SCS Keynote Speaker

THE SOCIETY FOR MODELING & SIMULATION INTERNATIONAL

TITLE: Simulations, emulations and connected graphs generation in wireless sensor and ad hoc networks

AUTHOR: Professor Ivan Stojmenovic, University of Ottawa

DAY/TIME: Tues, July 8, 9:15am, Regency 1-3

ABSTRACT:

Several recent studies underlined the lack of rigor in simulation practices that threatens the credibility of the published claims. While agreeing with some of the criticism, this article argues against some others and advocates for a different overall view. The primary goal of simulation should be to provide sufficient support for new concepts and protocols. 'Proof of concept' is the basic (not thorough or testbed based) simulation using assumptions in designed protocol, including comparison with truly competing existing solutions. We advocate for thorough literature review, solving one problem at a time and selecting independent variables that can assist best in explaining the performance under wide range of scenarios. While all models are unrealistic, some of them are useful. We advocate parallel advance of useful modeling and protocol design, where the simplicity is emphasized to preserve tractability.

We consider generation of graphs that represent specific scenarios that appear in wireless ad hoc, actuator, sensor and Internet networks. Most simulation studies for these networks use connected random unit disk graphs generated by placing nodes randomly and independently from each other. However, in real life usually networks are created in a cooperative manner; certain restrictions are imposed during the placement of a new node in order to improve network connectivity and functionality. We discuss how constrained connected random unit graphs can be generated by fast algorithms and what kind of desirable characteristics can be achieved compared to completely random graphs, especially for sparse node densities.

The ultimate test for many network layer protocols designed for wireless sensor networks would be to run on a large scale test-bed. To replace large and expensive realistic test-beds, we introduce a novel approach to emulation for routing based applications. We propose a specifically designed experimental setup using a relatively small number of nodes forming a real one-hop neighborhood used to emulate any size WSN. The source node is a fixed sensor, and all other sensors are forwarding neighbors candidates towards a virtual destination. The source node achieves one forwarding step, then the virtual destination position and neighborhood are adjusted. The same source is used again to repeat the process. The main novelty is to spread available nodes regularly following a hexagonal pattern around the central node, used as the source, and selectively use subsets of the surrounding nodes at each step of the routing process to provide the desired density and achieve changes in configurations.

BIO:

Ivan Stojmenovic received his Ph.D. degree in mathematics in 1985. He earned a third degree prize at the International Mathematics Olympiad for high school students in 1976.

He is Full Professor at the University of Ottawa, Canada.

He also held regular visiting positions in Serbia, Japan, USA, France, Spain, Brazil, Hong Kong, Taiwan, China (Distinguished Professor; Tsinghua University in Beijing and Dalian University of Technology, 2010-2), UK (Chair in Applied Computing, University of Birmingham, 2007/8). Stojmenovic is Fellow of the IEEE (Communications Society, class 2008), and Canadian Academy of Engineering (since 2012), and Member of the Academia Europaea (The Academy of Europe), from 2012 (section: Informatics). He was IEEE CS Distinguished Visitor 2010-11. He received 2012 Distinguished Service Award from IEEE ComSoc Communications Software TC. He was cited >13000 times. Google Scholar lists him as the top researcher in parallel and d distributed systems by citations, and among the top ten in two more fields: wireless networks and algorithms.

He received four best paper awards at conferences (IFIP PWC 2004, SENSORCOMM 2008, CSA 2009, ICA3PP 2011) and Excellence in Research Award of the University of Ottawa for 2009.

He presented a number of tutorials and invited talks.

He is recipient of the Royal Society Research Merit Award, UK, 2007-8.

He co-authored over 40 book chapters. He collaborated with >100 co-authors with Ph.D. and a number of their graduate students from 25 different countries. He (co) supervised >60 graduate students. His current research interests are mainly in wireless ad hoc, sensor, vehicular, actuator and robot networks. His research interests also include security, parallel computing, multiple-valued logic, evolutionary computing, neural networks, combinatorial algorithms, computational geometry, graph theory, computational chemistry, image processing, programming languages, and computer science education.

He was Director of the Ottawa-Carleton Institute for Computer Science (2002-2004). He has been editor-in-chief of IEEE Transactions on Parallel and Distributed Systems (2010-2013), Journal of Multiple-Valued Logic and Soft Computing (received Certificate of Appreciation from IEEE Computer Society in 2002 for establishing and maintaining the journal), International Journal of Parallel, Emergent and Distributed Systems (T&F), and Ad Hoc & Sensor Wireless Networks (OCP), and editor of several journals including IEEE Network and ACM Wireless Networks.