Performance Cockpit
From measurements to models

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Dennis Westermann

SAP Research

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Challenges of Software Performance Analysis

- Complex systems
- Performance models are hard to create

➔ How to combine measurements and models?
Outline

Software Performance Curves

Example

Integration into the PCM
Software Performance Curves

- Performance Measurements
- Statistical Inference
- Software Performance Curves
This would help us to...

Efficiently address various performance questions:

- Integrate
  - low-level details into architectural models
  - legacy components into prediction models

- Evaluate design alternatives

- Capacity planning

- Identification of performance bugs
Software Performance Cockpit

Admin

Performance Analyst

System Adapter

Analysis Adapter

System, Benchmark, and Application Expert

Analysis Expert

SUT

Systematic Definition of Experiments

Multiple Analysis Techniques

Reuse in Multiple Settings

Jens Happe - Integration of Performance Curves into the PCM
Example
Message-oriented Middleware

Classical Software Performance Engineering (SPE) requires detailed knowledge about the system’s internal structure...

Active MQ 5.3

Increasing message size?
Larger number of messages?
Delivery time?
Performance Cockpit
An Engineering Approach to Software Performance Curves

Admin

Performance Analyst

Delivery Time

# Messages

Message Size

System Adapter

Analysis Adapter

ActiveMQ

Linux

MARS

Genetic Optimization

System, Benchmark, and Application Expert

SUT

Analysis Expert

SPECjms2007

Regression
Performance Cockpit
Configuration

Resource Environment
Measurement Specification
Analysis Specification
Export Specification

platform:/resource/MoM/MoM.configuration
- Performance Evaluation Configuration
  - Resource Environment [1. Load Driver, 2. Load Driver, System Under Test]
    - System Node 1. Load Driver (satID: loaddriver1)
    - System Node 2. Load Driver (satID: loaddriver2)
    - System Node System Under Test (satID: sut)

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Performance Cockpit
Configuration

Resource Environment

Measurement Specification

Analysis Specification

Export Specification

- Adapter Repository
  - Adapter Descriptor Active MQ Adapter
  - Adapter Descriptor Linux 2.6 Adapter
  - Adapter Descriptor JMS Load Driver
    - Observation Parameter Delivery Time [ms]
  - Configuration Parameter Group
    - Configuration Parameter Arrival Rate [msg/s]
    - Configuration Parameter Message Size [kByte]
Performance Cockpit

Configuration


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**Integration of Performance Curves into the PCM**

**Resource Environment**

**Measurement Specification**

- Experiment Series: Message Size vs. Arrival Rate (Arrival Rate [msg/s], Message Size [kByte] -> Delivery Time [ms])
  - Full Exploration Strategy
  - Experiment Run Configuration ([ , ] [120 min])
  - Linear Double Variation Arrival Rate [msg/s] (min, max, step: 1.0, 600.0, 50.0)
  - Linear Double Variation Message Size [kByte] (min, max, step: 0.0, 800.0, 100.0)

**Analysis Specification**

**Export Specification**

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**Task Properties**

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Performance Cockpit

Configuration

Resource Environment
Measurement Specification
Analysis Specification
Export Specification

Analysis Specification

MARS MessageSize-vs-ArrivalRate

Many To One Dependency (Message Size [kByte], Arrival Rate [msg / s] --> Delivery Time [ms])

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<th>List</th>
<th>Tree</th>
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### Performance Cockpit

#### Configuration

- **Resource Environment**
- **Measurement Specification**
- **Analysis Specification**
- **Export Specification**

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**Export Specification**

- Report: How do message size and arrival rate influence the delivery time?
  - Plot3DGraph (-:, -)
  - Plottable Experiment Result Measurements

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**Platform:** /resource/MoM/MoM.adapterrepoistory

**Selection:** Parent | List | Tree | Table | Tree with Columns

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<tr>
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Example

Message-oriented Middleware

Experiment Series Controller

- System Controller
  - LoadDriver

- System Controller
  - LoadDriver

- System Controller

Message-oriented Middleware

Benchmark

Performance Cockpit

System under Test
Example
Message-oriented Middleware

Integration with model-based performance prediction?
Integration into the PCM

Scenarios

Completions

Composition
Integration into the PCM

Integration Points

How to integrate Performance Curves into the PCM?
Integration into the PCM
Integration Points

Variant A: Component

- SEFFs are not sufficient (queue length)
  → new type of components

- Performance Curves do (currently) not load resources
  Risk of wrong prediction results

- Performance Curves do not allow calls to external services
Integration into the PCM

Integration Points

Variant B: Resource

- Resources support queue lengths
  → new type of resource

- Performance Curves require complex interfaces that are not supported by resources
Variant C: QoS Annotation of System Required Roles

- No allocation to resources required
- No further required interfaces possible
- Complex interfaces can be supported

- Specific code generation for simulation necessary (queue length)
Integration into the PCM

Schematic Overview

Model Simulation

System Simulation Code

Performance Curve Adapter

Performance Curve Interpreter

<<QoSAnnotation>>

generated

implemented
Integration into the PCM

Meta-Model
Integration into the PCM

Simple Evaluation: A Performance Curve that simulates PS

Use Processor Sharing

Use Performance Curve

Measured Time
Integration into the PCM
Challenges & Ideas

- Validation with real case study (MOM)

- Extensions
  - Generation of load on resources
  - Evaluation and modelling of contention effects

- Ideas
  - Performance Curve Component with required roles
Current Work
Software Performance Cockpit

Integration into the PCM [Alexander Wert]

Core Architecture & Meta-Model [Chris Heupel]

Performance Analyst

Smart Measurements [Rouven Krebs]

UI Rendering Times [Yusuf Dogan]

Analysis Expert

Parameter Screening [Pascal Meier]

System, Benchmark, and Application Expert

SUT

System Adapter

Analysis Adapter

Admin

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Summary

Jens Happe - Integration of Performance Curves into the PCM

Software Performance Curves

Software Performance Cockpit

Message-oriented Middleware

Integration into the PCM
Publications 2010

Vision and Idea:


Application:

