

# Real-Time Simulation of Multi-Hop Ad hoc Networks

CHRISTIAN SCHERPE AND JÜRGEN WOLF

## Goals

- Development of a tool for **simulating network delay and loss characteristics in real-time** for multi-hop ad hoc networks (MANETs).
- Creating of **appropriate models for MANETs** (mapping movement behaviour to hop-to-hop resp. end-to-end delay and loss characteristics, representing network states appropriately).
- Demonstration of **correctness, precision, limits and multifunctionality** of the **simulation tool**.

## Main requirements

- **Accurate end-to-end computation** of
  - **delays**: The delays computed by the simulator should be sufficiently close to the expected delays resulting from physical components and processing of system software including protocols.
  - **losses**: Situations in which packets will be dropped should closely match situations where losses occur in real systems.
- **Exact fulfillment**: Just these packets which have been computed to be dropped should be dropped, the remaining packets have to be delivered according to the transmission delay calculated by the simulator.
- **Ensure real-time capabilities**: The combination of load generated by applications with artificial load enforces real-time capabilities for the complete simulation system
- **Flexibility regarding the way to calculate losses and delays**:
  - **Analytical models**,
  - **discrete-event simulation** on the basis of queueing networks,
  - and usage of **traces**have already been implemented and tested for models of standard packet-switching networks. (extensions are planned)
- **Combination of real load with load generated artificially**: Different types of load should be combined flexibly to shape the total load that affects the behavior of the simulated network.
- **Flexibility regarding the external interfaces**: The simulator should not be restricted to single protocols or interfaces.

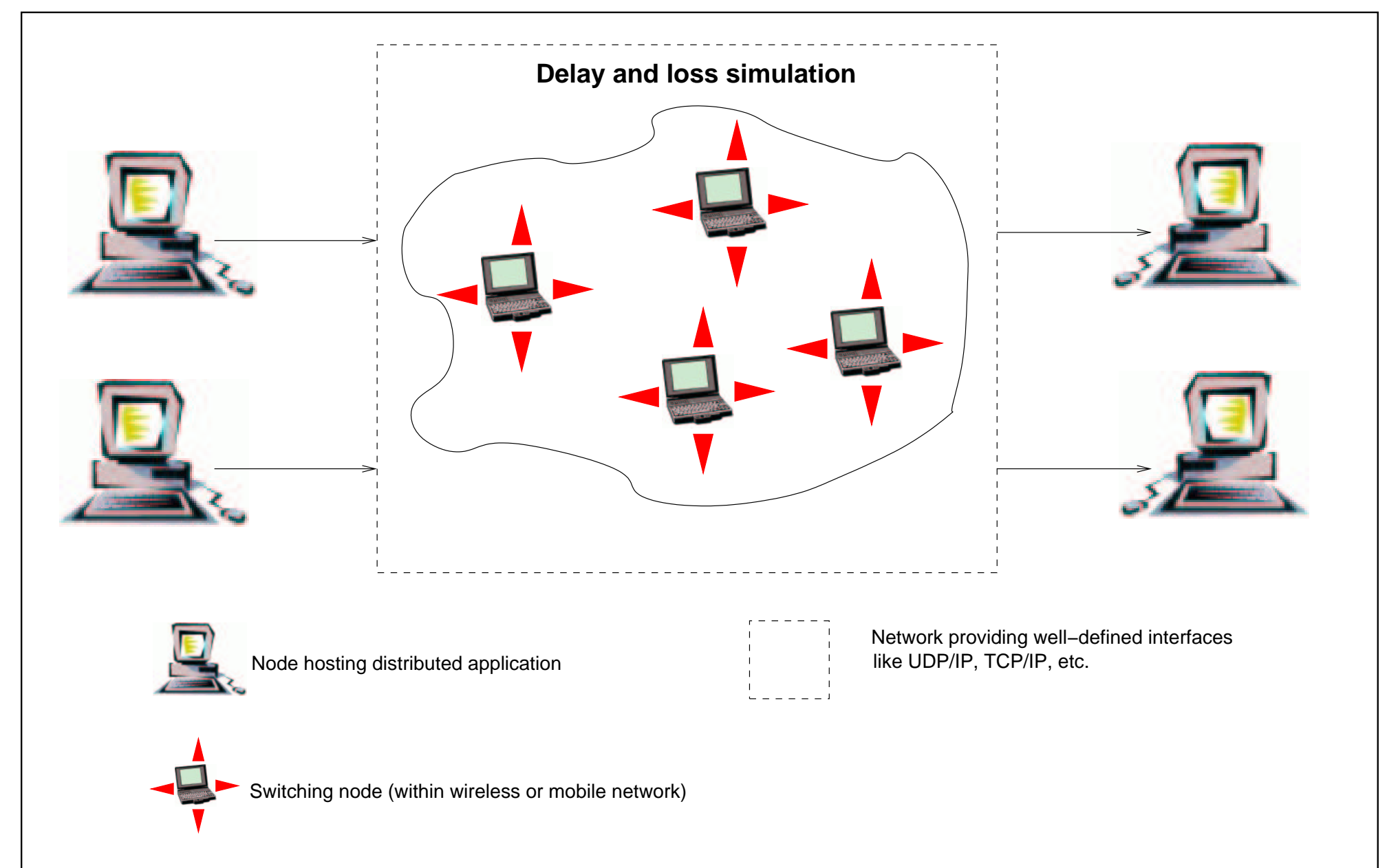


FIGURE 1: **Functionality**: Distributed applications communicating via the simulator can not realize any differences between the network simulator and actual physical networks.

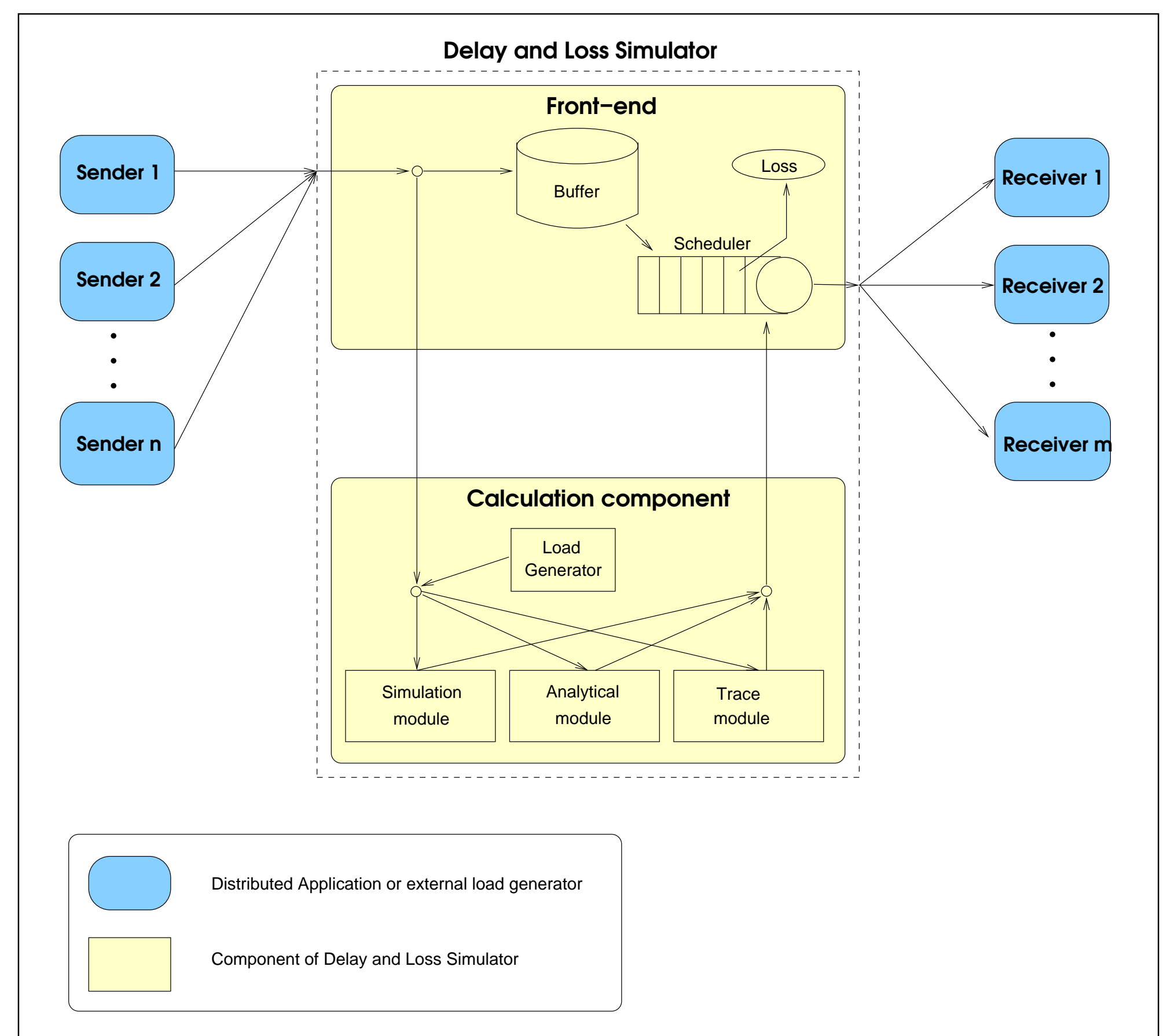


FIGURE 2: **Suggested architecture**: Simulator divided into **Front-end** (providing network interfaces and handling packets) and **Calculation component** (calculating effects on the path of packets through a simulated switching network, in particular, packet delays or losses are determined here).

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## CONTACT:

Christian Scherpe, Jürgen Wolf  
{2scherpe|jwolf}@informatik.uni-hamburg.de  
University of Hamburg  
Vogt-Kölln-Straße 30  
D-22527 Hamburg, Germany