Exploiting the Height of Vehicles in Vehicular Communication

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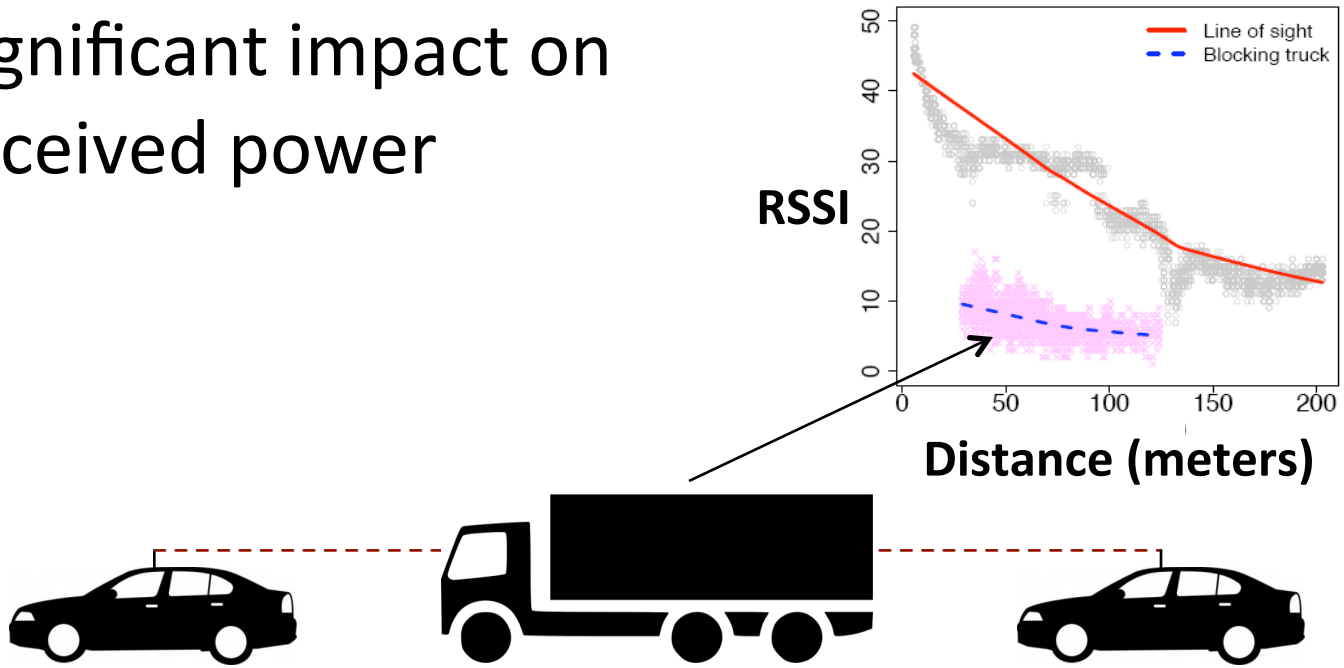
Outline

- Motivation
- Method
  - Experiments
  - Model
- Results
- Conclusion

Motivation

- Vehicles obstruct V2V communication [1, 2]
- Significant impact on received power



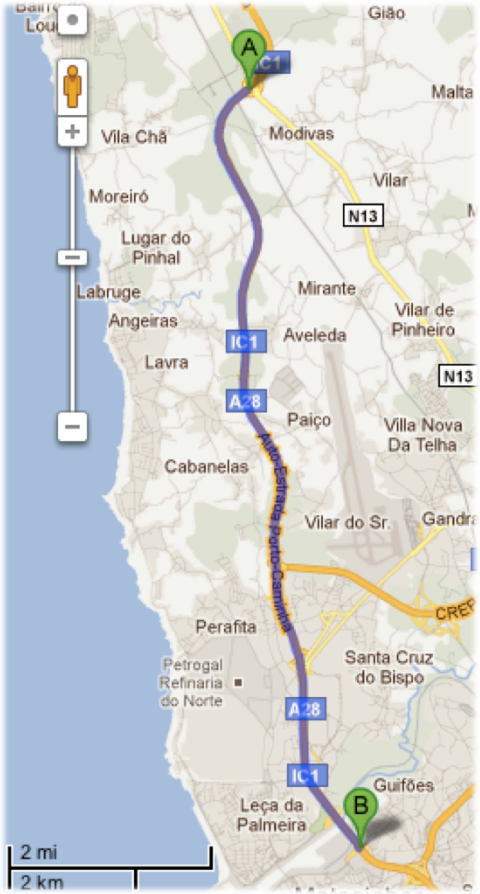
[1] M. Boban et al.: 'Impact of Vehicles as Obstacles in Vehicular Ad Hoc Networks', IEEE JSAC, Jan 2011.
[2] R. Meireles et al.: 'Experimental Study on the Impact of Vehicular Obstructions in VANETs', VNC 2010.

Idea

- Use tall vehicles as next hop relays
- Important: tall vehicles ≥ short vehicles + 1 m
- How much adverse shadowing can we avoid by choosing tall vehicles as next hops?

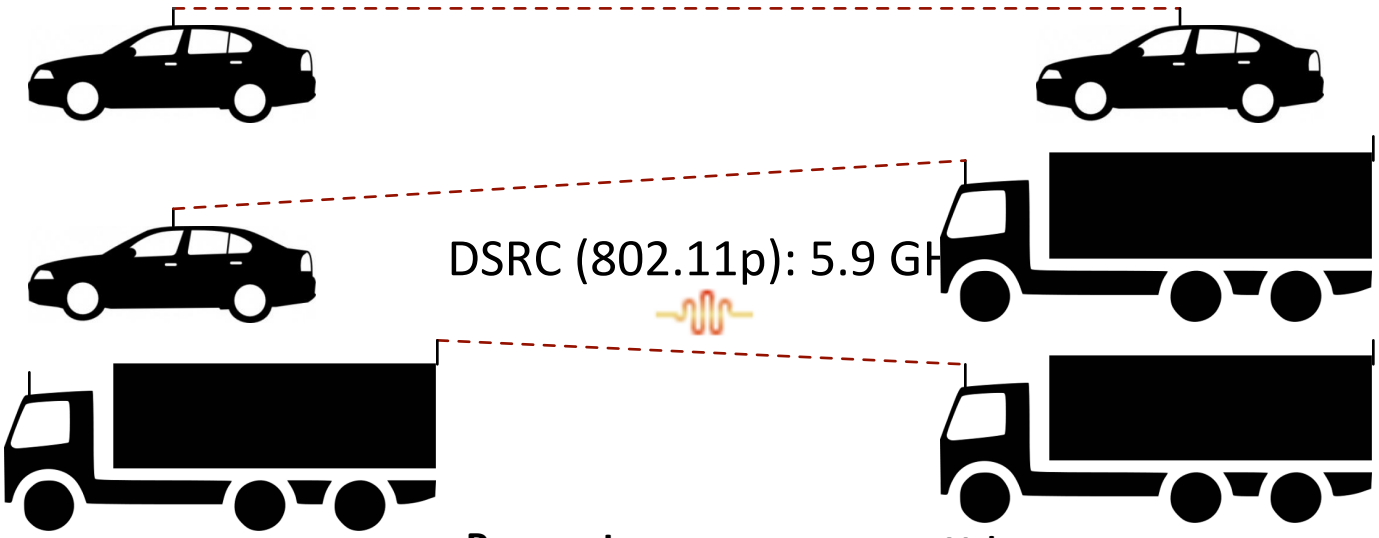
Method

- Perform small-scale experiments
- Implement realistic model
- Use same location
- Extend measurements using model



(c) Google Maps

Experiment Setup



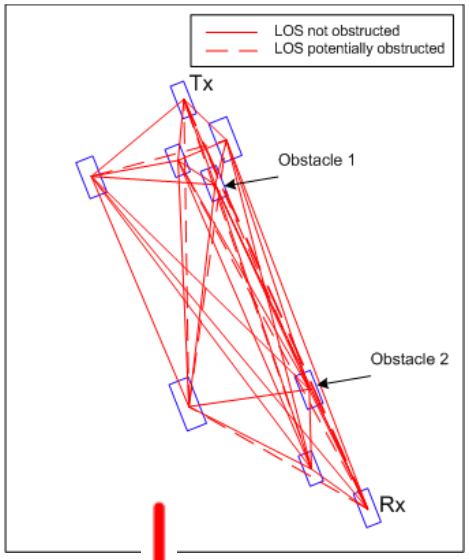
Parameter	Value
Channel	180
Center frequency (MHz)	5900
Bandwidth (MHz)	20
Data rate (Mbps)	6
Antenna gain (dBi)	5
Tx Power (dBm)	10
Beacon frequency (Hz)	10

Experiment Setup

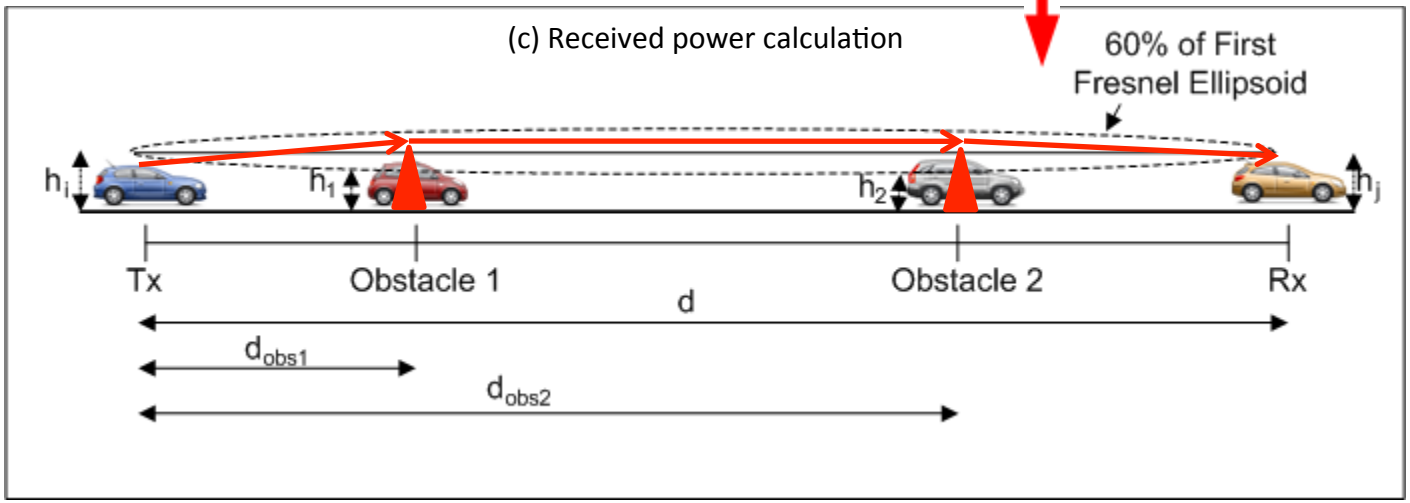
Model for evaluating the impact of vehicles [1]

(a) Stereoscopic aerial photography

(b) Abstracted model showing possible connections



(c) Received power calculation

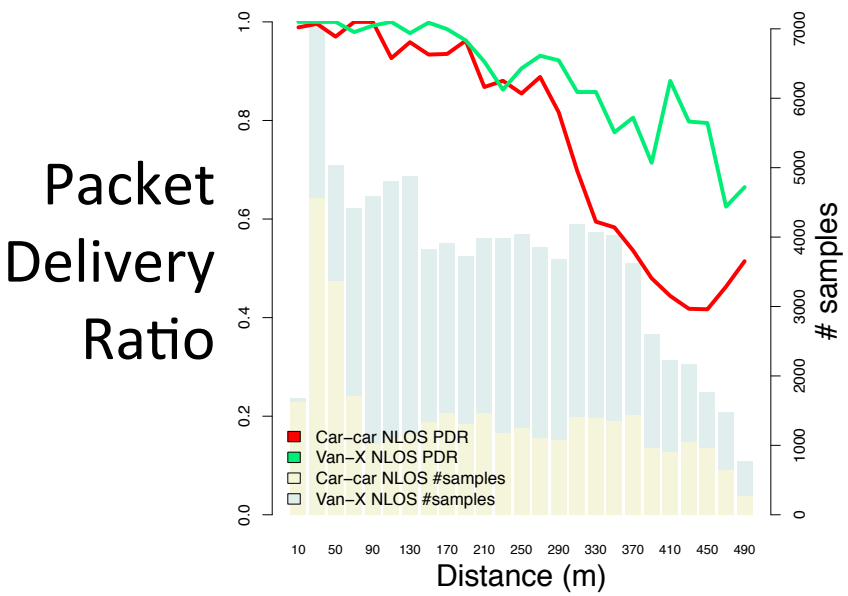


[1] M. Boban et al.: 'Impact of Vehicles as Obstacles in Vehicular Ad Hoc Networks', IEEE JSAC, Jan 2011.

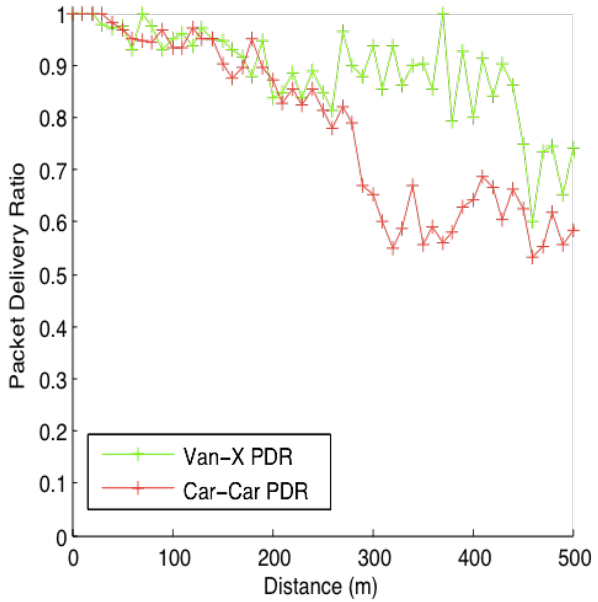
Results: PDR (NLOS)

- Good match between measurements & model

Red: Car-Car Green: Van-X



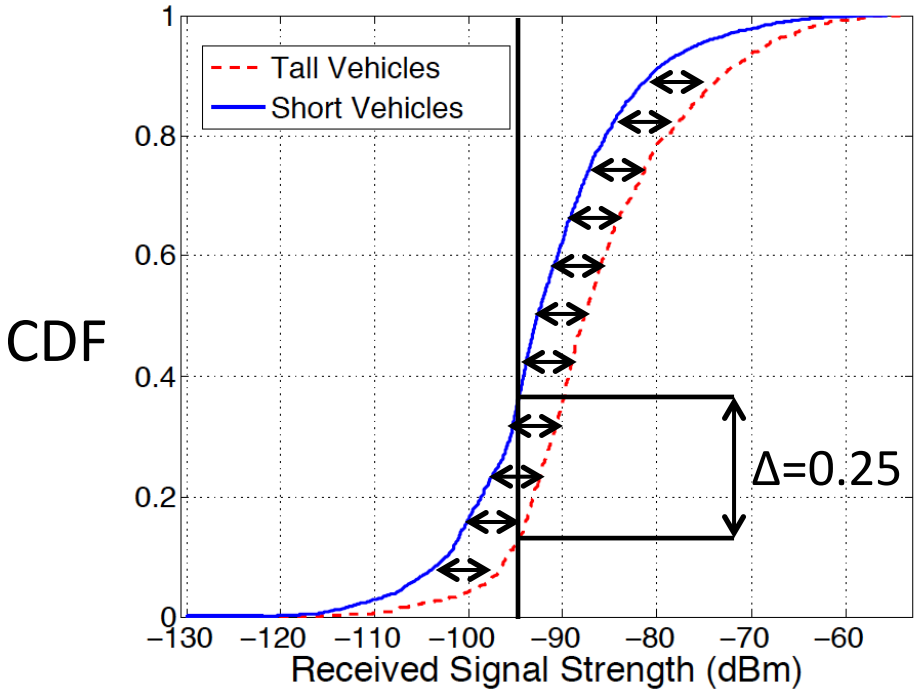
Measurements



Model

Results: Received Power

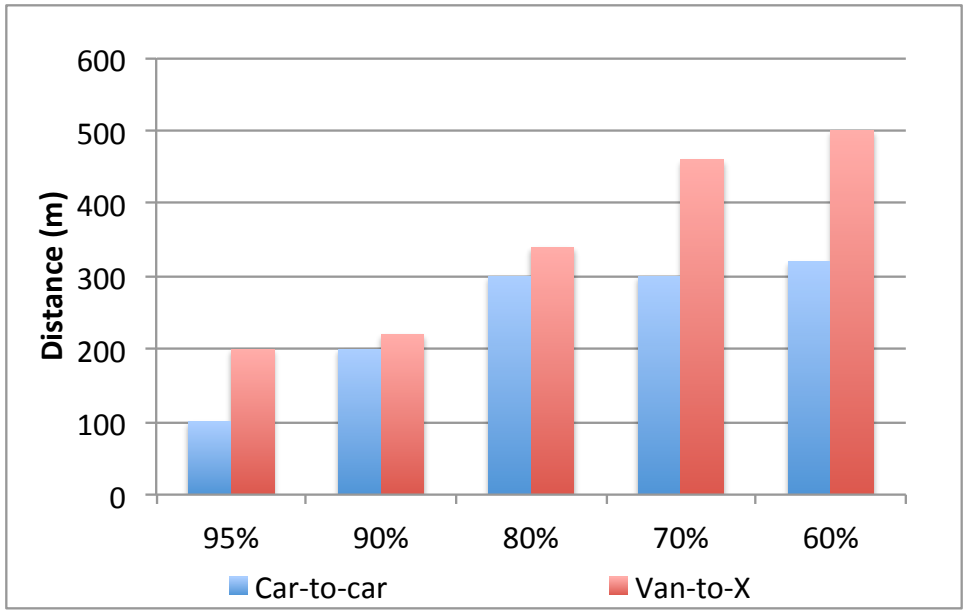
- Approximately 5 dB difference throughout
- For -95 dBm recv. sens., 25% more packets



Results: Effective Range

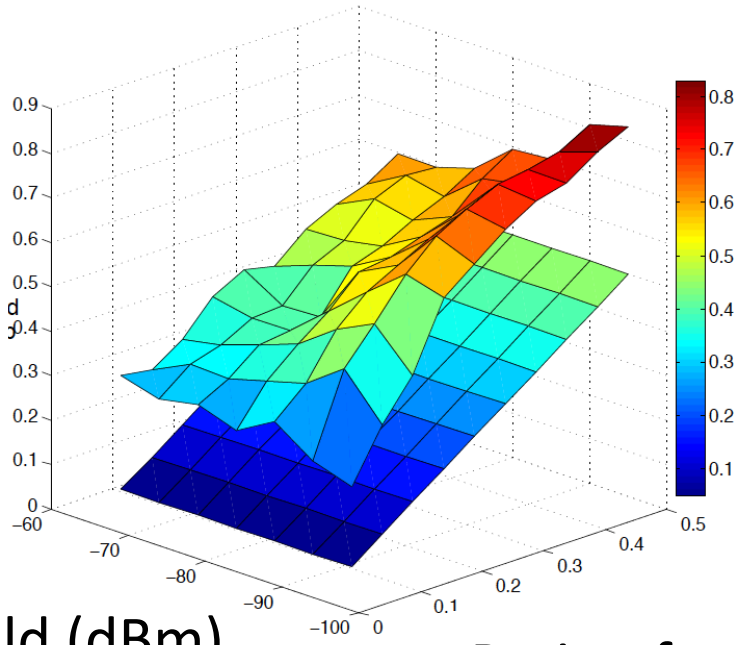
- Min: 20 meter increase for 90% delivery rate
- Max: 190 meters for 60% delivery rate
- Avg: 100 meters increase

Distance (meters)



Best Next Hop

- Largest number of second hop neighbors for farthest tall and farthest short vehicle



Conclusions

- Tall vehicles significantly improve:
  - Received signal power (**5 dB** on average)
  - Packet delivery ratio (**up to 30%**)
  - Effective communication range (**10% to 50%**)
- Can be used to enhance different routing protocols (overhead: 1 bit)
- Need two antennas on tall vehicles
- Correlate distance with vehicle type

Thank you

Questions?

Data will be available at http://drive-in.cmuportugal.org

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