Integrating the Palladio-Bench into the Software Development Process of a SOA Project

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Agenda

• Introduction
• Project Context
• Palladio-Bench Use Cases and Enhancements
• Palladio-Bench Limitations
• Future Work
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• **Introduction**
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  • Palladio-Bench Use Cases and Enhancements
  • Palladio-Bench Limitations
  • Future Work
Introduction

• An-Institut Technische Universität München (independent company - GmbH)
• Application-oriented research institute
• Industry collaboration to improve the applicability of research results in practice

• Performance analysis and prediction
• Performance Management Work Tools (PMWT)
• Focus on complex enterprise applications
Agenda

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  - Palladio-Bench Use Cases and Enhancements
  - Palladio-Bench Limitations
  - Future Work
Project Context

Current IT Landscape
Project Context

Target IT Landscape

Integrated UI

Activity 1  ...  Activity n

Processes

Enterprise Service Bus (ESB)

Service Providers

WS-Facade

System 1  ...  System N
Project Context

Technology

Oracle Application Development Framework (ADF)

Activity 1

System 1

Oracle Service Bus (OSB)

WS-Facade

System N

Oracle WebLogic Application Server

System ...

Karlsruhe, 2013-11-28
Project Context
Software Development Process (for ADF web applications)

Software Development Process

- ARIS - EPC
- UML Activity Diagrams
- Java Code
- Requirements Analysis
- Design
- Implementation
- Testing
Project Context
Performance Management Process
Project Context
Performance Management Tool Chain

Performance Prediction
- Response time prediction and analysis for web page transitions
- Call frequency prediction and analysis for web service operations
- Service-level agreement (SLA) calculation for web service operations
- Workload selection for load tests
- Lead time prediction for business processes

Performance Analysis

Simulate
PCM Simulation Results

Model
UML to PCM Transformation

Measure
Software Performance Curves

Performance Monitoring
Service Providers
Service Consumers

Performance Database

UML to PCM Transformation

Karlsruhe, 2013-11-28
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- **Palladio-Bench Use Cases and Enhancements**
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Palladio-Bench Use Cases and Enhancements

Why Palladio?

• PCM models are easily comprehensible by technical staff in an organization, thanks to …
  – … the UML alignment and
  – … different views on a system

• PCM models store performance related information that often will not be documented otherwise

• SimuCom / EventSim (we need > 10´000 users) work reliable once the model has been established

• Evaluating design alternatives
Palladio-Bench Use Cases and Enhancements
Generating Performance Models

- Repository, usage and system models are generated based on UML-based business processes models.
- Resource environment and allocation models are generated based on static information.
Palladio-Bench Use Cases and Enhancements
Generating Performance Models
Palladio-Bench Use Cases and **Enhancements**

Representing External Systems

- External web services are modeled as black box components
  - Response times of external systems are integrated as performance curves
  - Response times are specified as functions
  - Response time functions (curves) are derived from measurements using regression
    - Service-level agreements for response times are used if no measurements are available

- Representation of performance curves using the performance curve integration (PCI) plugin
  - PCI plugin for version 3.2 is adapted to version 3.4.1
  - Major change: aligned code with abstractsimengine (previously: umontreal.iro.lecuyer.simevents)
Palladio-Bench **Use Cases** and Enhancements
Performance Prediction and Performance Analysis

**Input:**
Number of Users

**Usage Model**
System components and web services

<table>
<thead>
<tr>
<th>Service</th>
<th># Calls</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>23</td>
<td>5 %</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>... %</td>
</tr>
<tr>
<td>SN</td>
<td>42</td>
<td>8.7 %</td>
</tr>
</tbody>
</table>

**Output:**
Service call frequency
Palladio-Bench **Use Cases** and Enhancements
Performance Prediction and Performance Analysis

**Input:**
Number of Users

**Output:**
View transition times

<table>
<thead>
<tr>
<th>View Transition</th>
<th>Called Services</th>
<th>Response Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1-&gt;P2</td>
<td>S1, S5</td>
<td>2s</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>... s</td>
</tr>
<tr>
<td>Px -&gt; Py</td>
<td>S23, S42</td>
<td>4 s</td>
</tr>
</tbody>
</table>
Palladio-Bench **Use Cases** and Enhancements
Performance Prediction and Performance Analysis

**Input:**
Number of Users

**Usage Model**

**System components and web services**

- S1
- ...
- SN

**Output:**
Process lead times

<table>
<thead>
<tr>
<th>Subprocess</th>
<th>Lead Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>42 s</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>PN</td>
<td>23 s</td>
</tr>
</tbody>
</table>

- Selection of test cases
- Simulation of process lead times
Palladio-Bench **Use Cases** and Enhancements
Performance Prediction and Performance Analysis

Input to negotiate service-level agreements with service providers

- Service call frequencies
- View transition times
- Process lead times
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Palladio-Bench Limitations

I/II

• Usage model reuse
  – Usage behaviors are reused in practice across multiple models
  – Missing possibility to reference usage models from usage models

• Visual representation of nested branches
  – Very complex for large business processes

• Representation of memory
  – Heap size is an important factor for capacity estimations
  – JSF application pose a high demand for heap memory → Garbage collection overhead
**Palladio-Bench Limitations**

II/II

- Better support for migrating models between Palladio-Bench versions -> PLEASE include diagrams ;-) 

- Visualization of simulation results
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Future Work

• Applying Kieker?

• Further development and integration of tools
  – Data exchange between PCM and the performance database
  – Associating versions of specific web service response time measurements with their PCM representation (i.e. response time differences)

• Simplify the usage of the performance modeling and simulation capabilities
  – Allow non-performance modeling experts to use the performance management tool chain (PCM simulations might be transparent in the background)

• Include resource demands into the performance management process
  – Similar to approaches of Brosig et al. 2011, Brunnert et al. 2013
Thank you for your attention!

Questions?

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