Praktikum Ingenieurmaßige Software-Entwicklung

Palladio Component Model – Part V (PCM)

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Outline

4. Software Architect
   a) System (Composed Structure)
   b) QoS Annotations on System Interfaces

5. System Deployer
   a) Resource Types, Resource Environment
   b) Allocation

6. Domain Expert
   a. Usage Model
   b. Parameter Characterisations

7. Result Interpretation
Domain Expert

- Familiar with the business domain
- Specifies user behaviour
  - Number of users
  - User Requests to the System
  - Input parameters characterisations as distribution functions
Usage Model

- Models **user** behaviour, not component!
- Similar to RDSEFFs, but
  - Does not refer to resources
  - Does not refer to inner components of a system
  - Does not model parametric dependencies
  - Includes a workload specification

- Usage Model
  - $1 \ldots n$ usage scenarios (1 per use case)
  - 1 workload per usage scenario
Usage Model

Usage Scenario

Workload: open or closed (like in SPE)

Branch

Call to a system provided service

Loop

Variable Usage
Outline

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Lecture 4
Lecture 5
SetVariableAction

- Characterisation of Return Values
- Only if performance relevant!
- Reserved Keyword RETURN
- May occur in different branches
Using Return Values of ExternalCallActions

- Assignment of output parameter characterisations to local variables
- Use local variables afterwards in parametric dependency specification
Component Parameters

- Global parameters for components
  - Configuration options
  - Static State
  - ...
- Declaration per assembly context
- Default value by component developer
- Cannot be changed dynamically (during simulation)
Model Validation

- Switch to Eclipse!
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Result Interpretation

▪ Performance Metrics PCM
▪ Statistics
▪ Analysing Histograms
▪ Analysing Cumulative Distribution Functions
Performance Metrics supported by SimuCom

✅ Response Time per Time Sensor
  - Histogram
  - Cumulative Distribution Function
  - Point Estimators with R (Statistics Package)

✅ Utilization per Resource
  - Percentage: Busy Period / Idle Period

❌ Currently NOT supported
  - Throughput
Statistics

- Point Estimators
  - Expected Value (Mean)
  - Standard Deviation
  - Variance
  - Median

- Compare Probability Distributions
  - Kolmogorov-Smirnov-Test
  - Chi-Square-Test
  - Anderson-Darling-Test
Result Interpretation

- **Usage Profile 1** (Prediction)
- **Usage Profile 1** (Measurement)

Histogram of Response Time (Seconds) with Probability on the y-axis and Response Time on the x-axis.
Result Interpretation

- Usage Profile 1 (Prediction)
- Usage Profile 1 (Measurement)
- Usage Profile 2 (Prediction)

Response Time (Seconds) vs. Probability
Result Interpretation

- **SDQ**: Software Design and Quality

**Response Time (Seconds)**

- **Probability**
  - **Usage Profile 1** (Prediction)
  - **Usage Profile 1** (Measurement)
  - **Usage Profile 2** (Prediction)
  - **Usage Profile 2** (Measurement)

**Palladio Component Model**

29.06.2007
Result Interpretation

- **Usage Profile 1**
  - Prediction

Cumulative Probability

- 0.75 Quartil
- Median
- 0.25 Quartil

Response Time (Seconds)

- Palladio Component Model
- 29.06.2007
Result Interpretation

Service Level Agreement: 90% of requests return in less than 8 seconds
Result Interpretation

- **Usage Profile 1**
  - (Prediction)
  - (Measurement)

- **Usage Profile 2**
  - (Prediction)
  - (Measurement)

**Cumulative Probability vs. Response Time (Seconds)**

- The graph illustrates the cumulative probability of response times for two usage profiles, one being predicted and the other measured.
- The x-axis represents response time in seconds, ranging from 0 to 13.
- The y-axis represents cumulative probability, ranging from 0.0 to 1.0.

**Key Points**

1. The comparison between predicted and measured response times helps in validating the model's accuracy.
2. The graph suggests that the model performs reasonably well, as the predicted and measured curves are close, especially for the longer response times.
Linking Resources
- work automatically in background
- latency specification for comm.link.resources

Scheduling Policies for ProcessingResources
- FCFS, PROCESSOR_SHARING, DELAY

System
- Output parameters for system external calls
- Broker lookup support for connectors

Usage Model
- User Delays (to model waiting/thinking)
Current Developments (Changelog)

- Stochastic Expressions
  - AND, OR, NOT for Boolean Expressions
  - Standard Probability Distributions
    - Exp(x), UniForm(x,y), Norm(x), ...

- OCL constraints for model validation

- SimuCom
  - Saving simulation results to disk
Lessons Learned Today

- Usage Model
  - for user behaviour
- Return Values
- Component Parameters
- Model Validation
- Result Interpretation
  - Probability distributions
  - Point estimators