

2nd international OMNeT++ Workshop

VirtualMesh: An Emulation Framework for Wireless Mesh Networks in OMNeT++

Thomas Staub, Reto Gantenbein, Torsten Braun
Universität Bern, Switzerland

www.iam.unibe.ch/~rvs

Overview

- > Introduction and Motivation
- > VirtualMesh
 - Architecture
 - Traffic Interception and Redirection
 - Packet Flow
 - Information Exchange with Simulation Model
- > Performance Evaluation
 - Latency between Hosts
 - Simulation Overhead
 - TCP Throughput
- > Conclusions

Experiments

Simulations

- + Quick validation of protocols
- + Large scale evaluations
- + Mobility
- + Reproducibility
- Different code as real system software
- Limited level of implementation details
- Approximation of real environment

Test Beds

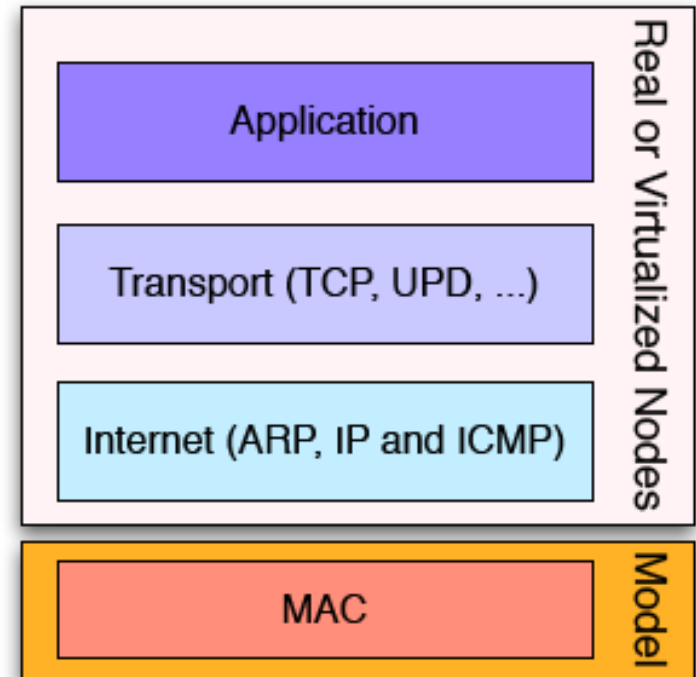
- + Real system software
- + Real environment
- Reproducibility
- Effort to test with different topologies
- Limited size
- Mobility
- Undesired interferences

Network Emulation

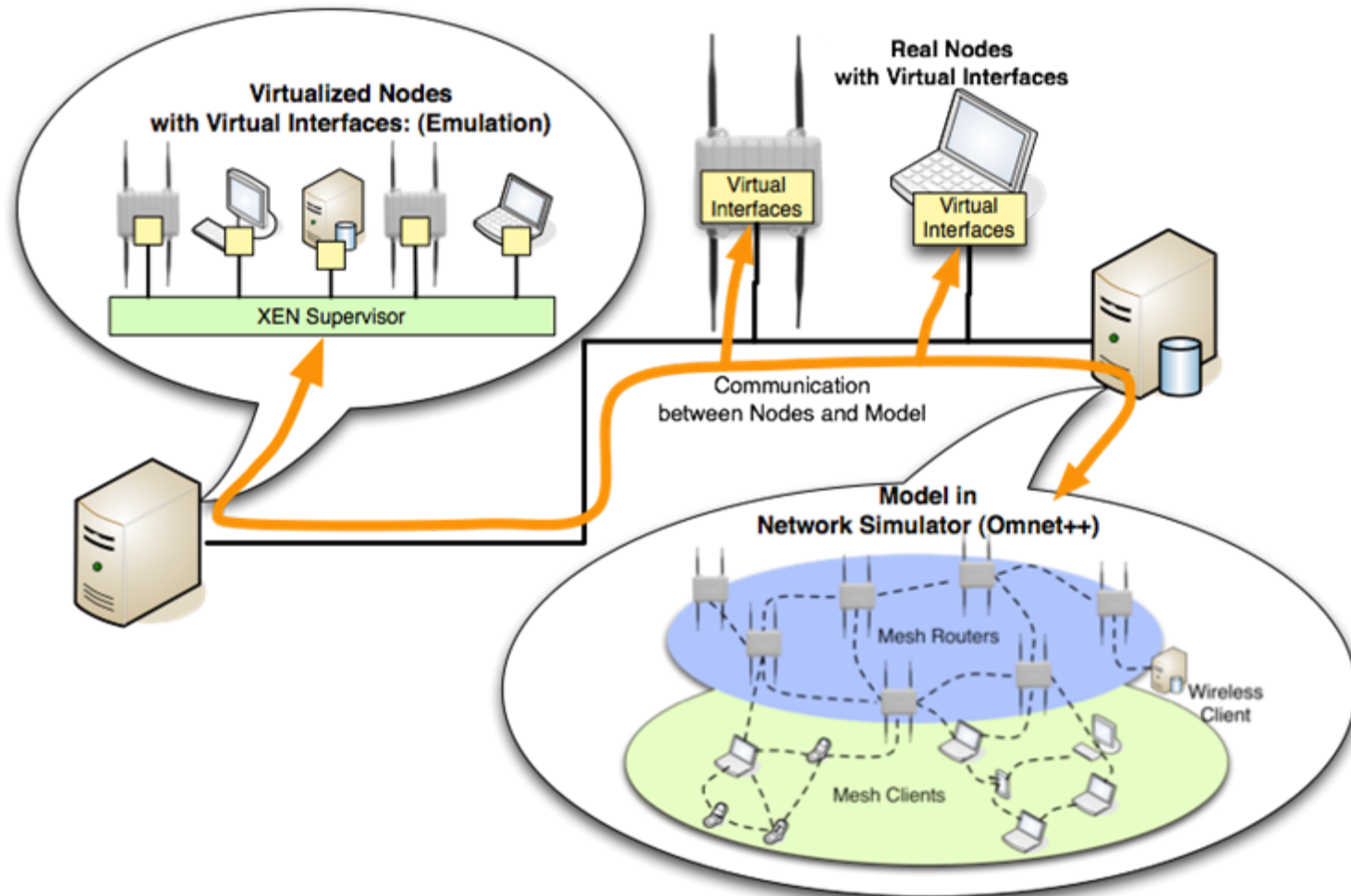
- > Reproducability
- > Larger scenarios
- > Mobility
- > Controlled interferences
- > Real system software

VirtualMesh

- > Combines simulation and real test-beds
- > Scalability by virtualization
- > Simulation of MAC and physical layer
- > Traffic redirection to a simulation model by virtual interface

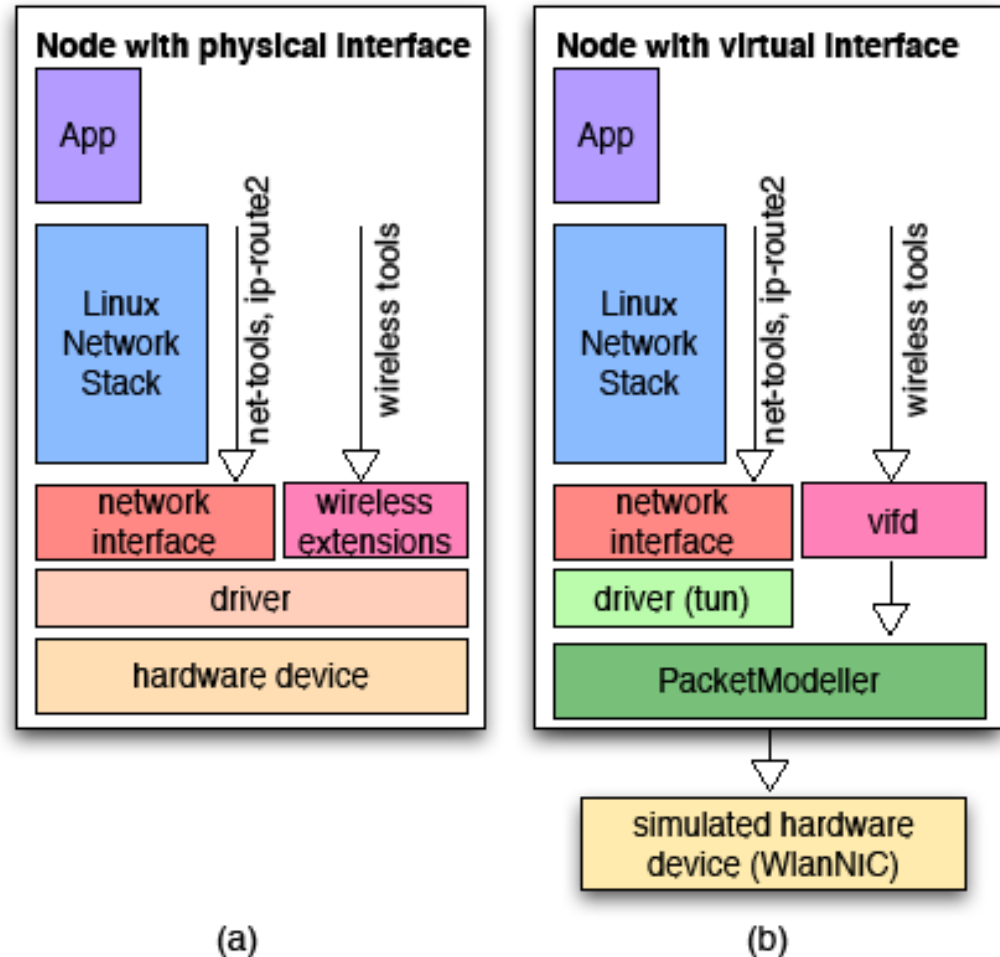


VirtualMesh Architecture

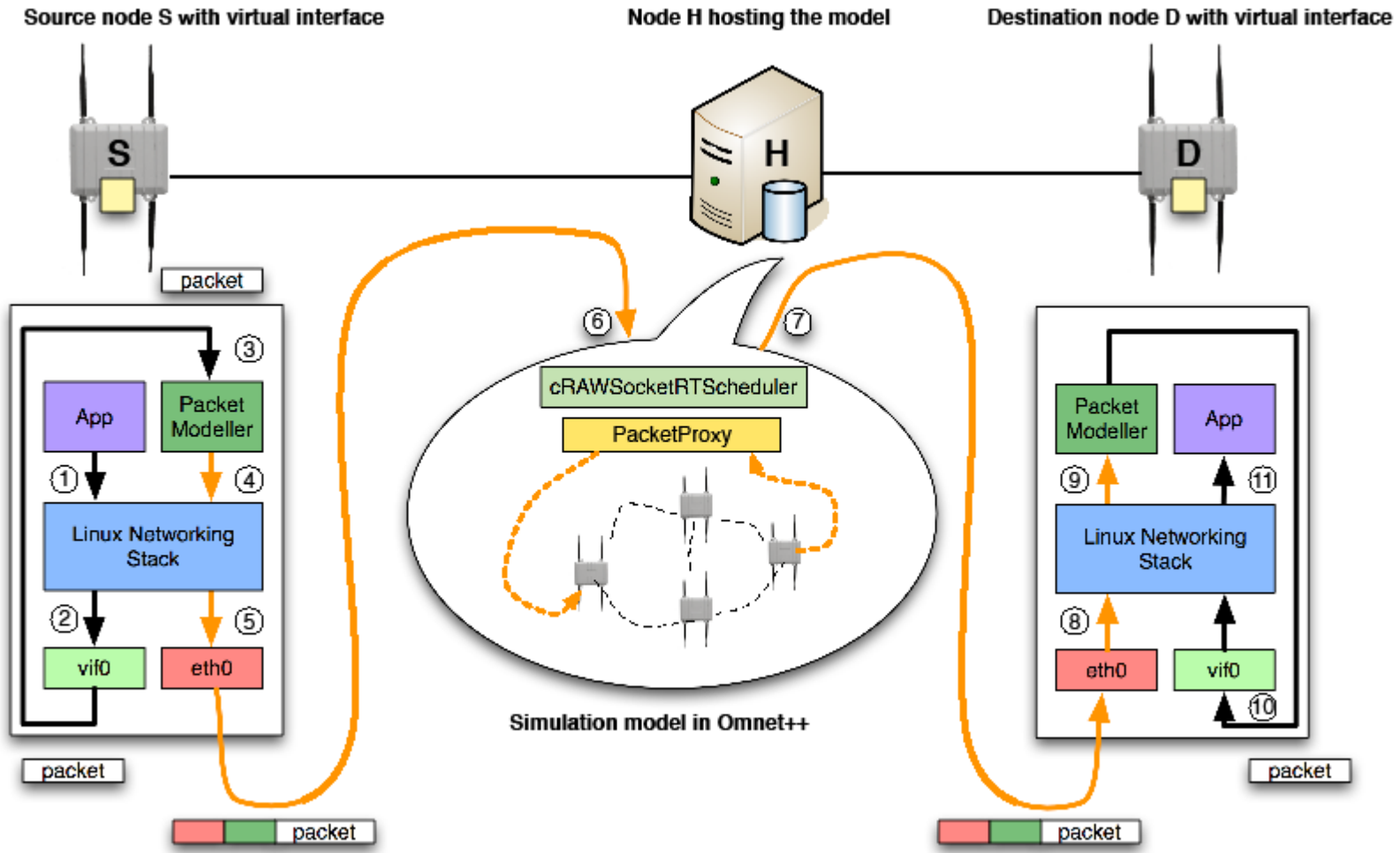


Traffic Interception and Redirection

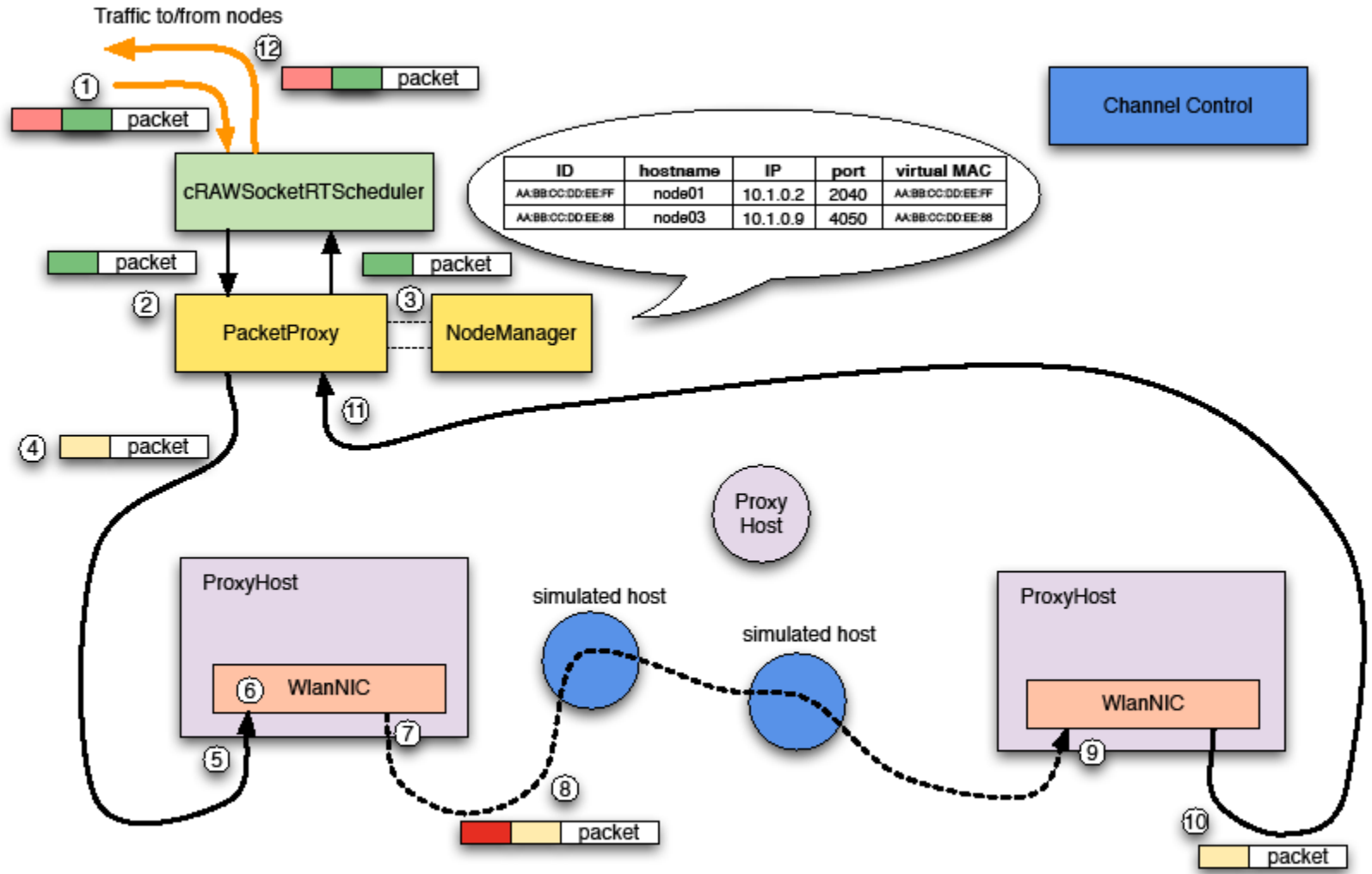
- > Replacement of wireless network device by virtual device *PacketModeller*
- > TUN/TAP redirects MAC frames to user space process
- > Identical configuration interface



Packet Flow

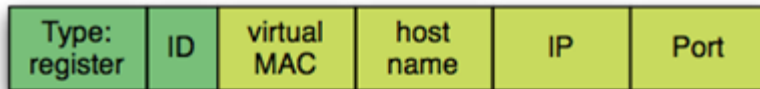


Packet Flow in Simulation Model



Information Exchange between PacketModeller and Simulation Model

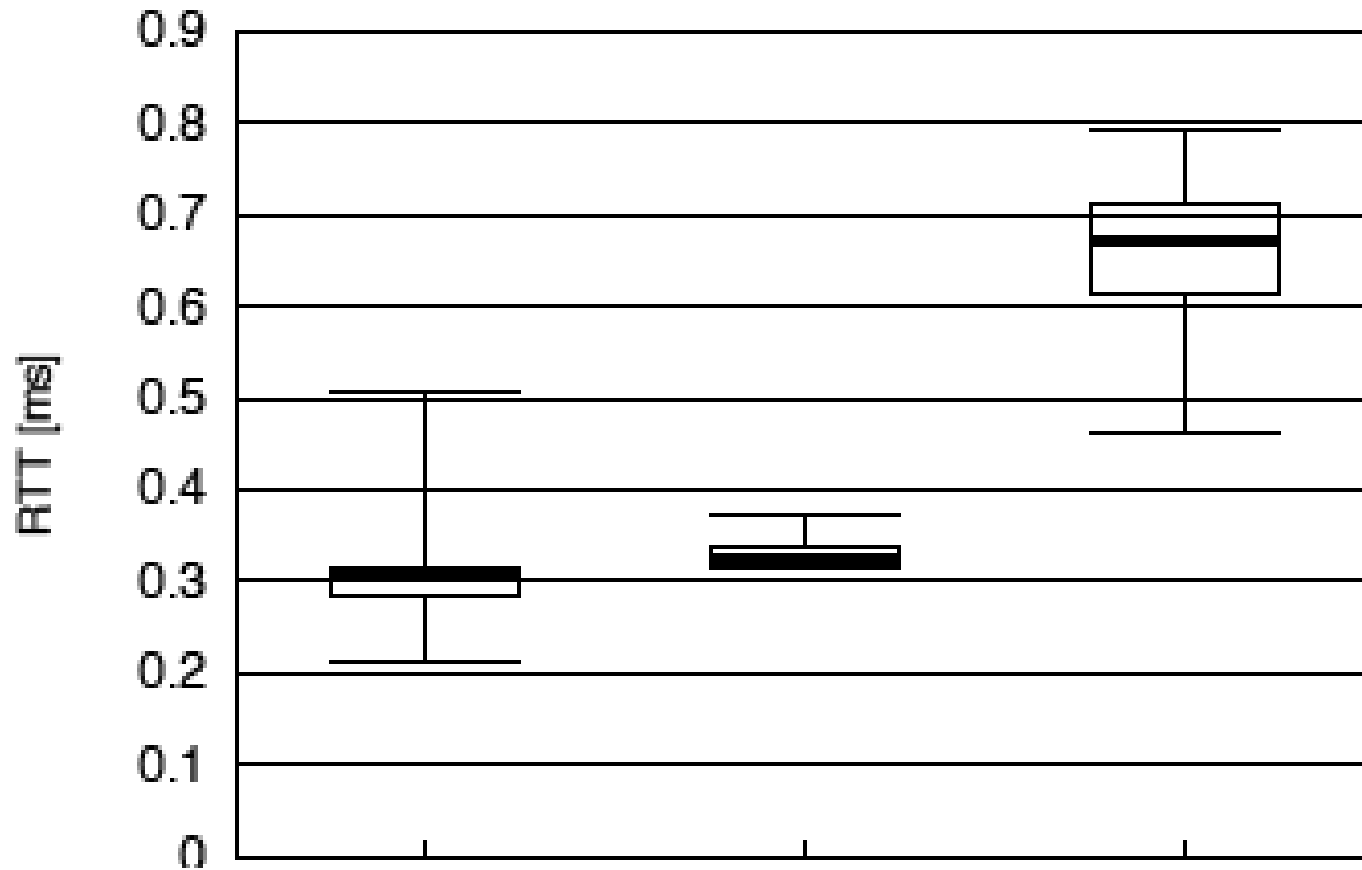
- > Simulation model must know static and dynamic parameters describing external nodes
 - Registration of static parameters by REGISTER message



- Dynamic parameters are included in DATA packets



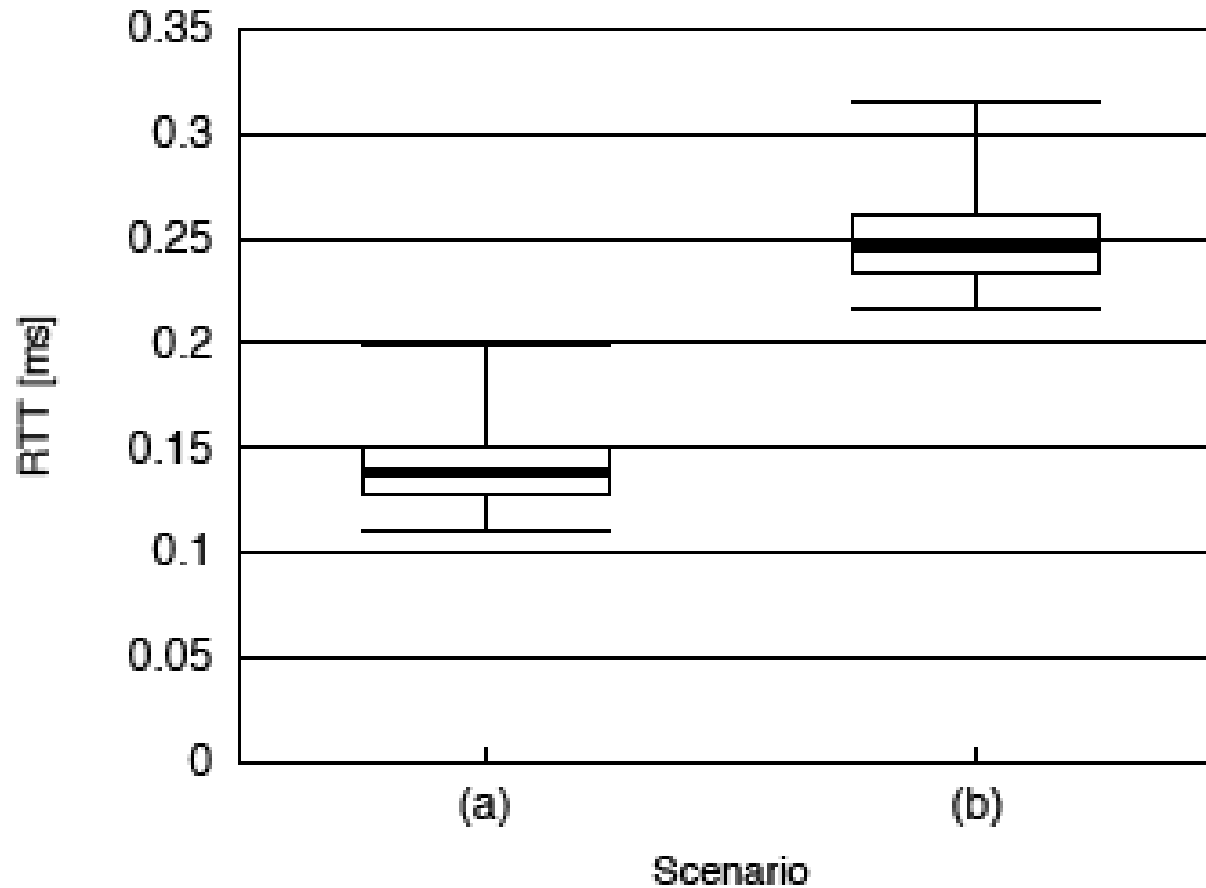
Performance Evaluation: Latency between Hosts



- a) physical host to physical host c) physical host to fully virtualized host
b) physical host to para-virtualized host

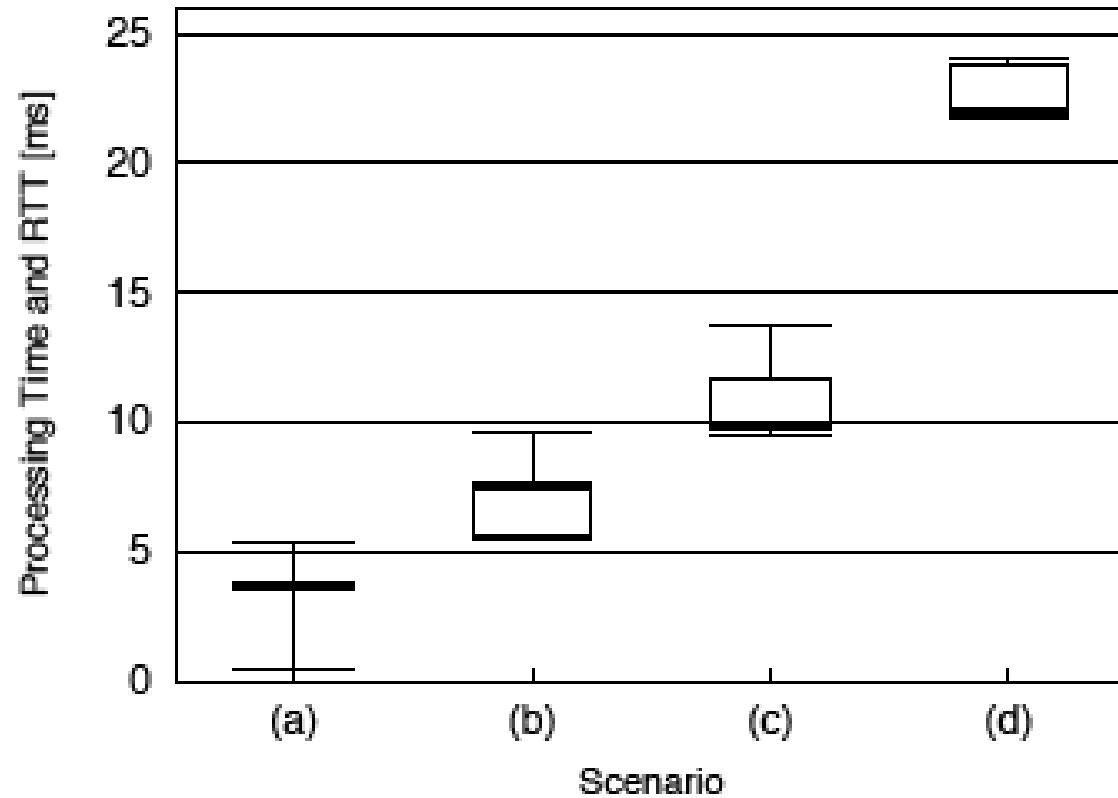
Performance Evaluation: Packet Modeller Overhead

- > RTTs between two virtualized hosts without/with PacketModeller

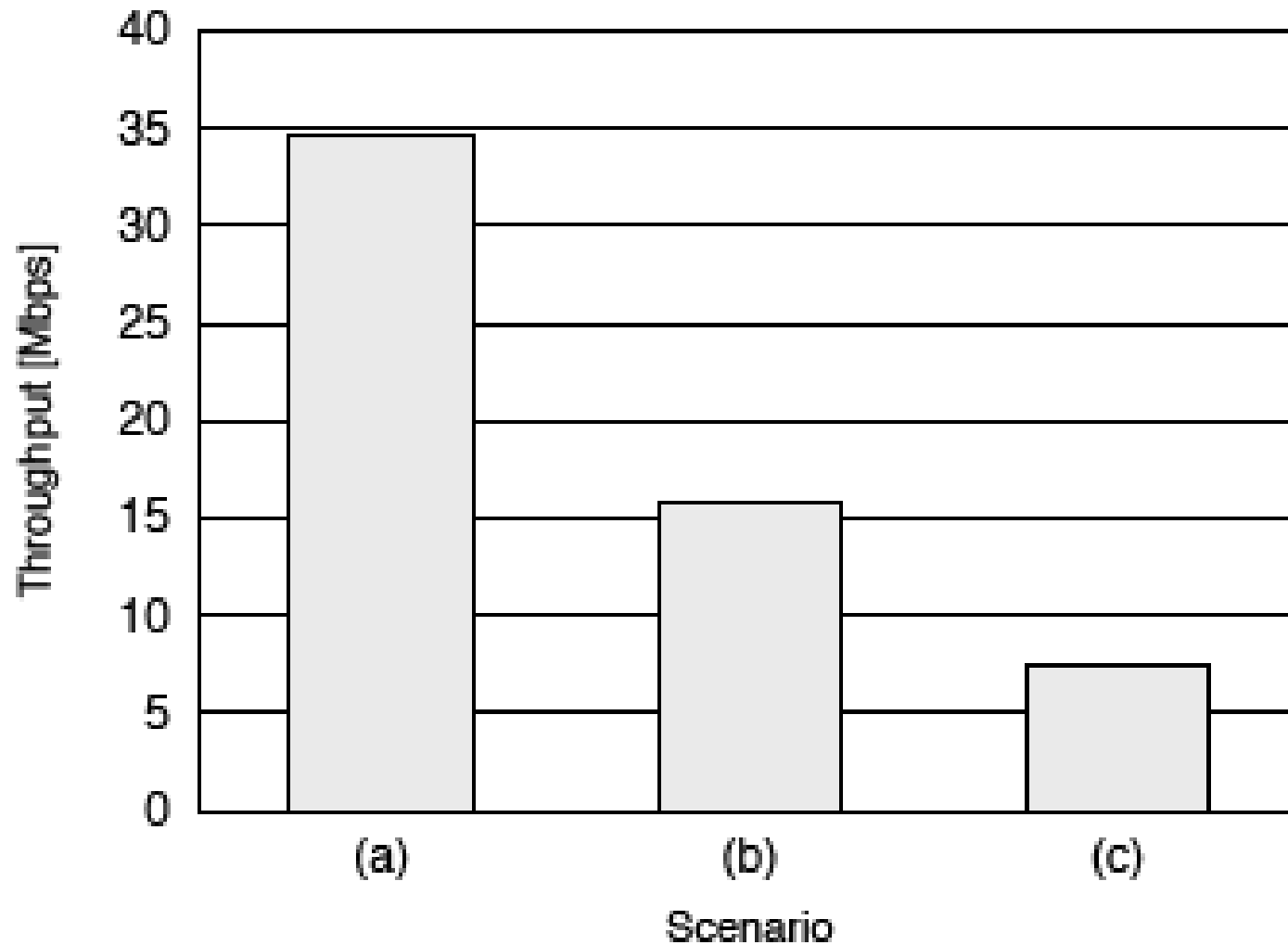


Performance Evaluation: Simulation Model Overhead

- > Simulation model processing
 - a) 2 context switches
 - b) 1 hop
 - c) 2 hops
 - d) 3 hops



TCP Throughput for 1/2/3-Hop Chains



Conclusions

- > Emulation provides a valuable extension of test and performance measurement facilities for communication software
- > VirtualMesh
 - Host virtualization
 - Traffic interception
 - Integration of OMNeT++