SimuLizar
Design-Time Modeling and Performance Analysis of Self-Adaptive Systems

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Simple Example: Requirements

R1: mean response time $\leq 0.8 \text{ s}$

R2: Minimize costs for utilizing Application Server $s_{n2}$

R3: Only if mean response time $> 0.8\text{s}$: Rebalance as fast as possible
SimuLizar: Approach

NF Requirements → Architecture + Adaptation Models → Self-Adaptive System

Simulation
SimuLizar: Extensions to Palladio

Monitoring Specification
<<monitoring>>

State Transition
<<condition>>
<<++>>
<<++>>

PMS Model

PCM Model

Self-Adapt. Rules

Static View (Repository)

Initial State View (System)

Allocation View
Simple Example: Solution Idea

Measure: response time

Condition: response time > 0,8

Reconfiguration: P(sn1) - 10%, P(sn2) + 10%
**Simple Example: Modeling**

**Measure:** mean response time with $\Delta t = 20.0s$

**Condition:** mean response time $> 0.8$

**Reconfiguration:** $P(sn1) - 10\%, P(sn2) + 10\% \rightarrow \alpha + 0.1$
Simulation Results & Interpretation

![Graph showing simulation results and interpretation](image)

- Response Time [s]
- Simulation Time [s]
- Sn1
- Sn2

20,0

LoadBalancer

ServerNode 1

ServerNode 2
Evaluation Design

NF Requirements → Architecture + Adaptation Models → Simulation → Self-Adaptive System Prototype

Valid? → +50

= ?
Evaluation Results

![Graph showing response time vs. time for Simulation and Prototype]

- **Response Time [s]** vs. **Time [s]**
  - Simulation
  - Prototype

Legend:
- sn1
- sn2
Conclusions
MAPE-K

Monitor Analyze Plan Execute

Knowledge

Managed Element
SimuLizar Simulation Tool

- PRM
- Analyze
- Plan
- Execute
- PCM Model Interpreter
- Palladio SimuCom

- PMS
- Self-Adapt Rules
- S-A Rule
- Self-Adapt
- Rules
- Monitor
- Analyze
- Plan
- Execute
- PCM

PCM Model Interpreter

Palladio SimuCom
Detecting Unsatisfactory Self-Adaptation