

# IEEE TCSIM Newsletter

Quarterly Newsletter- Issue 10 – Sept 2011



## Chair's Message by Dr. Dave Cavalcanti

Dear TCSIM Colleagues,

Welcome to the Q3 2011 issue of the TCSIM newsletter. This issue includes a new section compiling the latest on industry trends and news prepared by our editorial team. We encourage our readers to help us keep this new section more interesting and up to date by contributing with ideas and news links. I'd also congratulate the TCSIM student award winners at CGAMES and CMSB 2011.

The technical article in this issue describes a simulation platform for cognitive radio networks vehicular environments (CRVs). The proposed simulation tool enables more accurate modeling of vehicular mobility, network capabilities and cognitive radio functions. Last but not least, I'd like to remind you of our IEEE Computer Magazine special issue on "Modeling and Simulation of Smart and Green Computing Systems." Submissions will be accepted until March 1<sup>st</sup> 2012. Enjoy the reading!

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## TCSIM Mailing list

In order to facilitate communication and information sharing with TC members, a new TCSIM mailing list has been created using the IEEE Listserv system.

To send a message to the new TCSIM list, just send mail to

[TCSIM@LISTSERV.IEEE.ORG](mailto:TCSIM@LISTSERV.IEEE.ORG)

If you are not currently subscribed to the list please send a message to Prof. Kaushik Chowdhury at [krc@ece.neu.edu](mailto:krc@ece.neu.edu) who is currently managing all the subscriptions to the new TCSIM list. You can also search for the TCSIM list at

<http://listserv.ieee.org/>

We hope you can make use of this new list to share simulation related information with the TCSIM community.

## Editorial Board

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# Simulating Cognitive Radio Vehicular Networks:

## A New Integrated Approach

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Frequency agile networks enabled by “cognitive radio” (CR) technology promise high spectrum utilization and cost-effective spectrum use by transmitting in licensed frequencies that are currently unoccupied [1]. Vehicles equipped with such radios, called as CRVs, will usher in new high-bandwidth multimedia entertainment systems, public safety applications, vehicle to vehicle communication, among others. As deploying and testing CRVs involve high costs and considerable implementation complexities, there is a need to develop powerful and comprehensive simulation platforms.

A simulation tool for CRV should provide an accurate modeling of:

- Vehicular mobility, i.e. reproduce the drivers' behavior (through models of car-following, lane-changing, etc) and the components of the vehicular environment (e.g. intersections, traffic-lights, etc)
- Networking capabilities, i.e. implement existing protocols stacks for vehicular communications (e.g. the 802.11p [2]), and consider realistic propagation models in presence of buildings and obstacles
- CR functions, i.e. implement spectrum sensing to ensure that licensed users are not affected during the operation of the CRVs.

Several mobility generators have been proposed in the literature of vehicular networks (e.g. SUMO [3], MOVE [4], STRAW [5], VanetMobiSim [5]), among others. In most cases, these tools take as input the road topology which can be imported by digital maps (e.g. OpenStreetMap [6]), and produce as output a mobile trace describing the locations of each vehicle at each simulated interval. The mobility trace can then be imported into a network simulator, which models the characteristics of communication among vehicles, including: channel propagation models, MAC protocols, routing, transport and application protocols [7].

Our proposed simulator is a first step in this direction, building on the *ns-2 CRAHN* tool [8], which extends the NS2 tool with additional models for the simulation of CR networks. The *ns-2 CRAHN* model includes: (i) a trace-driven model of PU activity, (ii) a model of the cognitive functions undertaken by each CR, which includes the spectrum sensing, spectrum mobility and spectrum decision modules, and a (iii) cross-layer information repository that allows users to implement spectrum-aware policies at network and transport layers. Our extensions for the CRV environment [9] involve importing the mobility traces produced by SUMO.

The structure of the CRVs simulator is depicted in Figure 1. Here the map traces are imported from OpenStreetMap and used in SUMO to produce the mobility traces of each vehicle. Then, the mobility traces are imported into *ns-2 CRAHN*, and used to retrieve the location of each vehicle at instance of the simulation time. Moreover, this simulator discussed in [9] provides an additional propagation model, which considers the fading effect caused by buildings in the current scenario (the location of the building is included in the map). As a result, it is possible to evaluate the sensing accuracy of the licensed users by moving vehicles in outdoor scenarios.

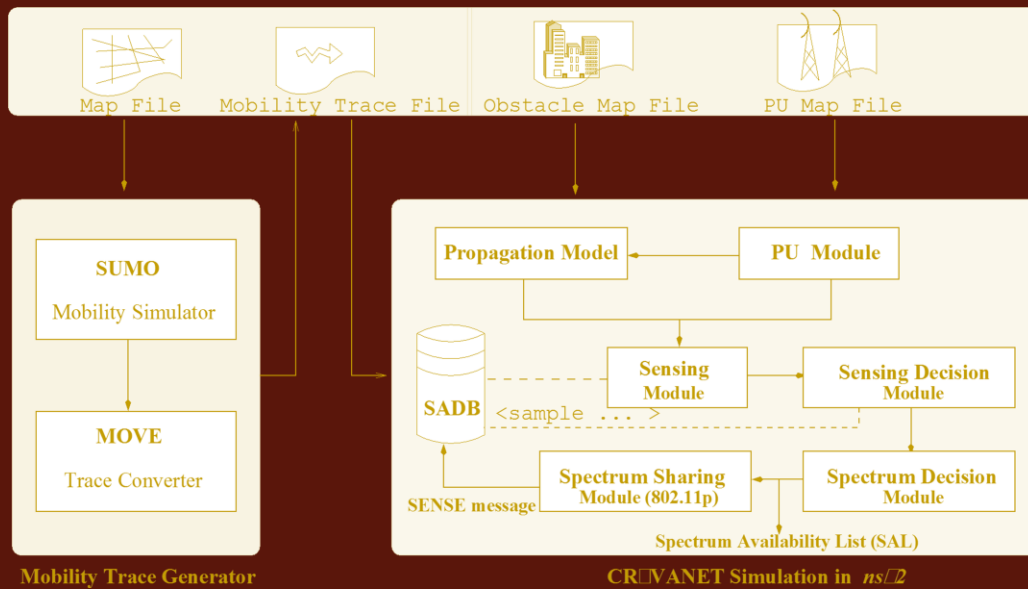


Figure. 1. A new simulator tool design for vehicular CR networks [9]

Our preliminary testing of this simulator tool involved investigating three scenarios for cooperative vehicle-vehicle networks, namely, Cog-V2V. This cooperative framework is facilitated by our proposed simulator tool, which can counter the effects of fading due to tall buildings in the vehicle path. We consider a street portion of 1 km, divided into cells of 100ms. The vehicles move on two lanes (one for each direction) with speed of less or equal to 15m/s. The licensed spectrum band is divided into 5 channels, and a TV broadcast may occupy in each channel. Such licensed or primary user (PU) transmits with a power of 27 dBm. We place six clusters of buildings at the side of the street, whose impact on the wireless channel is accurately captured by our tool.

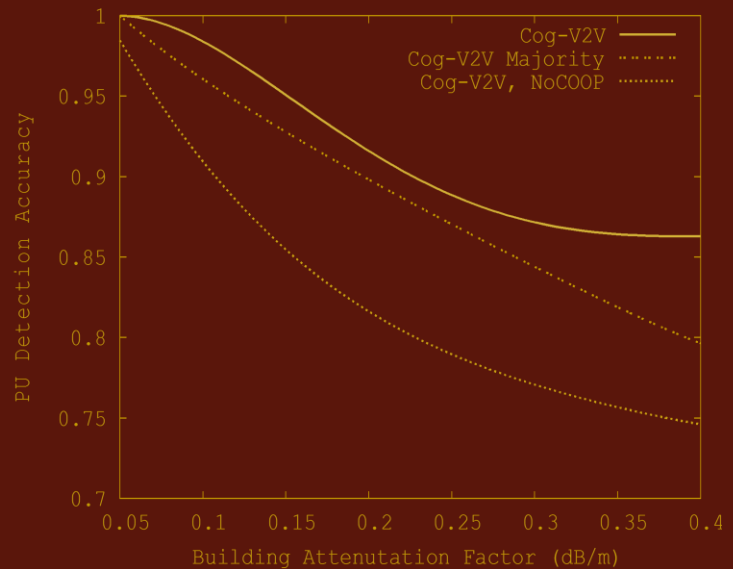


Figure 2. The performance of our simulator tool for different cooperation scenarios.

When vehicles sense the spectrum without any cooperation, the Doppler shift due to movement, as well as the multipath caused by the buildings, cause high level of errors (NoCOOP). A simple scheme for cooperation, such as running a majority-voting rule on all the sensing results of the vehicles within a single cell, slightly improves the performance (Majority).

However, the best results are obtained when a distance-based merging rule is used, i.e., the result of a neighboring vehicle is factored in the final decision. We calculate a ratio of a vehicle's individual distance from the other nodes reporting the sensing results, to the maximum possible distance of cooperation, i.e., the length of a cell. The inverse of this ratio becomes the weight for combining the results of the neighbors, where uncorrelated vehicle measurements are used to avoid group-fading effects.

### References:

[1] I. F. Akyildiz, W. Y. Lee, M. C. Vuran, and S. Mohanty. Next generation/dynamic spectrum access/cognitive radio wireless networks: A survey. *Computer Networks (Elsevier)*, 50(1):2127– 2159, 2006.

[2] Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications: Wireless Access in Vehicular Environment. *Ieee std 802.11p/d7.0*, 2009.

[3] Simulation of Urban MObility (SUMO) Project. Website: <http://sumo.sourceforge.net>.

[4] MObility model generator for VEhicular networks.

Website:  
<http://lens1.csie.ncku.edu.tw/move/index.htm>.

[5] STreet RAndom Waypoint (STRAW) Project.

Website:  
<http://www.aqualab.cs.northwestern.edu/projects/straw/index.php>.

[6] OpenStreetMap project. Website:  
<http://www.openstreetmap.org/>.

[7] F. Martinez, C. K. Toh, J.-C. Cano, C. T. Calafate, and P. Manzoni. A survey and comparative study of simulators for vehicular ad hoc networks (vanets). *Wireless Communications and Mobile Computing*, 99(7):1189–1212, 2009.

[8] M. Di Felice, K.R. Chowdhury, W. Kim, A. Kessler, and L. Bononi. End-to-end protocols for cognitive radio ad hoc networks: An evaluation study. *Performance Evaluation (Journal)*, (9):859–875, 2011.

[9] M. Di Felice, K.R. Chowdhury, and L. Bononi. Cooperative spectrum management in cognitive vehicular ad hoc networks. *IEEE Vehicular Networking Conference, Amsterdam, November 2011*.



## EYE ON IT Current Industry Trends

Sandia tool puts disaster models into one picture

<http://gcn.com/Articles/2011/09/12/Sandia-SUMMIT-unified-disaster-modeling.aspx?Page=1>

## Upcoming Events

### PCCC 2011

IPCCC 2011 - 30th International Conference on Performance Computer Communication Conference, Nov 17 to 19, Orlando, FL, [www.ipccc.org](http://www.ipccc.org)

### ISSPIT 2011

ISSPIT 2011 - 2011 IEEE International Symposium on Signal Processing and Information Technology, Dec 14 – 17, Bilbao, Spain. <http://www.isspit.org/isspit/2011/>

### MASS 2011

8th IEEE International Conference on Mobile Adhoc and Sensor Systems  
Oct 17-22, Valencia, Spain, <http://mass2011.upv.es/>

### SEGAH 2011

1st International Conference on Serious Games and Applications Health  
<http://www.ipca.pt/segah2011/>

## TCSIM Awards

### CGAMES 2011: TCSIM best student paper award

<http://www.cgamesusa.com/11/index.php>

1. Bee Prepared: Simulating Bee Vision in an Educational Game.  
Authors: Jeremy Long and Amy A. Gooch
2. Karido: A GWAP for Telling Artworks Apart  
Authors: Bartholomäus Steinmayr, Christoph Wieser, Fabian Kneißl and François Bry
3. Procedural Generation of Story-Driven Maps  
Authors: Elizabeth A. Matthews and Brian A. Malloy

### CMSB 2011

<http://contraintes.inria.fr/CMSB11/>

1. "Evaluation of design strategies for time course experiments in genetic networks: the XlnR regulon in *Aspergillus niger*"  
Authors: Jimmy Omony, Astrid R. Mach-Aigner, Leo H. De Graaff, Gerrit Van Straten and Anton J.B. Van Boxtel. has been nominated for the Best Student Paper award by the Programme Committee of the CMSB 2011 conference.

## Call for Papers: Special Issue on Modeling and Simulation of Smart and Green Computing Systems

**Final submissions due:** 1 March 2012

**Acceptance notification:** 1 May, 2012

**Final papers due:** 31 May 2012

**Publication date:** September 2012



Sustainable and efficient utilization of available energy resources is perhaps the fundamental challenge of the current century. Academic and industrial communities have invested significant efforts in developing new solutions to address the energy efficiency challenges in several areas from IT and telecommunications, to green buildings and cities, and smart grid.

Large scale and complex computing control and communication systems play a key role in almost all of these areas. Modeling and simulation methodologies for such complex and large-scale systems are necessary for comprehensive performance evaluation that precedes costly prototyping activities.

This special issue aims to disseminate the latest advances in modeling and simulation of smart and green computing systems, which are critical from the viewpoints of sustainable economic growth and environmental conservation. This special issue focuses on methodologies, simulation tools and techniques for evaluating computing, control and communication systems for achieving energy efficiency leading to long-term sustainability. Appropriate topics of interest include but are not limited to:

- Modeling and simulations of energy efficient computing systems
- Modeling and simulations of green communications systems
- Modeling and simulations of smart grid applications
- Simulation of intelligent transportation systems
- Building and energy management simulations
- Modeling and simulations of nature inspired computing and communication systems
- Innovative modeling and simulation methodologies, and tools
- Prototypes and testbeds of energy efficient computing and communication systems.

Articles should be understandable to a broad audience of science and engineering professionals.

The writing should be practical and original, avoiding too much focus on theory, mathematics, jargon, and abstract concepts. Accepted papers will be professionally edited for content and style.

All manuscripts are subject to peer-review on both technical merit and relevance to Computer's readership. Paper submissions are handled electronically. For author guidelines and information on how to submit a manuscript,

please visit: <http://www.computer.org/portal/web/peerreviewmagazines/computer>

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