IEEE TCSIM Newsletter

Issue 04 March 2010

Editorial Board

1. Dr. Mostafa El-Said, Editor-in-Chief
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3. Dr. Chittabrata Ghosh, Editor

Chair's Message

By Dr. Dave Cavalcanti, Chair of TCSIM

Dear TCSIM members,

Welcome to the 1st 2010 issue of the TCSIM newsletter. I'm happy to announce that we are increasing the frequency of publications of the TCSIM newsletter to quarterly issues in 2010. This will give us more opportunities to share relevant information and keep up to date with the TCs activities. As always, contributions from our members are highly appreciated and will make this publication even more interesting.

This issue features two invited articles. This issue also includes a list of upcoming events and new conferences and awards supported by the TCSIM in 2010.

Hope you enjoy the reading and thanks for your collaboration!

New 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. A separate welcome e-mail has been sent to all current contacts in the list. To send a message to the new TCSIM list, just send mail to 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 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/. For more info about the TCSIM activities, please visit us at http://tab.computer.org/tcsim/

Recent Events

1. (SIMUTools 2010) Third International Conference on Simulation Tools and Techniques

   March 15-19, Torremolinos, Malaga, Spain, *http://www.simutools.org/*

2. (ISGT 2010) Innovative Smart Grid Technologies

   January 19-21, Washington DC, *http://ewh.ieee.org/conf/isgt/2010/*

Upcoming Events

1. Spring Simulation Multi-conference (SpringSim'10)

   April 11-15, Orlando, FL, USA. http://www.scs.org/springsim/

2. (PADS 2010) Principles of Advance and Distributed Simulation

   17 May 10, - Georgia Institute of Technology, Atlanta, GA (USA). http://www.pads-workshop.org/pads2010/

3. (ISCC 2010) IEEE Symposium on Computers and Communications

   22 Jun 10, Riccione, Italy http://www.ieee-iscc.org/2010/

TCSIM Student Awards

TCSIM sponsors several Student Support Awards every year. The awards are intended to encourage and motivate student participation in conferences. The TCSIM awards are only given to students with accepted works in selected conferences. The awards selection process and distribution are fully managed by the organizing committees of the events.

Some of the events receiving TCSIM Student Awards in 2010 include

- SECON 2010 (Student Best Paper Award)
- CGAMES 2010 (Student Best Paper Award)
- MASS 2010 (Student Travel Grants)

For more information on the 2010 TCSIM Student Awards, please visit the TCSIM webpage: http://tab.computer.org/tcsim/

Cognitive Radio Module for the ns-2 Simulator

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Cognitive Radio (CR) networks are envisaged to address the problem of spectrum scarcity by allowing the opportunistic transmission in licensed bands [1]. As one of the key requirements is that the operation of the primary users (PUs) of the licensed band is not affected, there is a need for detailed testing of the protocols before actual deployment. As the classical ns-2 simulator does not have a CR module, the following work describes the first steps towards this direction. Our model allows easy change of a wide range of parameters, such as power, spectrum, channel bandwidth and frequency, custom-designed spectrum selection and sharing policies, and model accurately the activity of the PUs [2].

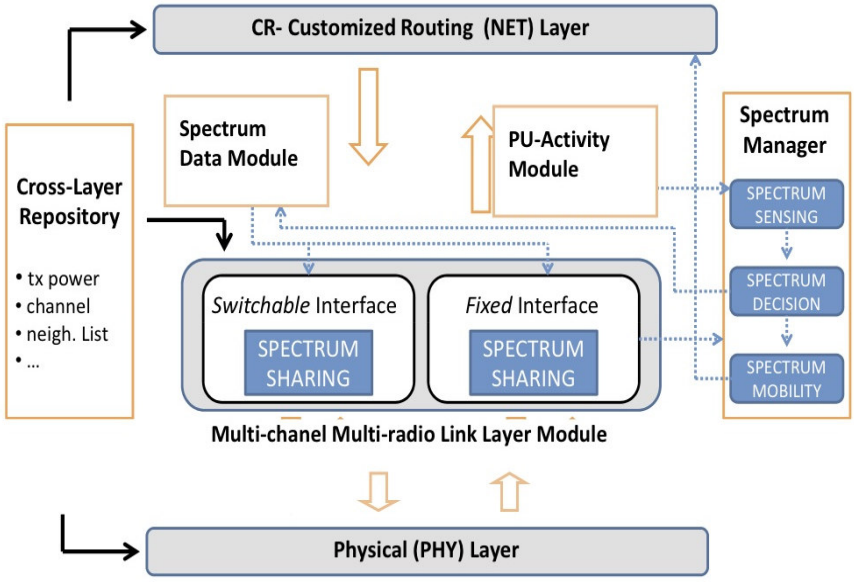

Figure 1. Block diagram for the ns-2 CR simulator extension

PU-Activity Block:

It describes the characteristics of active PUs, such as operating the spectrum band, location, transmitting range. It also contains the description of PU activity in each spectrum band, as a sequence of ON and OFF periods over simulation time.

Spectrum Data Module:

It describes the PHY characteristics of each channel, such as operating frequency, channel capacity and average bit error rate (BER).

Spectrum Manager Module:

It is further composed: the *Spectrum Sensing*, *Spectrum Decision*, and *Spectrum Mobility* blocks. The *Spectrum Sensing* block is responsible for detecting the activity of PUs on the current channel. The *Spectrum Decision* block chooses whether to stay or switch channels, the *Spectrum Decision* block chooses the next available channel, and finally, the *Spectrum Mobility* block manages the spectrum handoff process.

Multi-channel Multi-radio Link Layer Module:

It implements the multi-channel multi-radio environment. Each radio implements the *Spectrum Sharing* block for distributed channel access in wireless networks. The current implementation is based on the CSMA/CA MAC scheme. The *Spectrum Sharing* block interacts with the *PU Activity* block to model the interference caused by PUs on current ongoing transmissions of CR users.

CR-Customized Routing Layer Module:

Traditional routing protocols for wireless ad hoc networks can be used at network layer, as well as customized network protocols for CRAHNs. We also implement the SEARCH routing scheme for CRAHNs in the default distribution [3].

Cross-Layer Repository Module:

It enables information sharing among protocols at different layers of the protocol stack. For example, it may contain information collected at PHY layer (e.g. current transmitting power), MAC layer (e.g. current channel) and Network layer (e.g. current neighbors' list).

Our simulator is best used in protocol design for CR ad hoc networks. As an example, we show the throughput of different flavors of TCP (newReno, Reno, SACK, Vegas) using our simulator by varying the spectrum sensing time [2].

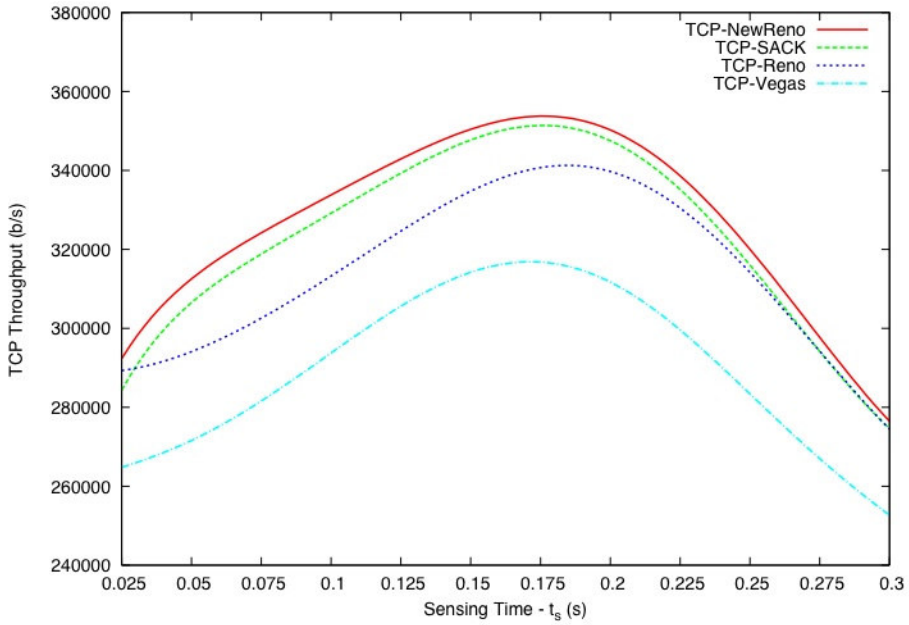

Figure 2. Simulation of TCP throughput for different sensing

References

[1] I. Akyildiz, W.Y. Lee and K. R. Chowdhury. CRAHNs: Cognitive Radio Ad Hoc Networks. In Ad Hoc Networks Journal (Elsevier), 7(5):810-836, July 2009.

[2] M. D. Felice, K. R. Chowdhury, L. Bononi, A. Kassler. End-to-end Protocols for Cognitive Radio Ad Hoc Networks: An Evaluation Study, Perf. Evaluation journal (submitted), 2010.

[3] K.R. Chowdhury and M. Di Felice. SEARCH: A Routing Protocol for Mobile Cognitive Radio Ad-hoc Networks. In Computer Communication Journal (Elsevier), 32(18): 1983-1997, December 2009.

AUVNetSim

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Underwater wireless communications have witnessed major developments in recent years, especially in the last decade. While the first generation of applications involved just a single transmitter and receiver communicating at low bit-rates, nowadays underwater communications are associated with complex systems requiring the networking of several devices exchanging information and reacting accordingly. These novel applications range from autonomous observation systems to cooperative missions between autonomous underwater vehicles (AUVs), bottom-mounted nodes, and surface crafts.

Acoustic technology is the most common physical layer for underwater networks. The underwater acoustic channel shows some unique characteristics that make it different than the more conventional electromagnetic channel, such as a very high path-loss, several colored noise sources, a usable bandwidth that decreases with distance, and pronounced multi-path and Doppler effects. It is the need to capture and exploit these unique properties in a cross-layer fashion what motivates the development of new simulation tools for underwater acoustic networks.

Within this scope, AUVNetSim is a new simulation library for testing acoustic networking algorithms [1,2]. It is written in standard Python [3] and makes extensive use of the SimPy discrete event simulation package [4]. Thus, it is platform independent and the same code can run on Windows, Linux or Mac OS, amongst others. In addition, AUVNetSim is redistributed under the terms of the GNU General Public License.

The main goals of AUVNetSim are:

- To accurately model the underwater acoustic channel in terms of path-loss and noise. Amongst others, rather than just using pre-established parameter values, the necessary power to transmit every single packet is computed as a function of the transmission distance, the center frequency and the available bandwidth.
- To provide a great variety of existing solutions for MAC, routing and transport layer protocols for underwater acoustic networks. An *end-user* willing to run several simulations by exploiting the resources that are already available can easily modify several system parameters without having to explicitly deal with Python code.

To ease the development of new MAC, routing and transport layer protocols as well as cross-layer solutions for underwater acoustic networks. For example, a *developer* who wants to include a new MAC protocol can simply do so by taking advantage of the existing structure.

Currently AUVNetSim supports the following features:

- At the physical layer: adjustable transmission, reception and sleep mode power consumptions, discrete and continuous transmission power control, frequency and bandwidth control, collision and interference detection.
- At the link layer: MAC protocols: ALOHA, ALOHA with power control, DACAP [5], DACAP with power control, CSMA-CA, CSMA-CA with power control; Link error control: ARQ, FEC.
- At the network layer: routing protocols: distributed Dijkstra's routing algorithm, FBR [6].
- Simulation of static nodes, involuntary moving nodes emulating underwater flows with controllable speed, and Underwater Autonomous Vehicles (AUVs), following either pre-established paths or moving "on demand".

In terms of outputs, AUVNetSim provides the following information:

- Energy consumption for every single node while actively transmitting, actively receiving, sleeping or being idle, energy consumption for every single packet, total energy consumption of the network.
- End-to-end delay for every single packet, route followed by every single packet.
- Number of collisions for every single packet, number of retransmissions per packet.
- Route followed by every node in the network (when moving).

A typical visualization of the outputs of the simulator is shown in Figure 1. In this case, 64 nodes are randomly deployed over a 10 km by 10 km area. Four actively transmitting nodes are located at (0,0), (0,10), (10,0) and (10, 10) kilometers, whereas a sink is located at (5,5) km. The size of each node is proportional to the energy consumed in transmission. The color of each node is proportional to the energy consumed in reception.

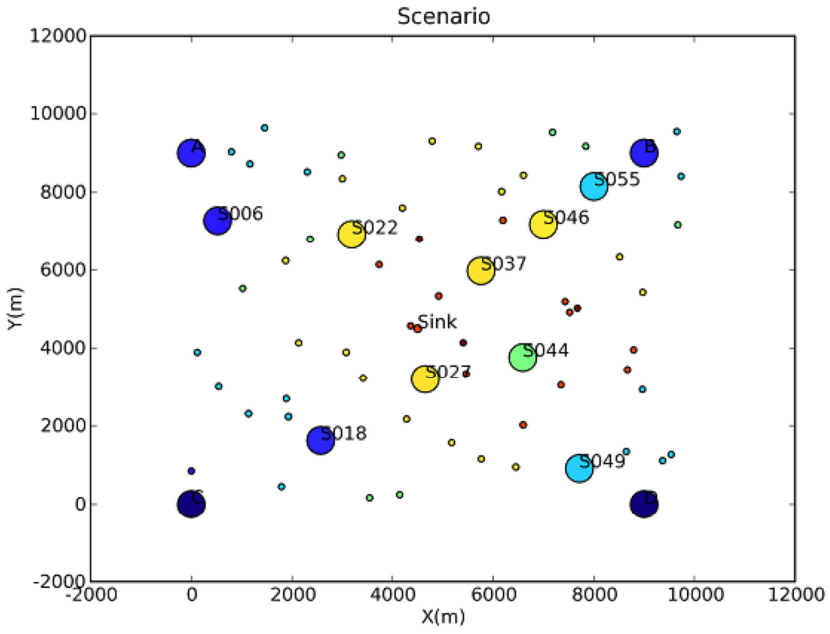

Figure 1: Scenario for simulation and resulting energy consumption per node.

References

[1] AUVNetSim Project Site, http://sourceforge.net/projects/auvnetsim/

[2] AUVNetSim Official Manual, http://seagrant.mit.edu/media/pubs_desc.php?id=1327

[3] Guido van Rossum, "Python Tutorial", http://docs.python.org/tut/

[4] T. Vignaux and K. Muller, "The SimPy Manual", http://simpy.sourceforge.net/

[5] B. Peleato and M. Stojanovic, "Distance Aware Collision Avoidance Protocol for Ad-Hoc Underwater Acoustic Sensor Net works," IEEE Communication Letters, pp.1025-1027, December 2007.

[6] J. M. Jornet, M. Stojanovic and M. Zorzi, "Focused Beam Routing protocol for Underwater Acoustic Networks," in Proc. of Third ACM International Workshop on Underwater Networks (WUWNeT'08) / MobiCom 2008, San Francisco, CA, September 2008.

Call for Papers – IEEE TCSIM Newsletter

The IEEE TCSIM Newsletters will publish short technical papers. The submissions should emphasize modeling, design, and analysis of computational methods for simulations and its applications in various areas, including, but not limited to, computer science, engineering, communications, and simulation applications. The submissions are invited covering, but not limited to, the following topics:

1. Simulation architecture modeling and prototyping
2. Simulation algorithm design, implementation, and analysis
3. Simulation complexity in computing
4. Parallel and distributed simulation
5. Design and usage of simulation tools
6. Real-time simulation monitoring
7. Simulation tools for communications and networks
8. Simulation of computer systems and applications
9. Agent-based simulation tools focus on the use of agents in engineering, human and social dynamics, military applications
10. Systems and process simulation
11. Simulation of ubiquitous networking and computing
12. Simulation of transportation systems
13. Automotive simulation applications
14. Building and energy management simulations
15. Machine learning
16. Virtual reality systems
17. Knowledge and data systems
18. Systems optimization
19. Web-based simulation and applications
20. Department of Defense Architecture Framework (DoDAF)-based network simulations
21. DoDAF-based vulnerability assessment

Submission

All papers must be submitted to elsaidm@gvsu.edu in four pages or fewer, including all figures, tables, and references. A manuscript submitted for publication should be original work that should not have been previously published and should not be under consideration for publication elsewhere. If an author uses charts, photographs, or other graphics from previously printed material, he/she is responsible for obtaining written permission from the publisher to use the material in his/her manuscript. The maximal number of figures and tables are five, and the number of reference is limited to ten. Submissions exceeding this length will be returned without review. Papers should use 7.875in x 10.75 in (20cm x 27.30cm) trim size and the IEEE transactions two-column format in 10-pt. font. Please submit electronically in PDF file, and ensure that the submitted file can be viewed in Acrobat Reader 8.0. No hard copy is necessary. A standard IEEE copyright release will also be required before fully acceptance.

All papers must include the authors' affiliation and e-mail addresses of all authors. All papers will be fully refereed for accuracy, technical content, and relevance. Contact Dr. El-Said at elsaidm@gvsu.edu with any questions concerning the paper submission and review process, or questions regarding the relevance of a paper to the IEEE TCSIM Newsletters.

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