The 37th IEEE Sarnoff Symposium
September 19 -21, 2016
Newark, NJ, USA
Conference Program

Sarnoff 2016 Organizing Committee

IEEE Princeton/Central Jersey Section

IEEE Communications Society

Welcome Messages from General Co-Chairs

It is our great pleasure to welcome you to the 37th IEEE Sarnoff Symposium, Sarnoff 2016, Newark, New Jersey, USA.

Sarnoff Symposium has a long tradition of bringing together researchers from academia and industry to discuss challenges and solutions to pressing issues in telecommunication and networking. The theme of Sarnoff 2016 focuses on software defined network, network function virtualization and challenges and solutions on the Internet of Things.

This year's conference program includes four keynote speeches, five tutorials, two panels, 34 technical papers in parallel sessions, four invited papers, poster competition, demos and exhibits, and numerous opportunities for informal networking.

The success of the conference depends on many people who have volunteered their time and worked tirelessly in planning and organizing the conference program, making sure the local arrangement and conference logistics are in place. In particular, we thank the Technical Program Chairs for organizing a high-quality technical program; the Technical Program Committee and reviewers for their thorough and timely reviewing of the papers, all members of the Organizing Committee who work very hard to ensure the smooth running of all aspects of the conference program, and our sponsors.

We are dedicated to broadening participation. In the recent years, Sarnoff Symposium has seen a steady growth on the number of student attendees including both graduate and undergraduate students internationally. We invite you to view their posters and give your feedback on their work.

It has been a great privilege to serve as the General Co-Chairs of Sarnoff 2016 and we hope you find the conference stimulating, fulfilling and enjoyable. Thank you for your support of Sarnoff and your attendance, and wish you a pleasant and rewarding experience at Sarnoff 2016.

Ziqian (Cecilia) Dong, New York Institute of Technology, USA

Deepak Kataria, IP Junction

General Co-Chairs of Sarnoff 2016

Message from the TPC Co-chairs

We take great pleasure in welcoming you to the 37th IEEE Sarnoff Symposium being held in Newark, New Jersey, USA. This year, we received 75 long papers and 12 short papers for review, and accepted 32 long papers and 2 short papers for presentation at the symposium. The acceptance rate was 42.67% for long papers 16.67% for short papers. It was a difficult task to select these papers from the many excellent submissions to be part of the technical program. In addition, this year's technical program features 4 invited papers on diverse topics. We have arranged the accepted papers into twelve sessions distributed across the two days of the symposium.

Each of the papers received at least three reviews from the members of the technical program committee (TPC) and the designated reviewers. In fact, several papers received four and even five reviews. We are particularly indebted to the highly competent and timely help of the TPC members and the designated reviewers. Hence, special thanks go to all the TPC members and reviewers, representing academia and industry from all over the world: *Thank you for your commitment and outstanding job under severe time constraints! We could not have produced such an exciting program without your help.*

We also thank the General Chairs, Prof. Ziqian (Cecilia) Dong and Dr. Deepak Kataria and the Organizing Committee and Steering Committee members for their assistance throughout the whole organization process of the conference. We also thank all the authors who submitted their work to IEEE Sarnoff 2016.

Finally, we understand that the success of a technical symposium such as IEEE Sarnoff rests on the participation and support of an enthusiastic and attentive audience. Therefore, we are very pleased to thank *you*, the participants, for attending the conference. We sincerely hope that you will enjoy the program, and that you will contribute to future editions of IEEE Sarnoff.

Cheers!

Rudra Dutta, North Carolina State University
Christian Makaya, IBM T.J. Watson Research Center
Byrav Ramamurthy, University of Nebraska-Lincoln

Organizing Committee

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Deepak Kataria, IP Junction

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Conference Program Overview

Monday, September 19, 2016				
TIME SLOT		**ROOM 215**	**ROOM 220**	**ROOM 225**	**GENERAL EVENTS: BALLROOM**

	8:00 am - 9:00 pm	Registration: Gallery			
8:00 am - 5:00 pm Registration: Gallery	9:00 am - 12:30 pm (Break 10:30 am - 11:00 am)	**Tutorial 1: Interdependencies Between Communications and Control in Cyber Physical Systems** Husheng Li, Professor, University of Tennessee	**Tutorial 2: On the Road to 5G: MATLAB Modelling of LTE, WLAN, and MIMO antenna arrays** Idin Motedayan-Aval, Senior Application Engineer, MathWorks	**Tutorial 3: Matching Theory and its Applications in Cognitive Radio Networks** Miao Pan, Assistant Professor, University of Houston	
	12:30 pm - 2:00 pm	Lunch Break: BALLROOM A			
	2:00 pm - 5:30 pm (Break 3:30pm - 4:00 pm)	**Tutorial 4: Cloud Computing for Smart Transportation** Ashwin Ashok, Post-Doctoral Research Associate, Carnegie Mellon University; and Wenjia Li, Assistant Professor, New York Institute of Technology	Tutorial 5: **Public Safety Communications – Traditional vs LTE** K. Raghunandan (RAGHU), New York City Transit; and Jose Martin, Power Trunk		

Tuesday, September 20, 2016				
TIME SLOT		**ROOM 215**	**ROOM 220**	**ROOM 225**	**GENERAL EVENTS: BALLROOM**

	8:00 am - 9:00 am	Registration: Gallery			
8:00 am - 5:00 pm Registration: Gallery	9:00 am - 9:15 am	Opening Ceremony & Welcome Message			
	9:15 am - 10:00 am	Keynote 1: Edward Lee, Professor of Electrical Engineering, University of California at Berkeley			
	10:00 am - 10:10 am	Coffee Break (10 minutes)			
	10:10 am - 11:20 am	**Technical session T1-A**	**Technical session T1-B**	**Technical session T1-C**	**NSF Information Session: Ballroom A**
		Downlink Power Control for Latency Aware Grid Energy Savings in Green Cellular Networks	FPGA-accelerated Simulation of a Hybrid-ARQ System using High Level Synthesis	Modeling and Optimization for Programmable Unified Control Plane in Heterogeneous Wireless Networks	Dr. Jack Brassil Program Director
		Modeling Energy Costs and Emissions for Anycast RWA in Optical Data Center Networks	Enumerating Single Destination, Policy-Preferred Paths in AS-level Internet Topology Maps	Dynamic Spectrum Leasing Methodology (DSLM): A Game Theoretic Approach	National Science Foundation
		Sub-Channel Allocation in Green Powered Heterogeneous Cognitive Radio Networks	Language of Choice: On Embedding Choice-related Semantics in a Realizable Protocol	Designing Optimal Heterogeneous Networks	Computer and Network Systems (CNS)
	11:30 am - 12:15 am	Poster Session: Gallery			
	12:15 pm - 1:15 pm	Lunch: Lunch Time Talk: Narayan Menon, CTO/EVP Engineering and Founder of XCellAir: Ballroom A			
	1:15 pm - 2:00 pm	Keynote 2: Frederick Scalera, Brooks Bawden, LLC, Ballroom A			
	2:00 pm - 2:10 pm	Networking Break (10 minutes)			
	2:10 pm - 3:20 pm	**Technical session T2-A**	**Technical session T2-B**	**Technical session T2-C**	
		Data management of sensor signals for high bandwidth data streaming to the Cloud	Transparent Virtual Network Embedding in Elastic Optical Networks	Optimization of LTE Radio Resource Block Allocation for Maritime Channels	
		Smart Wireless Sensor Networks Powered by Remaining Energy Cluster Head Selection Protocol	Dynamic Erasure-coded Data Retrieval in Elastic Optical Data Center Networks	Universal Filtered Multicarrier Systems:Testbed Deployment of a 5G Waveform Candidate	
		Two-target Device-Free Passive Localization by Combining Anomaly Link Selection and Weighted-Link Minimum Error Localization	Analysis of Beam Divergence and Input Bit Rate for Free Space Optical Communication Link	Distributed Spectrum Monitoring and Surveillance using a Cognitive Radio based Testbed	
	3:20 pm - 3:30 pm	Coffee Break (10 minutes)			
	3:30 pm - 4:30 pm	Panel Session 1 - Software-Defined Network and Network Function Virtualization: Ballroom A Ajay Rajkumar - Nokia (Moderator) Jack Brassil - National Science Foundation Kalyani Bogineni - Verizon Kandan Kathirvel - AT&T Jin Xiao - IBM T.J. Watson			
	4:30 pm - 6:00 pm	Invited paper session: Ballroom A (T3: 19,20,21,22) Market-based Path Service Composition for Software Defined Networks Evaluation and Performance Modeling of Two OXC Architectures Smart Connected Canines: IoT Design Considerations for the Lab, Home, and Mission-critical Environments Using Semantic Technologies to Mine Vehicular Context for Security			
	6:00 pm - 7:00 pm	Reception: Gallery			
	7:00 pm - 9:00 pm	Dinner Banquet and Award Ceremony (Banquet Speaker Joe Jesson): Ballroom A			

	Wednesday, September 21, 2016			
TIME SLOT	**ROOM 215**	**ROOM 220**	**ROOM 225**	**GENERAL EVENTS: ROOM**
8:00 am - 9:00 am	Registration: Gallery			
9:00 am - 10:00 am	Keynote 3: Chih-Lin I, China Mobile Chief Scientist, Wireless Technologies, China Mobile Research Institute: Ballroom A			
10:00 am - 10:10 am	Coffee Break (10 minutes)			
10:10 am - 11:20 am	**Technical session W-1A**	**Technical session W-1B**	**Technical session W-1C**	
	On The Continuous Coverage Problem for a Swarm of UAVs	Trustworthy and Protected Data Collection for Event Detection Using Networked Sensing Systems	Frame-based Temporal Occupancy Characterization for Compliance Enforcement in Opportunistic Spectrum Access Networks	
	Pepple: Programmable Network Measurement for Troubleshooting Soft Failures	One-to-All Regularized Logistic Regression-based Classification for WiFi Indoor Localization	Rate Performance of Adaptive Link Selection in Buffer-Aided Cognitive Relay Networks	
	Kuijia: Traffic Rescaling in Data Center WANs	DroidDeepLearner: Identifying Android Malware Using Deep Learning	Overlay Secondary Spectrum Sharing with Independent Re-attempts in Cognitive Radios	
11:20 am - 11:30 am	Networking Break (10 minutes)			
11:30 am - 12:15 pm	Keynote 4: Elza Erkip, Professor of Electrical and Computer Engineering, New York University: Ballroom A			
12:15 pm - 1:15 pm	Lunch: Ballroom A; **Lunch Time Talk: Michael Langdon from Juniper Contrail**			
1:15 pm - 2:45 pm	Panel Session 2 - What's next in the Internet of Things and Cyber Physical Systems?: Ballroom A Manish Parashar - Rutgers University Ying Ying Chen - Stevens Institute of Technology Dario Pompili - Rutgers University Douglas M. Freimuth - IBM T.J. Watson Research Center Alicia Abella - Cloud Technologies and Services Research Organization Davor Dokonal - AEDTechnologies			
2:45 pm - 2:55 pm	Coffee Break (10 minutes)			
2:55 pm - 4:25 pm	**Technical session W-2A**	**Technical session W-2B**		
	Edge Caching and Nearest Replica Routing in Information-Centric Networking	A Honeypot System for Wearable Networks		
	Transient Analysis of a Resource-limited Recovery Policy for Epidemics: a Retrial Queueing Approach	A Greedy Algorithm for Decentralized Bayesian Detection with Feedback		
	Lowest-Cost Network Node Identification for Data Caching for Information Centric Networks	A Novel Video Steganography Algorithm in DCT Domain Based on Hamming and BCH Codes		
		P2F2: Privacy-Preserving Face Finder		
4:30 pm - 4:45 pm	Closing Ceremony			

(8:00 am - 12:00 pm Registration: Gallery)

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Keynote Speakers

Edward Lee, Professor of Electrical Engineering, University of California, Berkeley

Title: The Internet of Important Things

Abstract:

Cyber-physical systems are integrations of computation, communication networks, and physical dynamics. Applications include manufacturing, transportation, energy production and distribution, biomedical, smart buildings, and military systems, to name a few. Increasingly, today, such systems leverage Internet technology, despite a significant mismatch in technical objectives. A major challenge today is to make this technology reliable, predictable, and controllable enough for "important" things, such as safety-critical and mission-critical systems. In this talk, I will analyze how emerging technologies can translate into better models and better engineering methods for this evolving Internet of Important things.

Biography:

Edward A. Lee is the Robert S. Pepper Distinguished Professor in the Electrical Engineering and Computer Sciences (EECS) department at U.C. Berkeley. His research interests center on design, modeling, and analysis of embedded, real-time computational systems. He is the director of the nine-university TerraSwarm Research Center (http://terraswarm.org), a director of Chess, the Berkeley Center for Hybrid and Embedded Software Systems, and the director of the Berkeley Ptolemy project. From 2005-2008, he served as chair of the EE Division and then chair of the EECS Department at UC Berkeley. He is co-author of six books and hundreds of papers. He has led the development of several influential open-source software packages, notably Ptolemy and its various spinoffs. He received the B.S. degree in Computer Science from Yale University in 1979, the S.M. degree in EECS from the Massachusetts Institute of Technology (MIT) in 1981, and the Ph.D. degree in EECS from UC Berkeley in 1986. From 1979 to 1982 he was a member of technical staff at Bell Telephone Laboratories in Holmdel, New Jersey, in the Advanced Data Communications Laboratory. He is a co-founder of BDTI, Inc., where he is currently a Senior Technical Advisor, and has consulted for a number of other companies. He is

a Fellow of the IEEE, was an NSF Presidential Young Investigator, and won the 1997 Frederick Emmons Terman Award for Engineering Education.

Elza Erkip, Professor of Electrical and Computer Engineering, New York University

Title: Cooperative Wireless Networking: Theoretical Foundations and 5G Applications

Abstract:

Foundations of cooperative networking have been extensively studied in the last 45 years, leading to a wide range of information and communication theoretic results establishing benefits of cooperation in various wireless scenarios. Many protocols have been developed to facilitate cooperation among terminals with remarkable improvements in communication rates and reliability. The impending 5G wireless revolution provides the perfect setting for implementing some of these protocols and reaping the potential gains of cooperation: Large number of antennas and wide bandwidth, as in millimeter wave systems, provide abundant degrees of freedom; full-duplex radio designs allow nodes to transcend traditional duplexing limitations; and applications such as Internet of Things provide a natural setting for cooperative communication and compression. This talk provides a brief overview of the theoretical foundations of cooperative communications along with a few examples suggesting how cooperation could significantly impact performance of future 5G wireless networks.

Biography:

Elza Erkip received the B.S. degree in Electrical and Electronics Engineering from Middle East Technical University, Turkey, and the M.S. and Ph.D. degrees in Electrical Engineering from Stanford University. Currently, she is a Professor of Electrical and Computer Engineering with New York University Tandon School of Engineering. Her research interests are in multiuser information theory, communication theory, and wireless communications.

Elza Erkip received the NSF CAREER award in 2001, the IEEE Communications Society Stephen O. Rice Paper Prize in 2004, the IEEE ICC Communication Theory Symposium Best Paper Award in 2007, and the IEEE Communications Society Award for Advances in Communication in 2013. She has been a member of the Board of Governors of the IEEE Information Theory Society since 2012 where she is currently the Second Vice President.   She was a Distinguished Lecturer of the IEEE Information Theory Society from 2013 to 2014.   She is a Fellow of the IEEE, a member of the Science Academy Society of Turkey and is among the 2014 and 2015 Thomson Reuters Highly Cited Researchers.

Elza Erkip has had many editorial and conference organization responsibilities. More recently, she was a Guest Editor of the IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS in 2015, a General Chair for the IEEE International Symposium of Information Theory in 2013 and an Associate Editor of the IEEE TRANSACTIONS ON INFORMATION THEORY in 2009-2011. She will be a Technical Chair of IEEE Wireless Communications and Networking Conference in 2017.

Frederick Scalera, Director of Public Safety Innovation with Brooks Bawden, LLC

Title: FirstNet the National Public Safety Network

Biography:

Frederick Scalera joined Brooks Bawden, LLC in 2016. Previously, Fred served as Bureau Chief of the Interoperable Communications Bureau and the FirstNet State Point of Contact (SPOC) within The New Jersey Office of Homeland Security and Preparedness. New Jersey is one of only five (5) early builders of the National Public Safety Broadband Network (NPSBN). Through Fred's leadership, JerseyNet, a deployable based LTE network, has become one of the leading early builder deployments.
Mr. Scalera has a long history of public safety service and innovation. Fred retired in 2008 as a Deputy Chief with the Nutley Fire Department in New Jersey. During his time with the Nutley

Fire Department, Fred worked as an Arson Investigator assigned to the Essex County Prosecutor's Office Arson Task Force. Fred became the first Fire Service Arson Investigator to attend a Police Academy. He served as an instructor at the Essex County Police Academy for over 25 years. Fred also created one of the first hazardous materials teams within the State of New Jersey. Working with the New Jersey State Police and the New Jersey Department of Health, Fred helped create standards for training and qualifications for hazardous material teams. During Fred's career with the Fire Service and Municipal Government he also became a Certified Fire Official and a Fire Sub Code Official under the New Jersey Construction Code. Other responsibilities included radio communications, the Township Information Technology Bureau, the Emergency Management Coordinator and the Township Safety Committee. Fred not only served his home Township of Nutley, but also within Essex County as a Deputy Sherriff, the Deputy Coordinator of the County Office of Emergency Management and the Hazardous Material Coordinator.

Fred also served in the New Jersey State Legislature. He rose to be the Deputy Speaker of the New Jersey General Assembly and the Chairman of the Homeland Security Preparedness Committee. Fred was also founder of the New Jersey Fire Caucasus.

After leaving Government in 2008, Fred became the Director of Public Safety Strategies for Alcatel-Lucent assigned to the Public Safety Broadband initiative in both the United States and Canada. Fred conducted the first successful LTE pilot in Las Vegas.

Dr. Chih-Lin I, China Mobile Chief Scientist, Wireless Technologies, China Mobile Research Institute

Title: Midway of the 5G Revolution

Abstract:

Three years after the outburst of a worldwide fever of 5G pursuit, the campaign on 5G standards has entered intensive debates over network architecture, protocol stack and physical layer technologies. Midway on this 5G revolution journey, we should reflect and be sure the future 5G standards are on the right track to satisfy the challenging demands of mobile communication in various scenarios in 2020s or even earlier.

Towards a "Soft, Green and Super-Fast" 5G, CMCC's 5G R&D activities followed several revolutionary R&D themes:1) Rethinking Shannon to start a green journey on wireless systems; 2) Rethinking Ring & Young for no more "cells"; 3) Rethinking signaling & control to make network applications- and load-aware; 4) Rethinking antennas to make Base Stations invisible via SmarTiles; 5) Rethinking spectrum & air interface to enable wireless signals to "dress for the occasion"; 6) Rethinking fronthaul to enable Soft RAN via next generation fronthaul interface (NGFI); and 7) Rethinking the protocol stack for flexible configurations of diversified access points and optimal function split between CU and DU.

This talk will give an overview of CMCC's fundamental rethinking and its impact on 3GPP 5G new radio (NR) standardization, international 5G activities, standardization roadmap, spectrum strategy, prototyping and field trial plans, recent key events and respective implications.

Biography:

Chih-Lin I received her Ph.D. degree in electrical engineering from Stanford University. She has been working at multiple world-class companies and research institutes leading the R&D, including AT&T Bell Labs; Director of AT&T HQ, Director of ITRI Taiwan, and VPGD of ASTRI Hong Kong. She received the IEEE Trans. COM Stephen Rice Best Paper Award, is a winner of the CCCP National 1000 Talent Program, and has won the 2015 Industrial Innovation Award of IEEE Communication Society for Leadership and Innovation in Next-Generation Cellular Wireless Networks.

In 2011, she joined China Mobile as its Chief Scientist of wireless technologies, established the Green Communications Research Center, and launched the 5G Key Technologies R&D. She is spearheading major initiatives including 5G, C-RAN, high energy efficiency system architectures, technologies and devices; and green energy. She was an Area Editor of IEEE/ACM Trans. NET, an elected Board Member of IEEE ComSoc, Chair of the ComSoc Meetings and Conferences Board, and Founding Chair of the IEEE WCNC Steering Committee.

She was a Professor at NCTU, an Adjunct Professor at NTU, and currently an Adjunct Professor at BUPT. She is the Chair of FuTURE 5G SIG, an Executive Board Member of GreenTouch, a Network Operator Council Founding Member of ETSI NFV, a Steering Board Member of WWRF, a member of IEEE ComSoc SDB, SPC, and CSCN-SC, and a Scientific Advisory Board Member of Singapore NRF. Her current research interests center around "Green, Soft, and Open".

Invited Speakers

Joe Jesson, CEO of RFSigint Inc.

Title: "Wireless Security Risks – Spanning 75 Years of Secure Information Myths"

ABSTRACT:
Joe discusses the incorrect assumptions and myths engineers and security experts made starting from 1941, "ENIGMA messages are completely secure and cannot be read" to currently (2016) stating "AES256 cannot be broken". While initially exploring the history of encryption, Joe discusses the Bletchley Park preferred interception receiver, the 1941 RCA AR-88, which was located and procured in 2016 and being restored at the Sarnoff Museum on the campus of The College of New Jersey in Ewing, New Jersey. Slides following the years and wireless design practices,

Joe will illustrate how each new communication products, from Air Force 1 Comm to 2G Cellphones were compromised and he discussed how the new automotive and Internet of Things (IoT) technology which assumes (incorrectly) existing wireless security is secure and how the new very low-cost ($15) spectrum analyzers and open source data SDR baseband correlation tools is employed to analyze and decode, display, and regenerate the data protocols. Finally, Joe will show how he incorporated the 11941 AR88 RF design in his electronics active component lab by having the students simulate, in PSPICE and LTSPICE the AR-88 tracked RF sections and how the existing 1941 vacuum tube design compares to a modern FET RF design – given the AR-88 existing inductors and capacitors but changing the bias to reflect the differences between the Pentode Vacuum tube and the FET model.

Biography:
Joe Jesson is currently the CEO of RFSigint Inc, a Wireless IP/Patent advisory service. Patent claims are compared and mapped and expert witness offerings on IoT, M2M, Telematics, and Telemetry patents. Also, Joe is CTO for Assurenet Inc, a NY video telematics company and CTO of Able Devices, a wireless software expert on a SIM card. Joe is an engineering researcher on a DOT grant and teaches, as Adjunct and Visiting Professor at TCNJ, engineering classes and Labs. In 2007, Joe received the GE Edison Award by the Chairman of GE, Jeff Immelt, while CTO and co-founder of GE's Asset Intelligence (now ID System's Asset intelligence) IoT

business. Joe was Instrumentation Engineer at the University of Chicago Jones laboratory and has advanced degrees from DePaul University.

# Narayan Menon, CTO/EVP Engineering and Founder of XCellAir

ABSTRACT:

This talk covers the evolution trajectory of Wi-Fi, as it shapes up to address expanded deployment scenarios and new use cases. Wi-Fi is a well-entrenched wireless technology, but it is seeing significant deployment growth, as operators (MSOs and MNOs) create vastly expanded and densified Wi-Fi networks, and seek to offer value-adding, monetizable services over these networks. In addition, new use cases are emerging for Wi-Fi. Shared spectrum systems and the Internet of Things (IoT) are examples of avenues for Wi-Fi evolution. This talk discusses these growth avenues and the unique issues and requirements they present.

Biography:

At XCellAir, Narayan develops and evangelizes the technology strategy and roadmap, and leads the development of XCellAir's cloud-based network management and optimization solutions. Prior to XCellAir, he drove research and development for InterDigital, developing next-generation wireless solutions – covering topics such as small cells and Wi-Fi, spectrum management, M2M/IoT and millimeter-wave technology. Narayan previously held leadership roles at Siemens Mobile Networks, Omnipoint Technologies and Hughes Network Systems in the development of TDMA, GSM/GPRS and 3G systems. Outside of work, Narayan follows a variety of sports and is an avid movie buff.

Narayan holds Engineering degrees from the Indian Institute of Technology, New Delhi and an Executive MBA from Hofstra University in New York.
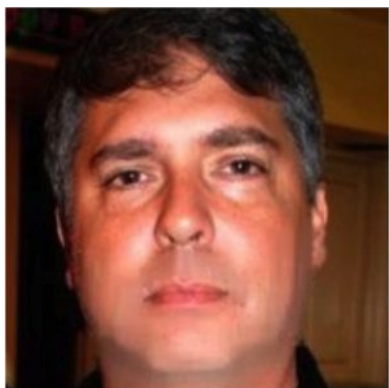
Michael Langdon, Director Systems Engineering at Juniper Networks

Biography:
Michael Langdon is Director, Engineering at Juniper Networks for the Contrail Business Unit where he supports field enablement for cloud and network services virtualization in an orchestrated architecture for service providers and enterprises. Michael is now on his second tour with Juniper. Starting in Juniper's early years, Michael was a Sales Engineer working with carrier customers in the Northeast. After almost 13 years he joined start up Contrail Systems to build & lead their Sales Engineering team. Juniper acquired Contrail in late 2012 and Michael has been an Engineering Director since. Michael has helped customers design and build some of the largest and most reliable networks on the planet. Previously Michael worked as an ISP consultant to carrier networks and as operations and engineering manager for one of the original NSFNet backbones (JvNCNet). Michael is a graduate of Villanova University and started his career as an officer in the US Navy onboard a Knox class frigate. Michael is based in the New York City area.

Panel 1 - Software-Defined Network and Network Function Virtualization (September 20, 3:30pm-4:30pm, Ballroom A)

1. Ajay Rajkumar

Ajay Rajkumar received a Ph.D. in Computer Science from Courant Institute of Mathematical Sciences, New York University. Dr. Rajkumar currently leads the SDN and Programmable Networks domain in Mobile Networks CTO at Nokia. Dr. Rajkumar has received Bell Labs President's Award for Design and Prototype of Base Station Router (BSR) which has since its early days evolved into Mobile Edge Computing and its concepts used to develop flat IP architectures across many different cellular standards. He has received another Bell Labs President's Silver award for the first prototype that demonstrated seamless interworking across heterogeneous access networks for real-time applications. Dr. Rajkumar led the mobile industry to develop standards that enable ubiquitous coverage across heterogeneous access and was the Founding Chair of IEEE 802.21 for Media Independent Handover. He was also a Member of the IEEE 802 Executive Committee Board. Dr. Rajkumar has been a frequent invited speaker at research labs, universities, industry and technical panels. He has many publications and has received more than 25 patents in very diverse areas of technology.

2. Jack Brassil

Jack Brassil currently serves as a Program Director in the Division of Computer and Network Systems at the National Science Foundation in Arlington, Virginia.

His program responsibilities include the Networking Technology and Systems (NeTS) core research program, and experimental networking and computing research infrastructure including GENI, US Ignite, and NSFFutureCloud.

Dr. Brassil has performed and managed computing and networking research for over 25 years, holding multiple positions at Bell Labs in Murray Hill and Holmdel, NJ, and HP Labs in Palo Alto, Ca.

He is a Senior Scholar in the Department of Computer Science at Princeton University (on leave), and is a Fellow of the IEEE.

3. Kalyani Bogineni
Fellow, Verizon

Dr. Kalyani Bogineni is a Fellow at Verizon, responsible for defining forward-looking network architectures using new technologies like SDN, NFV, 5G, Information Centric Networking and Mobile Edge Computing. Recently, she led a group of Verizon technologists, along with other industry leaders, to define Verizon's SDN-NFV architecture. The resulting document outlines the strategies necessary to evolve Verizon's existing network to meet the needs of new and emerging technologies. Prior to that project, Dr. Bogineni worked on network architecture and standardization for technologies including 4G/LTE, IP-optical integration, and Advanced Intelligent Networks.

4. Kandan Kathirvel

Gnanavelkandan Kathirvel is a Lead-System Architect and Cloud expert at AT&T working on Cloud Strategy, Cloud Architecture and Network function Virtualization (NFV). Kandan led the architecture work to support Cloud convergence, building external cloud and Content Delivery network (CDN) for AT&T. He is currently focused on AT&T's "Domain 2.0" initiative to virtualize large portions of AT&T Network services infrastructure on top of a common OpenStack based Cloud.

5. Jin Xiao

Jin Xiao is a research staff member at IBM T. J. Watson Cloud platforms and services. He is a lead architect and technical consultant on Next-generation enterprise optical networks and software-defined network functions for IBM global network service infrastructure. Dr. Xiao received his Ph.D. in Computer Science from University of Waterloo, Canada where he conducted research on network and service operations and management. His current focus is on network service automation for hybrid enterprise Cloud.

Panel 2 - What's next in the Internet of Things and Cyber Physical Systems? (September 21, 1:15pm-2:45pm, Ballroom A)

1. Prof. Dario Pompili

Dr. Dario Pompili in an associate professor in the Department of Electrical and Computer Engineering (ECE) at Rutgers University, NJ, USA, where since 2007 he is the director of the Cyber-Physical Systems Laboratory (CPS Lab). He received a PhD degree in ECE from the Georgia Institute of Technology in 2007, where he worked in the Broadband Wireless Networking Laboratory. He had previously received a "Laurea" (integrated BS/MS) and Doctorate degrees in Telecommunications and Systems Engineering from the University of Rome "La Sapienza," Italy, in 2001 and 2004, respectively.
In 2011, Dr. Pompili received the NSF CAREER award to design efficient communication solutions for underwater multimedia applications. In 2012, he received the ONR Young Investigator Program (YIP) award, one out of 26 awarded nationwide, to develop an uncertainty-aware autonomic mobile computing grid framework as well as the DARPA Young Faculty Award (YFA), one out of 51 awarded nationwide, to enable real-time information processing based on compute-intensive models for operational neuroscience. In 2015, he was nominated Rutgers Chancellor's Scholar. Dr. Pompili published more than a hundred refereed scholar publications: with almost 6,000 citations, he has an h-index of 27 and an i10-index of 42 (Google Scholar, July'16). Since 2014, he is a Senior Member of both the IEEE Communications Society and the ACM.

2. Douglas M. Freimuth

Douglas Freimuth is a Senior Technical Staff Member and Master Inventor in the Cognitive Internet of Things group at the IBM Thomas J. Watson Research Center where he has focused on the research, design and development of cloud networking and IoT technologies. He is a co-author of the IO Virtualization (IOV) specifications in the PCI SIG. He has also participated in the Distributed Management Task Force (DMTF) for activities related to deployment of Virtual Machines and cloud networks. He has 70+ disclosures and patents in the domain of cloud networking and has also published related papers, developed products and contributed to open source software. Doug was the IBM lead on the DARPA CORONET program where he led the creation of a cloud computing platform that automatically scaled compute and network resources across the wide area network.

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3. Manish Parashar

Manish Parashar is Distinguished Professor of Computer Science at Rutgers University. He is also the founding Director of the Rutgers Discovery Informatics Institute (RDI2). His research interests are in the broad areas of Parallel and Distributed Computing and Computational and Data-Enabled Science and Engineering. Manish serves on the editorial boards and organizing committees of a large number of journals and international conferences and workshops, and has deployed several software systems that are widely used. He has also received a number of awards and is Fellow of AAAS, Fellow of IEEE/IEEE Computer Society and ACM Distinguished Scientist. For more information please visit http://parashar.rutgers.edu/

4. Alicia Abella

Dr. Abella – AVP, Cloud Technologies and Services Research Organization – With 21 years of research experience, Dr. Abella has held positions that allow her to demonstrate her skills in a broad research spectrum which have unfolded into her organization's current responsibilities which include research in cloud computing, software-defined storage, human-computer interaction, mobile services, and Internet of Things.

In 2013, Dr. Abella received Columbia University's Medal of Excellence, an award given each year to an alumnus or alumna, under 45 years of age, whose record in scholarship, public service, or professional life is outstanding. This is the first time since 1929 – when the award was first given– that Columbia has awarded the medal to an engineer. In 2011, she was selected by President Obama to be on his Presidential Advisory Commission for Educational Excellence for Hispanics. Also in 2011, she was inducted into the prestigious WITI (Women in Technology International) Hall of Fame.

Besides her technical contributions, Dr. Abella has been a strong advocate in fostering the development of minorities and women in science and engineering. She received her B.S. in Computer Science from NYU and her M.S. and Ph.D. in Computer Science from Columbia University.

5. Davor Dokonal

As a Director of Cloud Services at AEDTechnologies, Davor consults companies on the utilization of cloud services in their operations, transformation of existing products or creation of new web and cloud-based offerings. As a project manager (PMP), scrum master and facilitator, he embeds with clients' teams to facilitate agile development or manage R&D and infrastructure deployment projects. As a security advisor, he performs security audits and assessments and advises on technical and security policy issues.While heading up the Strategic Product Management group at LM Ericsson's division on Long Island, Davor managed a program of mobile Internet applications, conceptualized new wireless services and new media usage models through close cooperation with global mobile operators. Amongst others, the teams' task was to create new M2MC services, the early incarnation of today's growing Internet of Things. Davor holds M.E.E. in Telecommunication and Information Technology from the School of Electrical Engineering, University of Zagreb, Croatia. He is a certified Project Management Professional (PMP), and a Senior Member if Institute of Electrical and Electronic Engineers. He is currently the Chair of the Long Island Computer Society and the editor of the IEEE Long Island Newsletter.

Tutorials – Monday, September 19, 2016

1) **Husheng Li**, Professor, University of Tennessee,
Email: hli31@utk.edu
Title: Interdependencies Between Communications and Control in Cyber Physical Systems: A Tutorial

Abstract: In the last decade, there have been substantial studies on cyber physical system (CPS). In CPS, there exist physical, computing and communication elements. For controlling the physical dynamics, sensors and controllers are connected via a communication network over which the measurement on the system state can be conveyed. Many systems can be categorized as CPSs, such as smart grids, unmanned aerial vehicles and robotic networks. The study on CPS can provide a comprehensive and inter-disciplinary framework for analyzing and designing these practical systems.
A particular important aspect of CPS is the interdependencies between its control and communications, which also means the interdependencies of the physical and cyber components of CPS. The understanding of the entanglement between control and communications has a substantial impact on the analysis and design of CPS. To that end, the following topics will be covered in the tutorial:
• Elements of CPS
• Basics of communications and control
• Impacts on communications on control system
• Communication capacity requirement for control in CPS
• Communication networking for control in CPS: network topology design, scheduling, routing
• Security and privacy in communications and control
• Applications in practical CPS such as smart grid

Intended audience: researchers, engineers, graduate students who are interested in CPS.
Speaker: Husheng Li, associate professor of The University of Tennessee, Knoxville.
Bio: Husheng Li received the BS and MS degrees in electronic engineering from Tsinghua University, Beijing, China, in 1998 and 2000, respectively, and the Ph.D. degree in electrical engineering from Princeton University, Princeton, NJ, in 2005. From 2005 to 2007, he worked as a senior engineer at Qualcomm Inc., San Diego, CA. In 2007, he joined the EECS department of the University of Tennessee, Knoxville, TN, as an assistant professor. He is promoted to associate professor in 2013. His research is mainly focused on cyber physical systems, smart grid, wireless communications, networking, and information theory. Dr. Li is the recipient of the Best Paper Awards of EURASIP Journal of Wireless Communications and Networks, 2005, EURASIP Journal of Advances in Signal Processing 2015, IEEE ICC, 2011 and IEEE SmartGridComm 2012, and the Best Demo Award of IEEE Globecom, 2010.

2) **Idin Motedayan-Aval**, Senior Application Engineer, MathWorks,
Email: Idin.Motedayen-Aval@mathworks.com
Title: On the Road to 5G: MATLAB Modelling of LTE, WLAN, and MIMO antenna arrays

Overview: Research and development of 5G technology is well under way. New modulation schemes, MIMO configurations and frequency bands are all candidates to form part of the new generation of mobile communication systems. Flexible and capable simulation platforms are needed to model, assess and develop these candidate technologies.

In this tutorial, you will learn how MATLAB LTE, WLAN, and phased array antenna capabilities can be used to investigate the key evolving technologies that will form the core of 5G systems. Technical examples and customer case studies will be used to illustrate how MATLAB can be used to:

• Capture and analyse off the air LTE and WLAN signals
• Model and evaluate the performance of LTE and WLAN systems
• Study the effect of multi-antenna (MIMO) interference rejection algorithms
• Modify existing 4G systems to evaluate 5G candidate technology

Agenda:

LTE and WLAN simulation and analysis with MATLAB

• Signal generation & analysis
• End to end simulation
• Golden reference verification
• Signal information recovery
Modelling antenna arrays and multi-antenna systems

• Simulating and assessing phased array signal processing and beamforming
• Antenna array modeling and simulation, including RF impairments
• Interference suppression in LTE
• MIMO design and beamforming in LTE and WLAN systems
• LTE release 12 Carrier Aggregation
Working with live signals
Transmit, receive, and analyze over-the-air LTE and WLAN signals using MATLAB with SDR hardware
Evolving 4G to 5G
• Modifying existing 4G systems
• Modelling 5G candidate technologies
• Evaluating 5G vs. 4G performance

Bio:

Idin Motedayen-Aval is a senior applications engineer at MathWorks in the Signal Processing and Communications group. He holds an MS degree in Electrical Engineering from the University of Michigan, and a BS degree in Computer Systems Engineering from the University of Massachusetts. His interests are in the general area of wireless communications, with past work concentrated on communication theory, coding, and joint data detection/channel estimation

techniques. Currently he focuses on working with top-tier companies in the semiconductor and communication industries to help expand and optimize their use of MathWorks tools.

3) **Miao Pan**, Assistant Professor, University of Houston,
Email: miaopan.ufl@gmail.com
Title: Matching Theory and its Applications in Cognitive Radio Networks

Abstract:
Spectrum trading creates more accessing opportunities for secondary users (SUs), and economically benefits the primary users (PUs). Compared with centralized spectrum trading designs, e.g., spectrum auction, distributed spectrum trading better captures instantaneous spectrum trading opportunities over large geographical regions without incurring extra infrastructure deployment and control cost. However, existing distributed spectrum trading designs have limited concern about spectrum reuse. Considering spatial reuse, in this talk, I will present a novel distributed frequency reuse based opportunistic spectrum trading (D-FROST) scheme, which can further improve spectrum utilization, provide more accessing opportunities for SUs, and increase the revenues of PUs. In this study, we employ conflict graph to characterize the SUs' co-channel and radio interference, and mathematically formulate a centralized PUs' revenue maximization problem under multiple wireless transmission constraints. Due to the NP-hardness to solve the problem and no-existence of centralized trading entity, we develop the DFROST algorithms based on dynamic matching with evolving preferences, and prove its stability. Through simulations, we show that the D-FROST algorithm is superior to other distributed spectrum trading algorithms without considering spectrum reuse, yields results close to the centralized optimal one, and is effective in increasing PUs' revenue and improving spectrum utilization. Besides, based on D-FROST, I will also discuss some privacy preserving issues of distributed spectrum trading.

Bio:
Dr. Miao Pan is an Assistant Professor in the Department of Electrical and Computer Engineering at University of Houston. He was a recipient of NSF CAREER Award in 2014. Dr. Pan received Ph.D. degree in Electrical and Computer Engineering from University of Florida in August 2012. He was an Assistant Professor in the Department of Computer Science at Texas Southern University from Fall 2012 to Spring 2015. Dr. Pan's research interests include cognitive radio networks, cyber-physical systems, and cybersecurity. He has published 20 papers in prestigious journals including IEEE/ACM Transactions on Networking, IEEE Journal on Selected Areas in Communications, IEEE Transactions on Mobile Computing, and IEEE Transactions on Smart Grid, and over 50 papers in top conferences such as IEEE INFOCOM, ICDCS, and IEEE IPDPS. His work on cognitive radio network won Best Paper Award in Globecom 2015. Dr. Pan serves as a Technical Reviewer for many international journals and conferences. He has also been serving as a Technical Program Committee member of several top international conferences, e.g., IEEE INFOCOM 2014 – 2017. Dr. Pan is a member of IEEE and IEEE ComSoc.

4) **Ashwin Ashok**, *Post-Doctoral to Assistant Professor, Georgia State University; and* **Wenjia Li**, *Assistant Professor, New York Institute of Technology*
Email: ashwinashok193@gmail.com; wli20@nyit.edu
Title: Cloud Computing for Smart Transportation
1 Tutorial Scope and Intended Audience
Computing requirements for vehicular applications are increasing tremendously, particularly with the exploding interest in driver-safety enhancement applications and autonomous vehicles. With the increasing number of vehicles being connected to the Internet, vehicles can already be seen as a part of the Internet– of–Things paradigm. The large scale nature of such an IoT system can be effectively and efficiently assisted by cloud-computing infrastructures and platforms, which may otherwise not be possible to handle with resource-constrained in–vehicular or other mobile-computing infrastructures. Cloud computing can provide flexible computational resources and high-capacity storage for data streams while ensuring safety, security and privacy. Designing cloud-assisted vehicular systems will require rethinking the design of mobile software architectures, frameworks and techniques to efficiently distribute computing resources across elements such as devices, infrastructures and vehicles in the smart transportation framework. The goal of this tutorial is to introduce to its audience the idea of cloud computing applied to the vehicular smart transportation systems. The tutorial will primarily discuss topics on cloud computing in the light of mobile computing systems, software architectures enabling a cloud computing system for vehicular use–case, and security and privacy issues in such systems. The intended audience for this tutorial would be researchers and students who are generally interested in the areas of cloud computing, intelligent transportation systems and mobile computing. The tutorial will be developed from a system design point of view. In particular, a session in the tutorial would incorporate a short procedural example of designing a real cloud–enabled mobile system. The tutorial would be delivered from a beginner level perspective of the audience. However, some basic knowledge of mobile systems in the audience would be helpful but not mandatory.

2 Description of Topics
2.1 Vehicular Cyber–Physical Systems and Cloud computing
• Introduction to Smart Transportation
• Vehicles and the IoT paradigm
• Cloud computing basics
• Cloud based mobile computing: Cloud Offloading concepts
• Vehicular computing system
• Cloud based applications in vehicles
• System design challenges in vehicular cloud computing
• Candidate emerging technologies and concepts for vehicular cloud computing

2.2 Security and Privacy
• Security, trust and privacy aspects of IoT systems
• Security and Privacy challenges in vehicular networks
• Designing Secure Mobile computing architectures
2.3 Example System Design
Design of a cloud–based computer vision application for vehicular On–board Unit execution:

Android mobile device + remote cloud server

Bio:

Ashwin Ashok is currently an Assistant Professor in the Dept. of Computer Science at Georgia State University where he leads research on mobile systems and Internet-of-Things. Prior to this he was a Postdoctoral Research Associate in ECE at Carnegie Mellon University under the mentorship of Prof. Peter Steenkiste (CMU) and in collaboration with Dr. Fan Bai (GM Research). While affiliated to the CMU-GM Continuous and Autonomous Driving Collaborative Research Lab (CRL) at CMU he developed cloud-computing systems for vehicular applications. Ashwin completed his Ph.D. in Oct'2014 from Wireless Information Network Lab (WINLAB) at Rutgers University where he worked under the guidance of Profs. Marco Gruteser, Narayan Mandayam and Kristin Dana. His doctoral thesis developed a novel inter-disciplinary concept called visual MIMO that explores the use of cameras and other optical arrays as receivers in a communication system. Ashwin has interned at QualComm (NJ) for a summer working on QualComm's LumiCast technology for visible light communication based indoor positioning. Ashwin is an experimentalist and has keen interests in system design and prototyping. He loves tinkering with circuits, Arduino and RaspberryPi.

Wenjia Li is an Assistant Professor in the Department of Computer Science at New York Institute of Technology. He specializes in cyber security, computer networks, and mobile computing, especially security, trust, and privacy issues in wireless networks, cyber-physical systems (CPS) such as intelligent transportation systems, internet of things (IoT), and mobile social networks. In addition to teaching various graduate courses such as algorithms and programming languages, Li is also a very active researcher. He served in the organizing committee for various prestigious international conferences such as ACM WiSec 2015, IEEE Sarnoff 2015, IEEE IPCCC 2014, etc. He also served as program committee member for many well-famed international conferences including IEEE GLOBECOM, IEEE WCNC, IEEE IPCCC, IEEE MDM, etc. Moreover, he reviews papers for many top-tier peer-reviewed journals, such as IEEE Transactions on Parallel and Distributed Systems (TPDS), IEEE Transactions on Wireless Communications (TWC), IEEE Transactions on Dependable and Secure Computing (TDSC), and IEEE Transactions on Information Forensics and Security (T-IFS), etc. His research is supported by the US Department of Transportation (US DOT) Region 2 University Transportation Research Center (UTRC). Li is a member of ACM and IEEE. Prior to joining NYIT in 2014, he was a tenure-track assistant professor at Georgia Southern University, at a Doctoral and Research University by The Carnegie Foundation for the Advancement of Teaching (2006), and at a public comprehensive university within the University System of Georgia (USG) between August 2011 and July 2014. He obtained his Ph.D. in computer science from University of Maryland Baltimore County (UMBC) in August 2011, and Masters degree in computer science and Bachelors degree in telecommunication engineering, both from Hunan University, China, in 2005 and 2002, respectively.

5) **K. Raghunandan (RAGHU)**, New York City Transit; and Jose Martin, CEO, Power Trunk
Email: raghunandan@ieee.org
Title: Public Safety communications – traditional Vs LTE

Abstract of tutorial:

Public safety communications involve not only the first responders (police, fire, EMS) but also public transport agencies such as rail, bus, EMS services. These systems are unique in terms of communication between one to many. It also commonly uses the Push-To-Talk (PTT) technology widely deployed throughout the world. In recent years the cellular standards body has tried to address this aspect of communication using Rel.12 of 4G LTE. The traditional public safety standards of P25, TETRA and others continue to be deployed and operate well. What are the advantages and limitations of the traditional Vs the broadband approach offered by 4G LTE? This tutorial explores some of the options and provides an overview of both approaches.

Course work:

• Public safety – narrowband. Deployment and usage
• Needs of the first responder – why keep away from the cellular world?
• Country wide spectrum allocations and advantages of VHF and UHF
• What is the security process in standards – P25 Vs TETRA
• Why use cellular – what is its strength? What is the advantage of broadband?
• Can broadband provide the same level of reliability and unique features of PTT?
• Worldwide guidelines on public safety standards and usage
• Conclusion

Learning Outcomes (Objectives):

1. This course will give audience better understanding of differences between narrowband public safety and broadband usage

2. For network administrators – this course provides a view of how smart phones Vs traditional portables may be segmented. It helps them to configure networks and transition from analog to digital technologies.

3. This course provides the basics to develop highly secure phone applications (both portable and smart phone platforms); learning how application related security is separated from the network, is the key.

4. For network managers who plan network architecture – this course provides a better understanding on coverage, capacity and deployments for critical communications.

5. For project managers this course provides a better understanding on why public safety communication has remained separate from the commercially available wireless systems. Why governments around the world see the need for this separation and some unique needs.

Course Length: The course is of 3.5 hours duration in two continuous sessions (of 90 minutes each) with a 15 minute break between the two sessions. It meets the CEU requirements needed by those with PE license. There will be a short quiz at the end of each session (just before the break and another at the end of course).

Contact information: K. Raghunandan (RAGHU), 646-252-4524 (off) and 646-306-3481 (cell). Email: raghunandan@ieee.org

Jose Martin, 201 630 4520

K. Raghunandan: An industry acknowledged wireless expert – has presented papers and tutorials extensively in IEEE and other industry forums. Several new technology wireless networks in the NY metro area were designed and implemented by him. Evaluation of vendor products, pilot trials and deployment over the years has brought considerable experience, which he will share with the audience. In Bell labs he worked on development of cell phones, radio network products and testing them in the lab and field, he has an in depth view of real world performance. He led

Radio Access Networks (RAN) team in the standards group 3GPP gaining insights on how a standards body ushers new wireless technologies. He holds bachelors, masters and research degrees in Electrical engineering and has over three decades of experience in industry, with a decade each in the aerospace, telecommunication and transportation industries, and currently works for New York City Transit.

Jose Martin: He is the CEO of Power Trunk, a subsidiary of Sepura UK. He holds a Master Engineer in Telecommunications (Madrid Technical University, 1987) with honors to his contributions to airborne real-time software in the European Space Agency program. Mr. Martin is a recognized land mobile radio industry pioneer. Since joining PowerTrunk's parent company, Teltronic S.A.U., fourteen years ago, he led the company's commercial expansion across the globe. For the last four years, in his role as Chief Operating Officer of PowerTrunk, Mr. Martin has spearheaded the acceptance of the TETRA standard by regulatory bodies in the United States and Canada, revolutionizing these land mobile radio markets. In addition Mr. Martin has been the driving force behind PowerTrunk's trailblazing implementations of the first ever TETRA land mobile radio networks in both the United States and Canada.

Technical Program

Time	Ballroom A	Room 215	Room 220	Room 225
Tuesday, September 20				
10:10 am-11:20 am		T1-A: *Green Networks*	T1-B: *Network Architectures*	T1-C: *Wireless Networks-1*
02:20 pm-03:30 pm		T2-A: *Internet of Things (IoT)*	T2-B: *Optical Networks*	T2-C: *Wireless Networks-2*
04:30 pm-06:00 pm	T3: *Invited Papers*			
Wednesday, September 21				
10:10 am-11:20 am		W1-A: *Reliability*	W1-B: *Security, Privacy and Trust-1*	W1-C: *Cognitive Radio Networks*
02:55 pm-04:25 pm		W2-A: *Information-Centric Networks*	W2-B: *Security, Privacy and Trust-2*	

Tuesday, September 20

Tuesday, September 20, 10:10 - 11:20

T1-A: Green Networks

Room 215

Downlink Power Control for Latency Aware Grid Energy Savings in Green Cellular Networks
Vinay Chamola (National University of Singapore, Singapore); Pratik Narang (National University of Singapore, India); Biplab Sikdar (National University of Singapore, Singapore)

Modeling Energy Costs and Emissions for Anycast RWA in Optical Data Center Networks
Arash Deylamsalehi, Pegah Afsharlar and Vinod M. Vokkarane (University of Massachusetts Lowell, USA)

Sub-Channel Allocation in Green Powered Heterogeneous Cognitive Radio Networks
Ali Shahini and Nirwan Ansari (New Jersey Institute of Technology, USA)

T1-B: Network Architectures

Room 220

FPGA-accelerated Simulation of a Hybrid-ARQ System using High Level Synthesis
Swapnil Mhaske (Rutgers University, USA); Hojin Kee and Tai Ly (National Instruments, USA); Predrag Spasojević (Rutgers University, USA)

Enumerating Single Destination, Policy-Preferred Paths in AS-level Internet Topology Maps
Mehmet Engin Tozal (University of Louisiana at Lafayette, USA)

Language of Choice: On Embedding Choice-related Semantics in a Realizable Protocol
        Robinson Udechukwu, Shireesh Bhat, Rudra Dutta and George N. Rouskas (North Carolina State University, USA)

T1-C: Wireless Networks-1

Room 225
Modeling and Optimization for Programmable Unified Control Plane in Heterogeneous Wireless Networks
        Brian Jalaian (Virginia Tech, USA); Venkateswara Dasari (US Army Research Laboratory, USA); Thomas Hou (Virginia Tech, USA)
Dynamic Spectrum Leasing Methodology (DSLM): A Game Theoretic Approach
        Sachin Sharma and Seshadri Mohan (University of Arkansas at Little Rock, USA)
Designing Optimal Heterogeneous Networks
        Amit K Mukhopadhyay (Bell Laboratories, Alcatel-Lucent, USA); Harold Batteram and Xiaohua Chen (Nokia, USA); Frank Louwdyk (Nokia, Australia); Ashoke Sharma (Alcatel-Lucent, USA); Zhengxue John Zhao (Bell Laboratories, Alcatel-Lucent, USA)

Tuesday, September 20, 14:20 - 15:30

T2-A: Internet of Things (IoT)

Room 215
Data management of sensor signals for high bandwidth data streaming to the Cloud
        Theodoros Soultanopoulos (Technical University of crete, Greece); Stelios Sotiriadis and Euripides G.M. Petrakis (Technical University of Crete (TUC), Greece); Cristiana Amza (University of Toronto, Canada)
Smart Wireless Sensor Networks Powered by Remaining Energy Cluster Head Selection Protocol
        Fawaz Alassery (Stevens Institute of Technology, USA); Walid Ahmed (Broadcom Inc., USA)
Two-target Device-Free Passive Localization by Combining Anomaly Link Selection and Weighted-Link Minimum Error Localization
        Shuyan Li and Wei Huang (New York Institute of Technology, P.R. China); Donglin Wang and Ziqian (Cecilia) Dong (New York Institute of Technology, USA)

T2-B: Optical Networks

Room 220
Transparent Virtual Network Embedding in Elastic Optical Networks
        Sunny Shakya (Ciena Corporation, USA); Xiaojun Cao (Georgia State University, USA)
Dynamic Erasure-coded Data Retrieval in Elastic Optical Data Center Networks
        Juzi Zhao and Vinod M. Vokkarane (University of Massachusetts Lowell, USA)
Analysis of Beam Divergence and Input Bit Rate for Free Space Optical Communication Link
        Muhammad Awan and Seshadri Mohan (University of Arkansas at Little Rock, USA)

T2-C: Wireless Networks-2

Room 225
Optimization of LTE Radio Resource Block Allocation for Maritime Channels
> Amit Kachroo, Mehmet Kemal Ozdemir and Hatice Mogulkoc (Istanbul Sehir University, Turkey)

Universal Filtered Multicarrier Systems:Testbed Deployment of a 5G Waveform Candidate
> Selahattin Gökceli, Buse Canlı and Gunes Karabulut Kurt (Istanbul Technical University, Turkey)

Distributed Spectrum Monitoring and Surveillance using a Cognitive Radio based Testbed
> Oluwaseyi Omotere (Prairie View A&M University, USA); Wasiu Opeyemi Oduola (Prairie View A & M University, USA); Nan Zou (PVAMU, USA); Xiangfang Li and Lijun Qian (Prairie View A&M University, USA); Deepak Kataria (IPJunction Inc, USA)

Tuesday, September 20, 16:30 - 18:00

T3: Invited Papers

Room: Ballroom A
Market-based Path Service Composition for Software Defined Networks
> Ilya Baldin (RENCI/UNC Chapel Hill, USA); Shu Huang (RENCI, USA)

Evaluation and Performance Modeling of Two OXC Architectures
> Jingxin Wu and Maotong Xu (George Washington University, USA); Suresh Subramaniam (The George Washington University, USA); Hiroshi Hasegawa (Nagoya University, Japan)

Smart Connected Canines: IoT Design Considerations for the Lab, Home, and Mission-critical Environments
> John Majikes, Sean Mealin, Rita Brugarolas, Katherine Walker, Sherrie Yuschak, Barbara Sherman, Alper Bozkurt and David L. Roberts (North Carolina State University, USA)

Using Semantic Technologies to Mine Vehicular Context for Security
> Sandeep Narayanan (University of Maryland, Baltimore County, USA); Sudip Mittal (University of Maryland Baltimore County, USA); Anupam Joshi (University of Maryland, Baltimore County, USA)

Wednesday, September 21

Wednesday, September 21, 10:10 - 11:20

W1-A: Reliability

Room 215
On The Continuous Coverage Problem for a Swarm of UAVs
> Hazim Shakhatreh and Abdallah A Khreishah (New Jersey Institute of Technology, USA); Jacob Chakareski (UA, USA); Haythem Bany Salameh (Yarmouk University, Jordan); Issa M Khalil (Qatar Computing Research Institute & Qatar Foundation, Qatar)

Pepple: Programmable Network Measurement for Troubleshooting Soft Failures
> Chen Xu (University of Massachusetts, Lowell, USA); Xiaoban Wu and Yan Luo (University of Massachusetts Lowell, USA); Brian Tierney (Lawrence Berkeley National Laboratory, USA); Jeronimo Bezerra (Florida International University, USA)

Kuijia: Traffic Rescaling in Data Center WANs
> Che Zhang, Hong Xu, Libin Liu, Zhixiong Niu, Peng Wang and Yongqiang Tian (City University of Hong Kong, Hong Kong); Chengchen Hu (Xi'an Jiaotong University, P.R. China)

W1-B: Security, Privacy and Trust-1

Room 220
Trustworthy and Protected Data Collection for Event Detection Using Networked Sensing Systems
> Md Zakirul Alam Bhuiyan and Jie Wu (Temple University, USA)

One-to-All Regularized Logistic Regression-based Classification for WiFi Indoor Localization
> Zifan Peng and Yuchen Xie (New York Institute of Technology, P.R. China); Donglin Wang and Ziqian (Cecilia) Dong (New York Institute of Technology, USA)

DroidDeepLearner: Identifying Android Malware Using Deep Learning
> Zi Wang, Juecong Cai, Sihua Cheng and Wenjia Li (New York Institute of Technology, USA)

W1-C: Cognitive Radio Networks

Room 225
Frame-based Temporal Occupancy Characterization for Compliance Enforcement in Opportunistic Spectrum Access Networks
> Sean Rocke (The University of the West Indies, Trinidad and Tobago); Alexander M. Wyglinski (Worcester Polytechnic Institute, USA)

Rate Performance of Adaptive Link Selection in Buffer-Aided Cognitive Relay Networks
> Bhupendra Kumar (IIT Delhi, India); Shankar Prakriya (Indian Institute of Technology, Delhi, India)

Overlay Secondary Spectrum Sharing with Independent Re-attempts in Cognitive Radios
> Senthil Kumar Muthukrishnan (PSG College of Technology, Coimbatore, India); Aresh Dadlani (Gwangju Institute of Science and Technology (GIST), Korea); Kiseon Kim (GIST - Gwangju, Reoublic of Korea, Korea); Richard O. Afolabi (University of Nevada, Las Vegas (UNLV), USA)

Wednesday, September 21, 14:55 - 16:25

W2-A: Information-Centric Networks

Room 215
Edge Caching and Nearest Replica Routing in Information-Centric Networking
> Feixiong Zhang (Rutgers University & WINLAB, USA); Yanyong Zhang and Dipankar Raychaudhuri (Rutgers University, USA)

Transient Analysis of a Resource-limited Recovery Policy for Epidemics: a Retrial Queueing Approach

  Aresh Dadlani (Gwangju Institute of Science and Technology (GIST), Korea); Senthil Kumar Muthukrishnan (PSG College of Technology, Coimbatore, India); Kiseon Kim (GIST - Gwangju, Reoublic of Korea, Korea); Faryad Darabi Sahneh (School of Computer Science, Georgia Institute of Technology)

Lowest-Cost Network Node Identification for Data Caching for Information Centric Networks

  Zhengqi Jiang, Di Wu and Roberto Rojas-Cessa (New Jersey Institute of Technology, USA)

W2-B: Security, Privacy and Trust-2

Room 220

A Honeypot System for Wearable Networks

  Krishna Kumar Venkatasubramanian (Worcester Polytechnic Institute, USA)

A Greedy Algorithm for Decentralized Bayesian Detection with Feedback

  Weiqiang Dong and Moshe Kam (New Jersey Institute of Technology, USA)

A Novel Video Steganography Algorithm in DCT Domain Based on Hamming and BCH Codes

  Ramadhan J. Mstafa (University of Bridgeport, USA); Khaled M. Elleithy (School of Engineering, University of Bridgeport, USA)

P2F2: Privacy-Preserving Face Finder

  Nora Almalki (NJIT, Saudi Arabia); Reza Curtmola, Xiaoning Ding, Narain Gehani and Cristian Borcea (New Jersey Institute of Technology, USA)

Poster Forum Index

An Asynchronous Transmission Protocol with Propagation Delay Study for WDM Networks

Peristera A. Baziana
School of Electrical and Computer Engineering
National Technical University of Athens
Athens, Greece

Can Mobile Device Users be Identified by How They Play A Game?

Padmaja Scindia
New York Institute of Technology
Computer Science Department

Jonathan Voris
New York Institute of Technology
Computer Science Department

Finding Partial Hash Collisions by Brute Force Parallel Programming

Vincent Chiriaco
Dept. of Computer Science
University of North Alabama

Aubrey Franzen
Dept. of Computer Science
Northern Kentucky Uinversity

Rebecca Thayil
Dept. of Physics
Bryn Mawr College

Xiaowen Zhang
Dept. of Computer Science
College of Staten Island / CUNY

User Density and Spatial Cloaking Algorithm Selection

Matthew Chan
Department of Computer Information Systems
Borough of Manhattan Community College, CUNY

Hassan Elsherbini and Xiaowen Zhang

Department of Computer Science
College of Staten Island, CUNY

Full-Duplex Communication in Cooperative Cognitive Radio Networks Preliminary Results

Sangwoo Park, Jin-Hyun Ahn, Seungwon Lee, and Iickho Song
School of Electrical Engineering
Korea Advanced Institute of Science and Technology

Configuring and Controlling a Software Defined Network with a Pica8 Switch

Jason Loux, Dawei Li, and Jie Wu
Department of Computer and Information Sciences
Temple University, Philadelphia

Exploiting the Locality of Virtual-Machine Images to Boost the Performance of a Cloud Platform

Shuo-Han Chen, Chi-Heng Lee, Wei-Kuan Shih
Department of Computer Science, National Tsing Hua University, Hsinchu, Taiwan

Tseng-Yi Chen, Tsan-sheng Hsu
Institute of Information Science, Academia Sinica, Taipei, Taiwan

Hsin-Wen Wei
Department of Electrical Engineering, Tamkang University, New Taipei City, Taiwan

Improving the 3-star Approximation Algorithm for Relay Node Placement in Wireless Sensor Network

Shuo-Han Chen, Chen-Hung Huang, Wei-Kuan Shih
Department of Computer Science, National Tsing Hua University, Hsinchu, Taiwan

Tseng-Yi Chen, Tsan-sheng Hsu
Institute of Information Science, Academia Sinica, Taipei, Taiwan

Hsin-Wen Wei
Department of Electrical Engineering, Tamkang University, New Taipei City, Taiwan

Rescuing Moribund NVM-based Sensor Nodes by an Energy-efficient WCV Routing Algorithm

Chi-Heng Lee, Shuo-Han Chen, Wei-Kuan Shih
Department of Computer Science, National Tsing Hua University, Hsinchu, Taiwan.

Tseng-Yi Chen,
Institute of Information Science, Academia Sinica, Taipei, Taiwan.

Hsin-Wen Wei,
Department of Electrical Engineering, Tamkang University, New Taipei City, Taiwan.

Heng-Yin Chen,
Display Technology Center, Industrial Technology Research Institute, Hsinchu, Taiwan

Improving Timeliness of Information through Replicating Requests

Caleb Skinner
Candidate for BSc
Department of Computer Science
The University of Texas at Austin

Yu Sang and Bo Ji
Department of Computer and
Information Sciences
Temple University

Digital Holographic Image Reconstruction and GPU Acceleration

Danielle Lopez
Rowan University

Ivan Mazo
Kean University

Shuqun Zhang
College of Staten Island

Ultra-wideband Signals for High-resolution Cognitive Positioning Techniques in 5G Wireless

Akeem A Adebomehin, Stuart D Walker
Department of Computing and Electronic Engineering
University of Essex
Colchester, United Kingdom

Reliable Path Provisioning in the Presence of Multiple Correlated Failures

Mauricio General, and Jorge E. Pezoa,
Department of Electrical Engineering
Universidad de Concepción
Concepción, Chile

QoSApp: Dynamic Bandwidth Management for QoS Applications Using OpenFlow

Daniel Lártiga, Nicolás Boettcher, Yasmany Prieto, and Jorge E. Pezoa
Department of Electrical Engineering
Universidad de Concepción
Concepción, Chile

Memory-Rate Trade-off for Caching and Delivery of Correlated Sources

P. Hassanzadeh, A. Tulino, J. Llorca, E. Erkip
Department of Electrical and Computer Engineering
NYU Tandon School of Engineering

Do Open Resources Encourage Entry into the Millimeter Wave Cellular Service Market?

Fraida Fund, Shahram Shahsavari, Shivendra S. Panwar, Elza Erkip, Sundeep Rangan
Department of Electrical and Computer Engineering
NYU Tandon School of Engineering

Optimal De-Anonymization in Random Graphs with Community Structure

Efe Onaran, Siddharth Garg, Elza Erkip
NYU Tandon School of Engineering

Access Control for a Database-Defined Network

Noemi Glaeser
University of South Carolina

Anduo Wang
Temple University

Demo and Exhibition

Sponsors

IEEE Princeton / Central Jersey Section

Conference Venue

Location and Map

Campus Center (All talks held here)
New Jersey Institute of Technology (NJIT)
150 Bleeker Street
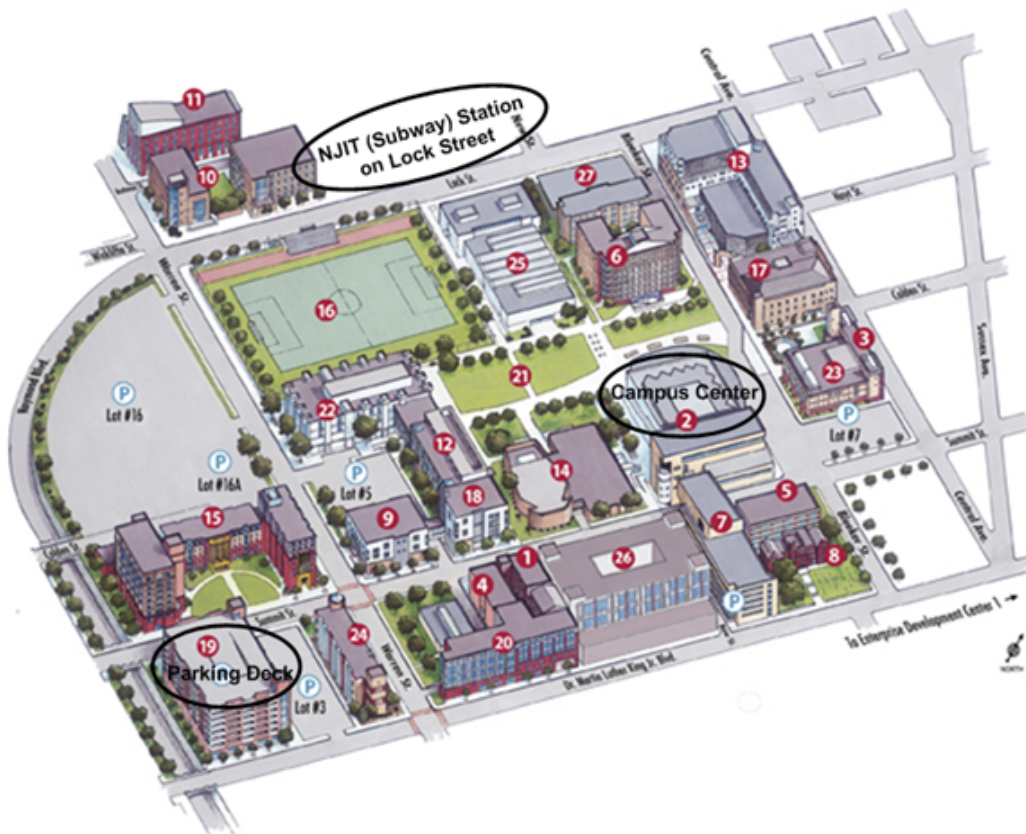University Heights
Newark, New Jersey – 07103

(Number 2 on the map below)

Parking Deck address:
New Jersey Institute of Technology (NJIT)
154 Summit Street
University Heights
Newark, New Jersey – 07102
(Number 19 on the map below)
Mention that you are with the Sarnoff Symposium for free entrance

Directions

Here is the campus area map on Google or get your own directions using the destination of 154 Summit Street, Newark, NJ 07102. This is the address for NJIT's Office of Public Safety and the NJIT parking deck.

Here's how to get to NJIT via:

- Driving Directions
- Public Transportation
- Google maps/directions (use **154 Summit Street**, Newark, NJ 07102)

Driving Directions

Garden State Parkway (GSP): Take exit 145 to Route 280 East, then follow Route 280 East directions.

New Jersey Turnpike: Take exit 15W to Route 280 West, then follow Route 280 West directions.

Route 280 West: **Due to ongoing construction, Exit 14B is closed for the foreseeable future. Your GPS may not be accurate.** Immediately after drawbridge, take Exit 15A (21 South). Merge onto Grant St. Continue straight towards N Broad St. At traffic light, make a wide left onto University Ave. Continue on University Ave for four blocks and turn right on Central Avenue. Make the first left on MLK Blvd. At first light, turn right on Warren Street. Go two blocks to Colden Street. Make a left on Colden Street. Follow signs to NJIT Parking Deck.

Route 280 East: Take Exit 13 (First Street/Newark). At light, make a right on First Street. Go three lights to W. Market Street. Make the soft left on W. Market Street. Go four lights to MLK Blvd. Make a left on MLK Blvd. Go one light to Warren Street. Make a left on Warren Street. Go two blocks to Colden Street. Make a left on Colden Street. Follow signs to NJIT Parking Deck.

Route 1 & 9 North & South: Take exit marked Newark, Route 21 (McCarter Highway). Get in the right lane on the bridge and take the Broad St. exit. Go about 1 mile. Make a left on Court Street. Make a right at third light on MLK Blvd. Make a left at fifth light on Warren Street. Go two blocks to Colden Street. Make a left on Colden Street. Follow signs to NJIT Parking Deck.

Route 78: Take Route 78 to the Garden State Parkway. Follow GSP directions.

Route 22: Take Route 22 to Route 21 North. Follow directions for Route 21 North.

Route 21 North: Get in the right lane on the bridge and take the Broad St. exit. Go about 1 mile. Make a left on Court Street. Make a right at third light on MLK Blvd. Make a left at fifth light on Warren Street. Go two blocks to Colden Street. Make a left on Colden Street. Follow signs to the NJIT Parking Deck.

Route 21 South: From 21 South, turn right on Bridge Street shortly after passing beneath Route 280 overpass. Turn left on Broad Street. Go one block and turn right on Washington Place. Go one block and turn left on Halsey Street. Go one block and turn right on Central Avenue. Make the third left on MLK Blvd. At first light, turn right on Warren Street. Go two blocks to Colden Street. Make a left on Colden Street. Follow signs to NJIT Parking Deck.

New York Thruway: Thruway to Exit 14A, Garden State Parkway. Follow GSP directions above.

George Washington Bridge: NJ Turnpike South to Exit 15W. Follow Route 280 West directions above.

Lincoln Tunnel: West on Route 3 to NJ Turnpike South to Exit 15W. Follow Route 280 West directions above.

From Brooklyn, Queens and Long Island: Take Verrazano-Narrows Bridge (Interstate 278) and follow 278 across Staten Island. Cross Goethels Bridge. Follow signs to New Jersey Turnpike North then follow New Jersey Turnpike directions above.

Back to the Top

Public Transportation

Newark Liberty International Airport

Five miles from NJIT campus. A minibus (Newark Airlink) or taxi service connects the airport with Penn Station in Newark bus, city subway and taxi connections may be obtained at the station.
Note: Train service is available directly from Newark Liberty International Airport to Newark Penn Station.

Newark Penn Station

Connections to the NJIT campus may be made by bus, city subway, or taxi.

Morris & Essex Line Broad Street Station

A five-block walk to the NJIT campus via MLK Blvd. or University Ave. to Central Avenue. Taxi service is also available. NJ Transit Light Rail is also available. (Note: the Light Rail route requires a switch at Newark's Penn Station; this mode of transport will take you some time).

- See NJ Transit website.
- See Broad Street Station on Google maps.

Newark Light Rail

From Penn Station in Newark, take the Warren Street stop for the NJIT Campus. The Newark City Subway is now part of the Newark Light Rail System run by NJ Transit.

- See NJ Transit website.
- See Lock Street Subway/Light Rail stop on Google maps.

NJ Transit Go bus 28

Go bus 28 provides a faster, more convenient trip between Bloomfield, Downtown Newark and Newark Liberty International Airport. Go bus 28 departs every 10 – 15 minutes from 3:30am to 2:00am daily. That's virtually continuous service. No matter what shift you work, what classes you take, or where life takes you along the route, go bus 28 will get you there, day or night!

NJIT/Rutgers Shuttle Schedule

The shuttle bus is operated jointly with Rutgers-Newark and provides transportation for the University community between the two campuses, major mass transit systems, and Harrison and Kearny. As a courtesy, shuttle service is free to the Rutgers/NJIT community who present identification.

All University Shuttle Buses are in direct radio communications with Public Safety headquarters. A handicapped accessible van is also available to transport handicapped persons throughout our campus during Shuttle Service hours.

More information about the shuttle buses.