

# A Multi-Channel IEEE 1609.4 and 802.11p EDCA Model for the Veins Framework



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# Veins - Vehicles in Network Simulation

## Features up to now

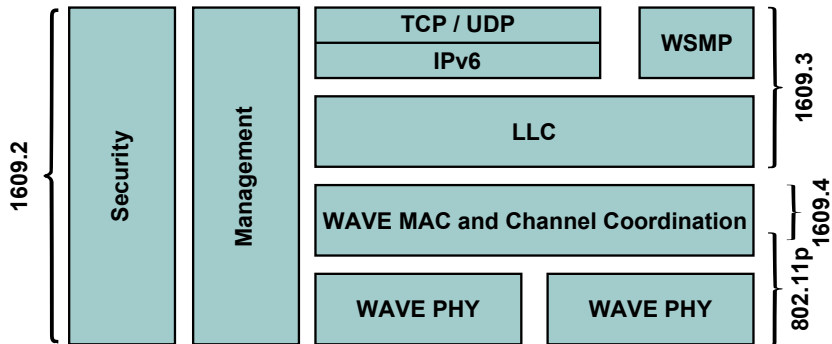
- Realistic movement patterns [1,2,3]
  - ▶ Crowd-Sourced Geo-data
  - ▶ Validated city-scale mobility by using SUMO [3]
  - ▶ Bidirectionally coupled simulation [1]
- Representation of the physical layer
  - ▶ Line-of-sight propagation [4]
  - ▶ Non-line-of-sight propagation [4]
  - ▶ Detailed interference computation
- Mac Layer?
  - ▶ 802.11b MiXiM models

[1] C. Sommer, R. German, and F. Dressler, "Bidirectionally Coupled Network and Road Traffic Simulation for Improved IVC Analysis," IEEE Transactions on Mobile Computing, January 2011  
[2] F. Dressler, C. Sommer, D. Eckhoff, and O. K. Tonguz, "Towards Realistic Simulation of Inter-Vehicle Communication: Models, Techniques and Pitfalls," IEEE Vehicular Technology Magazine, September 2011.

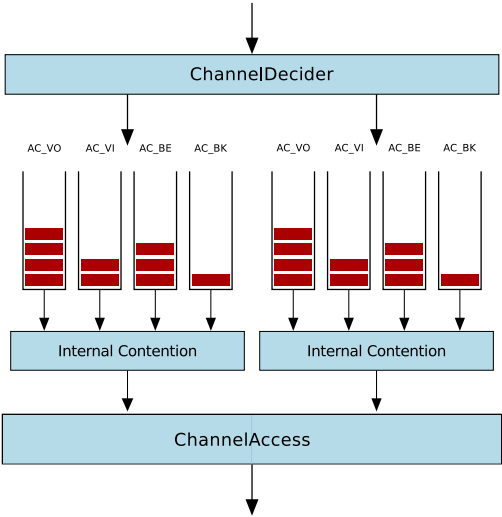
[3] Uppoor, Sandesh and Fiore, Marco, "Large-scale Urban Vehicular Mobility for Networking Research," Proceedings of 3rd IEEE Vehicular Networking Conference (VNC 2011), Amsterdam, Netherlands, November 2011

[4] C. Sommer, D. Eckhoff, R. German, and F. Dressler, "A Computationally Inexpensive Empirical Model of IEEE 802.11p Radio Shadowing in Urban Environments," in 8th IEEE/IFIP Conference on Wireless On demand Network Systems and Services (WONS 2011), Poster Session.

# WAVE Protocol Stack



# 1609.4, EDCA, 802.11p



# Veins - Vehicles in Network Simulation

New! Full-Featured IEEE 1609.4 and IEEE 802.11p Mac Layer

## Features

- The whole package (It makes a difference! [5])
- Detailed representation of the standard
  - ▶ Correct Timings and Parameter values
- Full EDCA functionality
- 1609.4 Channel Switching
- Computationally efficient
- 802.11p validated Bit Error Models [6]
- Full representation of the PHY packet format with all timings
- Open Source, available in Veins2.0rc2 at <http://veins.car2x.org/>

[5] D. Eckhoff, C. Sommer, and Falko Dressler, "On The Necessity of 802.11p models for IVC Simulation," in 75th Vehicular Technology Conference VTC2012-Spring, Tokyo, Japan, May 2012  
[6] P. Fuxjaeger, A. Costantini, D. Valerio, P. Castiglione, G. Zacheo, T. Ze-men, and F. Ricciato, "IEEE 802.11p Transmission Using GNURadio," in 6th Karlsruhe Workshop on Software Radios (WSR), Karlsruhe, Germany, March 2010

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## What can I do with it?

- Simulation of multi-channel applications
- Safety application evaluation regarding 1609.4 latencies
- Protocol simulation with
  - Realistic throughput
  - Validated path loss models
- Play around and have fun with it

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**Thanks!**

See you at my poster!

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