

2016



**COMMUNICATIONS SYSTEMS**  
**INTEGRATION AND MODELING**  
**TECHNICAL COMMITTEE (CSIM-TC)**

***NEWSLETTER***

**Christos Verikoukis (Chair)**  
**Dzmitry Kliazovich (Vice-chair)**  
**Burak Kantarci (Secretary)**

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## **ABOUT CSIM**

The Communications Systems Integration and Modeling technical committee focus its activities on simulation, analytical tools and measurement of communications links and networks. CSIM has been sponsoring activities on traffic modeling, performance and integration of next generation wireless and wireline networks.

CSIM sponsors its traditional bi-annual workshop CAMAD, as well as special issues in the IEEE Communications Magazine and in the IEEE Journal on Selected Areas in Communications. CSIM is very active in ICC and in GLOBECOM and was one of the co-founders of MILCOM. CSIM has its roots on the Communications Systems Engineering Technical committee and its past chairs are:

2015-now – Christos Verikoukis

2013-2015 – Stefano Giordano

2011-2013 – Harry Skianis

2009-2011 – Fabrizio Granelli

2007-2009 – Pascal Lorenz

2005-2007 – Nelson L.S. da Fonseca

2002-2005 – Mike Devetsikiotis

2000-2002 – Mohammad Ilyas

1999-2000 – Hussein Mouftah

1996-1999 – Guy Omydar

1994-1996 – Bill Tranter

**For more information : <http://sites.ieee.org/tc-csim/>**

## 1. Short Courses / Tutorials by CSIM Members

### **Random Graphs and Wireless Communication Networks Short Course (by Prof. Justin Coon):**

As networked systems become more complex, mathematicians and engineers will need to draw from a more diverse background and set of tools to analyse and design them. For this reason, Prof. Justin Coon (Department of Engineering Science, Oxford University) and Prof. Carl Dettmann (School of Mathematics, Bristol University) have developed a two-day short course that will educate graduate students, postdocs and practicing engineers in the nuances of network theory and, in particular, how network analysis and design should be approached in the context of wireless applications. Emphasis will be placed on spatially embedded networks, i.e., spatial and geometric effects will be considered, thus facilitating a study of networks from a physical layer perspective. As such, researchers interested in ad hoc networks (e.g., MANETs, VANETs), sensor networks and cellular networks will find the course useful.

This course will take place during 5–6 September, 2016 at Oriel College in Oxford. Lecture notes and worked examples will be provided for students as part of the course to ensure attendees can refer back to the material and apply it in the context of their scholarly or professional activities. The syllabus will cover a range of fundamental topics:

- Random graph models: Erdős-Rényi graphs, scale-free graphs, small world graphs, random geometric graphs, temporal graphs, directed graphs.
- Graph properties: mean degree, k-connectivity, percolation, graph spectra, reachability/accessibility, transitivity.
- Mobility models: random walks, Lévy, random waypoint.
- Stochastic geometry: basic theory, pair distance distributions, point processes, probability generating functional, Campbell's theorem.

Once the foundations have been laid, the program will treat communication network topics, such as:

- Pair connection functions: unit disc, small-scale fading, large-scale fading, SIMO, MISO, MIMO, beamforming, trust, secrecy, general connection functions, average connection probability, mean degree, pair correlation.
- Ad hoc networks: random graph model, connectivity, boundary effects.
- Cellular networks: hexagonal cell model, fluid model, point processes, interference, mobility.
- Secure networks: secrecy graphs, PHY secrecy and intrinsic security, in/out isolation, weak connectivity, strong connectivity.

Registration is **free**, but space is limited. To register, contact Justin Coon ([justin.coon@eng.ox.ac.uk](mailto:justin.coon@eng.ox.ac.uk)). This course is supported by EPSRC grant no. EP/N002350/1: <http://www.eng.ox.ac.uk/sen>.

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### **Tutorial at ISWCS 2015: Modelling and analysis of ad hoc networks (by Prof. Justin P. Coon (Oxford), Prof. Carl Dettmann, and Dr. Orestis Georgiou)**

Prof. Justin P. Coon (Oxford), Prof. Carl Dettmann (Bristol), and Dr. Orestis Georgiou (Toshiba) gave a tutorial on network modelling and analysis at ISWCS 2015.

A small cohort of about 10 researchers attended, and the discussion was lively. The summary of the tutorial is as follows:

Urbanization is a significant worldwide trend, which Smart City technologies and the Internet of Things (IoT) paradigm aim to address. These rely heavily on wireless communications for sensing and control purposes; however, the cost and complexity of planning and deploying such infrastructures is often prohibitive. Unlike centralized infrastructures (e.g. cellular and Wi-Fi), the promising infrastructure-less technologies of ad hoc and mesh networks enable the formation of much larger, more flexible network topologies. Such technologies are supported by the development of ‘smarter’ wireless devices and sensors able to self-organize and harness statistical data to improve network performance. Understanding how these large scale and dense complex structures connect is therefore a prerequisite to constructing robust network designs, protocols and deployment methodologies. Many current trends involve more extensive and complex infrastructure, namely denser deployments, the adoption of multiple directional mm-wave antennas, the abundance of wireless sensors, and the operation of large-scale distributed networks in high path loss environments. These developments advocate the importance of connectivity and resilience in ad hoc networks and substantiate the timeliness of delivering courses that enable flexible models for network researchers to adapt and exploit.

In the tutorial, a theoretical approach to understanding the key topological features affecting connectivity in wireless ad hoc networks was presented. The approach is rooted in a mathematical framework developed using techniques from statistical physics, and is capable of accounting for boundary effects, antenna directivity, and the inherent path loss of the propagation medium. Within the framework, engineering insight was highlighted, and analytic formulae were derived. Presentation involved numerous examples, which served as a basis for the development and analysis of the emerging fields of heterogeneous, cognitive and cooperative networks. Participants thus received an introductory tutorial on this topic as well as instruction on how to apply these techniques to their own research activities.

#### Outline

1. Introduction / Motivation
  1. Why, when and where decentralized can be better?
  2. Ad hoc and sensor network applications
  3. Decentralized solutions and challenges for SmartGrid, D2D, and IoT
2. Modelling Random Networks
  1. Mathematical preliminaries (statistical quantities, random processes, outage definition, etc)
  2. Pairwise connection models (hard, soft, fading, single/multiple antenna, directional)
  3. Network model (cluster expansion)
  4. Useful statistical observables (coverage, node degree, k-connectivity)
3. From Infinite to Finite Networks
  1. Asymptotic results and how to make sense of them
  2. Boundary effects: when and how important are they?
  3. Basic boundary components in two and three dimensions
  4. Universality and general formulas
  5. Example for “house” domain (using MIMO model)
  6. Complex and fractal geometries
4. Advanced Topics
  1. General diversity and power scaling laws
  2. Directional antenna network design
  3. Connecting through small openings
  4. Absorption and reflection effects in hallways
5. Future directions and challenges

## 2. Recently Accomplished Events

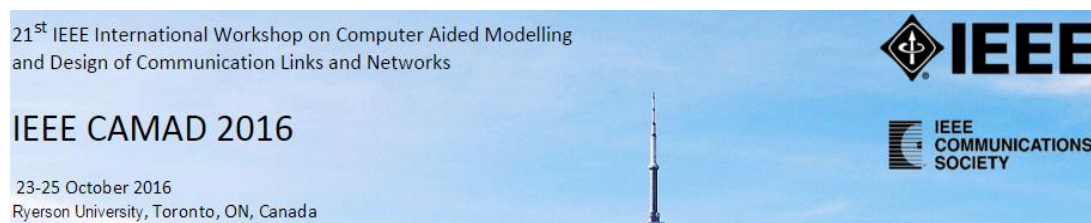
### 14th Mathematics of Networks Meeting

The 14th Mathematics of Networks (MoN14) Meeting was held at Oriel College, University of Oxford on the 21st of September 2015. MoN is an informal series of meetings that has been running since 2003. The series encourages interdisciplinary communication in networking research. The theme of the meeting varies from year to year, but MoN14 was focused on spatially embedded networks and played host to several exciting talks about communication networks. Information and slides are available at <http://www.monmeetings.org>.

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## 3. Upcoming Events

### **CSIM's Flagship Event: 21st IEEE International Workshop on Computer-Aided Modeling Analysis and Design of Communication Links and Networks (CAMAD)**



CSIM's flagship event IEEE CAMAD 2016 will be held as a stand-alone event on 23-25 October 2016, at Ryerson University in Toronto, Ontario, Canada. IEEE CAMAD will focus on Communications for Smart Cities this year. IEEE CAMAD will be hosting several special sessions, and will bring together scientists, engineers, manufacturers and service providers to exchange and share their experiences and

new ideas focusing on research and innovation results under wireless communications in smart cities. In addition to contributed papers, the conference will also include keynote speeches, panel and demo sessions.

\* Paper Submission: June 5, 2016 (Extended) \* Notification of acceptance: July 5, 2016

\* Camera-Ready Version: August 1, 2016

For more information, visit: <http://www.ieee-camad.org/>

#### General Chairs

Jelena Mistic, Ryerson University, ON, Canada  
Burak Kantarci, Clarkson University, NY, USA

#### Technical Program Chairs

Dongmei Zhao, McMaster University, ON, Canada  
Petros Spachos, University of Guelph, ON, Canada  
Marco Di Renzo, Paris-Saclay University / CNRS, France  
Ioannis Papapanagiotou, Netflix, USA

For all the members of the CAMAD 2016 Organizing Committee, please visit <http://www.ieee-camad.org>

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<https://www.linkedin.com/groups/8208393>

### **The 5th IEEE Cloud Networking (CLOUDNET) Conference**

Cloud Networking has emerged as a promising direction for cost-efficient and reliable service delivery across data communication networks. The dynamic location of service facilities and the virtualization of hardware and software elements are stressing the communication network and protocols, especially when datacenters are interconnected through the Internet.

Although the "computing" aspects of Cloud technologies have been largely investigated, lower attention has been devoted to the "networking" aspects. The 2016 5th IEEE International Conference on Cloud Networking (IEEE CloudNet 2016), part of the IEEE Cloud Computing Initiative, precisely addresses these aspects.

<http://cloudnet2016.ieee-cloudnet.org/>

Conference topics include (but are not limited to):

- Data Center Network Management, Reliability, Optimization
- Distributed Data Center Architectures and Services, IaaS, PaaS, SaaS
- Energy-Efficient Datacenters and Networks
- Big Data Management
- Internet Routing of Cloud data
- Virtual Ethernet Switching, Data Center Bridging
- Cloud Traffic Characterization and Measurements
- Intra-Cloud vs Inter-Cloud Management
- Cloud Traffic Engineering and Control-Plane Architectures
- Green Data Centers and Cloud Networking



- Security, Privacy, and Confidentiality in Cloud Networking
- Virtualization of Network Equipment
- Unified User and Machine Mobility Management
- Data Flow Management and Load Balancing
- Multipath Routing
- Congestion control
- Software Defined Networking
- Network Function Virtualization
- Fog/Edge Computing
- Mobile Cloud Networking
- Cloud Federation and Hybrid Cloud Infrastructure
- Storage Area Networks, Optical Interconnect, Fiber Channels
- Content and Service Distribution

Paper submission: May 15, 2016

Acceptance notification: July 15, 2016

Camera-ready paper: August 1, 2016

General Chair

Stefano Giordano, University of Pisa, Italy

Technical Program Committee co-chairs

Deep Medhi, University of Missouri-Kansas Cty, USA

Achille Pattavina, Politecnico di Milano, Italy

For more details and full list of organizing committee members:

<http://cloudnet2016.ieee-cloudnet.org/>

### **The 1st Symposium on Spatially Embedded Networks**

Oxford University will host a two-day symposium focused on spatially embedded networks from 7-8 September, 2016. The symposium will bring together experts from the mathematics and engineering communities working on elements of graph theory, complex networks, information theory and communication theory. Invited talks from leading experts in fields related to mathematics and communication networks (e.g., cellular, ad hoc) will form part of the event, and submissions in line with the general topic of spatially embedded networks will be considered for presentation. More details on guest speakers and the submission process will be made available shortly (see <http://www.eng.ox.ac.uk/sen/events.html>).

This will be the first of a series of three multi-disciplinary symposia that will take place over the next three years. This event will be hosted at Oriel College (the fifth oldest college in Oxford, founded in 1326). Registration is **free**, but space is limited. For inquiries, contact Justin Coon ([justin.coon@eng.ox.ac.uk](mailto:justin.coon@eng.ox.ac.uk)). This event is funded by EPSRC grant no. EP/N002350/1: <http://www.eng.ox.ac.uk/sen>.



#### 4. Platforms and Tools for Modeling and Performance Evaluation



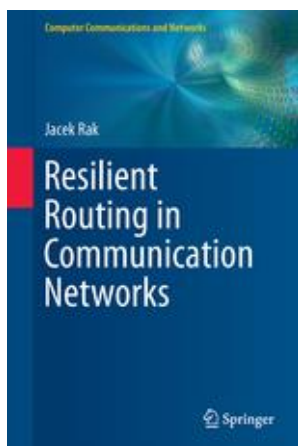
Public-cloud providers rarely make promises or expose details about the design or the performance of the network infrastructures they make available to cloud resources. Therefore, customers have to cope with their limited awareness about these environments, although specific cloud applications and services would benefit from this kind of information.

The Traffic Research Group at the University of Napoli (Italy) recently released \*CloudSurf\* ([traffic.comics.unina.it/cloudsurf/](http://traffic.comics.unina.it/cloudsurf/)), an open-source monitoring platform that allows to monitor the performance of public-cloud networking infrastructures by enforcing non-cooperative approaches, i.e. without relying on information restricted to the cloud provider or to entities playing a privileged role with respect to the provision of cloud services.

CloudSurf integrates a number of network monitoring tools and enables to perform monitoring activities related to the intra-datacenter, the inter-datacenter, and the cloud-to-user networks. It currently supports the two leading cloud providers (Amazon Web Services and Microsoft Azure). Providing also useful features such as experiment-cost estimation and enabling easy data sharing---thanks to the community repository which gathers and makes available experimental data---it constitutes a useful tool for the research community to investigate public-cloud networking infrastructures and their performance.

#### 5. New books by CSIM members

**Rak, J.: Resilient Routing in Communication Networks,**



Springer, November 2015

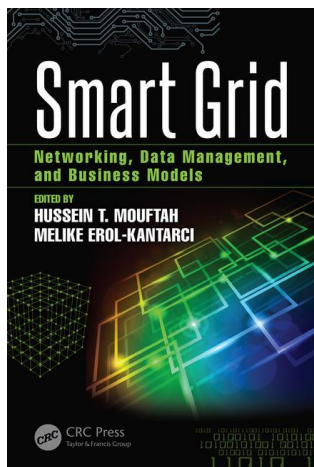
Series: Computer Communications and Networks

Available as hardcover and eBook at:

<http://www.springer.com/us/book/9783319223322>

This book presents a comprehensive overview of resilient routing techniques in communication networks, as well as related open research areas, describes new approaches related to resilient routing for: Future Internet, Wireless Mesh Networks (WMNs), Vehicular Ad-hoc Networks (VANETs), and discusses how to maintain reliable transmission in the presence of disaster-based region disruptions and malicious human activities

**Mouftah, H. T. and Erol-Kantarci, M.: Smart Grid: Networking, Data Management, and Business Models, (CRC Press)**



Available as hardcover and eBook at:

<https://www.crcpress.com/Smart-Grid-Networking-Data-Management-and-Business-Models/Mouftah-Erol-Kantarci/p/book/9781498719704>

This book delivers a comprehensive overview of smart grid communications, discussing the latest advances in the technology, the related cyber security issues, and the best ways to manage user demand and pricing. The book consists of 16 chapters authored by world-renowned experts. This book considers the use of cognitive radio and software-defined networking in the smart grid, explores the space of attacks in the energy management process, the need for a smart grid simulator, and the management issues that arise around smart cities, describes a real-time pricing scheme that aims to reduce the peak-to-average load ratio, explains how to realize low-carbon economies and the green smart grid through the pervasive management of demand, and presents cutting-edge research on microgrids, electric vehicles, and energy trading in the smart grid.

## 6. Upcoming special issues by CSIM members

### Internet of Things (IoT) Feature Topic in IEEE Communications Magazine

Internet of Things is seen as a set of vertical application domains that share a limited number of common basic functionalities (such as communications and networking protocols and operating systems APIs). In this view, consumer centric solutions, platforms, data management, and business models have to be developed and consolidated in order to deploy effective solutions in the specific fields. The availability of low cost general purpose processing and storage systems with sensing/actuation capabilities (now available also to prosumers) coupled with communication capabilities are broadening the possibilities of IoT leading to open systems that will be highly programmable, virtualized and will support large numbers of APIs. Internet of Things emerges as a set of integrated technologies new exciting solutions and services that are set to change the way people live, produce goods. Internet of Things is rewarded by many as a fruitful technological sector in order to generate revenues. IoT covers a large wealth of consumer centric technologies (from sensors to communications up to software platforms) and it is applicable to an even larger set of application domains (from manufacturing to e-health, from logistics to automotive). Innovation will be nurtured and driven by the possibilities offered by the combination of increased technological capabilities, new business models and the rise of new ecosystems. IoT will be characterized by a few enablers:

\* Sensors, actuators and new consumer devices.

\* New Communication capabilities (from short range to LPWAN to 4G and 5G networks, with NB-IoT). In addition, new communication protocols and the exploitation of NFV/SDN for better communications.

- \* Data management and Big Data analysis to deal with large data sets and streams generated by IoT systems.
- \* New solutions for large distributed systems (e.g., combination of Cloud, Grid and Edge/Fog Computing).
- \* Cognitive systems. Large IoT systems will be more and more complex, and as such they will require new cognitive techniques in order to be effective.
- \* Platform programmability. APIs and other means for supporting the programmability of IoT systems in order to enable the exploitation of programmable features made available.
- \* New Business models and ecosystems. What is the value of IoT systems, what ecosystems support it, how to monetize IoT.
- \* Consumer centric aspects including IoT application development, utilization of semantics and security, privacy, trust.

This proposed Feature Topic (FT) issue will gather articles from a wide range of perspectives in different industrial and research communities of IoT. The primary FT goals are to advance the understanding of the challenges faced in IoT communications, networking, distributed processing, new signal processing capabilities, software platforms and end – users devices over the next decade, and provide further awareness in the IoT research communities on these challenges, thus fostering future investigation. In addition a perspective on the business possibilities of IoT are of interest in order to enable and deploy the foreseen technical solutions. Original research papers are to be solicited in topics including, but not limited to, the following themes

- \* Existing and future communication architectures and technologies for large IoT systems
- \* Existing and future use cases and deployment of large IoT systems
- \* Design and evaluation of large IoT test beds, prototypes, and platforms for consumer centric IoT application development and deployment
- \* Identification of viable business models and related ecosystems
- \* Solution and services supported by consumer devices
- \* Security, Privacy and interworking issues for cooperative IoT operations
- \* Interfaces, cross-platform communication and programmability for IoT systems
- \* Autonomics mechanisms for QoS and performance evaluation for IoT solutions
- \* Game-theoretic and control-theoretic mechanisms for IoT resource allocation and management
- \* Integrating 4G and 5G wireless technologies into IoT communications and Platforms
- \* Integration of cognitive techniques with IoT systems
- \* Energy-efficient communications considering opportunistic policies for large IoT systems
- \* Big data and data analytics solutions for IoT systems
- \* Comparison and improvement of IoT communication protocols
- \* Novel distributed techniques (e.g., Edge/Fog computing)
- \* New sensing and actuation capabilities and devices and their applicability

#### Important Dates

Submission Deadline: June 15, 2016

Notification Due Date: August 15, 2016

Final Version Due Date: September 15, 2016

Feature Topic Publication Date: December, 2016

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## 7. Status of the Special Interest Groups (SIGs)

CSIM-TC currently has the following 7 active SIGs:

- SIG on Internet Measurements (led by Antonio Pescape)
- SIG on Smart Grid Communications (led by Periklis Chatzimisios)
- SIG on Software Defined Networking (led by Stefano Giordano)
- SIG on Service modeling for multi-tenant 5G cell-less architectures
- SIG on Heterogeneous Ultra-Dense Networks: Modeling, Simulation, Performance Evaluation and Optimization (led by Marco Di Renzo and Justin Coon)
- SIG on Resource Optimization in Heterogeneous Wireless Access Networks (led by Vangelis Angelakis and Prof. Björn Landfeldt)
- SIG on Optimization of Networking Technologies for the Internet of Things (led by Matteo Cesana and Elias Tragos)

SIG activities will be reported in November-December 2016 issue of the newsletter.