IEEE CITS 2014

2014 International Conference on Computer, Information and Telecommunication Systems

Jeju Island, South Korea. July 7-9, 2014

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CITS 2014 General Chair's Message

Welcome to the 2014 International Conference on Computer, Information and Telecommunication Systems (CITS 2014). This year's conference marks the third CITS, which is being held on annual basis.

CITS 2014 offers a unique forum for researchers and practitioners from academia, industry, business, and government to share their expertise results and research findings in all areas of Computer, Information and Telecommunication Systems.

This year's conference includes an outstanding technical program, distinguished keynote speakers, and insightful tutorials. We have chosen Shineville Luxury Resort, in the Tosan Tourism District, the only marine tourism district of Jeju, South Korea, as conference venue. The site provides excellent meeting facilities and will be a comfortable setting for our conference.

The CITS 2014 technical program consists of several parallel tracks and will last for three days. Each track consists of several sessions of top quality papers. The topics covered in the program include, among others, wireless networks, wireless sensor networks, computer networks and telecommunications, admission control in networking, parallel and distributed computing, databases and data mining, hardware/architecture/real-time systems, MIMO systems, modeling and simulation, performance evaluation, digital signal processing, image processing, pattern recognition, multimedia systems and video processing, character and pattern recognition, artificial intelligence, neural networks, fuzzy logic, genetic algorithms, learning automata, cloud computing, web systems, security and information assurance, cryptography, algorithms, biometrics, global navigation systems, e-services and e-business, and collaborative learning systems.

This year, we received a large number of quality papers. Only very high quality papers have been accepted. The acceptance ratio is about 34.5%. This is indicative of the diligent work of the technical program committee chairs, track chairs, technical program committee members and reviewers. The accepted papers come from all over the World with representation from academia, industry, business and government.

Many individuals have contributed to the success of this high caliber international conference. Our sincere appreciation goes to all authors including those whose papers were not included in the program. Many thanks are also due to our distinguished keynote speakers for their valuable contribution to the conference.

Special thanks are also due to the senior program chair, Prof. Isaac Woungang, for his superior role in leading the technical program efforts and to Program Chair Kuei-Fang Hsiao for her excellent work. Thanks also are due to the other program chairs, namely Professors Young-Sik Jeong, Doo-Soon Park, Jaime Lloret, and Kasim Al-Aubidy. Many thanks also go to the technical program committee members and reviewers for their timely work and efforts.

Special thanks go to the publication chair, Prof. Daniel Cascado Caballero, for his outstanding work and dedication. Thanks to our dedicated Webmaster Antonio Bueno. Special thanks go to the international publicity committee members especially, Prof. Der-Jiunn Deng, Essia Hamouda, and Lei Shu.

We would like to also thank other members of the organizing committee, including the tutorials, the special sessions, and the workshops chairs as well as the various international liaisons. Special thanks are due to the international steering committee of the CITS.

We would like to thank the IEEE Communication Society, SCS and FTRA for their technical co-sponsorship of the conference.

Finally, on behalf of the 2014 IEEE International Conference on Computer, Information and Telecommunication Systems (CITS 2014), The Society for Modeling and Simulation International (SCS), and the Future Technology Research Association (FTRA), we invite all of you to join us in Jeju Island, at CITS 2014. Enjoy the program and your stay in the beautiful city of Jeju, Korea.

- **Prof. Mohammad S. Obaidat**, General Co-chair of IEEE CITS 2014, Fellow of IEEE, Fellow of SCS, Past President of the Society for Modeling & Simulation International (SCS), Professor of Computer Science and Software Engineering, Monmouth University, NJ, USA.
- **Professor James (Jong Hyuk) Park**, General Co-chair of IEEE CITS 2014, Seoul National Univ. of Science and Technology, Korea.
- **Professor Isaac Woungang,** Senior Program Chair of IEEE CITS 2014, Department of Computer Science, Ryerson University, Toronto,
- **Professor Han-Chieh Chao**, General Co-chair of IEEE CITS 2014, National Ilan University, Taiwan, IEEE Senior member, Fellow of IET (IEE), Chartered Fellow of British Computer Society.

Prof. M. S. Obaidat

Prof. J. H. Park

Prof. I. Woungang

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Program At a Glance

	Monday, July 7
15:00 – 17:30	Registration

	Tuesday, July 8		Wednesday, July 9
8:30 – 9:00	Opening Session	8:30 – 8:40	Announcements
9:00 – 10:20	Keynote Speech 1	8:40 – 10:00	Keynote Speech 2
10:20 - 10:40	Break	10:00 –10:20	Break
10:40 – 12:00	1A: Computer Systems and Software I	10:20 – 12:00	2A: Distributed Systems and Information Systems
12:00 - 13:20	Lunch	13:00 – 13:20	Lunch
13:20 - 14:40	1B: Network and Telecommunication Systems I	13:20 - 14:20	2B: Network and Telecommunication Systems II
14:40 - 15:00	Break	14:20 – 14:40	Break
15:00 - 16:00	1C: Computer Networks and Systems	14:40 – 15:40	2C: Security and Information Assurance
16:00 - 16:20	Break	15:40 – 16:00	Break
16:20 – 17:20	1D: Computer Systems and Software II	16:00 – 17:30	2D: Tutorial
		17:30 – 17:50	Closing Session

CITS 2014 Banquette will be on Tuesday, July 8, 2014 at 7:00 pm at the site of the conference "The Shine Ville Luxury Resort "

Schedule

Monday, July 7

15:00 - 17:30

Registration

Tuesday, July 8

8:30 – 9:00

Opening Session

9:00 - 10:20

Keynote Speech 1

Recent advances in crucial enabling information and communication technologies for smart homes and cities and samples of our related works.
Session Chair: Prof. Helen D. Karatza

Distinguished Keynote Speaker: Professor Mohammad S. Obaidat

IEEE Fellow and SCS Fellow
Past President, Society for Modeling & Simulation International (SCS)
Past Advisor to the President of Philadelphia University
Editor-in-Chief, International Journal of Communication Systems
Editor-in-Chief, Journal of Information Processing
Editor-in-Chief, Journal of Convergence
Distinguished Speaker of IEEE Computer Society (1994-1997)
Distinguished Lecturer of ACM (1995-Present)
Distinguished Lecturer of SCS (2006-Present)
Professor of Computer Science & Software Engineering
Monmouth University, W. Long Branch, NJ 07764, USA
E-mail: msobaidat@gmail.com
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Digital and smart homes and cities have become an important research and development area in the 21st century due mainly to their significance to national and international health, economy, safety, transportation, and security, among others. ICT Systems have played a vital role in the emergence and development of smart cities and homes. The impressive advances in areas of information and wired and wireless communications technology have brought with them the prospect of embedding different hierarchies of smartness and intelligence in the modern home and cities. Offering comfort and safe and healthy living with an intelligent form of collaboration with their residents has been the prime goal of smart and digital homes and cities. Contingent upon the settings, the communications may be multifaceted such as mobile agent based and context-aware services or they may be uncomplicated such as controlling the room temperature or its humidity level. Sophisticated situations include the delivery of position/location-aware info content of the resident of the digital home as well as his/her activities.

The availability of inexpensive low-power sensors, the RF IC chips, and the embedded microprocessors/ microcontrollers have made tremendous impact on digital homes and cities; with large quantity of sensors, which jointly manage and make the inferences from the collected data on the state of the home and city as well as the actions and behavior of the inhabitants. As the worldwide life expectancy, especially in developed countries and newly industrialized counties is increasing, the percentage of senior/elderly citizens is increasing at an accelerated

pace and most projections suggest that this increase worldwide will reach about 10 millions in the coming decade. Senior citizens usually live in care centers, hospitals or their own homes with some relative supervision/care. Smart homes and cities can be used efficiently and economically in order to accommodate the needs of this population.
The increase of worldwide population, especially in populous countries and cities and the increase migration of citizens to cities have also brought with it challenges in transportation systems, health care, utility's supplies, learning & education, sensing city dynamics, computing with heterogeneous data sources, managing urban big data, and environmental protection including pollution and others.

In this keynote, we will shed some light on the roles of key enabling Information and Communications technologies to smart cities and homes including wireless systems, smart phones, broadband Internet access, cybersecurity, IoTs, Wireless Sensor Networks, RFID, Optical Networks and Systems, Smart Grids, Smart and Digital TV, GPS, GIS, Big Data, Cloud Computing Systems, Biometrics, e-based Systems, among others. We will also investigate the advances, current trends, challenges and future in the research and development in smart homes and cities. We will review the fundamental techniques in the design, operation, and development of these systems. We will also emphasize the importance of ICT technologies as enabling systems in this fascinating field.

Some of our recent research results, especially the ones related to the use of wireless networks and security for smart and digital homes will be presented. Among these, an adaptive MAC protocol for distributed wireless LANs that is capable of operating efficiently under bursty traffic conditions. According to the proposed protocol, the mobile station that is granted permission to transmit is selected by means of a neural-based algorithm. Another new protocol for dynamically setting 802.11 wireless LAN waveforms and transmission power levels based on the wireless channel's signal to noise ratio will be introduced. Our method, known as Signal-to-Noise Ratio-Waveform Power Adaptation (SNR-WPA), changes the power in discrete steps matched to each of the 802.11 data rate-waveform steps. By matching the power to the spreading symbol rate, our technique maximizes the network throughput while minimizing MAC layer contention. We present a new scheme to authenticate and authorize 802.11 wireless nodes within a network. This new layer of security relies on a neural network decision engine that restricts network access to mobile nodes whose physical location is within a threshold distance from the wireless access point or the controller of the network. This method gives an extra layer of security and allows enforcing policies by which network access is only allowed from a certain section of the network. We will also introduce a new security scheme that attempts to fix a flaw in the disassociation mechanism of the WPA protocol. Other related wireless research efforts by our group will be presented.

Short Bio:

Professor Mohammad S. Obaidat (Fellow of IEEE and Fellow of SCS) is an internationally well-known academic/researcher/ scientist. He received his Ph.D. and M. S. degrees in Computer Engineering with a minor in Computer Science from The Ohio State University, Columbus, Ohio, USA. Dr. Obaidat is currently a full Professor of Computer Science and Software Engineering at Monmouth University, NJ, USA. Among his previous positions are Advisor to the President of Philadelphia University, President of the Society for Modeling and Simulation International, SCS, Chair of the Department of Computer Science and Director of the Graduate Program at Monmouth University and a faculty member at the City University of New York. He has received extensive research funding and has published about Thirty (30) books and over Six Hundreds (600) refereed technical articles in scholarly international journals and proceedings of international conferences. Professor Obaidat has served as a consultant for several corporations and organizations worldwide. Mohammad is the Editor-in-Chief of 3 scholarly international journals. He is also an editor, advisory editor of numerous journals and transactions.

He has guest edited numerous special issues of scholarly journals such as IEEE Transactions on Systems, Man and Cybernetics, SMC, IEEE Wireless Communications, IEEE Systems Journal, SIMULATION: Transactions of SCS, Elsevier Computer

Communications Journal, Journal of C & EE, Wiley Security and Communication Networks, Journal of Networks, and International Journal of Communication Systems, among others. Obaidat has served as the steering committee chair, advisory Committee Chair and program chair of numerous international conferences. He is the founder of two well-known international conferences: SPECTS and CITS. He has chaired numerous international conferences and has given numerous keynote speeches worldwide.

Between 1994-1997, Obaidat has served as distinguished speaker/visitor of IEEE Computer Society. Since 1995 he has been serving as an ACM distinguished Lecturer. He is also an SCS distinguished Lecturer. Between 1996-1999, Dr. Obaidat served as an IEEE/ACM program evaluator of the Computing Sciences Accreditation Board/Commission, CSAB/CSAC. Between 2009-2011, he served as the President of the Society for Modeling and Simulation International, SCS. He also has served as SCS Senior Vice President (VP), VP Conferences and VP Membership. He has received several awards for his papers in international Conference such as IEEE GlobCom, IEEE AICCSA, IEEE DCNET, IEEE CITS, etc.

Prof. Obaidat has been awarded a Nokia Research Fellowship and the distinguished Fulbright Scholar Award. He received the SCS Outstanding Service Award for his excellent leadership, services and technical contributions. Dr. Obaidat received very recently the Society for Modeling and Simulation Intentional (SCS) prestigious McLeod Founder's Award in recognition of his outstanding technical and professional contributions to modeling and simulation. He received in Dec 2010, the IEEE ComSoc-GLOBECOM 2010 Outstanding Leadership Award for his outstanding leadership of Communication Software Services and Multimedia Applications Symposium, CSSMA 2010. He received very recently the Society for Modeling and Simulation International's (SCS) prestigious Presidential Service Award for his outstanding unique, long-term technical contributions and services to the profession and society. During the 2004/2005, he was on sabbatical leave as Fulbright Distinguished Professor and Advisor to the President of Philadelphia University in Jordan, Dr. Adnan Badran. The latter became the Prime Minister of Jordan in April 2005 and served earlier as Deputy Director General of UNESCO.

His research interests are: wireless communications and networks, telecommunications and Networking systems, security of network, information and computer systems, security of e-based systems, performance evaluation of computer systems, algorithms and networks, green ICT, smart homes and cities, high performance and parallel computing/computers, applied neural networks and pattern recognition, adaptive learning and speech processing. Prof. Obaidat is a Fellow of the Society for Modeling and Simulation International SCS, and a Fellow of the Institute of Electrical and Electronics Engineers (IEEE). For more information; see: http://bluehawk.monmouth.edu/mobaidat/

10:20 - 10:40

Break

10:40 - 12:00

Computer Systems and Software I (1A)

Session Chair: *Aissaoui Hassane*

A Comparative Study of Redundant Feature Detection based Feature Selection Methods

Su-Fen Chen (Nanchang Institute of Technology, P.R. China); Xue-Qiang Zeng (Tongji University, P.R. China)

An Evaluation Model for Analysing Persuasive Systems in Mobile Healthcare
Waransanang Boontarig (King Mongkut's University Of Technology Thonburi, Thailand); Gerald Quirchmayr (University of Vienna, Austria); Wichian Chutimaskul (King Mongkut's University of Technology Thonburi, Thailand); Borworn Papasratorn (King Mongkut's University of Technology Thonburi, Thailand)

Flow Identification and Characteristics Mining from Internet Traffic with Hadoop
Yuanjun Cai (Beijing University of Posts and Telecommunications, P.R. China); Bin Wu (Beijing University of Post and Telecommunications, P.R. China); Xinwei Zhang (Beijing University of Posts and Telecommunications, P.R. China); Min Luo (Huawei Technologies, USA); Jinzhao Su (Huawei Technologies Company, P.R. China)

High Accuracy and Low Storage Hybrid IP Traceback
Yang Minghour (Chung Yuan Chritian University, Taiwan); Jia-Ning Luo (Ming Chuan University, Taiwan); Ming-Chien Yang (Aletheia University, Taiwan); Wei-Chun Hsu (Chung Yuan Christian University, Taiwan)

12:00 - 13:20

Lunch

13:20 - 14:20

Network and Telecommunication Systems I (1 B)

Session Chair: *Bader Alkandari*

A Handover Prediction Mechanism Based on LTE-A UE History Information
Ying-Hong Wang (TamKang University, Taiwan); Guo-Rui Huang (Tamkang University, Taiwan); Yi-Chia Tung (Tamkang University, Taiwan)

A Novel Vertical Handoff Decision Making Algorithm Across Heterogeneous Wireless Networks
Nouri Omheni (University of Sfax, Tunisia); Faouzi Zarai (Sfax University, Tunisia); Mohammad S. Obaidat (Monmouth University, USA) and Kuei-Fang Hsiao (Ming-Chuan University, Taiwan)

Increase performance of four-class classification for Motor-Imagery based Brain-Computer Interface
Thang Le (King Mongkut's Institute of Technology Ladkrabang (KMITL), Thailand); Chivalai Temiyasathit (King Mongkut's Institute of Technology Ladkrabang (KMITL), Thailand)

Wireless Sensor Network in Precision Agriculture Application
Mohamed Rawidean Mohd Kassim (MIMOS, Malaysia); Ibrahim Mat (MIMOS, Malaysia); Ahmad Nizar Harun (Malaysia, Malaysia)

14:20 – 14:40

Break

14:40 – 15:40

Computer Networks and Systems (1C)

Session Chair: *Fu Cai, Aissaoui Hassane*

SDNBroker: Heterogeneous Cloud Serving Systems over Software-Defined Networking
Jiann-Liang Chen (National Taiwan University of Science and Technology, Taiwan); Yiwei Ma (National Taiwan University of Science and Technology, Taiwan)

A Kind of Intelligent Lighting Control System Using the EnOcean Network
Xiaohui Li (Wuhan University of Science and Technology, P.R. China); Guang Chen (Wuhan University of Science and Technology, P.R. China); Bing Zhao (China Electric Power Research Institute, P.R. China); Xiaobing Liang (China Electric Power Research Institute, P.R. China)

A Novel Approach for Throughput Analysis of Multi-hop Multi-Rate WLANs
Bader Alkandari (Worcester Polytechnic Institute, USA); Kaveh Pahlavan (WPI, USA)

Robust Features for Impulsive Noisy Speech Recognition using Relative Spectral Analysis
Hajer Rahali (ENIT, Tunisia); Zied Hajaiej (ENIT, Tunisia)

15:40 – 16:00

Break

16:00 – 17:20

Computer Systems and Software II (1D)

Session Chair: *Min Kyung An, Bader Alkandari*

Energy Aware Sensing and Transmission (EAST) Scheme for Firefighter Monitoring System
Mahin Khushbakht Atiq (Sejong University, Korea); Hyung Seok Kim (Sejong University, Korea)

K-clique Community Detection based on Union-Find
Fu Cai (HuaZhong University of Science and Technology, P.R. China)

A Retail Application Based On Indoor Location With Grid Estimations
Danqing Cai (SAP Asia, Singapore)

Wednesday, July 9

8:30 – 8:40

Announcements

8:40 – 10:00

Keynote Speech 2

Performance of grids and clouds - State-of-the-art and future research directions
Session Chair: Dr. Kuei-Fang Hsiao

Distinguished Keynote Speaker: Professor Helen D. Karatza
Department of Informatics
Aristote University of Thessaloniki, Greece
karatza@csd.auth.gr

The popularity of grids and clouds has been growing rapidly, and their performance becomes more important due to the tremendous increase of users and applications.

Because of the nature of these systems, there are important issues that must be addressed, such as: resource allocation, efficient scheduling, energy conservation, reliability, security and trust, cost, availability, quality. Effective management of grid and cloud resources is crucial to use effectively the power of these systems and achieve high system performance. Furthermore, due to the cost of electrical power consumption and the environmental impact, energy efficiency in grid and cloud systems is a global IT concern.

Cloud computing is a concept that has emerged from grid computing; it provides users the ability to acquire computational resources on demand from its virtually infinite pool on a pay-as-you-go basis.

The cloud computing paradigm can offer various types of services, such as computational resources for HPC applications, web services, social networking, etc. Resource allocation and scheduling is a difficult task in clouds where there are many alternative heterogeneous computers. If cloud computing is going to be used for HPC, appropriate methods must be considered for allocating resources to user requests efficiently, VM scalability, as well as effectively scheduling the tasks. The scheduling algorithms must seek a way to maintain a good response time to leasing cost ratio. Furthermore, adequate data security and availability are critical issues that have to be considered along with energy-efficient solutions that are required to minimize the impact of cloud computing on the environment.

In this talk I plan to present state-of-the-art research covering a variety of concepts on grid and cloud computing, and to provide future trends and directions in the cloud computing area.

Short Bio:

Helen D. Karatza is a Professor in the Department of Informatics at the Aristotle University of Thessaloniki, Greece. Dr. Karatza's research interests include Computer Systems Modeling and Simulation, Performance Evaluation, Grid and Cloud Computing, Energy Efficiency in Large Scale Distributed Systems, Resource Allocation and Scheduling and Real-time Distributed Systems.

Professor Karatza has authored or co-authored over 180 technical papers and book chapters including four papers that earned best paper awards at international conferences. She is senior member of IEEE, ACM and SCS, and she served as an

elected member of the Board of Directors at Large of the Society for Modeling and Simulation International (2009-2011). She has served as Program Chair and Keynote Speaker in International Conferences.

Professor Karatza is the Editor-in-Chief of the Elsevier Journal "Simulation Modeling Practice and Theory", Area Editor for Computers Systems and Networks of the "Journal of Systems and Software" of Elsevier, and she has been Guest Editor of Special Issues in multiple International Journals.

10:00 - 10:20

Break

10:20 - 12:00

Distributed systems and Information systems (2A)

Session Chair: *Helen D. Karatza*

Scheduling Jobs with Different Characteristics in Distributed Systems
Helen Karatza (Aristotle University of Thessaloniki, Greece)

Power and Delay-aware Multi-path Routing Protocol for Ad Hoc Networks
Salwa Othmen (University of sfax, Tunisia); Aymen Belghith (University of Sfax, Tunisia); Faouzi Zarai (Sfax University, Tunisia); Mohammad S. Obaidat (Monmouth University, USA); Lotfi Kamoun (LETI Laboratory University of Sfax Tunisia, Tunisia)

A Modified Backoff Algorithm for Safety Message Delivery in IEEE 802.11p/WAVE Networks
Yan-Jing Wu (Shih Chien University, Kaohsiung Campus, Taiwan); Wen-Shyang Hwang (National Kaoshiung University of Applied Science, Taiwan)

Global Identity Management of Virtual Machines Based on Remote Secure Elements
Aissaoui Hassane, AH (Mines-Telecom Institute/ Telecom-Paris-Tech, France); Pascal Urien (Télécom ParisTech, France); Guy Pujolle (University Pierre et Marie Curie - Paris 6, France)

Discriminative Leaf based Hough Forest for Vehicle Detection
Xue Fan (Hanyang University, Korea); Teng Yu (Hanyang University, Korea); Jingchun Piao (Hanyang University, Korea); Shin Hyunchul (Hanyang University, Korea)

12:00 - 13:20

Lunch

13:20 – 14:00

Network and Telecommunication Systems II (2B)

Session Chair: *Sook Chin Yip*

Minimum Latency Data Collection in Interference-Aware Wireless Sensor Networks
Min Kyung An (Sam Houston State University, USA); Hyuk Cho (University of Texas at Austin, USA)

Robot and Human Teacher A Structure of Quiz and Questionnaire to Analyze the Efficiency of Teaching

Noraidah Blar (Universiti Teknikal Malaysia Melaka, Malaysia); Fairul Azni Jafar (Utsunomiya University, Japan); Syahril Idris (Universiti Teknikal Malaysia Melaka, Malaysia)

Enhancement of Hough Voting by Using Appearance Similarity for Object Detection

Teng Yu (Hanyang University, Korea); Xue Fan (Hanyang University, Korea); Jingchun Piao (Hanyang University, Korea); Shin Hyunchul (Hanyang University, Korea)

14:00 – 14:20

Break

14:20 – 15:40

Security and Information Assurance (2C)

Session Chair: *Chun-Hsin Wu*

A Privacy-Preserving and Cheat-Resilient Electricity Consumption Reporting Scheme for Smart Grids

Sook Chin Yip (Multimedia University, Malaysia); KokSheik Wong (University of Malaya, Malaysia); Raphael Phan (Faculty of Engineering, Multimedia University, Malaysia); Su Wei Tan (Multimedia University, Malaysia); Ivan Ku (Multimedia University, Malaysia); Hew Wooi Ping (University Malaya, Malaysia

Decrypted data detection based on dynamic dataflow analysis

JianXiong Wu (China Information Technology Security Evaluation Center, P.R. China)

Secure Multi-Key File-Sharing for Cloud Storage with Erasure Coding

Chun-Hsin Wu (National University of Kaohsiung, Taiwan); Pai-Hsing Wang (National University of Kaohsiung, Taiwan)

15:40 – 16:00

Break

16:00 – 17:30

Tutorial

Energy-efficient radio resource management for 5G
Session Chair: Ms. Sook Chin Yip

Dr. Abolfazl Mehbodniva
Department of Communications Engineering
Tohoku University, Japan

The information and communication technology (ICT) data traffic is expected to increase 1,000 fold by 2020. This increasing demand is quickly draining the scarce radio resources and will eventually affect our nations' economy. This strongly motivates the need for intensive research on the 5th Generation (5G) of wireless networks, even before the saturation of current 4G technologies. Unlike its predecessors, 5G is not solely restricted to boosting the data rates, but must also establish a sustainable ICT environment. Early research and investments in 5G have already started, e.g., the European Commission has recently invested 50 million Euros into 5G research with a 2020 target. This signifies the urgency to start the same motion in other countries. The main 5G mission will be to develop spectrum- and energy-efficient networks capable of reaching speeds of 10 Gbps while limiting energy consumption.

Beyond conventional cellular data, machine-to machine (M2M) and device to device (D2D) communication will be responsible for a big portion of 5G traffic. According to recent forecasts, there will be 12.5 billion inter-connected machine-type devices worldwide by the year 2020, up from 1.3 billion in 2012. As an indispensable part of 5G, M2M communications will hence dominate the next decade in various application areas, including intelligent buildings, healthcare, smart cities, national emergency infrastructure, and public transportation. This unprecedented growth in the number of devices connected to the cellular system requires novel approaches for network design, modeling, and management, to handle problems in quality-of service provisioning, interference, and mobility. Specifically, the ability of 5G systems to sustain trillions of connected devices while providing high QoS and minimizing the energy expenditures is of utmost importance. In this tutorial we introduce different aspects of 5G and its design challenges with emphasis on two key elements, i.e., spectral-efficiency and energy-efficiency.

17:30 – 17:50

Closing Session