



Impact of Radio Propagation Models in Vehicular Ad Hoc Networks Simulations

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Outline

- ① Introduction (Context, ...)
- ② Modelling Physical Phenomena
- ③ Propagation models in NS2
- ④ Shadowing-Pattern model
- ⑤ Impact on multi-hop network
- ⑥ Conclusion and future works

Introduction - Ad Hoc Network

- ◉ Wireless Network without base station (infrastructure)
- ◉ Terminal behavior
 - ◉ Transmitter and Receiver of Information
 - ◉ Relay of Information
- ◉ Multi-hops network
- ◉ Organisation, specific routing, ...
- ◉ Mainly: static network or slightly mobile network



Introduction - Car to Car Communication

- ① Ad Hoc Network
- ① High Mobility Network
- ① Big size of Network
- ① Difficulties in delivery (e.g. difference between going and returning)
- ① Using geographical coordinates and angles in order to route information : Geocasting
- ① High level of error transmission



Modelling of Physical Phenomena

- ① **Static obstacles:** buildings, trees, tunnels ...
- ① **Moving obstacles:** other vehicles
- ① **Interferences:** other communications
- ① **Multi-path** propagation
- ① **Speed** effect: mobile devices

- ① **Problem**
 - Multiple error frequencies
 - Various error distribution (different from uniform or random)

Propagation Models in NS2

Existing models

- **Two Ray Ground**: based on a 2-path propagation
- **Shadowing**: based on a random variation (fast-fading emulation)
- **Ray-tracing**: needs to model the environment and is CPU-intensive
- **Experiment-driven**: parameters are defined by a real measurement [Eude, Ducourthial, Shawsky]
- **Yin et al.**: propose an error rate combining fast-fading and Doppler effect

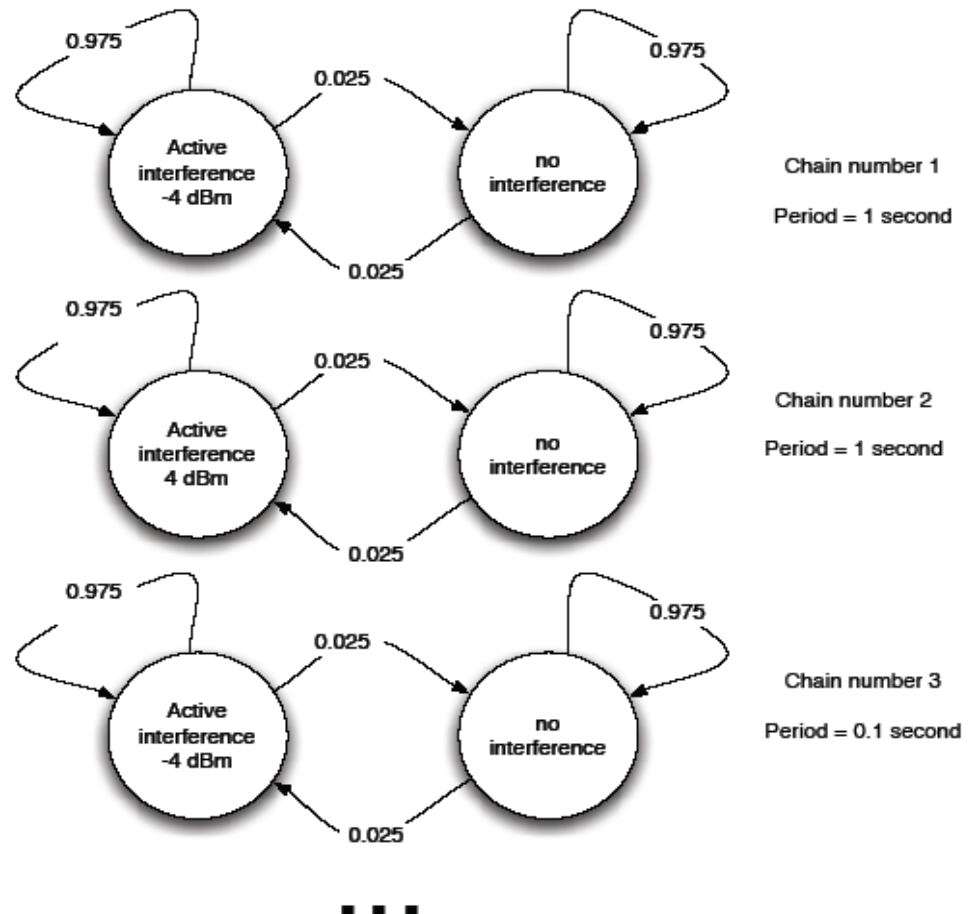
Shadowing-pattern Model

🎯 Methodology

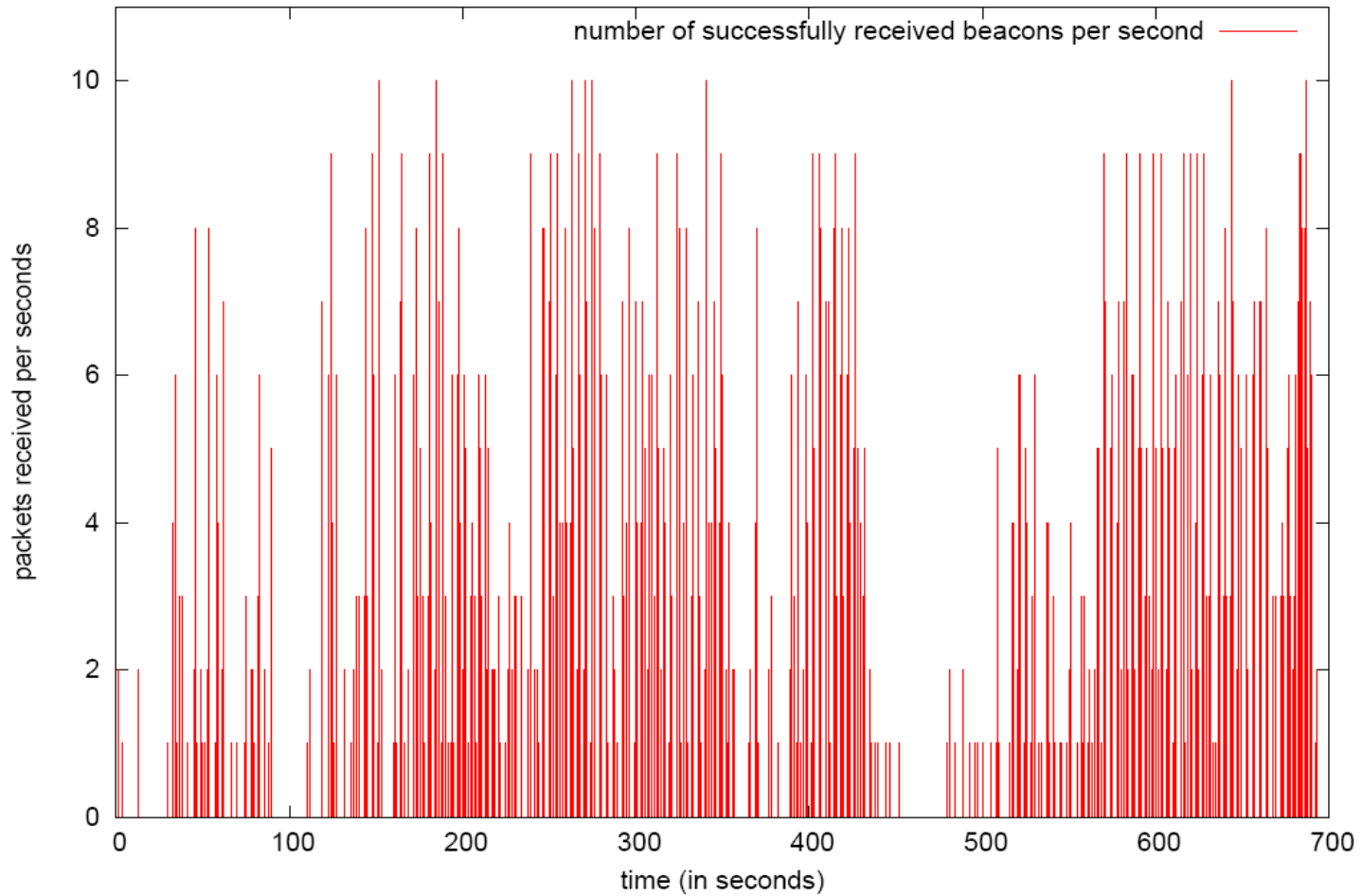
- Real experiment on a urban road with a recording of every transmission
- Analyze of communication including
 - Mean packet drops
 - Distribution of packet drops
- Definition of shadowing-pattern parameters
- Comparison experimental result vs simulation result

Shadowing-pattern model

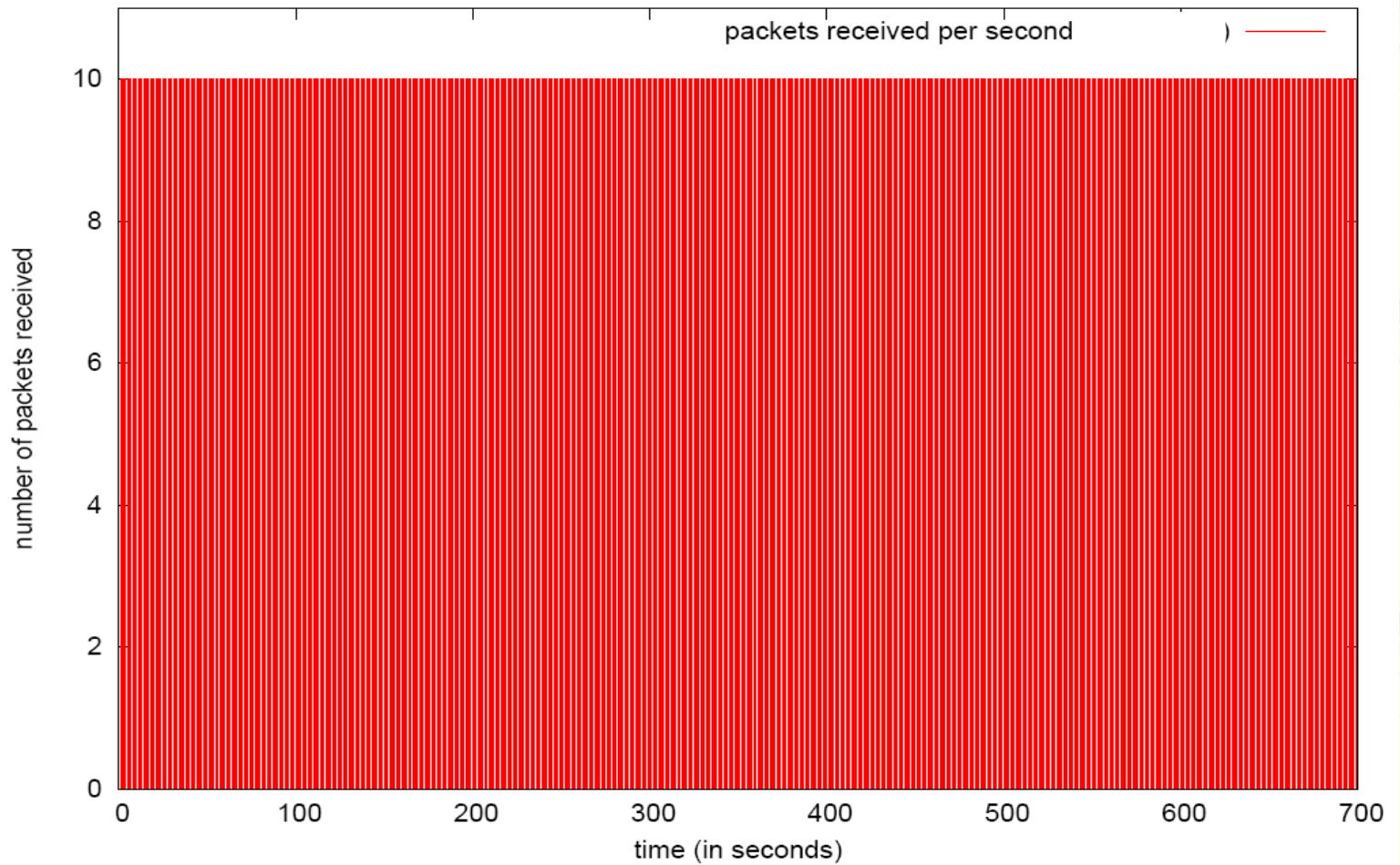
- Set of 2-state Markov chains
- Each pair of Markov chains increases and decreases equally the error rate (same means)



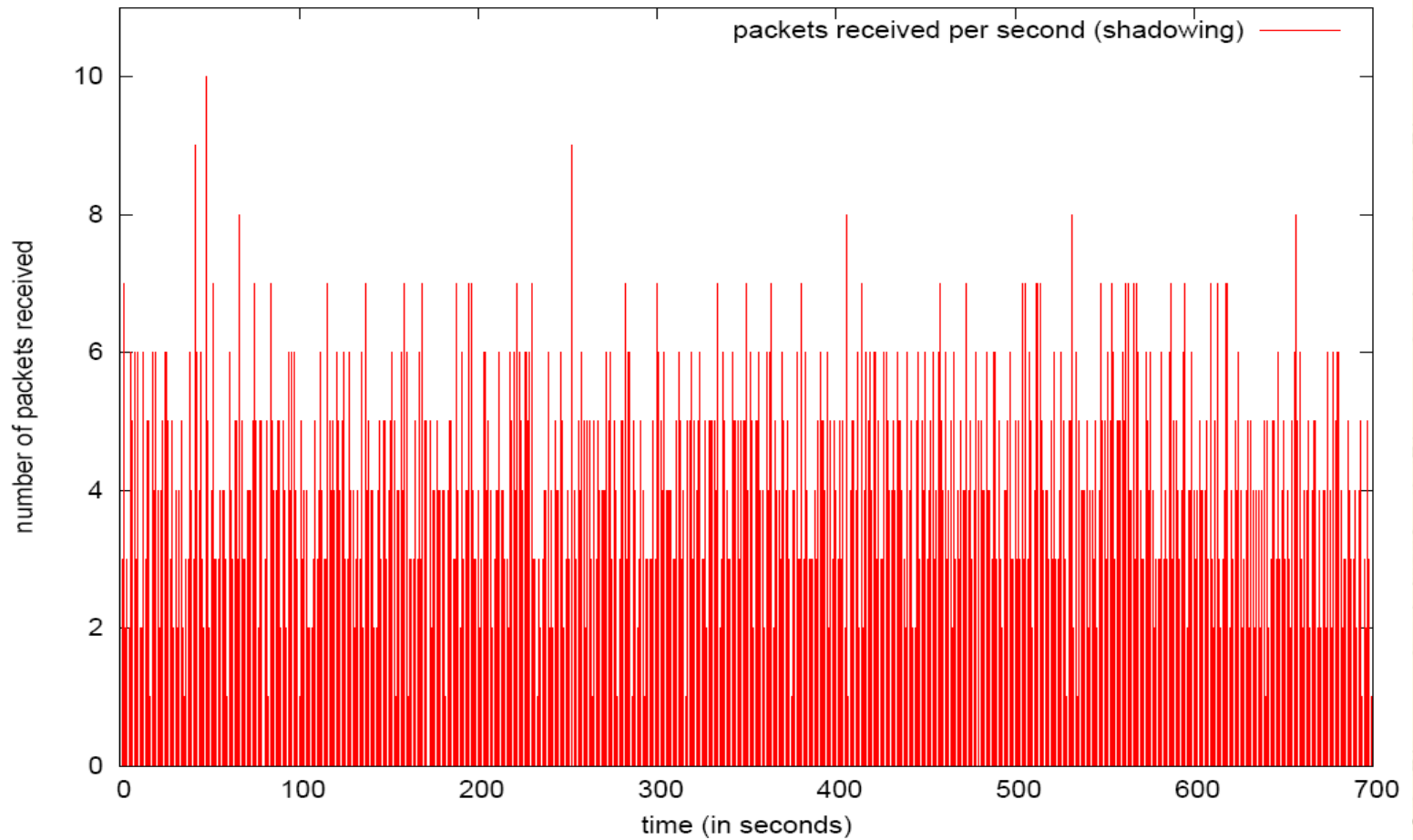
Experimental Results



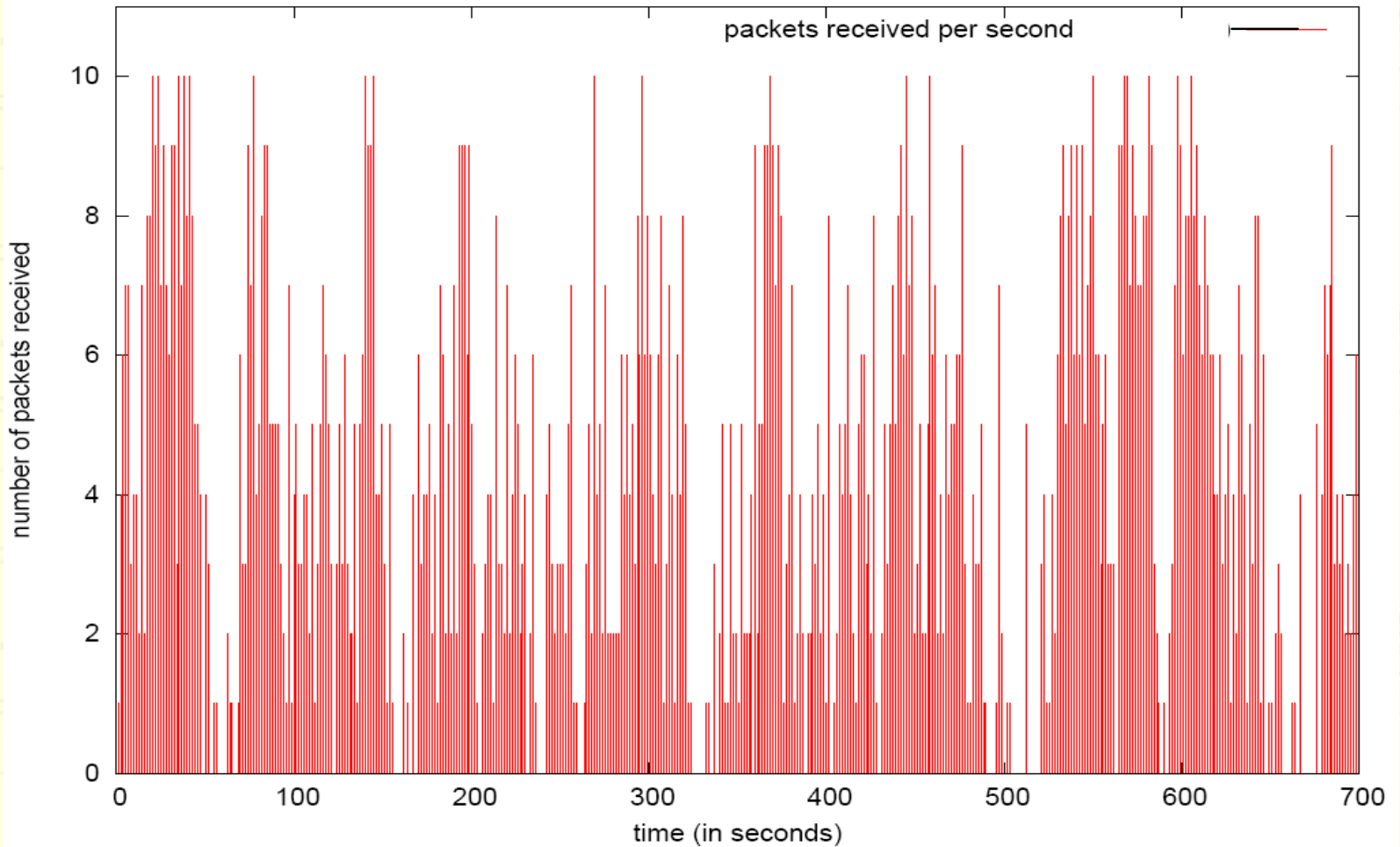
Two Ray Ground Results



Shadowing Results



Shadowing-pattern Results

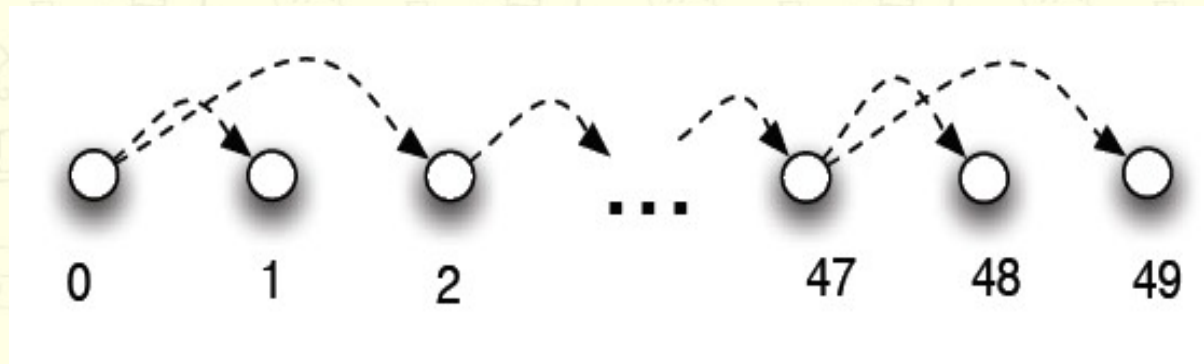


Analyze of Distribution Error

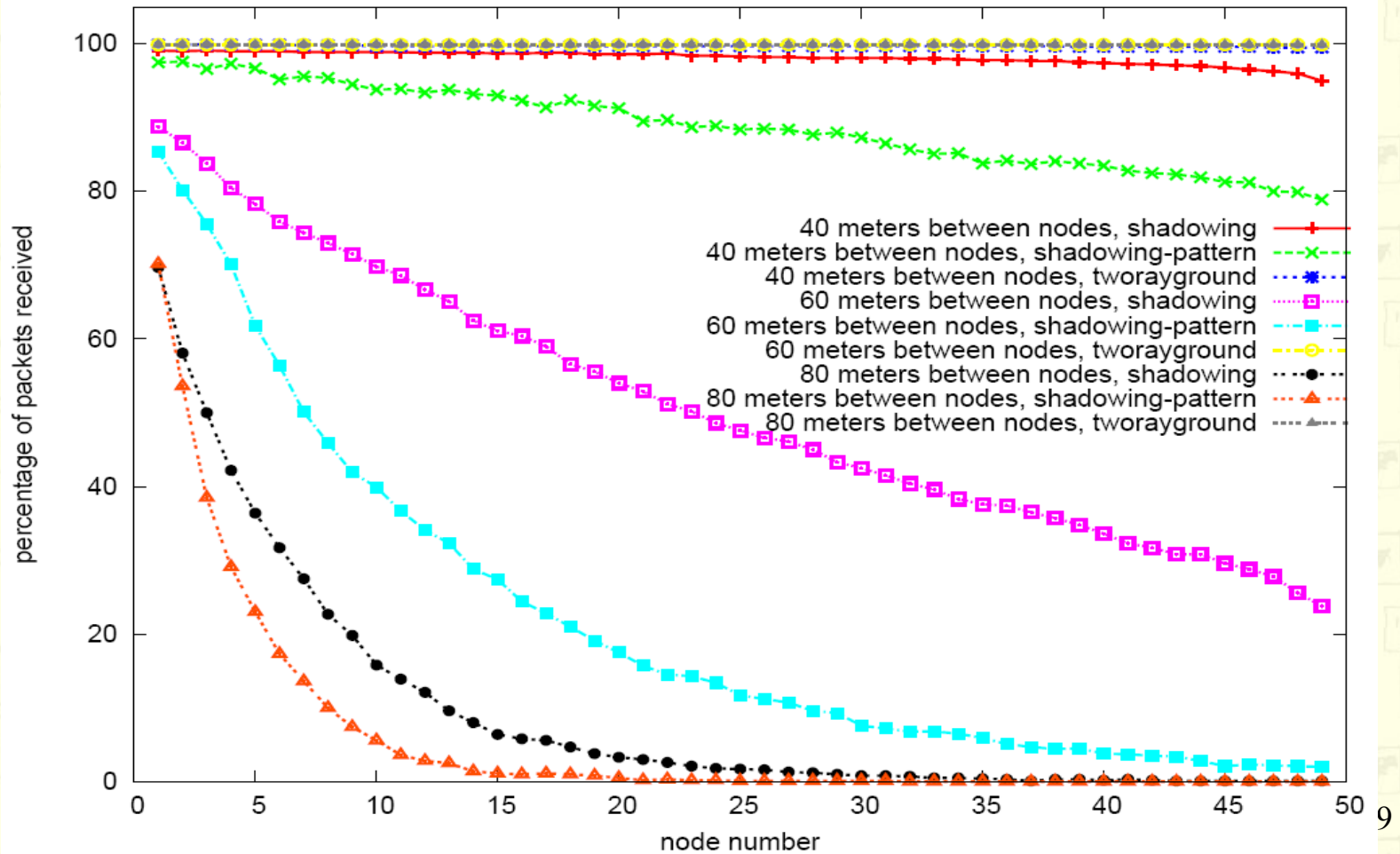
distribution	random	experimental	shadowing	shadowing-pattern
Nearest-neighbor value	0.0320	0.0259	0.0310	0.0247

Simple multi-hop network

- Chain of 50 nodes
- Distance between each node
 - 40 meters
 - 60 meters
 - 80 meters



Results



Conclusion and future works

- ① Burst of Losses has an impact on communications and decrease significantly performances
- ① Shadowing-pattern model is near from realistic propagation behavior
- ① VANET simulations must integrate this type of propagation model
- ① Loss behavior is global in our model, we want to add a location parameter in our model.