s) 30PC, 18CC</td>
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Service Effect Specifications (SEFFs)

Component Behavior

XY.GetNewSample()

Controller. ReadData()

SharedMemory. StoreData()
Industrial Case Studies
Performance Prediction

Annotated Behavioural Description
- <<InternalAction>>
  - ReadIds
  - ResourceDemand
    - 5 <CPU>

Performance Measurement

Queueing Network Simulation

Performance Prediction (e.g. Response Time Distribution)
## Case studies

### Summing up the results

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++: very good; +: good; ●: ok; -: bad; --: very bad; ✗: No results
Q-ImPrESS
Reverse Engineering – Conclusion

- Promising approach to reverse engineering for model based software quality prediction
- Support for C++ incomplete
  - Real world dialects (MS C++) problematic
  - No precompiled header support
    => Performance issues
Power and productivity for a better world™
Q-ImPrESS
Further information

- http://www.q-impress.eu
- http://jira.ow2.org/browse/QIMPRESS
- http://sdqweb.ipd.kit.edu/wiki/SoMoX
- http://sissy.fzi.de/
- http://sdqweb.ipd.kit.edu/wiki/Palladio_Component_Model