

# **SEDLANE**

## **Simple Emulation of Delays and Losses for Ad hoc Networks Environment**

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# Introduction

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- SEDLANE (Simple Emulation of Delays and Losses for Ad hoc Networks Environment)
  - Simple and easy to implement
  - No specific or expensive networking hardware
  - Controlled and repeatable tests
  - Emulate different ad hoc network parameters (routing protocols, mobility, and TCP throughput) using a small set of emulated variables (delay, loss)
  - Emulating multi-hop wireless ad hoc network (any size) using small number of physical machines

# Related Work

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- User Mode Linux (UML)
  - performance severely reduced, when used to wireless ad hoc network emulations → UML runs in user mode
- MobiEmu, Mobile Network Emulator (MNE)
  - separate device for each emulated wireless host
    - Non-scalable
- ModelNet, MobiNet
  - setup remains complex

# SEDLANE

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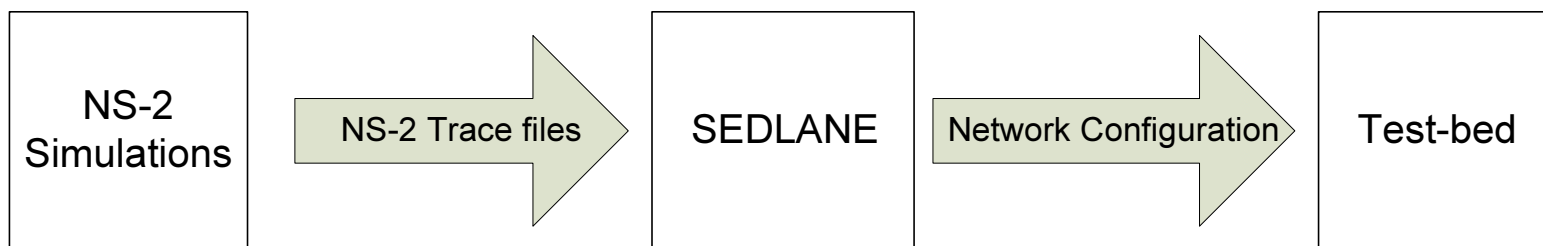
*r*<sub>TCP</sub> is the TCP connection throughput,  
*M* is the maximum packet length,  
*t* is the round trip time of the connection

and *l* is the average loss measured during the lifetime of the connection.

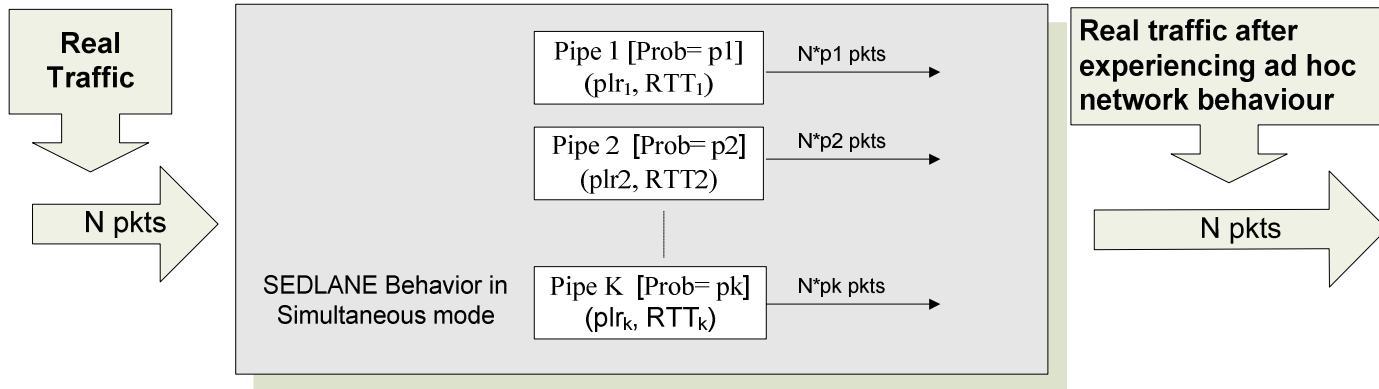
$$r_{TCP} = \frac{1.22 * M}{\tau * \sqrt{l}}$$

**SEDLANE** emulates ad hoc network environment through RTT (Round-Trip delay Time) and data loss rates over the connections.

- NS-2 Trace files → Delay and Loss values
- SEDLANE → Configure *ipfw* traffic pipes
- Dummynet → Data packets traffic shaping tool



# SEDLANE Operation Modes

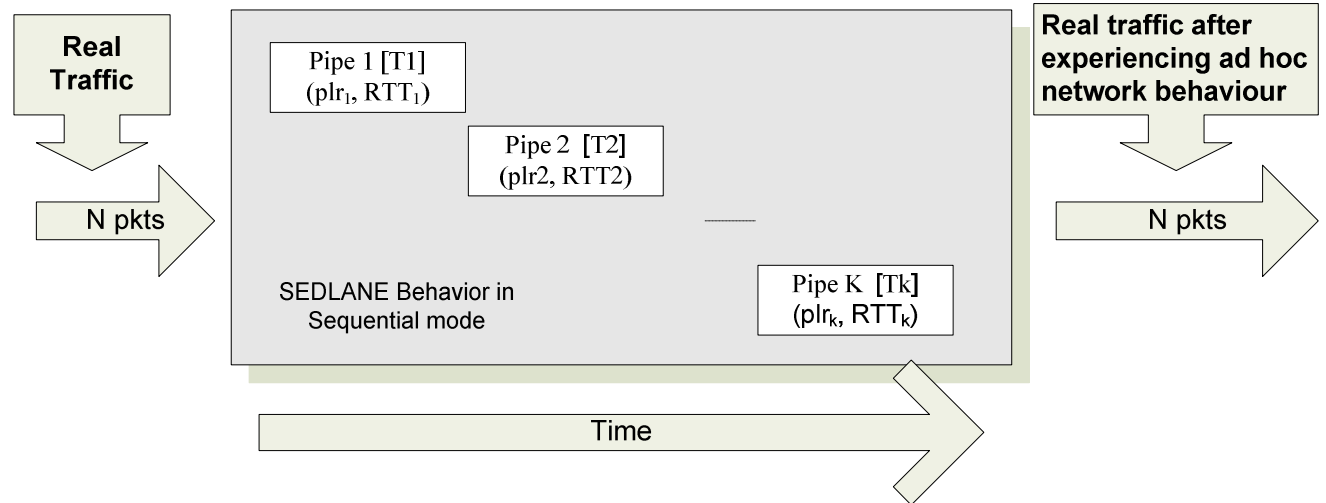


## **Simultaneous operation mode:**

- SEDLANE configures all ipfw rules at the same time, assigning each pipe a different probability value.
- Emulation time is not restricted by the simulation time.

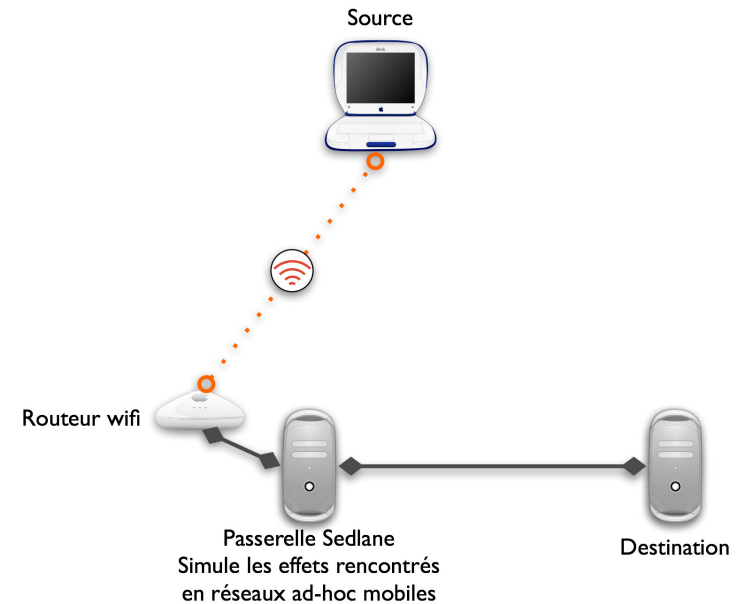
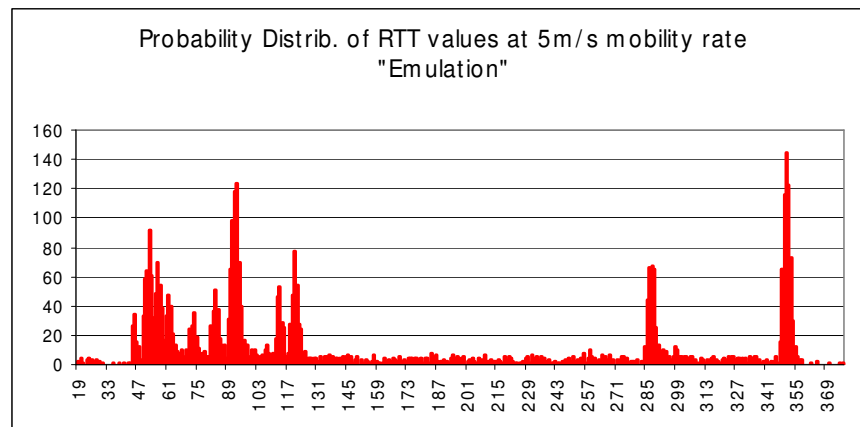
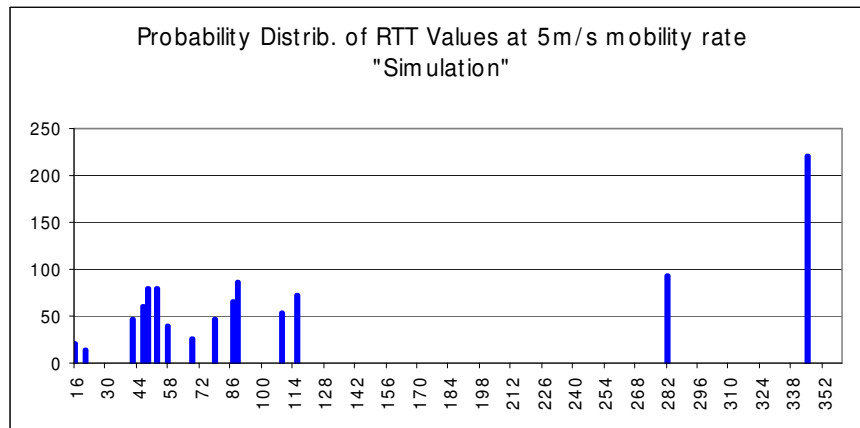
## **Sequential operation mode:**

- SEDLANE configures only one ipfw rule at a time.
- Each rule will be flushed after a certain "lifetime" before a new rule with a new RTT and loss value is configured.
- Emulation time is identical to the simulation time.



# Performance Analysis

## (Simultaneous Operation Mode)



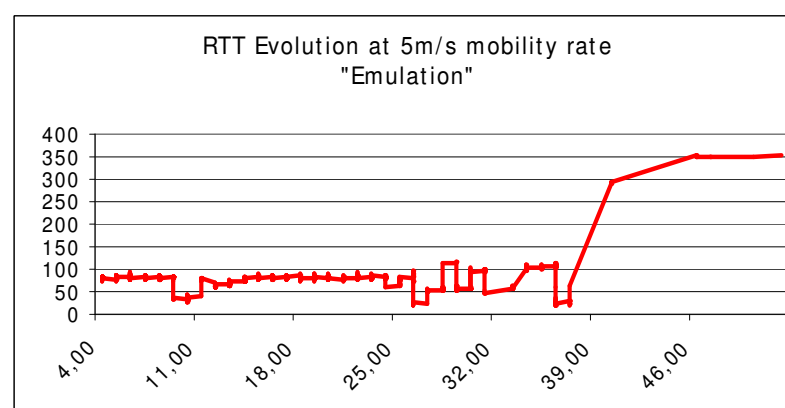
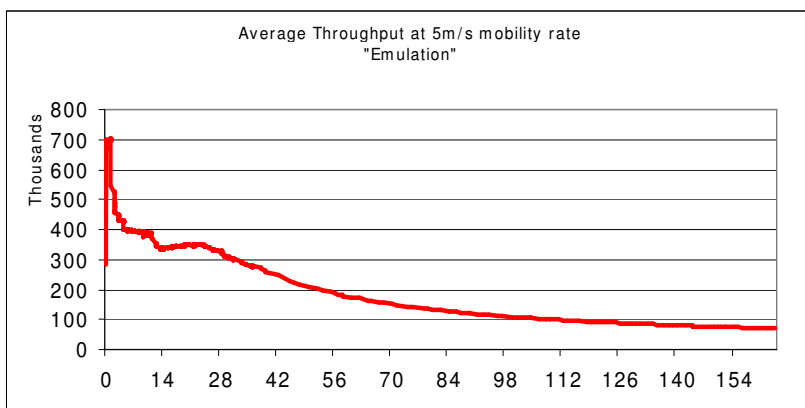
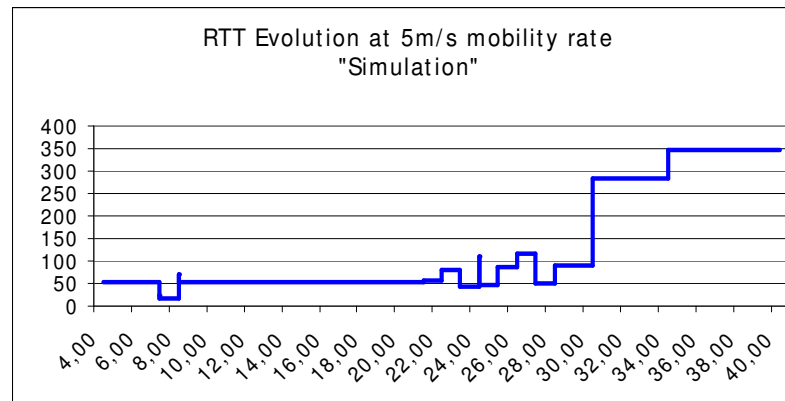
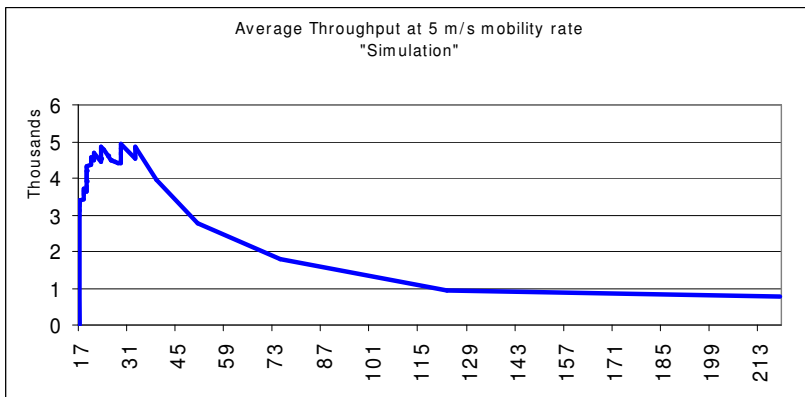
*Validation Test-bed configuration*

***Probability distribution Of RTT values is kept regardless of the amount of data transmitted***

# Performance Analysis

## (Sequential Operation Mode)

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# Conclusion & Future Work

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- Conclusion:

- SEDLANE → capable of emulating the different network parameters and having an accurate network performance.
- SEDLANE → can emulate ad hoc network scenarios and give the same performance in terms of delay and data packet loss as in the network simulator.
- SEDLANE → helps in testing and evaluating many ad hoc network features (such as mobility rates, ad hoc routing protocols, and transmission control protocol).

- Future work:

- Using SEDLANE to evaluate the devices' energy consumption when running specific applications over ad hoc networks.