Karlsruhe Institute of Technology

Software Design and Quality

The OMPCM Simulator for Model-Based Software Performance Prediction

A Model-Driven Approach for Combining Network and Software Architecture Simulation

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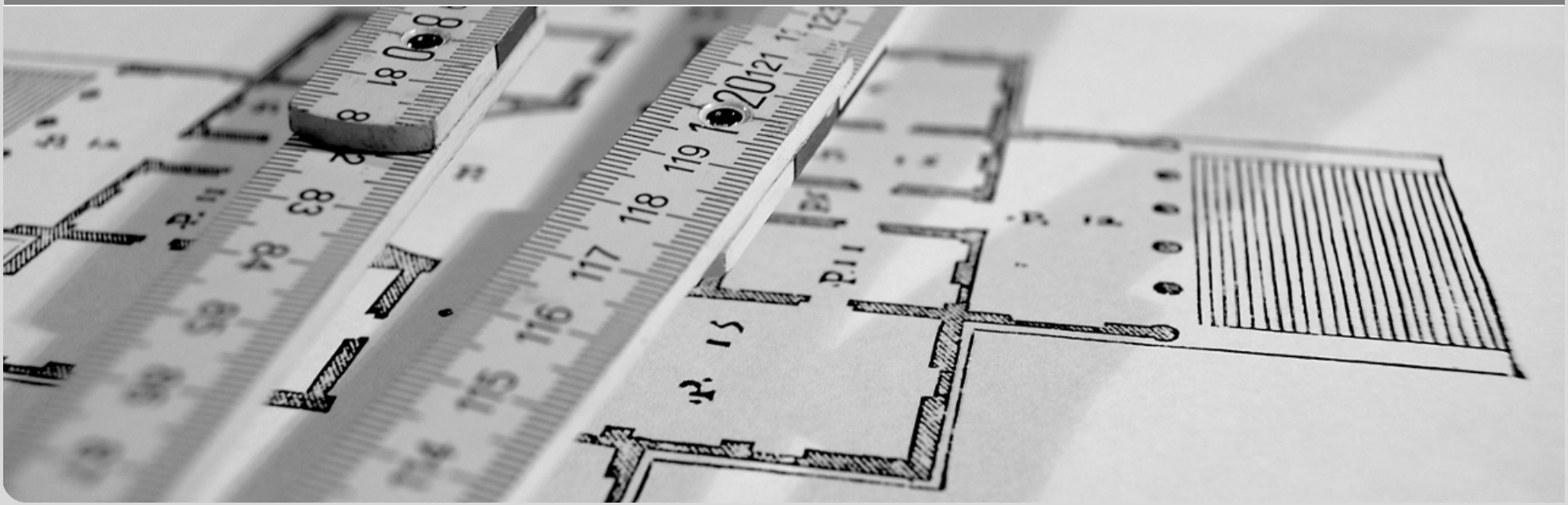
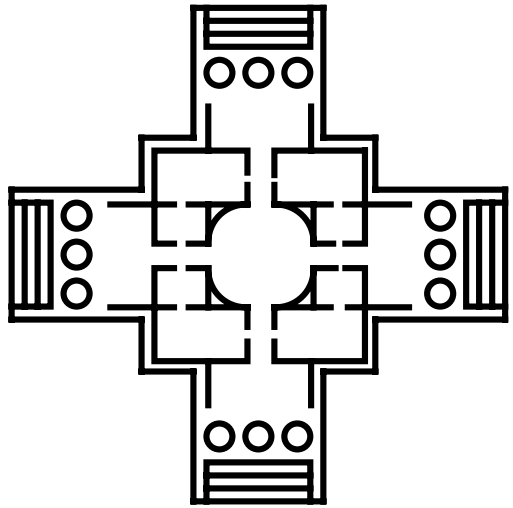
CHAIR FOR SOFTWARE DESIGN AND QUALITY



Motivation: Palladio Component Model

- Palladio Component Model (PCM)
  - Component-based software architecture
  - Captures performance-relevant behaviour
  - Prediction of performance and reliability
- Tool Support
  - Eclipse-based UI: Palladio-Bench
  - Simulators and analytical solvers



www.palladio-simulator.com

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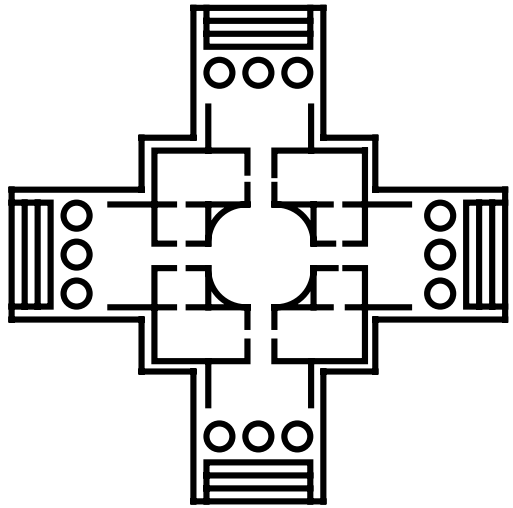

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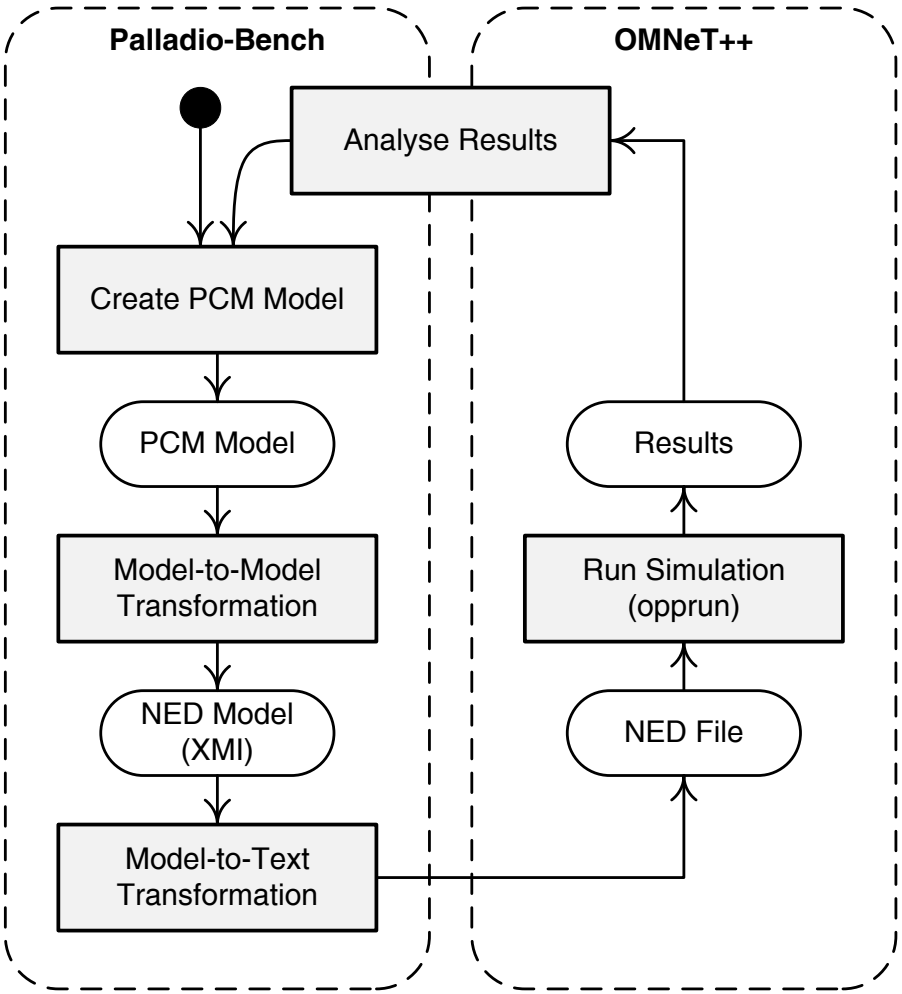
Problem: Only trivial simulation for network communication

→ Use existing network simulation

Model-driven Process



- Integrates OMNeT++ with the PCM
- Model-driven approach
  - SimCore intermediate model
  - Model transformations
- Integrated seamlessly
  - No manual editing required
  - Launch OMPCM from Palladio-Bench
  - Import simulation results

Model-driven approach

SimCore Model

- Simplistic intermediate model
  - Comprises reduced set of operations
  - Remove redundancies
  - Complex operations are composed
- Simplifies simulation development

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- Converts Palladio to SimCore
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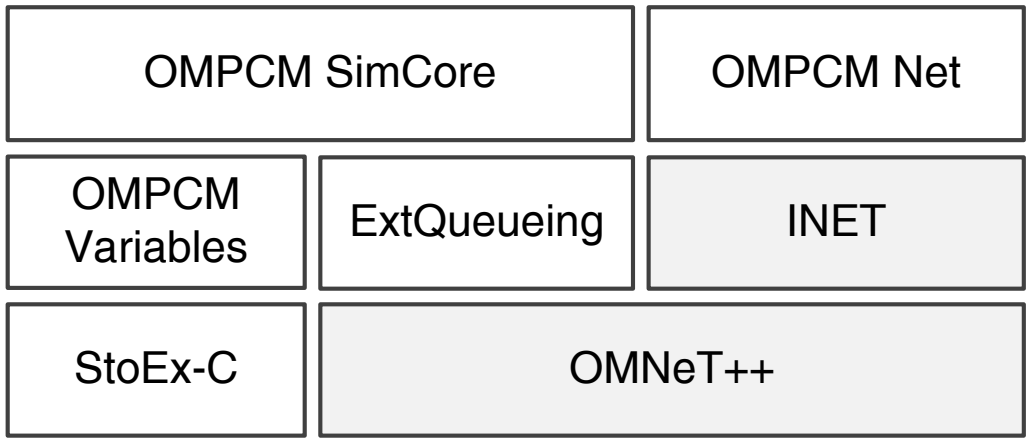
Model-to-Text Transformation (Xtext)

- Creates a textual NED File
- Derived from adapted NED grammar

Implementation



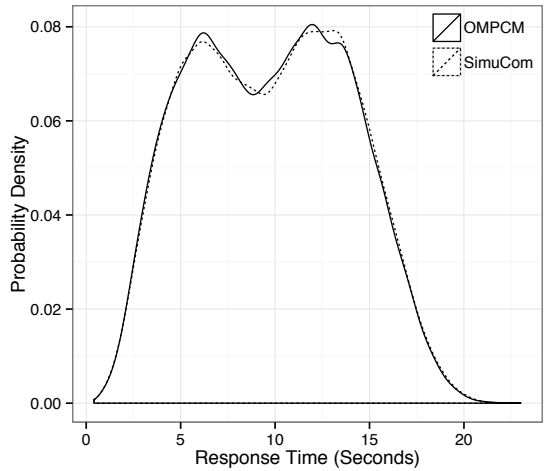
Modular Structure

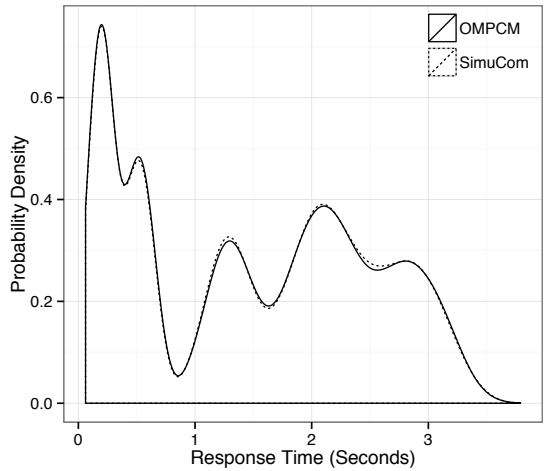
- OMPCM SimCore: Provides control-flow elements, message position denotes current instruction
- OMPCM Net: Bridges between SimCore and INET, provides component proxies

Validation

- Based on comparison to reference simulator
  - Uses MediaStore case-study
  - Single user and multi user scenarios
  - Response time & resource utilisation

  → OMPCM yields consistent Results
- Simulation up to 20% faster
- Differences due to different PRNGs
- Influence of Network:
  - Scenarios are sensitive to network
  - Simulation takes ∼10 times longer





Conclusion and Future Work

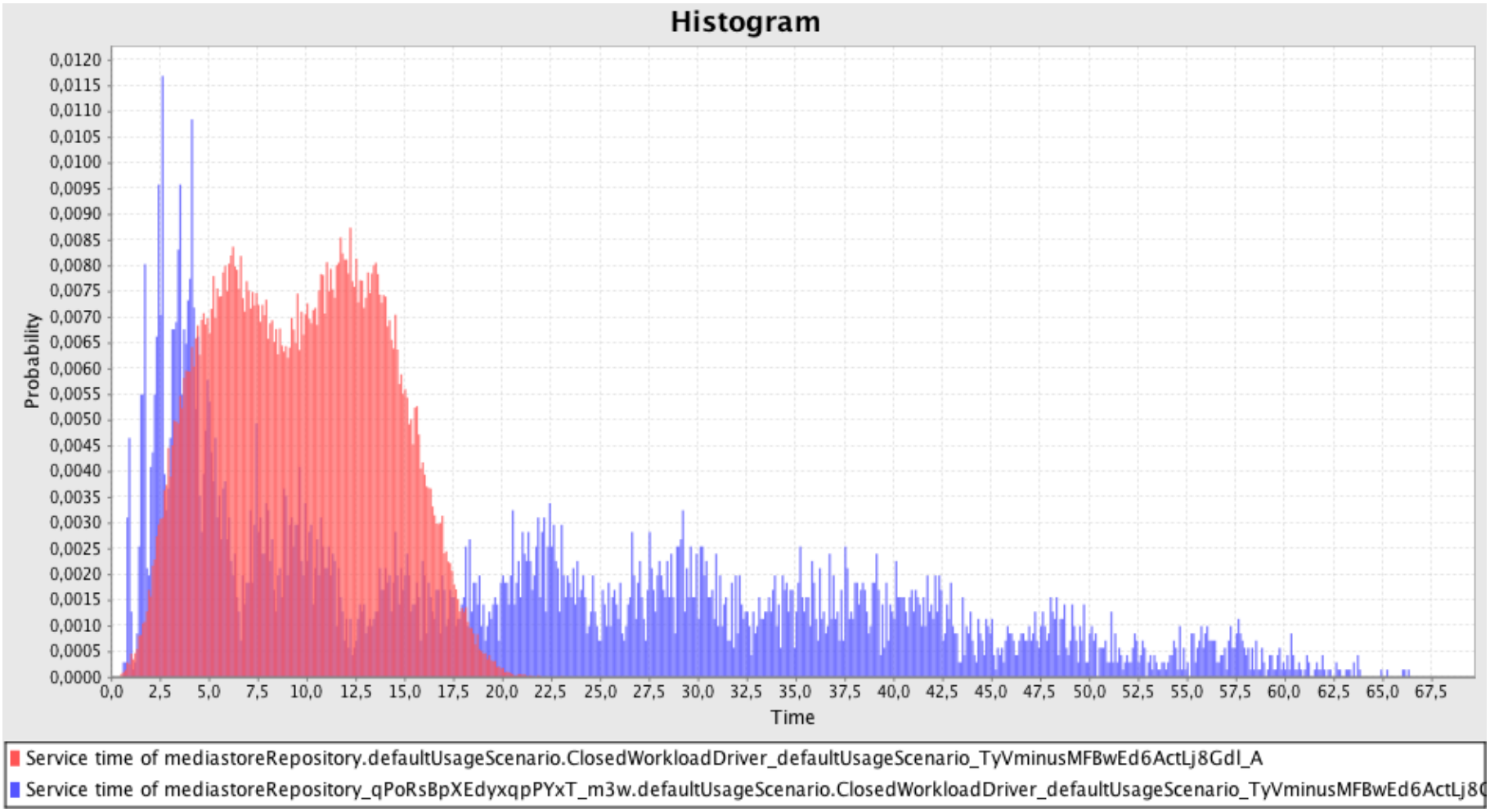
Contributions

- Software architecture performance simulator based on OMNeT++
  - Detailed simulation of network influences
  - Usable for load generation on existing network models
- Model-driven process
  - Uses model transformations
  - Enables seamless integration
  - Can be applied to other domains

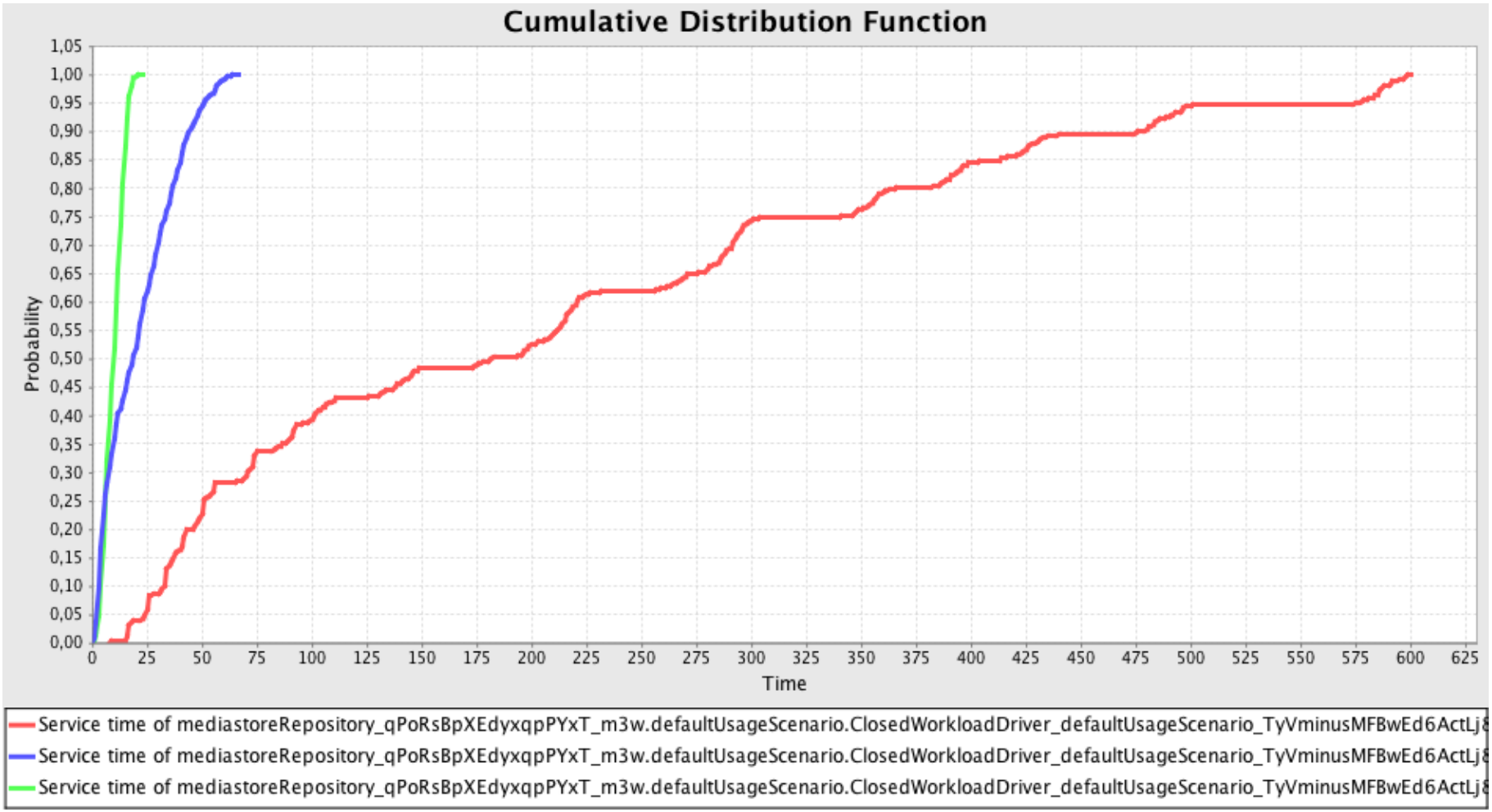
Future Work

- Further studies on impact of network influences
- Integration of the OverSim network implementation

Experiments



First results - 10 vs. 100Mbps vs 1Gbps



First results(3)

Scenario	Mean	Stddev	Variance
10Mbps	209.099	168.4204	28365.4144
100Mbps	21.0884	16.1496	260.809
1Gbps	9.7218	4.3588	18.8867

Table : MediaStore response times