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Vivek Tangudu IIIT Bangalore, India	**N.T.S.S.Srinivas** IISc Bangalore, India
Ishaan Singh National Institute of Technology Karnataka, Surathkal, India	

Schedule
Tuesday, 3 January 2023

Tutorials

10:00 AM – 1:00 PM	***COMSNETS 2023 Tutorial #1*** **Toward Automated Security Risk Assessment: Models, Metrics, and Recent Applications** **Venue: Sigma 1**	***COMSNETS 2023 Tutorial #2*** **Identification of Causal Dependencies in Multivariate Time Series** **Venue: Sigma 3**	***COMSNETS 2023 Tutorial #3*** **5G Architecture Overview, Software Stack and Use Cases** **Venue: Indian Affairs**
2:00 PM – 5:00 PM	***COMSNETS 2023 Tutorial #4*** **Deep Learning based Radio Frequency Signal Classification: Hands-on** **Venue: Sigma 1**	***COMSNETS 2023 Tutorial #5*** **5G Non-Terrestrial Networks: Recent Advancements, Open Challenges, and Research Tools** **Venue: Sigma 3**	***COMSNETS 2023 Tutorial #6*** **Cloud-native Networking Deep Dive** **Venue: Indian Affairs**

COMSNETS 2023 All Hands Meeting

5:30 PM – 8:00 PM

Participants: All organizing committee members, All volunteers, All sponsors, Event Managers, Hotel Staff

Venue: Club Lounge, 8th Floor, Chancery Pavilion Hotel

Schedule
Wednesday, 4 January 2023

Cybersecurity & Privacy Workshop **10:00 AM – 6:00 PM** ***SIGMA 1***	***NetHealth Workshop*** **10:00 AM – 6:00 PM** ***INDIAN AFFAIRS***	***Connected Vehicles & Autonomous Driving*** **10:00 AM – 6:00 PM** ***SIGMA 3***
Tea Break		
Cybersecurity & Privacy Workshop	NetHealth Workshop	Connected Vehicles & Autonomous Driving
Lunch Break		
Cybersecurity & Privacy Workshop	NetHealth Workshop	Connected Vehicles & Autonomous Driving
Tea Break		
Cybersecurity & Privacy Workshop	NetHealth Workshop	Connected Vehicles & Autonomous Driving

Research Café & COMSJOB: Industry perspectives
Participating Organizations: All Sponsoring Organizations
Indian Affairs

6:00 PM – 7:00 PM

COMSNETS 2023 WELCOME RECEPTION
Pool Side, Chancery Pavilion Hotel

7:15 PM – 10:00 PM

Schedule
Thursday, 5 January 2023

9:30 AM – 10:00 AM	***CELEBRATING 15 YEARS OF COMSNETS*** ***COMSNETS 2023 Inauguration and Opening Remarks*** **(9:30 AM – 10:00 AM)** General Co-Chairs; TPC Co-Chairs; Steering Committee Co-Chairs COMSNETS Co-Founders ***SIGMA HALL***		
10:00 AM – 11:00 AM	**COMSNETS Keynote Talk # 1** **Speaker:** Margaret Martonosi, National Science Foundation, USA ***SIGMA HALL***		
11:00 AM – 11:30 AM	**Tea/Coffee Break**		
11:30 AM – 1:00 PM	**Paper Sessions** (11:30 AM – 1:00 PM)		
	Session T1-1 **Invited Talk #1** **Venue: Sigma 1**	**Session T2-1** **Invited Talk #2** **Venue: Sigma 3**	**Demos & Exhibits** **Venue: Indian Affairs**
1:00 PM – 2:00 PM	**Lunch Break**		
1:00 PM – 4:00 PM	**Poster Session** **Venue: Pool Side**		**Demos & Exhibits** **Venue: Indian Affairs**
3:30 – 4:00 PM	**Tea/Coffee Break**		

Schedule
Thursday, 5 January 2023

<table>
<tr><td rowspan="2">3:30 PM – 5:00 PM</td><td rowspan="2">Graduate Forum
(2:30 PM – 5:00 PM)
Invited Session & Talks
Venue: Sigma 1</td><td colspan="2">Paper Sessions (3:30 PM – 5:00 PM)</td></tr>
<tr><td>Session T2-2
Invited Talk #3
Venue: Sigma 3</td><td>Demos & Exhibits
Venue: Indian Affairs</td></tr>
<tr><td>5:00 PM – 6:30 PM</td><td colspan="3">COMSNETS Panel Discussion #1
Topic: The Impact of Future Networks on Sustainability
SIGMA HALL</td></tr>
<tr><td>6:30 PM – 7:30 PM</td><td colspan="3">COMSNETS Keynote Talk # 2
Speaker: Matti Latva-aho, University of Oulu, Finland
SIGMA HALL</td></tr>
<tr><td>7:30 PM – 8:30 PM</td><td colspan="3">COMSNETS Association Meeting
SIGMA HALL</td></tr>
<tr><td>8:30 PM – 10:30 PM</td><td colspan="3">Cocktails & Dinner for Organizing Committee and Association Members
SIGMA HALL FOYER</td></tr>
</table>

Schedule
Friday, 6 January 2023

<table>
<tr><td>9:30 AM – 10:30 AM</td><td colspan="4">COMSNETS Keynote Talk # 3
Speaker: Ashutosh Sabharwal, Rice University, USA
SIGMA HALL</td></tr>
<tr><td>10:30 AM – 11:30 AM</td><td colspan="4">COMSNETS Keynote Talk # 4
Speaker: Saurabh Bagchi, Purdue University, USA
SIGMA HALL</td></tr>
<tr><td>11:30 AM – 11:45 AM</td><td colspan="4">Tea/Coffee Break</td></tr>
<tr><td rowspan="2">11:45 AM – 1:00 PM</td><td colspan="4">Paper Session (11:45 AM – 1:00 PM)</td></tr>
<tr><td>Session T1-2
Invited Talk # 4
Venue: Sigma 1</td><td colspan="2">Session T2-3
Invited Talk # 5
Venue: Sigma 3</td><td>Demos & Exhibits
Venue: Indian Affairs</td></tr>
<tr><td>1:00 PM – 2:00 PM</td><td colspan="4">Lunch Break</td></tr>
<tr><td>2:00 PM – 4:00 PM</td><td>Session T1-3
Invited Talk # 6
Venue: Sigma 1</td><td>Poster Session
1:00 PM – 4:00 PM
Venue: Pool Side</td><td>Demos & Exhibits
Venue: Indian Affairs</td><td>Women in Engineering (WiE)
Venue: Sigma 3</td></tr>
<tr><td>3:30 PM – 4:00 PM</td><td colspan="4">Tea/Coffee Break</td></tr>
</table>

Schedule
Friday, 6 January 2023

<table>
<tr><td rowspan="2">4:00 PM – 5:30 PM</td><td colspan="3">Paper Session (4:00 PM – 5:30 PM)</td></tr>
<tr><td>Session T2-4
Invited Talk # 7
Venue: Sigma 1</td><td>Demos & Exhibits

Venue: Indian Affairs</td><td>Women in Engineering (WiE)

Venue: Sigma 3</td></tr>
<tr><td>5:30 PM – 7:00 PM</td><td colspan="3">COMSNETS Panel Discussion #2
Topic: 15 Years of COMSNETS and the Future of Networking!
SIGMA HALL</td></tr>
<tr><td>7:00 PM – 11:00 PM</td><td colspan="3">COMSNETS 2023 BANQUET
SIGMA HALL
FIRESIDE chat with Bhavish Agarwal
7:00 PM – 7:45 PM

COMSNETS 2023 Award Ceremony

Best Papers; Best Posters; Best Demos; Best Graduate Forum Travel Awards
7:45 PM – 8:00 PM

Handing over the Baton to the COMSNETS 2024 Committee
Group Picture with the 2023 Organizing Committee Members and Volunteers
8:00 PM – 8:10 PM

COCKTAILS and DINNER
Pool Side
8:15 PM – 11:00 PM IST</td></tr>
</table>

Schedule
Saturday, 7 January 2023

<table>
<tr><td>9:30 AM – 11:30 AM</td><td>Paper Session (9:30 AM – 11:30 AM)</td><td>Tutorial (10:00 AM – 1:00 PM)</td></tr>
<tr><td></td><td>Session T1-4
Invited Talk # 8
Venue: Sigma 1

Session T2-5
Venue: Sigma 3</td><td rowspan="3">COMSNETS 2023 Tutorial #7

OTFS Aided Cell-free Massive MIMO for Beyond 5G

Venue: Indian Affairs</td></tr>
<tr><td>11:30 AM – 12:00 Noon</td><td>Tea/Coffee Break</td></tr>
<tr><td>12:00 Noon – 1:00 PM</td><td>Industry Keynote Talk # 1

Speaker: Vita Bortnikov, IBM Research, USA

SIGMA HALL</td></tr>
<tr><td>1:00 PM – 2:00 PM</td><td colspan="2">Lunch Break</td></tr>
<tr><td rowspan="2">2:00 PM – 4:00 PM</td><td colspan="2">Paper Session (2:00 PM – 4:00 PM)</td></tr>
<tr><td>Session T1-5
Invited Talk # 9
Venue: Sigma 1</td><td>Session T2-6
Invited Talk # 10
Venue: Sigma 3</td></tr>
<tr><td>4:00 PM – 4:30 PM</td><td colspan="2">Tea/Coffee Break</td></tr>
<tr><td>4:30 PM – 6:00 PM</td><td colspan="2">COMSNETS Panel Discussion #3

Topic: Is Affordable Ubiquitous Communications possible?

SIGMA HALL</td></tr>
<tr><td>6:00 PM – 6:30 PM</td><td colspan="2">Main COMSNETS Conference Closure</td></tr>
</table>

Schedule
Sunday, 8 January 2023

MINDS Workshop **10:00 AM – 6:00 PM** ***Indian Affairs***	***TASIR Workshop: Testbeds for Advanced Systems Implementation and Research*** **10:00 AM – 6:00 PM** ***SIGMA 1***	***Standards Driven Research Workshop*** **10:00 AM – 6:00 PM** ***SIGMA 3***
Tea Break **11:00 AM – 11:30 AM**		
MINDS Workshop	TASIR Workshop	Standards Driven Research Workshop
Lunch Break **1:00 PM – 2:00 PM**		
MINDS Workshop	TASIR Workshop	Standards Driven Research Workshop
Tea Break **4:00 PM – 4:30 PM**		
MINDS Workshop	TASIR Workshop	Standards Driven Research Workshop
COMSNETS CONFERENCE & WORKSHOPS CLOSURE		

Thursday, 5 January 2023 | 11:30 AM - 1:00 PM

T1-1: Network Management

- (Invited Talk) **Whodunnit? A case-study of an investigation to find a multi-core scalability bottleneck**
  Speaker: *Varsha Apte (IIT Bombay, India)*

- **LiteEx: A Lightweight Feature Extraction Tool for Captured Network Traces**
  Speakers: *Mayank Swarnkar (Indian Institute of Technology BHU), Rakesh Kumar (Indian Institute of Technology BHU), Raja Baidyo (Indian Institute of Technology BHU)*

- **Impact Analysis of Tunnel Probing Protocol on SD-WAN's Mainstream Traffic**
  Speakers: *Pavan Iddalagi (IIIT-Bangalore, India), Amrita Mishra (International Institute of Information Technology Bangalore, India)*

- **CSMA/CA-based MAC Protocol for Aerial Audio Networking**
  Speakers: *Dania Qara Bala (Indian Institute of Technology Bombay, India), Bhaskaran Raman (Indian Institute of Technology, Bombay, India)*

Thursday, 5 January 2023 | 11:30 AM - 1:00 PM

T1-2: Cloud Technologies

- **[Experience] Multicloud Deployment of AI Workflows Using FaaS and Storage Services**
  Speakers: *Manju Ramesh (TCS Research, India), Dheeraj Chahal (TCS, India), Rekha Singhal (TCS, India)*

- **Megha: Decentralized Federated Scheduling for Data Center Workloads**
  Speakers: *Meghana Thiyyakat (PES University, India), Subramaniam Kalambur (PES University, India), Dinkar Sitaram (Cloud Computing*

Innovation Council of India, India)

- **(Invited Talk) A Push-Pull Train for Safety of Autonomous Vehicle Software**
  Speakers: *Suhrid Wadekar (Goodwin Procter LLC, Boston, USA)*

- **A Cost Effective Reliability Aware Scheduler for Task Graphs in Multi-Cloud System**
  Speakers: *Suman Banerjee (IIT Kharagpur, India), Atharva Tekawade (Indian Institute of Technology Jammu, India)*

Thursday, 5 January 2023 | 3:30 PM – 5:00 PM

T2-2: Security

- **(Invited Talk) Challenges and Opportunities in Enabling Secure 5G Positioning**
  Speakers: *Mridula Singh (CISPA, Germany)*

- **Security Management in Content Distribution Networks: a delay-variance reduction approach for content mirror site placement**
  Speakers: *Kaliappa Ravindran (City University of New York, USA), Chin-Tser Huang (University of South Carolina, USA)*

- **Defending Root DNS Servers Against DDoS Using Layered Defenses**
  Speakers: *A s m Rizvi (University of Southern California & Information Sciences Institute, USA), Jelena Mirkovic (University of Southern California, USA), John Heidemann (University of Southern California, USA), Wesley Hardaker (University of Southern California Information Sciences Institute, USA), Robert Story (University of Southern California & Information Sciences Institute, USA)*

- **Clarity: Analysing Security in Web Applications**
  Speaker: *Neetesh Saxena (Cardiff University, United Kingdom (Great Britain)), Connor Potter (Cardiff University, United Kingdom (Great Britain)), Soumyadev Maity (Iiit Allahabad, India)*

Friday, 6 January 2023 | 11:45 AM – 1:00 PM

T1-2: IoT

- **(Invited Talk) Trust and Reputation Management for Blockchain-enabled IoT**
  Speaker: *Salil Kanhere (UNSW, Sydney, Australia)*

- **Occupancy counting in dense and sparse settings with a low-cost thermal camera**
  Speakers: *Soumya Ranjan Sahoo (Indian Institute of Science Education and Research Bhopal, India), Haroon Rashid Lone (Indian Institute of Science Education and Research Bhopal, India)*

- **mmAssist: Passive Monitoring of Driver's Attentiveness Using mmWave Sensors**
  Speakers: *Argha Sen (Indian Institute of Technology Kharagpur, India), Anirban Das (IIT Kharagpur, India), Prasenjit Karmakar (IIT KHARAGPUR, India), Sandip Chakraborty (Indian Institute of Technology Kharagpur, India)*

Friday, 6 January 2023 | 11:45 AM – 1:00 PM

T2-3: Wireless Architectures and Protocols

- **SENTINEL: Self Protecting 5G Core Control Plane from DDoS Attacks for High Availability Service**
  Speaker: *Aditya Chilukuri (Indian Institute of Technology, Hyderabad, India), Shwetha Vittal (Indian Institute of Technology Hyderabad, India), Antony Franklin A (Indian Institute of Technology Hyderabad, India)*

- **ReFleX: Enabling Full Duplex Relay Cluster**
  Speakers: *Avishek Banerjee (The Ohio State University, USA), Lu Chen (The Ohio State University, USA), Kannan Srinivasan (The Ohio State University, USA)*

- **(Invited Talk) Hybrid Full Duplex MAC protocol**
  Speakers: *Dinesh Rajan (Southern Methodist University, USA)*

Friday, 6 January 2023 | 2:00 PM – 3:30 PM

T1-3: Cloud Applications

- **(Invited Talk) The Evolution of Networks and Management in a 6G world: An Inventor's View**
  Speaker: *Gerald Karam (Nokia Bell Labs, USA)*

- **Experience: Implementation of Edge-Cloud for Autonomous Navigation Applications**
  Speakers: *Yuvraj Chowdary Makkena (IITH & TiHAN, India), Rajashekhar Reddy Tella (Indian Institute Technology Dharwad, India), Nisarg Dipenbhai Parekh (India), Prem Kumar Saraf (IIT Hyderabad, India), Annu Sahu (IIT HYDERABAD, India), Hershita Shukla (IIT Hyderabad & Indian Institute of Technology Hyderabad, India), Akhila Matathammal (Indian Institute of Technology Hyderabad, India), Sarat Chandra Sai Danda (IIT HYDERABAD, India), Praveen Chandrahas Achyuthuni (Indian Institute of Technology, Hyderabad, India), Dr. Akshay Kumar Jadhav (IIT Hyderabad, India), Praveen Tammana (IIT Hyderabad, India), Koteswararao Kondepu (Indian Institute of Technology Dharwad, India), Rajalakshmi P (IIT Hyderabad, India)*

- **Multitask Scheduling of Computer Vision Workloads on Edge Graphical Processing Units**
  Speakers: *Arani Bhattacharya (IIIT-Delhi, India), Paritosh Shukla (IIIT-Delhi, India) Ansuman Banerjee (Indian Statistical Institute, India), Saumya Jaipuria (Indian Statistical Institute, India) Nanjangud Narendra (Ericsson Research, India), Dhruv Sekhar Garg (Vellore Institute of Technology, India)*

- **Trust-based Misinformation Containment in Directed Online Social Networks**
  Speakers: *Arnab Kumar Ghoshal (Asutosh College, Kolkata, India), Nabanita Das (Indian Statistical Institute, India), Soham Das (Microsoft, USA), Subhankar Dhar (San Jose State University, USA)*

Friday, 6 January 2023 | 4:00 PM – 5:30 PM

T2-4: Learning (1)

- **Dual-Stream CNN-BiLSTM Model with Attention Layer for Automatic Modulation Classification**
  Speakers: *Ashok Parmar (Sardar Vallabhbhai National Institute of Technology Surat, India), Divya K (Sardar Vallabhbhai National Institute of Technology Surat, India), Ankit Chouhan (Sardar Vallabhbhai National*

Institute of Technology, India), Kamal Manharlal Captain (Sardar Vallabhbhai National Institute of Technology, India)

- **IndoorRSSINet – Deep learning based 2D RSSI map prediction for indoor environments with application to wireless localization**
  Speakers: *Nibin Raj (Indian Institute of Space Science and Technology, India), Vineeth Bala Sukumaran (Indian Institute of Space Science and Technology, Trivandrum, India)*

- **Causality-Aware Channel State Information Encoding**
  Speakers*: Serene Banerjee (Ericsson Research, India), Athanasios Karapantelakis (Principal Researcher, Sweden), Lackis Eleftheriadis (Senior Specialist Sustainable AI Ops, Sweden), Hamed Farhadi (Ericsson Research, Sweden), Vandita Singh (Ericsson Research, Sweden), Karthik Rm (Ericsson Research, India)*

- **(Invited Talk) Digital Transformation and Divide in Education through the COVID-19 Pandemic**
  Speaker: *Baek-Young Choi (University of Missouri - Kansas City, USA)*

Saturday, 7 January 2023 | 09:30 AM – 11:30 AM

T1-4: Sustainability & Energy Efficiency

- **(Invited Talk) Design for sustainability – an imperative for future mobile networks**
  Speaker: *Satish K. (Nokia Bell Labs, Bangalore, India)*

- **Efficient Memory Optimized Aggregated Bit Vector (EMOABV) Algorithm with Dynamic ABV Intersection Result Cache**
  Speakers: *Lakshmi Sowjanya Dokku (Samsung Research Institute, India), Uday Trivedi (Samsung R&D Institute, Bangalore, India), Jyotsna Sangamesh (Samsung R & D India Bangalore, India)*

- **Fast Proactive Re-Route with Detours on Joint Paths in Named-Data Networks for Communications of Smart Electric Power Transmission Grids**
  Speakers: *Boyang Zhou (Zhejiang Lab, China), Zhen Zhu (Zhejiang Lab,*

China), Yinghui Nie (Zhejiang Lab, China), Xiang Chen (Zhejiang University, China), Bingjing Yan (Zhejiang University, China), Qiang Yang (Zhejiang University & College of Electrical Engineering, China), Chunming Wu (College of Computer Science, Zhejiang University, China)

- **iCharge: An IoT-Assisted Framework for Efficient Charging of the Electric-Vehicles**
  Speakers: *Jagnyashini Debadarshini (Indian Institute of Technology Bhubaneswar, India), Megha Vardhan Rejeti (Indian Institute of Technology Bhubaneswar, India), Sudipta Saha (Indian Institute of Technology Bhubaneswar, India), Chandrashekhar Narayan Bhende (Iit Bhubaneswar, India)*

- **Lessons Learnt From the Implementation of the IEEE 802.15.4e-TSCH MAC**
  Speakers: *Deeksha P Rao (Indian Institute of Science, India), Ipsita Sanyal (University of Manchester, India), Sachin Sm (IISc, India), T Venkata Prabhakar (IISc, India), Rakshana Gunasekaran (Indian Institute of Science, India)*

Saturday, 7 January 2023 | 9:30 AM – 11:30 AM

T2-5: Physical layer Technologies

- **A Wideband Array Antenna with Elliptical Slots on Substrate Integrated Waveguide Technology**
  Speakers: *Somayeh Komeylian (Ryerson University, Canada), Christopher Paolini (San Diego State University, USA), Mahasweta Sarkar (San Diego State University & Center for Neurotechnology, USA)*

- **A Stable Link Allocation Algorithm for 5G Millimeterwave Networks**
  Speakers: *Subhojit Sarkar (Indian Statistical Institute, India), Subhankar Ghosal (Auriss Technologies Pvt. Ltd.), Subhadip Bandyopadhyay (GAIA, Ericsson, India), Sasthi C. Ghosh (Indian Statistical Institute, India)*

- **A High Bandwidth 4 x 1 Antenna Array of Circular Patches with Two Sectors**
  Speakers: *Somayeh Komeylian (Ryerson University, Canada), Christopher*

Paolini (San Diego State University, USA), Mahasweta Sarkar (San Diego State University & Center for Neurotechnology, USA)

- **Frequency Division Duplex Based Cooperative VFD: Outage Analysis and Relay Power Allocation**
  Speakers: *Justin Jose (Indian Institute of Technology Indore, India), Parvez Shaik (Texas A & M University at QATAR, Qatar & Texas A & M University, Qatar), Shubham Bisen (Indian Institute of Technology Indore, India), Vinat Goyal (Indian Institute of Information Technology Pune, India), Vimal Bhatia (Indian Institute of Technology Indore, India)*

Saturday, 7 January 2023 | 2:00 PM – 4:00 PM

T1-5: Learning (2)

- **(Invited Talk) Toward Long Term Health of Two Sided Online Marketplaces**
  Speaker: *Debdoot Mukherjee (Meesho, India)*

- **Bayesian Regression for Interpretable Network Dimensioning**
  Speakers: *Shrihari Vasudevan (Ericsson, India), Sleeba Puthenpurakel (GAIA, Ericsson, India), Marcial Gutierrez (Ericsson, Sweden), M.J. Prasath (Ericsson, India)*

- **Weak Supervision and Transformed-based Sentiment Analysis on Multi-lingual Data**
  Speaker: *Shubhangi Rastogi (Bennett University Times Group, India)*

- **FedNSE: Optimal Node Selection for Federated Learning with Non-IID Data**
  Speakers: *Sourav Bansal (IIT Delhi, India), Manav Bansal (IIT Delhi, India), Rohit Verma (Intel Labs, India), Rajeev Shorey (Indian Institute of Technology Delhi & UQIDAR, India), Huzur Saran (Indian Institute of Technology, India)*

- **Multi-Agent Packet Routing (MAPR): Co-Operative Packet Routing Algorithm with Multi-Agent Reinforcement Learning**
  Speakers: *Aniket Modi (IIT Delhi, India), Rishi Shah (IIT Delhi, India), Krishnanshu Jain (IIT Delhi, India), Rohit Verma (Intel Labs, India), Rajeev*

Shorey (Indian Institute of Technology Delhi & UQIDAR, India), Huzur Saran (Indian Institute of Technology, India)

Saturday, 7 January 2023 | 2:00 PM – 4:00 PM

T2-6: Privacy & Blockchain

- **Towards adoption of secure communication protocol in Software Defined Networks**
  Speakers: *Gayatri Priyadarsini Kancherla (Indian Intitute of Technology Gandhinagar, India), Sameer G Kulkarni (Indian Institute of Technology, Gandhinagar, India)*

- **Thwarting Piracy: Anti-debugging Using GPU-assisted Self-healing Codes**
  Speakers: *Adhokshaj Mishra (Uptycs India Pvt. Ltd., India), Manjesh K Hanawal (Indian Institute of Technology Bombay, India)*

- **Data Protection in Permissioned Blockchains using Privilege Separation**
  Speakers: *Arun Joseph (Indian Institute of Science, India), Nikita Yadav (Indian Institute of Science Bengaluru, India), Vinod Ganapathy (Indian Institute of Science, India), Dushyant Behl (IBM Research, India), Praveen Jayachandran (IBM India, India)*

- **(Invited Talk) AI for Climate Change and Finance**
  Speaker*: Supratik Mukhopadhyay (Louisiana State University (LSU), USA)*

KEYNOTE SPEAKERS

Margaret Martonosi
National Science Foundation, USA
Thursday, 5 January 2023, 10:00 AM – 11:00 AM
Title: The Computing and Information Science and Engineering Landscape: A Look Forward

Abstract:

The United States National Science Foundation (NSF) supports a majority of US academic research in the Computer and Information Science and Engineering (CISE) topic areas. A long-time computing researcher herself, Dr. Margaret Martonosi is now serving a 4-year term leading the NSF CISE Directorate, and stewarding the CISE directorate's $1B+ annual budget on behalf of research, education, workforce and infrastructure funding in CISE topic areas and for science as a whole. In this talk, she will discuss key themes for the computing and communications research fields, and how CISE is developing programmatic opportunities to advance research related to them. Martonosi will relate these themes to the topics most relevant to the COMSNETS community, and will also discuss international collaborations in these topics as well.

Bio:

Margaret Martonosi is the US National Science Foundation's (NSF) Assistant Director for Computer and information Science and Engineering (CISE). With an annual budget of more than $1B, the CISE directorate at NSF has the mission to uphold the Nation's leadership in scientific discovery and engineering innovation through its support of fundamental research and education in computer and information science and engineering as well as transformative advances in research cyberinfrastructure. While at NSF, Dr. Martonosi is on leave from Princeton University where she is the Hugh Trumbull Adams '35 Professor of Computer Science. Dr. Martonosi's research interests are in computer architecture and hardware-software interface issues in both classical and quantum computing systems. Dr. Martonosi is a member of the National Academy

of Engineering and the American Academy of Arts and Sciences. She is a Fellow of the Association for Computing Machinery (ACM) and the Institute of Electrical and Electronics Engineers (IEEE).

Matti Latva-aho
University of Oulu, Finland
Thursday, 5 January 2023, 06:30 PM - 07:30 PM
Title: From non-public private 5G networks towards local 6G connectivity

Abstract:

One of the novel features of 5G is the local connectivity solutions and private networks for which some of the specific spectrum bands have been already allocated. 6G will target at developing mobile technologies at higher spectrum bands for mmWave bands and even sub-THz bands. When systems operate at higher spectrum bands, local networks start to make even more sense as the communication link ranges are drastically dropping due to harsh propagation conditions. In particular, when operating in indoor environments, private networks can achieve total interference isolation making adjacent networks co-existence straight forward and simple. This will open totally new business opportunities and can greatly accelerate digitalization of society. Property owners will be part of the value chain with dedicated networks customized for their own needs: hospitals, schools, shopping malls, factories, office buildings, private households etc. can have different offerings and capabilities of networks in the future. The global private 5G network market size was valued at USD 1.38 billion in 2021 and is expected to expand at a compound annual growth rate (CAGR) of 49.0% from 2022 to 2030. Currently, private 5G networks are non-public and not requested to allow roaming with MNOs networks. Towards 6G, the private network concept needs to be enlarged to enable also open local connectivity and roaming. The reason for this is both technical due to extremely high frequencies as well as the digitalization needs and expectations from the society. New players are needed with new investments speeding up digitalization of society. Furthermore, discussions on the technical superiority of 6G enabling up to Tbps peak datarates, cm level positioning, sub ms latency and ultra reliability at lower energy consumption etc., are also encouraging to focus on local connectivity solutions in innovative 6G

developments. Evolutionary path of 5G solves larger area coverage needs also in the future – and local connectivity solutions will be part of this evolution.

Bio:

Matti Latva-aho received the M.Sc., Lic.Tech. and Dr. Tech (Hons.) degrees in Electrical Engineering from the University of Oulu, Finland in 1992, 1996 and 1998, respectively. From 1992 to 1993, he was a Research Engineer at Nokia Mobile Phones, Oulu, Finland after which he joined Centre for Wireless Communications (CWC) at the University of Oulu. Prof. Latva-aho was Director of CWC during the years 1998-2006 and Head of Department for Communication Engineering until August 2014. Currently he is professor at the University of Oulu on wireless communications and Director for National 6G Flagship Programme. He is also a Global Fellow with Tokyo University. Prof. Latva-aho has published over 500 conference or journal papers in the field of wireless communications. He received Nokia Foundation Award in 2015 for his achievements in mobile communications research.

Ashutosh Sabharwal
Rice University, USA
Friday, 6 January 2023, 9:30 AM – 10:30 AM
Title: Next-generation Wireless Networks will be “Multi-function”

Abstract:

As the wireless standards occupy larger parts of the spectrum with an ever-larger number of antennas, there is an opportunity to also use the communications spectrum for “imaging” the environment. Next-generation networks like 6G will be multi-function, i.e., use the same spectrum for multiple functions. In this talk, we will first briefly review our research contributions over the past decade that could play a role in developing multi-function networks. And then highlight our recent efforts to develop theoretical foundations to understand the tradeoff in multi-function networks.

Bio:

Ashutosh Sabharwal's research interests are wireless theory, design, and large-scale deployed testbeds. He was one of the inventors of in-band full-duplex communications, a technology used in both wireline and wireless standards. He is the

founder of the WARP project (warp.rice.edu), an open- source project used by 150+ research groups worldwide. He is currently leading several NSF-funded center-scale projects, notably Rice RENEW (renew-wireless.org), to develop an open- source software-defined massive MIMO wireless network platform. He received the 2017 IEEE Jack Neubauer Memorial Award, 2018 IEEE Advances in Communications Award, 2019 ACM Test-of-time Award, 2019 ACM MobiCom Community Contribution Award, and 2021 ACM Test-of-time Award. He is a Fellow of IEEE and the National Academy of Inventors.

Saurabh Bagchi
Purdue University, USA
Friday, 6 January 2023, 10:30 AM – 11:30 AM
Title: Dependability and Data Analytics: A Match Made in the Cloud

Abstract:

We live in a data-driven world as everyone around has been telling us for some time. Everything is generating data, in volumes and at high rates, from the sensors embedded in our physical spaces to the large number of machines in data centers which are being monitored for a wide variety of metrics. The question that we pose is:

Can all this data be used for improving the dependability of cloud computing systems?

Dependability is the property that a computing system continues to provide its functionality despite the introduction of faults, either accidental faults (design defects, environmental effects, etc.) or maliciously introduced faults (security attacks, external or internal). We have been addressing the dependability challenge through large-scale data analytics applied end-to-end from the small (networked embedded systems, mobile and wearable devices) [e.g., CVPR-22, Eurosys-22, NeurIPS-20, Sensys-20, UsenixSec-20, NDSS-20] to the large (edge and cloud systems, distributed machine learning clusters) [e.g., OSDI-22, Sigmetrics-22, UsenixATC-21, DSN-20, UsenixATC-20]. In this talk, I will first give a high-level view of how data analytics has been brought to bear on dependability challenges, and key insights arising from work done by the technical community broadly. Then I will do a deep dive into the problem of

configuring complex cloud systems to meet dependability and performance requirements, using data-driven decisions.

For the detailed part, I will show how distributed applications on the cloud can be configured for dependability and predictable performance even as the workloads are changing unpredictably. I will then discuss an exciting and emerging area of cloud computing called serverless applications on the cloud and show they can be configured for dependability and performance determinism.

Bio:

Saurabh Bagchi is a Professor in the School of Electrical and Computer Engineering and the Department of Computer Science at Purdue University in West Lafayette, Indiana and the CTO of a cloud computing startup, KeyByte. His research interest is in dependable computing and distributed systems. He is the founding Director of a university-wide resilience center at Purdue called CRISP (2017-present) and PI of the Army's Artificial Intelligence Innovation Institute (A2I2) (2020-25) that spans 9 universities. He was selected to the International Federation for Information Processing (IFIP) in 2020 and is a Fellow of the Institute of Engineering and Technology (IET) (2022). He serves on IEEE Computer Society's Board of Governors (2022-24, previously 2017-20). He is an IEEE Computer Society Distinguished Contributor (2021) and Distinguished Visitor (2020), an IEEE Golden Core member (2018), an ACM Distinguished Scientist (2013), and a Distinguished Speaker for ACM (2012).

Saurabh is proudest of the 25 PhD students and 50 Masters thesis students who have graduated from his research group and who are in various stages of building wonderful careers in industry or academia. In his group, he and his students have way too much fun building and breaking real systems. Along the way this has led to 13 best paper awards or runners-up awards at IEEE/ACM conferences and a Test of Time Award. Saurabh received his MS and PhD degrees from the University of Illinois at Urbana-Champaign and his BS degree from the Indian Institute of Technology Kharagpur, all in Computer Science.

FIRESIDE CHAT

Bhavish Aggarwal
Founder & CEO, Ola group
Friday, 6 January 2023, 7:00 PM – 8:00 PM

Bio:
Bhavish Aggarwal is the Founder & CEO of Ola group, India's leading EV manufacturer and mobility company. He is passionate about engineering and technology and firmly believes that a sustainable future is ours to build. Bhavish started Ola in 2010 as a ride hailing platform with a mission to build mobility for a billion people and transform the way India travels. Today, Ola is dedicated towards spearheading the world's transition to sustainable mobility through manufacturing future-proof electric vehicles and developing advanced technologies. Bhavish is leading Ola's growth as a vertically integrated mobility group with a focus on revolutionizing the future of mobility through best products, technologies, and services. Prior to setting up Ola, he worked with Microsoft as a researcher for two years filing two patents and having three papers published in international journals. He is an alumnus of the Indian Institute of Technology, Bombay where he graduated with a bachelor's degree in Computer Science and Engineering.

Chair

Pamela Kumar
TSDSI, India

Moderators

Monisha Ghosh
Notre Dame, USA

Venkat Padmanabhan
Microsoft Research India

INDUSTRY INSIGHTS KEYNOTES

Vita Bortnikov
IBM Research, USA
Saturday, 7 January 2023, 12:00 PM – 01:00 PM
Title: The Journey to Multi-Cloud Networking

Abstract:

Multi-cloud Networking is crucial for sustainability of modern enterprise in today's hyper-connected era where applications, data, and devices are globally distributed among multiple cloud providers, private data centers, mobile locations, and edge environments.
Decades ago Internet protocol allowed world-wide connectivity and completely changed the world. However, in the past fifteen years a wide set of private networking technologies have emerged including public cloud SDNs for VPC services, SDN overlays for data centers, and SD-WANs for interconnecting remote locations. These technologies were created to provide the required networking capabilities while overcoming the shortcomings of the original Internet protocol design. As a result the current networking world is a collection of different non-compatible and non-interoperable public and private networking technologies.

Bio:

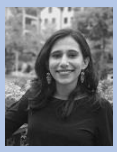
Vita is an IBM Fellow for Multi-cloud Networking and Software Defined Infrastructure She leads the Networking strategy in IBM Research, building the next generation networking to enable multi-cloud evolution. Vita is an expert in distributed systems — a critical discipline in computer science with applications to cloud computing and beyond. Her passion lies in combining theory and technology to bring about practical innovations for large-scale systems. Towards this end she specializes in high availability, robustness and scalability applied to enterprise solutions. During her career Vita contributed to a number of strategic products - WebSphere, PureApp, IBM Cloud, Blockchain. She also was at the foundation of the Istio Service Mesh project. Vita holds MSc and BSc from The Technion - Israel Institute of Technology.

INVITED SPEAKERS

Varsha Apte
IIT Bombay, India
Thursday, 5 January 2023 | 11:30 AM - 1:00 PM
Title: Whodunnit? A case-study of an investigation to find a multi-core scalability bottleneck

Suhrid Wadekar
Goodwin Procter LLC, Boston, USA
Thursday, 5 January 2023 | 11:30 AM - 1:00 PM
Title: A Push-Pull Train for Safety of Autonomous Vehicle Software

Mridula Singh
CISPA, Germany
Thursday, 5 January 2023 | 3:30 PM – 5:00 PM
Title: Challenges and Opportunities in Enabling Secure 5G Positioning



Salil Kanhere
UNSW, Sydney, Australia
Friday, 6 January 2023 | 11:45 AM – 1:00 PM
Title: Trust and Reputation Management for Blockchain-enabled IoT

Dinesh Rajan
Southern Methodist University, USA
Friday, 6 January 2023 | 11:45 AM – 1:00 PM
Title: Hybrid Full Duplex MAC protocol

Gerald Karam
Nokia Bell Labs, USA
Friday, 6 January 2023 | 2:00 PM – 3:30 PM
Title: The Evolution of Networks and Management in a 6G world: An Inventor's View

Baek-Young Choi
University of Missouri - Kansas City, USA
Friday, 6 January 2023 | 4:00 PM – 5:30 PM
Title: Digital Transformation and Divide in Education through the COVID-19 Pandemic

Satish K.
Nokia Bell Labs, Bangalore, India
Saturday, 7 January 2023 | 9:30 AM – 11:30 AM
Title: Design for sustainability – an imperative for future mobile networks

Debdoot Mukherjee
Meesho, India
Saturday, 7 January 2023 | 2:00 PM – 4:00 PM
Title: Toward Long Term Health of Two Sided Online Marketplaces

Supratik Mukhopadhyay
Louisiana State University (LSU), USA
Saturday, 7 January 2023 | 2:00 PM – 4:00 PM
Title: AI for Climate Change and Finance

TUTORIALS

Tutorial 1

Tuesday, 3rd January, 2023, 10:00 AM – 01:00 PM

Title:

Toward Automated Security Risk Assessment: Models, Metrics, and Recent Applications

Speakers:

Dr Dan Dongseong Kim (University of Queensland, Australia)

Abstract:

Graphical security models such as attack graphs, attack trees, and other variants have been used for attack/threat modeling and analysis. This tutorial introduces how we can automate security risk analysis for given systems and networks. This will introduce the basic concepts of graphical security models, metrics, and their applications. The tutorial is organized as follows. It starts with an introduction to security modeling and analysis followed by the three fundamental terms/concepts such as graphical security models, measurement and metrics. The last part is focused on the recent advances in graphical security models and their applications in various application domains. The agenda will be: Introduction - Basic Concepts, Terminologies; Graphical security models, measure and metrics, and life cycle; Recent advances in graphical security models; and Graphical security models and their applications (Cloud computing, Moving Target Defense, IoT, etc).

Tutorial 2

Tuesday, 3rd January, 2023, 10:00 AM – 01:00 PM

Title:

Identification of Causal Dependencies in Multivariate Time Series

Speakers:

Sujoy Roychowdhury, Serene Banerjee, and Ranjani H.G. (Ericsson, India)

Abstract:

Telecommunications networks operate on enormous amount of time-series data, and often exhibit anomalous trends in their behaviour. This is caused due to increased latency and reduced throughput in the network which inevitably leads to poor customer experience. One of the common problems in machine learning in the telecom domain is to predict anomalous behaviour ahead of time. Whilst this is a well-researched problem, there is far less work done in identifying causal structures from the temporal patterns of various Key Performance Indicators in the telecom network. The ability to identify causal structures from anomalous behaviours would allow more effective intervention and generalization of different environments and networks. The tutorial is focused on discussing existing frameworks for establishing causal discovery for time-series data sets. In this hands-on tutorial, we will be covering at least 3 state-of-the- art methods on causal time series analysis including Granger causality, convergent cross-mapping, Peter- Clark Momentary Conditional Independence and Temporal Causal discovery framework. The need for a causation analysis, beyond correlation will also be explained using publicly available datasets, such as, double pendulum dataset. The state-of-art methods are chosen to cover various aspects of the causal time series analysis, such as modelling the non-linearity, attempting the problem from chaos and dynamic systems (CCM), information-theoretic approaches (PC-MCI), or having a data-driven approach (TCDF). State-of- the-art survey papers show that none of the methods can be said to be ideal for all the possible time series and there are relative advantages and shortcomings for each of these methods.

Tutorial 3

Tuesday, 3rd January, 2023, 10:00 AM – 01:00 PM

Title:

5G Architecture Overview, Software Stack and Use Cases

Speakers:

Atahar Khan, Satya Priyo Dhar, and Ramakrishnan Shanmugasundaram
(Cisco, India)

Abstract:

Mobile networks are seeing a dramatic evolution as they prepare for the transition to 5G and meet the demands of new 5G services like Massive IoT, enhanced mobile

broadband, tactile internet, smart city, and virtual reality. The demands on the service provider network will increase multi-fold to support new 5G use cases capabilities such Enhanced mobile broadband (eMBB), Ultra reliable low latency communications (URLLC) and massive machine type communications (MMTC). These services require programmability in the network along with simpler architecture that can be scaled rapidly through automation. This detailed technical tutorial showcases the transformation journey of the IP networks as they transition to 5G through architecture, use cases, practical case-study, design best practices, software stack & automation.

Tutorial 4

Tuesday, 3rd January, 2023, 02:00 PM – 05:00 PM

Title:

Deep Learning based Radio Frequency Signal Classification: Hands-on

Speakers:

Prabhu Chandhar and Sathish Babu (Chandhar Research Lab, India)

Abstract:

Radio Frequency (RF) signal classification is a key technique of Dynamic Spectrum Access (DSA) to utilize the unused spectrum in Cognitive Radio (CR) to meet the ever- increasing traffic demands for the next generation 5G and beyond cellular networks. In recent years, the RF signal classification for CR-based applications using Deep Learning (DL) architectures has received considerable attention. This tutorial focuses on a DL-based framework with Convolution Neural Network (CNN) architecture for classifying various modulation schemes such as BPSK, QPSK and GMSK. The real-time GSM signals captured from the nearby base stations will be used to analyze the performance of the developed CNN architecture.

Tutorial 5

Tuesday, 3rd January, 2023, 02:00 PM – 05:00 PM

Title:

5G Non-Terrestrial Networks: Recent Advancements, Open Challenges, and Research Tools

Speakers:

Sumit Kumar and Jorge Querol (University of Luxembourg, Luxembourg)

Abstract:

The integration of 5G with Non-Terrestrial Network (NTN) components is going through a series of technological advancements and soon satellites will be a part of the 5G ecosystem. The integration is also boosted-up by its formal standardization in the 3GPP Release-17 and further enhancements are planned for Release-18. Benefits of 5G-NTN are enormous and so are the challenges. This tutorial aims to educate the audience on the latest advancements in 5G Non-Terrestrial Networks (5G-NTN), the current status of research, implementation challenges, experimentation tools, and open research problems. The first part of the tutorial overviews the basics of 5G-NTN, potential use cases, different architectures, and their trade-offs. The first part also provides peculiar features of 5G New Radio (NR) and satellite communication for an in-depth understanding of the second and third parts of the tutorial. The second part addresses the standardization of NTN in the 5G ecosystem followed by the technical challenges posed by both the NTN channel and the 5G protocol stack. The third part of the tutorial focuses on the description of software and hardware research tools and details of ongoing/completed 5G-NTN projects. The third part of the tutorial also includes a few demonstrations using open-source software OpenAirInterface. Finally, the long-term outlook of 5G-NTN and open research topics are discussed.

Tutorial 6

Tuesday, 3rd January, 2023, 02:00 PM – 05:00 PM

Title:

Cloud-native Networking Deep Dive

Speakers:

Chander Govindarajan and Priyanka Naik (IBM Research, India)

Abstract:

Widespread adoption of container deployment for microservices has spurned a whole body of research in cloud-native networking. The interest is more profound with multi-cloud networking to support edge deployments. The tutorial aims to cover the cloud/ multi-cloud networking concepts with a hands-on experience.

Tutorial 7

Saturday, 7th January, 2023, 10:00 AM – 01:00 PM

Title:

OTFS Aided Cell-free Massive MIMO for Beyond 5G

Speakers:

Prem Singh (IIIT Bangalore) and Ekant Sharma (IIT Roorkee)

Abstract:

Fifth generation (5G) cellular communication uses massive multiple-input multiple-output (MIMO) technology to enable precise beamforming towards any location in the cell. Several countries have commercially deployed 5G systems with massive MIMO technology. Researchers have already started to look for beyond 5G technologies, with an aim to support the ever increasing demands for a wide range of network services, seamless growth in the number of wireless connected devices and to provide a better user experience. In this regard, many new technologies have emerged, such as ultra-massive multiple-input multiple-output (UM-MIMO), cell-free massive MIMO, reconfigurable intelligent surfaces, orthogonal time-frequency space (OTFS), among others, as a probable candidate for beyond 5G (B5G) communication systems.

Cell-free massive MIMO concept has been recently proposed as a promising technique for B5G systems, thanks to its capability to support a high density of network devices, while providing substantial improvement in connectivity, spectral and energy efficiencies. A cell-free massive MIMO system is a distributed architecture where a large number of geographically distributed access points (APs) serve a number of users distributed over a large area. Many aspects of cell-free systems are being actively researched, with a focus on technical foundations, resource allocation and signal processing and practical implementation. Nevertheless, high mobility scenarios, such as high-speed railways, vehicle to vehicle (V2V) communications, and unmanned aerial

vehicles (UAV) communications have remained largely unexplored. These applications pose a significant challenge in designing cell-free technology for future wireless communication systems. High Doppler spread and multipath propagation observed in such applications result in a doubly dispersive channel, which significantly degrades its estimation and tracking.

Orthogonal frequency division multiplexing (OFDM) has been a dominant waveform for more than a decade. 4G-LTE and 5G-new radio (NR) technologies use OFDM waveform to overcome the effect of a frequency-selective wireless channel. However, the bit error rate (BER) of OFDM waveform, which multiplexes symbols in the time-frequency (TF) domain, deteriorates significantly over doubly dispersive channels. The recently-proposed orthogonal time-frequency space (OTFS) waveform, instead multiplexes symbols in the Delay-Doppler (DD) domain, and has been shown to achieve a significantly lower BER than OFDM over vehicular speeds ranging from 30 km/h to 500 km/h. OTFS waveform has recently been amalgamated with massive MIMO and cell free massive MIMO technologies for catering high mobility use cases for beyond 5G wireless systems. The topics to be covered in this tutorial are as follows:

Cell-free, small-cell and cellular networks;
Cell-free massive MIMO system;
Cell-free massive MIMO channel properties;
Practical pulse-shaped MIMO-OTFS system model;
MIMO-OTFS channel properties;
Low-complexity receiver design for cell-free massive MIMO-OTFS

PANEL DISCUSSIONS

The Impact of Future Networks on Sustainability
Thursday, 5 January 2023, 5:00 PM – 6:30 PM

Panel Discussion 1

Salil Kanhare
UNSW, Sydney, Australia

Praveen Jayachandran
IBM Research, India

K, Satish
Nokia Bell Labs, Bangalore, India

Deepaknath Tandur
Hitachi Energy, Bangalore, India

Marina Thottan
Amazon Web Services, USA

Kishor Narang
Narnix Technolabs Pvt. Ltd., India

Abstract:

Sustainability has been established as a cornerstone of the 6G era. As investigations of 6G architecture are explored in various communities, energy and broader sustainability challenges have been identified. The use of virtualized platforms for Radio Access Network processing imply greater energy use, and more cloud platforms to be managed. The introduction of AI/ML everywhere in 6G suggests energy hungry computations, and specialized power hungry processors. What are the power sources of all these cloud platforms? Especially on a global basis, and with computing so widely distributed - not solely in giant well managed data centers. A longer term goal of 6G is communications everywhere, including various non-terrestrial networks. How will they affect global sustainability with airborne, non-satellite platforms? As we look at these future networks based around 6G and its successors we are faced with a paradox - we need these architectural and technical changes to bring greater function and benefit and sustainability, and yet the methods used may negatively affect sustainability. As a second perspective, 6G with its richer, more wide spread functionality can also help solve other sustainability issues as a tool. Consequently 6G may consume sustainable resources but also save more indirectly through its employment in new solutions. This panel will discuss and help the audience explore these challenging issues.

15 Years of COMSNETS and the Past, Present, and Future of Networking

Panel Discussion 2

Saturday, 6 January 2023, 5:30 PM – 7:00 PM

Dr. Anurag Kumar
Indian Institute of Science, Bangalore, India

Monisha Ghosh
University of Notre Dame, USA

Venkat Padmanabhan
Microsoft Research India

Dr. Huzur Saran
Indian Institute of Technology, Delhi

Abstract:

This is the 15th year of COMSNETS. COMSNETS continues to be a premier international conference dedicated to advances in Networking and Communications Systems. Undoubtedly, we are in an exciting time when we assume connectivity to be a fundamental right.Since its start, COMSNETS as well as the overall area of systems and networking have evolved and often dramatically so. This panel will go down the memory lane and reminisce about what the community thought networking was, and where it would be, where we actually are, and where we think we will be in the coming decades.

Is Affordable Ubiquitous Communication Possible?

Panel Discussion 3

Saturday, 7 January 2023, 4:30 PM – 6:00 PM

Satish Jamadagni
RIL Jio, India

Suresh Chitturi
Samsung Research, India

Dhananjay Gore
Qualcomm Research, India

Prof. Chandra R Murthy
Indian Institute of Science, India

Abstract:

Ubiquitous communication is a significant goal of the 6G era. It is meant to unify terrestrial and non-terrestrial networks and radio systems to allow people to be enabled by telecommunication no matter where they may live in the world. Imagine the large swathes of the 7 continents of the world that are frequently only sparsely inhabited. Consider the ocean going traveler or those in the air space above us. 6G is intended to weave all platforms together seamlessly with the communication end points (such as the smartphone or other device), More so this should be affordable, so that it is not a service only for the wealthy, but for all people - this is what will make communication ubiquitous: accessible to anyone, and available everywhere. The technical challenges seem daunting. This panel will explore how 6G will usher in the start to this laudable vision, even though it may take many years and more than one generation of radio technology to achieve it.

RESEARCH DEMOS

Demonstration 1
Noise Recycling using GRAND for Improving the Decoding Performance

Speakers:
Arslan Riaz (Boston University, USA)
Amit Solomon (Massachusetts Institute of Technology, USA)
Furkan Ercan (Boston University, USA)
Muriel Médard (MIT, USA)
Rabia T Yazicigil (Boston University, USA)
Ken R. Duffy (Hamilton Institute, Maynooth University, Ireland)

Abstract:

Although noise is often modelled as an independent Gaussian process in communication systems, a single communication channel is typically impacted by temporally correlated noise. While this correlation is usually broken up through interleaving and discarded, this demonstration shows that an accurate continuous noise estimate can be obtained in a purely hard-detection scenario by exploiting the temporal correlation that can be removed from the subsequent channels resulting in a significantly improved decoding performance and energy efficiency. This technique requires only simple receiver-side changes with no sender-side alterations and works for any codebook structure, decoder, and modulation scheme. We will use the hard-detection Guessing Random Additive Noise Decoding (GRAND) chip to demonstrate the decoding gains of greater than 2 dB obtained by employing noise recycling in hardware. We further show that significant energy savings of up to 36X and latency reduction of up to 12X can be obtained when GRAND is used for noise recycling.

Demonstration 2
FENCE: A Real-Time Privacy-Preserving Solution for Enterprise Internet Forensics at Scale

Speakers:
Maruthi S. Inukonda (IIT Hyderabad, India & Freelancing Opensource Solutions Architect, India)
Sai Harsha Kottapalli (Microsoft, India & IIT Hyderabad, India)
Bheemarjuna Reddy Tamma (IIT Hyderabad, India)
Sparsh Mittal (IIT Roorkee, India)

Abstract:

In this demo, we present FENCE, a privacy-preserving, scalable solution for enterprise networks that continuously collects Internet access artifacts in real-time to help post-incident Internet forensics. We have built a data lakehouse to store these artifacts in a secure and compact query-friendly format. We implemented FENCE using open-source frameworks, deployed in a large enterprise with thousands of bring-your-own-devices (BYOD), and demonstrated that it works effectively in production environments.

Demonstration 3
A Smartphone-based Application to Detect Parkinson's Disease Using Audio

Speakers:
Saumya Mathkar (Bits Pilani, Goa, India)
Prakhar Karsh and Udit Baluja (Bits Pilani Goa, India)
Surjya Ghosh (BITS Pilani Goa Campus, India)
Sougata Sen (Birla Institute of Technology and Science, Pilani, Goa, India)
Vinayak Naik (BITS Pilani, Goa, India)

Abstract:

Parkinson's disease (PD), a commonly occurring neurodegenerative disease, affects millions worldwide. One approach to detecting PD is observing variations in an individual's speech patterns, such as tone, jitter, shimmer, and pitch. In this demo, we present PidiBuddy, a smartphone-based system that detects PD based on the user's voice data. To reduce privacy concerns and dependency on background infrastructure and facilitate usage by naive users, PidiBuddy runs end-to-end on the smartphone. It collects short speech segments, extracts features, and infers PD (each step happens in situ) using a Random Forest-based machine learning model. Before deploying the model on the device, we trained the model offline using a publicly available speech dataset comprising a set of MFCC (Mel-frequency cepstral coefficients) related speech features. The initial findings from the system are promising in terms of PD detection performance, system parameters, and system usability, all of which we aim to improve further in our ongoing work.

Demonstration 4
Demonstrating Deep Learning driven BPSK Demodulation using Software-Defined Radios

Speakers:
Arhum Ahmad (INDIA & IIT ROPAR, India)
Satyam Agarwal (Indian Institute of Technology Ropar, India)

Abstract:

Our objective in this demonstration is to demodulate the received BPSK signal using a deep neural network. In conventional demodulation, the performance is limited by the carrier frequency/phase offsets, hardware imperfections and use of multiple levels of nonlinear devices such as synchronizer, offset detector, etc. To improve the detection performance under high noise (i.e., low SNR), varying channel conditions and hardware impairments, we propose and demonstrate a deep neural network based demodulator which is able to detect bits even at lower SNRs. Results show that we can detect the received signal under synchronization offsets, varying channel parameters and hardware imperfections due to its high proficiency in learning signal patterns and detecting the pattern embedded in noise. The demonstration will be carried out on USRP coupled with Matlab.

Demonstration 5
Demonstration of LegalHelper: A Low-cost tool for Smart Translation and Creation of Legal Contracts

Speakers:
Garvit Chugh and Suchetana Chakraborty (Indian Institute of Technology Jodhpur, India)

Abstract:

This demonstration presents the working principles and key features of a unique mobile application named LegalHelper. The application is developed to address the existing challenges in terms of reduced interpretability and low perception of the legal documents as commonly faced by the general public. The core software is built up by leveraging the power of cutting-edge technologies such as Blockchain, Computer Vision, and Natural Language Processing. The main components to be demonstrated include (a) Smart Translation, and (b) Smart Contract.

Demonstration 6
Closed loop optimization of 5G network slices

Speakers:
Kavya Govindarajan (IBM Research, India)
Seep Goel (IBM Research - India, India)
Praveen Jayachandran (IBM India, India)
Steve Glover (IBM Software, UK)
JM Pulido Villaverde (IBM Software, Spain)
Jacques Cresp (IBM, France)
Joel Viale, Sophie Martin and Fabrice Livigni (IBM Global Sales, France)

Abstract:

The rising popularity of 5G is expected to drive transformation in a large number of industries, thereby generating a diverse set of use cases with distinct and specific requirements on throughput, latency, availability etc. 5G Slicing, one of the key enablers of 5G, will allow different applications with custom QoS requirements to be supported on the same physical infrastructure. A slice, during its lifecycle from planning to decommissioning, requires a scalable Management and Orchestration (MANO) framework that automates the slice deployment and its management. The dynamic nature of slices and the strict QoS requirements of 5G applications, requires a more intelligent MANO framework with analytics capabilities for slice SLO assurance and optimization capabilities for resource efficiency. In this demo, we present an end-to-end 5G slicing lifecycle framework with additional capabilities of optimal cost-efficient placement of slices and 3GPP compliant Data and Analytics Function (DAF) module for intelligent monitoring for assurance.

Demonstration 7
Radian: Paperless Academic Testimonials Enabled for Long-Term Validation

Speakers:
Souvik Pan (Indian Institute of Technology Bhilai, India)
Dhiman Saha (IIT Bhilai, India)
Rajat Moona (Indian Institute of Technology Bhilai, India)

Abstract:

Portable Document Format (PDF) are widely used throughout the world for exchanging documents. The main reason of their popularity is that this format maintains the structure of the original document without taking into consideration the software that was used to draft the document. PDFs also provide authenticity and integrity of documents by using and verifying digital signatures. Since this all happens digitally the security notion of the verification has to be stronger than in analog world. Nowadays digital certificates and digital contracts have equivalent importance as that of physical certificates and contracts. Digital signatures using cryptographic algorithms provide a way to verify a PDF's authenticity and integrity.

Demonstration 8

Split Computing based Quantized PoseNet Model for Distributed AI Architecture in IoT-Edge

Speakers:

Jyotirmoy Karjee (Samsung, Bangalore, India)

Praveen Naik S, Kartik Anand and Chandrashekhar S Byadgi (Samsung R&D Institute, Bangalore, India)

Ramesh Babu Venkat Dabbiru (Samsung India Software Operations, India)

Srinidhi N (Samsung R&D Institute, Bangalore, India)

Abstract:

In recent times, Internet of Things (IoT) devices is gaining popularity in advanced wireless technology (i.e., 5G). However, in 5G applications (say in edge platform), the IoT devices have limited computation & processing capabilities which makes it challenging to execute Deep Neural Network (DNN) models on them. To address this, we introduce Split Computing technology, to partition DNN inference layers based on the computational capabilities (such as bandwidth, battery level and processing power, etc.) of IoT and edge (computationally powerful) devices, respectively. To validate split computing, we propose a framework called Distributed Artificial Intelligence (DAI) architecture. We use the architecture for a fitness application (use-case) where we estimate the pose of a person using our proposed Quantized Split PoseNet DNN (QSP-DNN) algorithm which partitions the DNN layers among IoT device and edge based on Wi-Fi bandwidth. We conduct extensive experiments to validate the QSP-DNN algorithm using DAI architecture. The QSP-DNN with DAI compares split execution (computed among IoT device & edge) for partial offload and full-offload executed on edge device. The result shows that using QSP-DNN in DAI architecture provides split execution performing 20.76 % improvement compared to the full offload case.

Demonstration 9
ANROL: Autonomous Navigation based on ROS and Laser Odometry

Speakers:
Akshat Vikram Singh and Yash Agrawal (Indraprastha Institute of Information Technology Delhi, India)
Rahul Gupta (IIIT Delhi, India)
Abhishek Kumar (Indraprastha Institute of Information Technology Delhi, India)
Vivek A Bohara (Indraprastha Institute of Information Technology, Delhi (IIIT-Delhi), India)

Abstract:

In this paper, the design and implementation of robust and precise localization and navigation scheme are proposed for an autonomous mobile robot. The proposed scheme utilizes the features of Light Detection and Ranging (LiDAR), Hector Simultaneous Mapping and Localization (SLAM), and Adaptive Monte Carlo Localization (AMCL) which is intuitively integrated with Range Flow 2D Laser Odometry (RF2O) to achieve the accuracy in the pose identification of the mobile robot. Here, the use of Hector SLAM provides aids in avoiding obstacles and the use of RF2O Laser Odometry eliminates the need for additional hardware sensors for the odometry data. And thus the proposed technique is precise and efficient in terms of power and computational complexity in a reduced form factor. The working of the developed robot is also demonstrated through the mapping and localization in a physical lab space which follows a complete close loop that ensures the accuracy and efficacy of the implemented algorithm.

Demonstration 10
Demonstration of a Testbed with State Estimation for Studying Security in Measurement and Control of Electric Power Transmission Grid

Speakers:
Yinghui Nie, Zhen Zhu and Boyang Zhou (Zhejiang Lab, China)
Chenfan Huang and Longxiang Cheng (Zhejianglab, China)

Abstract:

In modern power transmission grids, the vulnerability of measurement and control (MC) process can be exploited to cause serious deviations in the state estimation (SE), which can disrupt the grid operation stability. The security validation of these systems requires a testbed to reproduce the MC process. In this demo, we present a novel electric power transmission testbed with SE for studying the security in MC of the grid. The testbed aims to validate how cyber attacks can affect the operation of the grid by simulating the MC process. The simulation involves the electric dynamics and process control of the grid, as well as the MC process in a single substation and multiple substations. We demonstrate how the testbed works through carrying out the false measurement data injection attack experiments based on the IEEE 14-bus power system. The SE results of the grid under the attacks deviate a lot in the voltage and power of physical nodes in the grid, from the normal condition without the false data. The deviation further causes unstable grid operations.

Demonstration 11
A Reliability Assurance Framework for Cloud-Native Telco Workloads

Speakers:
Mudit Verma and Dushyant Behl (IBM Research, India)
Praveen Jayachandran (IBM India, India)
Amandeep Singh (IBM Texas United States, USA)
Matthew Thomas (USA)

Abstract:

With the onset of 5G, Telecom service providers around the world are in the midst of a radical transformation of their networking infrastructure, moving away from vertically optimized proprietary hardware and software boxes, to Cloud Native (containerized) network functions (CNFs), communicating over standardized interfaces and running on Kubernetes clusters that operated on commodity off-the-shelf hardware. While CNFs, managed by container orchestrators provide greater agility, manageability, and significantly lower operational costs, the reliability and performance assurance have become much more complex with thousands of virtualized moving parts. Given the criticality of the workload, these large-scale

containerized Telco systems require fast and completely automated reliability assurance pipelines where complex issues are detected, isolated, and remediated automatically. In this demo, we present a framework for a closed-loop assurance pipeline with CNF-level autoscaling as a use-case implemented on a real 5G workload.

Demonstration 12
BlockPaaS: Blockchain Platform as a Service

Speakers:
Yuvaraj Rajendra and Venkatesan Subramanian (Indian Institute of Information Technology, Allahabad, India)
Sandeep K Shukla (Indian Institute of Technology Kanpur, India)

Abstract:

Blockchain Technology is preferred in various applications for its decentralization, integrity and availability features. Much research is going on for blockchain technology's efficient design and utilization. Also, the application of blockchain in the IoT environment is a new area of focus. However, researchers have problems testing various blockchain features on IoT devices. Hence, we developed the Blockchain Platform as a Service (BlockPaaS), which allows users to run various blockchain protocols on the IoT hardware instantly.

Demonstration 13
On eBPF extensions to Kubernetes CNI datapath

Speakers:
Palani Kodeswaran (IBM Research India, India)
Dushyant Behl and Sayandeep Sen (IBM Research, India)
Hai Huang (IBM T. J. Watson Research Center, USA)

Abstract:

The combination of expressiveness and access to native Linux kernel capabilities explains the wide adoption of extended Berkeley Packet Filter(eBPF) as de-facto choice for implementing software based in-kernel network functions. While full of potential, it is infeasible to abandon existing (in-kernel) networking infrastructure and switch to eBPF based solutions overnight. To this end, we present an evolutionary approach for extending existing in-kernel networking infrastructure with eBPF modules such that new enhancements and feature replacements can be done to extend the present networking infrastructure. We demonstrate feasibility of eBPF based feature evolution of in-kernel networking by using Kubernetes CNI as an example.

Demonstration 14
Demonstration of a V2X Use Case Using MEC-assisted 5G Emulation Framework

Speakers:
Madhuri Annavazzala (IIT Hyderabad, India)
Arun Kant Dubey (IIT Hyderabad & Indian Institute of Technology Hyderabad, India)
Supriya Dilip Tambe (Indian Institute of Technology Hyderabad, India)
Bheemarjuna Reddy Tamma (Indian Institute of Technology, Hyderbad, India)
Antony Franklin A (Indian Institute of Technology Hyderabad, India)

Abstract:

With the advancements in 5G technology, Multi-access Edge Computing (MEC) has always been at the forefront due to its ability to provide additional computational power with reduced network latency compared to cloud computing. Most applications from the Vehicle to Everything (V2X) and Intelligent Transport Systems (ITS) domains are stringent in latency requirements, for which MEC is an excellent enabler. As per MEC architecture, MEC applications can leverage the benefits of storing essential information as a part of MEC services to further reduce the latency. In this work, we enhance an in-house 5G emulation framework by integrating it with ETSI MEC Location Service API for supporting various ITS use cases. We demonstrate the use case of

providing proximity alerts to the drivers using SUMO platform and a mobile application.

Demonstration 15
Demo of Hybrid LiFi/WiFi Network for an Indoor Environment

Speakers:
Saswati Paramita (IIIT-Delhi, India)
Anand Srivastava (Indraprastha Institute of Information Technology Delhi, India)
Vivek A Bohara (Indraprastha Institute of Information Technology, Delhi (IIIT-Delhi), India)
Abhijit Mitra (IIIT-Delhi, India)
M Hari Ramamoorthy, Hai Krishna Atluri and Paventhan Arumugam (ERNET India, India)

Abstract:

Light Fidelity (LiFi) is complementary to Wireless Fidelity (WiFi) that uses light as the communication medium with leveraging the indoor lighting infrastructure. LiFi has limited coverage but provides a higher data rate, in contrast WiFi has broader coverage with a comparatively lower data rate. The hybrid LiFi/WiFi network (HLWN) takes advantage of both LiFi and WiFi to provide higher average data rate with over a larger coverage area. In HLWN, LiFi and WiFi can coexist and complement each other, as the spectrum of LiFi and WiFi are non-overlapping and non-interfering. In this work, we demonstrate the realistic performance of a hybrid LiFi/WiFi network in a physical testbed environment for different indoor scenarios and evaluate its data rate and handover latency performance.

Demonstration 16
WiROS: A QoS Software Solution for ros2 in a WiFi Network

Speakers:
Bishal Jaiswal, Himanshu Tyagi, Aditya Gopalan and Vishal Sevani (Indian Institute of Science, India)

Abstract:

Robot Operating System (ROS) has played a pivotal role as a communication middleware among different peripherals, including sensors and actuators of robotics and other systems, with the advancement of connected systems around the globe. The development of DDS based ros2 has increased its popularity to be used for multi-bot communication over the network as well. However, latency and throughput become a bottleneck for latency critical applications such as remote surgery, remote driving in dense data traffic. ROS2 publishes its sensors & actuators messages in the form of topics. A middleware solution can be designed considering the target critical topic's traffic flows and the required QoS for such applications. We perform a comparative study of the target application affected because of other ongoing traffics in the network. A software solution to get desired QoS for the applications in a static traffic scenario has been developed based on prioritization of the message data flow and WiFi's EDCA parameter configuration.

Demonstration 17
NATIVE: Network Aggregation-based Tiled Live Video Streaming

Speakers:
Keshav Gambhir and Tanmay Rajore (IIIT Delhi, India)
Shubham Chaudhary (IIIT-Delhi, India)
Taral Jain, Avishi Gupta and Mukulika Maity (IIIT Delhi, India)
Arani Bhattacharya (IIIT-Delhi, India)

Abstract:

The COVID-19 pandemic has forced most interactions to move to online space, starting from online lectures, conferences in hybrid mode, and work-from-home office works. Hence, it is essential for live video streaming to be reliable and provide a good quality of experience (QoE) to users. However, in large sections of the world, the cellular network is not reliable enough to be used for online participation in such events. To quantify this problem, we first measure the QoE in terms of lag, video resolution, and dropped calls on a popular video conferencing platform Google Meet over three

different cellular ISPs in New Delhi, India. We observe significantly worse quality of experience metrics compared to a study recently performed in the US. To mitigate this problem, we propose NATIVE (Network Aggregation-based Tiled lIve Video strEaming), a system of aggregating the cellular network connectivity using a secondary or helper device in the vicinity trusted by the user. The implementation of NATIVE uses tiled encoding of video, where the video frames are divided into rectangular units known as tiles. All the tiles are divided into two subsets which are scheduled independently via the available network interfaces depending on its importance. The receiver device receives video segments from the two network paths and stitches back the tiles in them to play. We show the demo of NATIVE using two laptops and a cloud server where the server acts as a streamer.

Demonstration 18
Link quality analysis of LoRa for Internet of Underwater Things

Speakers:
Shrutkirthi S. Godkhindi, Prabhakar Venkata T. and Preetham Reddy (Indian Institute of Science, India)

Abstract:

Our goal in this work is to achieve reliable communication between nodes across a water surface. To this extent, we conduct an extensive measurement campaign covering a few scenarios that place the transmitters and receivers at different depths underwater. Our experimental results indicate that the path loss exponent is significantly higher for underwater communication. The links between Tx and Rx crossing a water surface has an asymmetric nature. Furthermore, Tx-Rx nodes have to be aligned inline or at 270 to support a higher PDR.

Demonstration 19
Securing Containers: Honeypots for Analysing Container Attacks

Speakers:
Arjun Sable (Indian Institute of Technology Bombay, India)
Yogesh C Jadhav and Maithri Suresh (IIT Bombay, India)
Manjesh K Hanawal (Indian Institute of Technology Bombay, India)

Abstract:

Docker Containers are increasingly being used to develop, deploy and distribute software. However, they are also vulnerable to various attacks resulting in breaches and access to the host machines. To understand the various attacks on the containers and study them in a sandbox environment, we develop a honeypot. The honeypot systematically collects data logs of all the activities both inside and outside the container. We build on open source log gathering tool Osquery and Docker APIs to obtain `evented' activity logs. Our honeypot provides granular information about the container activities which can be analyzed to build detection rules and secure the containers.

Demonstration 20
An Edge-inclusive WebRTC-based Protocol to Enable Embodied Visual Analytics in Telerobot

Speakers:
Abhijan Bhattacharyya (Tata Consultancy Services Ltd., India)
Ashis Sau, Madhurima Ganguly and Suraj Kumar Mahato (Tata Consultancy Services, India)

Abstract:

In this paper, we propose a WebRTC-based protocol for a Telerobotic session that enables forking of the Telerobot's live visual feed to the MEC (while the robot is parallelly engaged in live multimedia session) for running real-time analytics and feed the inferences back to the remote operators and observers via the Robot.

Demonstration 21

Demonstrating Multi-modal Human Instruction Comprehension with AR Smart Glass

Speakers:
Dulanga Kaveesha Weerakoon Weerakoon Mudiyanselage (Singapore Management University, Singapore)
Vigneshwaran Subbaraju (Institute of High Performance Computing, Singapore)
Minh Anh Tuan Tran (University of Colorado Boulder, USA)
Archan Misra (Singapore Management University, Singapore)

Abstract:

We present a multi-modal human instruction comprehension prototype for object acquisition tasks that involve verbal, visual and pointing gesture cues. Our prototype includes an AR smart-glass for issuing the instructions and a Jetson TX2 pervasive device for executing comprehension algorithms. With this setup, we enable on-device, computationally efficient object acquisition task comprehension with an average latency in the range of 150-330msec.

PRODUCT DEMOS

Demonstration 1
Interact with Cisco SD-WAN via REST API's - A POSTMAN WAY!!

Speaker:
Uma Sankar Mohanty (Cisco Systems Ltd., India)
Pulkit Bindlish (Cisco Systems Limited, India)

Demonstration 2
Config Generator for Cisco Devices - Using Python, Jinja2 & CSV with Validation

Speaker:
Uma Sankar Mohanty (Cisco Systems Ltd., India)
Pulkit Bindlish (Cisco Systems Limited, India)

Demonstration 3
Use the Unused: ThousandEyes Hosted on Enterprise Portfolio

Speaker:
Uma Sankar Mohanty (Cisco Systems Ltd., India)

Demonstration 4
Zero Touch DNA Center Automation and Assurance Implementation using APIs - A POSTMAN WAY

Speaker:
Sunil Pareek, Ambarish Kumar (Cisco Systems, India)
Senthil Kumar Chandramohan (Cisco Systems, India)

Demonstration 5
Protect your Remote Worker - In Hybrid World

Speaker:
Senthil Kumar Chandramohan (Cisco Systems, India)
Jay Tiwari (& Cisco Systems, India)

Demonstration 6
ThousandEyes from a Network Engineer's Perspective

Speaker:
Uma Sankar Mohanty (Cisco Systems Ltd., India)
Pulkit Bindlish (Cisco Systems Limited, India)

Demonstration 7
Accelerate 5G R&D using Netsim

Speaker:
Pranav Viswanathan (TETCOS, India)

Demonstration 8
Dozee AI-Powered Contactless Remote Patient Monitoring and Early Warning System

Demonstration 9
Rapid prototyping of Industry 5.0 use cases for 5G-Networks using a Network-Robot Co-Simulation Framework

Speaker:
Srikrishna Acharya and Kaustuv Saha (Nokia, India)

Demonstration 10
Networked Robotics research at Nokia IISc center

Speaker:
Ayush Das (Indian Institute of Science (IISc), Bangalore, India
Bhagiya Jaykumar Amarhibhai (Indian Institute of Science (IISc), Bangalore
Eeshan Kulkarni Prashant (Indian Institute of Science (IISc), Bangalore, India
Hari Haran R (Indian Institute of Science (IISc), Bangalore, India
Jayant Teotia (Indian Institute of Science (IISc), Bangalore, India
Jeel Himmatbhai Chatrola (Indian Institute of Science (IISc), Bangalore, India
Nishanth A Rao (Indian Institute of Science (IISc), Bangalore, India
Nishchal Hoysal G (Indian Institute of Science (IISc), Bangalore, India
Pankaj Kumar Mishra (Indian Institute of Science (IISc), Bangalore, India
Srijan (Indian Institute of Science (IISc), Bangalore, India
Varan C R (Indian Institute of Science (IISc), Bangalore, India
Amrutur Bharadwaj (Indian Institute of Science (IISc), Bangalore, India
Pavan Tallapragada (Indian Institute of Science (IISc), Bangalore, India
Pushpak Jagtap (Indian Institute of Science (IISc), Bangalore, India
Shishir NY (Indian Institute of Science (IISc), Bangalore, India
Suresh Sundaram (Indian Institute of Science (IISc), Bangalore, India

Demonstration 11
Secure and Private AI/ML using Privacy Enhancing Techniques

Speaker:
Delton Antony (Cybersecurity and Privacy research, TCS)
Imtiyazuddin (Cybersecurity and Privacy research, TCS)

Demonstration 12

A QoE-centric robust live video-streaming mechanism for latency-critical interactive applications

Speaker:
Madhurima Ganguly, Robotics and Autonomous System (TCS Research)
Ashish, Robotics and Autonomous System (TCS Research)
Abhijan Bhattacharyya, Robotics and Autonomous System (TCS Research)

Demonstration 13
Tele-operated Robot with 5G for Manufacturing Operations

Speaker:
Rolif Lima, Robotics and Autonomous System (TCS Research)
Utsav Rai, Robotics and Autonomous System (TCS Research)
Vismay Vakharia, Robotics and Autonomous System (TCS Research)
Hardik Mehta, Robotics and Autonomous System (TCS Research)
Aditya Choudhary, Robotics and Autonomous System (TCS Research)
Amitkumar Parmar, Robotics and Autonomous System (TCS Research)
Kaushik Das, Robotics and Autonomous System (TCS Research)

Demonstration 14
Intelligent Orchestration and Management of NextGen Networks with Cognitive Approach

Speaker:
Shameemraj M Nadaf (TCS Research, India)
Garima Mishra (TCS Research, India)
Hemant K Rath (TCS Research, India)

POSTERS

1. **Weighted GNN-based Betweenness Centrality Considering Stability and Connection Structure**
   Ramya D Shetty and Shrutilipi Bhattacharjee (National Institute of Technology Karnataka, India)
2. **Self-Supervised Reinforcement Learning for Proactive Prediction of Passive Intermodulation**
   Serene Banerjee (Ericsson Research, India); Pratyush Kiran Uppuluri (GAIA, Ericsson, India); Rahul Sharma (GAIA Ericsson, India); Subhadip Bandyopadhyay (GAIA, Ericsson, India)
3. **Defense Against Byzantine Attack in Cognitive Radio Using Isolation Forest**
   Danish Ahmed Mehmuda, Chinmay Bhagat, Dhrupam Pankaj Patel and Kamal Manharlal Captain (Sardar Vallabhbhai National Institute of Technology, India); Ashok Parmar (Sardar Vallabhbhai National Institute of Technology Surat, India)
4. **Analysis of PAPR in OTFS Modulation with Classical Selected Mapping Technique**
   Sneha Chennamsetty (Mahindra University, India & Hyderabad, India); Subbarao Boddu (Mahindra University, India); Prabhu Chandhar (Chandhar Research Labs Pvt Ltd, India); Sri Satish Krishna Chaitanya Bulusu (Mahindra University École Centrale, India)
5. **Out of Band Emission Suppression and PAPR Analysis in OFDM systems**
   Roshan S Sam (Lekha Wireless Solutions, India); Vishal Pundalik Kalkundrikar (Lekha Wireless, India); Seetharam Kashyap and Sreenath Ramanath (Lekha Wireless Solutions, India)
6. **Railways Communication Beyond 5G: Opportunities and Challenges**
   Ipshita Panda (Lekha Wireless Solution Pvt. Ltd., India); Sreenath Ramanath (Lekha Wireless Solutions, India)
7. **Intelligent RMCSA Algorithm for Space Division Multiplexed Elastic Optical Network (SDM-EON)**
   Baljinder Singh Heera and Anjali Sharma (Indian Institute of Technology Kanpur, India); Kumari Akansha (IIT Kanpur, India); Yatindra Nath Singh (Indian Institute of Technology Kanpur, India)
8. **Distributed Probabilistic Congestion Control in LEO Satellite Networks**
   Pranav S. Page and Kaustubh Bhargao (Indian Institute of Technology, Bombay, India); Hrishikesh Baviskar (IIT Bombay, India); Gaurav S. Kasbekar (Indian Institute of Technology, Bombay, India)

9. **Data Centric Approach to Modulation Classification**
   Venkatesh Sathyanarayanan (University of California San Diego, USA); Peter Gerstoft (University of California, San Diego, USA); Aly El Gamal (Purdue University, USA)
10. **Touch-Interfacing Middleware Network Design in 6G**
    Mantisha Gupta (Shri Mata Vaishno Devi University, India); Rakesh Kumar Jha (School of Electronics and Communication Kakryal & Shri Mata Vaishno Devi University, India)
11. **Survivable Transparent OFDM Optical Grids/Clouds: Efficient Dynamic Route Selection with Minimized Spectral Fragmentation**
    Sougata Das (CDE Blockchain & Cognizant Technology Solutions, India); Monish Chatterjee (Asansol Engineering College & West Bengal University of Technology, India)
12. **MatchVNE: A Stable Virtual Network Embedding Strategy Based on Matching Theory**
    Keerthan Kumar Tg (National Institute of Technology Karnataka, India); Ankit Srivastava (National Institute of Technology Karnataka, Surathkal, India); Anurag Satpathy (National Institute of Technology, Rourkela, India); Sourav Kanti Addya (National Institute of Technology Karnataka, India); Shashidhar G. Koolagudi (NIT, Surathkal, India)
13. **Hand it Over Carefully: Security Breach during Handover in 5G-V2X**
    Meenu Rani Dey and Moumita Patra (IIT Guwahati, India)
14. **Speed Estimation of UAVs in Dense Urban Deployments**
    Ipshita Panda (Lekha Wireless Solution Pvt. Ltd., India); Sreenath Ramanath (Lekha Wireless Solutions, India)
15. **CancelOut GCN Diffusion(CoutGCN): Finding the Influential Spreaders to Diffuse Information**
    Koyena Chowdhury (National Institute of Technology Durgapur, India); Amit Paul (National Institute of Technology, India); Animesh Dutta (National Institute of Technology Durgapur, India)
16. **Autonomous Vehicle Cyber-Attacks Classification Framework**
    Yazan Aref and Abdelkader Ouda (University of Western Ontario, Canada)
17. **enVolve+: Inertial Sensing to Reinforce Involvement of Silent Listeners during an Online Interaction**
    Garvit Chugh and Suchetana Chakraborty (Indian Institute of Technology Jodhpur, India); Sandip Chakraborty (Indian Institute of Technology Kharagpur, India)
18. **Demonstration of RF-VLC Hand-over using Receiver side Channel Selection**
    Sathisha R N (Indian Institute of Science, Bangalore & Siddaganga Institute of Technology, Tumakuru, India); Faheem Ahmad and Varun Raghunathan (IISc, India)

19. **Low-cost PM Sensors Performance, Drift Analysis, Calibration and Optimal Deployment**
    Gautam Tiwari (IIT Delhi, Bharti School & IIT DELHI, India); Brejesh Lall (Indian Institute of Technology Delhi, India)
20. **IRS-Aided Communication System with Phase Noise and Hardware Impairments: Performance Analysis and Characterization**
    Mohd Hamza Naim Shaikh (IIIT Delhi, India); Vivek A Bohara (Indraprastha Institute of Information Technology, Delhi (IIIT-Delhi), India); Anand Srivastava (Indraprastha Institute of Information Technology Delhi, India)
21. **A Low-Cost Edge-IoT Based Smart Poultry Farm**
    Ajay Yadav and Alokik Vijay (Bennett University, India); Tushar Garg (Panipat Institute of Engineering and Technology, India); Vikas Goyal (Bennett University, India); Rashmi Yadav (Jaipur National University, India); Rahul Mukherjee (Bennett University, India)
22. **Channel Modeling for Diffusive Molecular Communication Systems in The Presence of Multiple Silent Absorbing Targets**
    Ajit Kumar and Akarsh Yadav (IIT Patna, India); Sudhir Kumar (Indian Institute of Technology Patna, India)
23. **Virtual Machine Placement in Non-Cooperative Cloud Federation-Alliance**
    Sourav Kanti Addya (National Institute of Technology Karnataka, India); Anurag Satpathy (National Institute of Technology, Rourkela, India); A. Turuk (NIT Rourkela, India); Bibhudatta Sahoo (National Institute of Technology, Rourkela, India)
24. **Downlink SNR Estimation of Wi-Fi Clients using Machine Learning**
    Siddharth Dhama (Indian Institute of Technology, Mandi & Arista Networks, India); Nadeem Akhtar and Preyas Hathi (Arista Networks, India); Samar Agnihotri (Indian Institute of Technology Mandi, India)
25. **Energy Detector for Spectrum Sensing using Robust Statistics in non-Gaussian Noise Environment**
    Bandaru Bhavana and Samrat Sabat (University of Hyderabad, India); Swetha Namburu (GRIET, India); Trilochan Panigrahi (National Institute of Technology, Goa, India)
26. **Intelligent routing for enabling haptic communication in 6G Network**
    Anutusha Dogra (Shri Mata Vaishno Devi University, India); Rakesh Kumar Jha (School of Electronics and Communication Kakryal & Shri Mata Vaishno Devi University, India)
27. **Efficient Privacy-Preserving Authentication using Blockchain for VANET**
    Shubham Tomar and Akhil Pariyarath (Malviya National Institute of Technology, India); Meenakshi Tripathi (MNIT Jaipur, India)
28. **FreeSteer: A Smartphone Application for Detecting Anxiety in Novice Drivers through Smart Glasses**

Debasree Das (Indian Institute of Technology Kharagpur, India); Pragma Kar (Jadavpur University, India); Sugandh Pargal and Sandip Chakraborty (Indian Institute of Technology Kharagpur, India)

29. **Improving Threat Detection Capabilities in Windows Endpoints with Osquery**
    Akshay Bakshi, Tanish Sawant, Prasad Thakare and Azeez Moiz Dandawala (Veermata Jijabai Technological Institute, India); Manjesh K Hanawal (Indian Institute of Technology Bombay, India)
30. **Opinion Dynamics: Bots and the Spiral of Silence**
    Ashish Shukla (IIT Bombay, India); Neeraja Sahasrabudhe (IISER Mohali, India); Sharayu Moharir (Indian Institute of Technology Bombay, India)
31. **Strategic Energy Saving Technique for Multiple Visible Light Communication Access Points (VAP)**
    Vishal Kumar (Delhi Technological University (DTU), India); Rohit Kumar (DTU Delhi, India)
32. **ANROLA: Autonomous Navigation with ROS and Laser Odometry**
    Akshat Vikram Singh and Yash Agrawal (Indraprastha Institute of Information Technology Delhi, India); Rahul Gupta (IIIT Delhi, India); Abhishek Kumar (Indraprastha Institute of Information Technology Delhi, India); Vivek A Bohara (Indraprastha Institute of Information Technology, Delhi (IIIT-Delhi), India)
33. **ED.Ai: A Ballistic Simulator for Cardiac and Respiratory Micro-vibration Testing**
    Pooja Kadambi (Turtle Shell Technologies Pvt. Ltd.); Madhusmita Rawooth (Turtle Shell Technologies Pvt. Ltd., India); Nishita Anand (Turtle Shell Technologies Private Limited, India); Amar Dani, Rishabh Samra Jain and Gaurav Parchani (Turtle Shell Technologies Pvt. Ltd., India)
34. **SmartHART: A Priority-aware Scheduling and Routing Scheme for IIoT Networks using Deep Reinforcement Learning**
    Shanti Chilukuri, Aditya Gupta and Hemanth Sri Sai Pulamolu (GITAM, India)
35. **Enhanced User Pairing and Power Allocation Strategies for Downlink NOMA Systems with Imperfections in SIC**
    Siva Mouni Nemalidinne (IITH, India); Pavan Reddy M and Abhinav Kumar (Indian Institute of Technology Hyderabad, India); Prabhat Kumar Upadhyay (Indian Institute of Technology Indore, India)
36. **Monitoring Engagement in Online Classes Through WiFi CSI**
    Vijay Kumar Singh (IIIT Delhi, India); Pragma Kar (Jadavpur University, India); Ayush Madhan-Sohini and Madhav Rangaiah (IIIT Delhi, India); Sandip Chakraborty (Indian Institute of Technology Kharagpur, India); Mukulika Maity (IIIT Delhi, India)

37. **Is There a Faulty Browser or Faulty Protocol: Performance Analysis of YouTube Video Streaming through the Lens of different Browsers**
    Sapna Chaudhary (Indraprastha Institute of Information Technology, Delhi, India); Sandip Chakraborty (Indian Institute of Technology Kharagpur, India); Mukulika Maity (IIIT Delhi, India)
38. **Double Deep Reinforcement Learning assisted Handovers in 5G and Beyond Cellular Networks**
    Shweta Verma, Abhirami S and Abhinav Kumar (Indian Institute of Technology Hyderabad, India); Sai Dhiraj Amuru (IIT Hyderabad, India)

Poster Review Committee

- **Sarath Babu (Iowa State University, USA)**
- **Joan Bas (CTTC, Spain)**
- **Sandip Chakraborty (IIT Kharagpur, India)**
- **Aizaz Chaudhry (Carleton University, Canada)**
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- **Matthew Danish (University of Cambridge, UK)**
- **Subhankar Dhar (San Jose State University, USA)**
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- **Himanshu Gandhi (IIT Delhi, India)**
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- **Vijay K Shah (George Mason University, USA)**
- **Rahul Singh (IISc, India)**
- **Vishrant Tripathi (MIT, USA)**
- **Simon Yau (National Instruments, USA)**

Workshop on Machine Intelligence in Networked Data and Systems (MINDS)

8 January 2023, Indian Affairs

Time	Title	Speaker/Authors
9.30 : 9.45	Welcome by Workshop Chairs	
9.35 : 10.05	Keynote 1: Deep Learning meets Software Engineering	Dr. Aditya Kanade, Principal Researcher, Microsoft Research, India
10.05: 10.15	Keynote 1: Q&A	
10.15 : 10.55	Keynote 2: Hammer vs. Gavel, or How I Learned to Stop Learning and Love the Old-Fashioned Algorithm	Prof. Indranil Gupta, Professor, University of Illinois, Urbana-Champaign, USA
10.55: 11.05	Keynote 2: Q&A	
11.05: 11.30	Tea Break	
11.30: 12.00	Invited Talk 1: Learning Optimal Phase-Shifts of Holographic Metasurface Transceivers	Dr. Manjesh Hanawal, Associate Professor, Industrial Engineering and Operations Research at the Indian Institute of Technology Bombay, Mumbai, India
12.00: 12.15	Paper 1: ZoneSync: Real-Time Identification of Zones in IoT-Edge	Manish Kausik H, Jagnyashini Debadarshini, Himanshu Goyal, Sudipta Saha
12.15: 12.30	Paper 2: Scene Reconstruction and Trajectory Estimation in Hierarchical MANET	Atrayee Gupta
12.30: 12.45	Paper 3: Financial Fake News Detection via Context-Aware Embedding and Sequential Representation using Cross-Joint Networks	Padmapriya Mohankumar, Ashraf Kamal, Vishal Kumar Singh, Amrish Satish
12.45: 14.00	Lunch Break	
14.00: 14.15	Paper 4: Estimating Task Completion Times for Network Rollouts using Statistical Models within Partitioning-based Regression Methods	Venkatachalam Natchiappan, Shrihari Vasudevan, Thalanayar Muthukumar
14.15: 14.30	Paper 5: Network Intrusion Detection Through Machine Learning With Efficient Feature Selection	Rohan Desai, Venkatesh Tiruchirai Gopalakrishnan

14.30: 14.45	**Paper 6: Understanding Network Nodal Points for Emergency Services**	M Saravanan, V Rajagopalan, Divya Sachdeva
14.45: 15.00	**Paper 7: SIRM: Cost efficient and SLO aware ML prediction on Fog-Cloud Network**	Chetan Phalak, Dheeraj Chahal, Rekha Singhal
15.00: 15.30	**Tea Break**	
15.30 : 16.10	**Keynote 3: Fast, Furious, and Reliable: From serverful to serverless cloud computing for computer vision**	**Dr. Somali Chatterji,Assistant Professor, College of Engineering and College of Agriculture, Purdue University**
16.10: 16.20	**Keynote 3: Q&A**	
16.20: 16.50	**Invited Talk 2: Continuous Time Bandits: A new learning model**	**Dr. Rahul Vaze, Associate Professor, School of Technology and Computer Science, Tata Institute of Fundamental Research, Mumbai, India**
16.50: 17.00	**Concluding Remarks and Best Paper Award**	

Cyber Security and Privacy Workshop

4 January 2023, SIGMA1

	Session 1: Security	
10:00-11:00	Keynote Talk: Security of Critical Cyber Physical Systems: A C3i Hub Perspective	Sandeep K. Shukla
11:00-11:30	Tea break	
11:30-11:50	Moving-Target-Defense based Security Mechanisms: A System Management Perspective	Kaliappa Ravindran; Michael Iannelli; Arun Adiththan
11:50-12.10	Boolean Similarity Measure for Assessing Temporal Variation in the Network Attack Surface	Ghanshyam Bopche; Deepnarayan Tiwari; Gopal N. Rai
12:10-12:30	RcAMA - An Recursive Composition Algebra-based Framework for Detection of Multistage Attacks	Ghanshyam Bopche; Gopal N. Rai; Deepnarayan Tiwari
12:30-12:50	Health Assessment of 1485 Top Level Domain's Name Servers	Balaji Rajendran; Pushparaj Shetty D; Sithu D Sudarsan
12:50-1:10	Investigating IoT Systems Security Attacks using Network Forensics	Ayushi Mishra; Priyanka Bagade
1:10-2:00	Lunch	
	Session 2: Blockchain	
2:00-2:20	Secure Onboarding and Management of Electronic Shelf Labels in Retail	Giridhar Mandyam; Mauro Scagnol; Nicolas Graube
2:20-2:40	Practical Coded Sharding for Blockchains	Kanchi Gopinath; Nilesh Rathi
2:40-3:00	MyoChain: A Blockchain Protocol for Delay Bounded Transaction Confirmation	Aditya Ahuja; Vigneswaran R; Rajan M A; Sachin Lodha
3:00-3:20	crossTrustChain: Cross-Chain Interoperability using Multivariate Trust Models	Dhruv Avinash Patel; Harsh Anand; Suchetana Chakraborty
3:20-3:40	A ZK-SNARK based Proof of Assets Protocol for Bitcoin Exchanges	Swaroopa Reddy
3:40-4:00	Tea break	
	Session 3: Privacy	
4:00-4:20	ProFace: A Cancelable Face Template Protection Approach	Surabhi Garg; Arun Kumar Jindal; Rajan M A; Srinivasa Rao Chalamala
4:20-4:40	Detecting Sensitive Information from Unstructured Text in a Data-Constrained Environment	Saurabh Anand; Manish Shukla; Sachin Lodha
4:40-5:00	State of Internet Privacy and Tales of ECH-TLS	Manjesh K Hanawal; Sameer G Kulkarni; Vinod S Khandkar
5:00-6:00	Panel	Sandeep K. Shukla; Salil Kanhere; Mridula Singh, Sachin Lodha

Workshop on Networking Humanitarian Technology for Healthcare (NetHealth)

4 January 2023, INDIAN AFFAIR

10:00-10:15	**Welcome by Workshop Chairs**	
10:15 - 11:00	Keynote 1: Upcoming trends in HealthTech and their role in Healthcare	Mr. Gaurav Parchani, CTO, Dozee
11:00-11:30	**Networking over Tea/Coffee**	
11:30-11:45	*Web-based Training Platform with AR Games for Dyslexic Children*	Connie Man-Ching Yuen; Ka-Fai Ng; Chi-Wai Yung; Jogesh K. Muppala; Cheuk-Hong Lok; Senrui Zhou; Hoi-Chung Lau
11:45-12:00	Micro-Vibration based Health Monitoring: Effect Of External Factors on Ballistocardiogram Signals	Ume Hani Jawad; Vaishnavi Rangaraj; Arpitha Kumar; Rakshith K. Shetty; Swarna Kedia; Abhishek Mahesh Appaji; Madhusmita Rawooth; Pooja Kadambi; Pavan Kaushik; Vishwa Singh
12:00-12:15	*An Optimal Preferred Network Offload Scan Framework for Smart Wearable IoT Devices*	Govind Singh; Monika Prakash; Anshul Pandey
12:15-12:30	*IOT based Sensor System for 24x7 monitoring movement disorder symptoms using machine learning*	Abin Ghosh; Nishita Anand; Pavan Kaushik; Vaishali Bagrodia; Pramod Kumar Pal; Ravi Yadav
12:30 - 13:00	Invited Talk: Flexible electronics based wearable devices	Prof Dipti Gupta, IIT Bombay
13:00-14:00	**Networking over Lunch**	
14:00-15:00	Panel discussion: Role of Technology in Public Health	Prof. Smitha Nair, TISS Bombay Dr. Peehu Pardeshi Dr. Niranjan, C-CAMP Nitesh,CEO, Innaccel
15:00-15:15	*Deep Learning for Knee Osteoarthritis Severity Stage Detection using X-Ray Images*	Bhaveshkumar Choithram Dharmani; Kavin Khatri
15:15-15:30	*A comparative study on Wavelet Transform-based algorithm for calculating Heart Rate from Ballistocardiography*	Kanishk Soman; Nishita Anand; Ashwathi Nambiar; Amar Dani
15:30-15:45	*iBMSR: Intelligent Body Mass Status Recognition from Respiratory Auscultation*	Subhrangshu Adhikary; Arindam Ghosh; Subrata Nandi
15:45-16:00	**Networking over Tea/Cofee**	

16:00-16:15	*FedEmo: A Privacy-Preserving Framework for Emotion Recognition using EEG Physiological Data*	Mohd Ayaan Anwar; Manan Agrawal; Neha Gahlan; Divyashikha Sethia; Gaurav Kumar Singh; Rishabh Chaurasia
16:15-16:30	*Skin Tone Assessment Using Hyperspectral Reconstruction from RGB Image*	Nishchal Jagadeesha; Ankur Trisal; Vijay N Tiwari
16:30-16:45	*Clinical Validation of an Indigenous Micro-Vibration Vital Parameter Monitor DOZEE VS*	Swarna Kedia; Inam Ur Rahman; Ashish Kaushal; Mahizhvannan E; Rishabh Samra Jain; Rachna Radhakrishna; Srishti Rao; Kumar Chokalingam; Madhusmita Rawooth; Pooja Kadambi; Gaurav Parchani
16:45-17:00	*A Real-time IoMT Enabled Remote Cardiac Rehabilitation Framework*	Shereena Shaji; Ravi Sankaran; Ramesh Guntha; Rahul Krishnan Pathinarupothi
17:00-17:30	Keynote 2	Dr. Vijay Narayan Tiwari , Samsung
17:30-18:00	**Closing & Best Paper Award announcement**	

Workshop on Standards-driven Research

8 January 2023, SIGMA 3

10:00-10:15	**Welcome by Workshop Chairs**	
10.15--11	Keynote: Reconfigurable Intelligent and Holographic Surfaces for Wireless Communications	Dr. Marco Di Renzo
11--11.30	Tea break	
11.30 --12	Invited talk: Integrated Communication and Sensing	Dr. Vinosh James
12 --12.20	A 5G OpenAirInterface (OAI) Testbed with MEC: Deployment, Application testing and Slicing Support	Priyal Kirti Thakkar; Shashvat Sanadhya; Pimmy Gandotra; Brejesh Lall
12.20--12.40	Performance Evaluation of Video Streaming Applications with Target Wake Time in Wi-Fi 6	Govind Rajendran; Rishabh Roy; Preyas Hathi; Nadeem Akhtar; Samar Agnihotri
12.40 --13.00	Security for oneM2M based smart city network: An OM2M implementation	Vigneswara Ihita Gangavarapu; Vybhav K Acharya; Bala Likhith Kanigolla; Sachin Chaudhari; Thierry Monteil
13.00 --14.00	Lunch	
14.00--14.30	Invited talk: Standardization and Research Activities in Unlicensed Spectrum	Dr. Anand
14.30--14.50	Performance Evaluation of Video Streaming Applications with Target Wake Time in Wi-Fi 6	Govind Rajendran; Rishabh Roy; Preyas Hathi; Nadeem Akhtar; Samar Agnihotri
14.50 --15.10	Towards Next-generation Ultra-Wideband Technology	Aniruddh Rao Kabbinale; Ankur Bansal; Karthik Srinivasa Gopalan
15.10 --15.40	Invited Talk: Standards based research - 3GPP perspective	Dr. Dhivagar
15.40 --16.00	Tea Break	
16.00 --16.30	Invited talk: Research trends in mmwave antennas for 5G standardization activity-3GPP perspective	Dr. Soumava Mukherjee
16.30 --17.00	Invited Talk: Unified Last Mile Communication Protocol Stack - Reference Architecture	Mr. Kishor Narang

Workshop on Connected Vehicles & Autonomous Driving

4 January 2023, SIGMA 3

9:30 - 10:00	**Welcome by Workshop Chairs**	
10:00 - 11:00	**Keynote-1:** Autonomous Navigation Research at IIT Hyderabad	Prof. P. Rajalakshmi
11:00 - 11:30	**Tea Break**	
11:30 - 12:00	Paper-1: Novel Crash Prevention Framework for C-V2X using Deep Learning	Foram Shah; Dhaval Karshanbhai Patel; Kashish Dineshbhai Shah; Mehul Shirishchandra Raval; Mukesh Zaveri; Shabbir N Merchant
12:00 - 13:00	**Keynote-2:** Cloud Car - a new paradigm for next-gen software-defined connected autonomous vehicles	Dr. Ramachandra Budihal
13:00 - 14:00	**Lunch Break**	
14:00 - 15:00	**Keynote-3:** Outracing champion Gran Turismo drivers with deep reinforcement learning	Dr Kaushik Subramanian
15:00 - 15:30	Paper-2: A Lightweight IoT-Based Framework for Vehicular Ad Hoc Network (VANET) (ITS Special Session)	Chandra Shekhar, Jagnyashini Debadarshini, Puneet Kumar Singh, Sudipta Saha
15:30 - 16:00	**Tea Break**	
16:00- 16:30	Paper-3: Impact of V2V Communication on Energy Consumption of Connected Electric Trucks in Stable Platoon Formation	Devika Koonthalakdu Baby; Rohith G; Shankar Subramanian
16:30 - 17:00	Paper-4: VeCEn: A Data Acquisition Framework for Heterogeneous Vehicular Networks	Sagar Kavaiya; Dhaval Karshanbhai Patel; Mukesh Zaveri; Mehul Shirishchandra Raval; Shabbir N Merchant
17:00 - 17:30	Paper-5: Smartverse: Blockchain based Crowdsourced V2X Message Verification and Dissemination System	Jivthesh Mr; Rohit Mathew Samuel; Gaushik Mr; Sai Shibu N B; Sethuraman N Rao; Nidhin Mahesh A
17:30 - 17:40	**Closing**	

TASIR Workshop: Testbeds for Advanced Systems Implementation and Research

8 January 2023, SIGMA 1

9:30-9:45	**Welcome by Workshop Chairs**	
9:45-10:30	Keynote: Building Reliable and Resilient Mobile Network with 5G and MEC testbeds for Mission Critical Applications	Dr Antony Franklin
10:30-11:00	Invited Paper: Spectrum Activity Monitoring and Analysis for Sub-6 GHz Bands Using a Helikite	Sung Joon Maeng, Özgür Özdemir, Haridevan Nandakumar, Ismail Güvenç, Mihail Sichitiu, Rudra Dutta, Magreth J Mushi (North Carolina State University, USA)
11:00-11:30	Tea Break	
11:30-11:50	Delay-based Fidelity Monitoring of Distributed Network Emulation	Houssam ElBouanani, Chadi Barakat, Walid Dabbous, Thierry Turletti
11:50-12:10	Performance Measurement of Distributed Storage on Edge Devices	Priyam Loganathan (BITS Pilani, Goa, India), Dhruv Rauthan (BITS Pilani, Goa, India), Animesh Trivedi, (VU Amsterdam, The Netherlands), Vinayak Naik (BITS Pilani, Goa, India)
12:10-12:40	Invited Paper: Experimental Research Reproducibility and Experiment Workflow Management	Yuri Demchenko (University of Amsterdam, The Netherlands), Sebastian Gallenmüller (Technical University of Munich, Germany), Serge Fdida (Sorbonne University, France) Panayiotis Andreou (University of Central Lancashire
12:45-14:00	Lunch	
14 - 14:45	Keynote: Intelligent wireless systems in the age of AI : From resilient communications to non-intrusive security & the importance of data	Dr Subhramoy Mohanti
14:45 - 15:05	A Multi-Tenant System for 5/6G Testbed as-a-Service	Raffaele Bolla (University of Genoa, Italy), Roberto Bruschi (CNIT, Italy), Chiara Lombardo (University of Genoa & CNIT- Italy), Sergio Mangialardi (University of Genoa, Italy), Alireza Mohammadpour (CNIT - S2N National Lab, Italy), Ramin Rabbani (UNIGE, Italy), Beatrice Siccardi (DITEN - University of Genoa, Italy)
15:05 - 15:30	Tea Break	

15:30 - 15:50	A Scalable Heuristic on Energy Consumption of Fog-RAN	Bharat Dwivedi, Sandip Chakraborty, Debarati Sen
15:50 - 16:10	EELAS: Energy Efficient and Latency Aware Scheduling of Cloud-Native ML Workloads	Ilias Syrigos, Dimitris Kefalas, Nikos Makris, Thanasis Korakis
16:10 - 16:55	Keynote: Indian 6G technology roadmap	Dr Abdul Kayum
16:55 - 17:15	Closing + Adjourn	

GRADUATE FORUM

- **Making Ductless-split Cooling Systems Energy Efficient using IoT**
  Keshav Kaushik (BITS Pilani, India)
  Vinayak Naik (BITS Pilani, Goa, India)
- **On the Principles of Distributed Sampling and Detection of Poisson Counting Processes**
  Ralte Vanlalruata (IIT Kharagpur, India)
- **Exploiting Drift Detection Techniques for Next Generation Radio Access Networks**
  Gudepu Venkateswarlu (IIT Dharwad, India)
  Venkatarami Reddy Chintapalli (IIT Hyderabad, India)
  Luca Valcarenghi (Scuola Superiore Sant'Anna, Italy)
  Koteswararao Kondepu (Indian Institute of Technology Dharwad, India)
- **Finding Survivors in a Terrestrial Region: A Solution to the Unmanned Aerial Vehicle Trajectory Planning Problem**
  Santhosh Kumar K (National Institute of Technology Calicut, India)
  Arun Raj Kumar P (NIT Calicut, India)
- **Semi-Global Circular Centrality to find Influential Spreaders**
  Anju Bhuiya (NIT Durgapur, India)
  Koyena Chowdhury (National Institute of Technology Durgapur, India)
  Suman Nandi (NIT Durgapur, India)
  Animesh Dutta (National Institute of Technology Durgapur, India)
- **Online Learning Algorithms for Mobile Data Offloading**
  Sushma Moyya and Naveen Kolar Purushothama (Indian Institute of Technology Tirupati, India)
- **Opinion Differences in Social Networks: Are Opinions Too Far in Finite Time?**
  Sushmitha Shree S (IIT Madras, India)
  Avhishek Chatterjee and Krishna P Jagannathan (Indian Institute of Technology Madras, India)
- **Modulation Classification for NOMA Systems using a Modified Residual-CNN**
  Ashok Parmar (Sardar Vallabhbhai National Institute of Technology Surat, India)
  Kamal Manharlal Captain (Sardar Vallabhbhai National Institute of Technology, India)
- **CPRA: Co-operative Packet Routing Algorithm**
  Aniket Modi (IIT Delhi, India)

- **Fixed Budget Beam Identification in Millimeter Wave Systems via Unimodal Bandits**
  Debamita Ghosh (Indian Institute of Technology Bombay, India)
- **Energy Efficient Multiple Visible Light Communication Access Points (VAP)**
  Vishal Kumar (Delhi Technological University (DTU), India)
  Rohit Kumar (DTU Delhi, India)
- **VNFTestChain: Blockchain Based Test Framework for Trusted VNF Services in 5G and B5G**
  Panchanan Nath (Central Institute of Technology Kokrajhar, India)
  Pranav Kumar Singh (Indian Institute of Technology Guwahati & Central Institute of Technology Kokrajhar, India)
  Anshuman Kalla (Uka Tarsadia University (UTU), India)
  Maharaj Brahma (Central Institute of Technology Kokrajhar, India

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Re-imagine ways of working with industry and academic partners to accelerate change

Multi-modal Transportation Solutions for Indian Scenarios

Energy efficient autonomous navigation enabled different modes of Electric Vehicles: Last mile connectivity, Shared Shuttle services, Urban Air Mobility – personalized air vehicles.

e-Bike

UAM Based PAV

Autonomous Campus Shuttle

Autonomous Car

UAM Based PAV

e-Bike

Autonomous Aerial Vehicles (UAVs)

Quad wing dragonfly UAV

Lidar on drone

Next Gen Hybrid Mobility Ground & Aerial Vehicle (Flying Cars)

Bio Inspired Flapping Wings

Micro and Nano Drones Bio-Inspired Flies (<2Kg)

Small category drones (2-25 Kg)

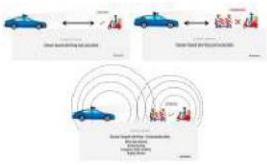
Unmanned Aerial Vehicle Research at TiHAN

Medium and Large Drones (above 25 Kg)

Complex structure, stability, Integration of payload & capacity, Increased sensor complexity and integration, Limited power, Endurance, hybrid fuel, Operational Range, communication and control links, Compute Platform flight and perception Search and Rescue, Surveillance, Disaster, Civil and Military, Urban Air Mobility, Agri, Environment, Infrastructure.

India's first Autonomous Navigation Testbed

- A first of it's kind state-of-the-art testbed for Autonomous Navigation (Aerial/Terrestrial).
- Technology development and thorough validation before going for real field deployment.



C-V2X for Safety

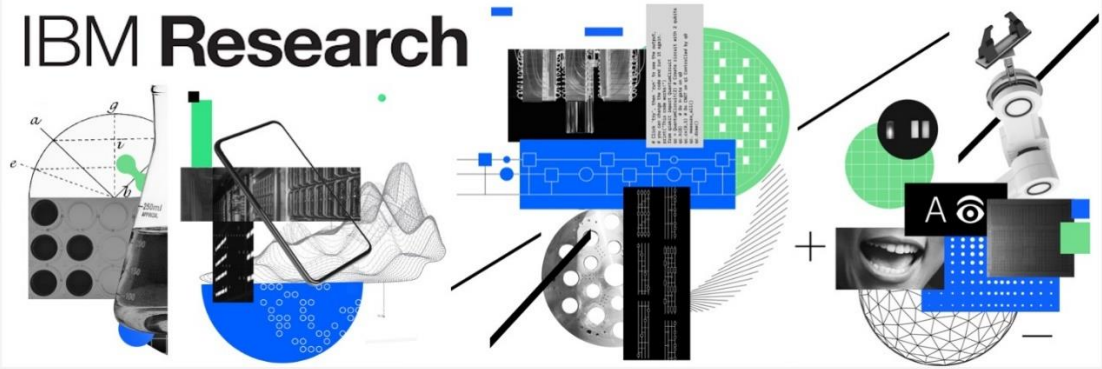
Use Case

Connected Vehicle

Mobile app for V2X alerts over DSRC

Pedestrian detection using Edge Cloud for V2X

IBM Research



IBM Research – India: Research Themes

1.	Privacy preserving and interoperable digital assets	Security
2.	Conversational AI	Data and AI
3.	Neurosymbolic AI	
4.	Trusted Data and AI	
5.	Metadata Management	
6.	AI Applications	
7.	AI for Code	
8.	Reliable Hybrid Cloud	Hybrid Cloud
9.	Quantum Applications	Quantum Computing
10.	Climate and Sustainability	Impact Science

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The School of Computing and Information Systems is the only SMU school offering research and education programmes in STEM (Science, Technology, Engineering and Math) disciplines.

SMU
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RESEARCH AREAS AND ACHIEVEMENTS

CREATE COMPUTING TECHNOLOGY AND SYSTEMS

ARTIFICIAL INTELLIGENCE & DATA SCIENCE

- Data Management & Analytics
- Intelligent Systems & Optimisation
- Machine Learning & Intelligence

- **Prof. Jing JIANG** and **Prof. LIM Ee-Peng** received the Test of Time Award at the European Conference on Information Retrieval (ECIR 2021) for their paper "Comparing Twitter and Traditional Media Using Topic Models".
- **Research Engineer Chaithanya Shankaramurthy BASRUR**, **PhD Graduate Arambam James SINGH**, **Arunesh SINHA** (Former Faculty), and **Associate Prof. Akshat KUMAR** received the Best Demonstration Award at the International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2021) for the demonstration "Ship-GAN: Generative Modeling Based Maritime Traffic Simulator".

HUMAN-MACHINE COLLABORATIVE SYSTEMS

- Pervasive Sensing & Systems
- Multimedia
- Human-Computer Interaction

- **Assistant Prof. WANG Yong** received the Best Paper Honorable Mention at the ACM Conference on Human Factors in Computing Systems (CHI 2022) for the paper "Structure-aware Visualization Retrieval".
- **Associate Prof. Rajesh Krishna BALAN** received the Distinguished Paper Award at the Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT 2021) for the paper "HeartQuake: Accurate Low-Cost Non-Invasive ECG Monitoring Using Bed-Mounted Geophones".

INFORMATION SYSTEMS & TECHNOLOGY

- Software Engineering & Systems
- Cybersecurity
- Information Systems Management

- **Research Scientist Ferdian THUNG**, **PhD Graduate WANG Shaowei**, **Prof. David LO** and **Associate Prof. JIANG Lingxiao** received the Test-of-Time Award at the 33rd IEEE International Symposium on Software Reliability Engineering (ISSRE 2022) for the paper "An Empirical Study of Bugs in Machine Learning Systems".
- **Bowen ZHAO**, **Yingjiu LI**, **Ximeng LIU**, **Prof. PANG Hwee Hwa** and **Prof. Robert H. DENG** received the Best Paper Award (Main Track) at the 5th IEEE Conference on Dependable and Secure Computing (IEEE DSC 2022) for the paper "FREED: An Efficient Privacy-Preserving Solution for Person Re-Identification".

EDUCATION PROGRAMMES

EDUCATION IN COMPUTING TECHNOLOGY AND SOLUTION DEVELOPMENT

UNDERGRADUATE

- B.Sc. (Information Systems)
- B.Sc. (Computer Science)
- B.Sc. (Computing and Law)
- B.Sc. (Software Engineering) SkillsFuture Work-Study Degree

POSTGRADUATE PROFESSIONAL

- Master of IT in Business (MITB)

DOCTORAL

- Ph.D. in Computer Science
- Ph.D. in Information Systems
- Doctor of Engineering

MITB was placed within the top 2 in Asia for the fourth year running in the 2022 QS World University Rankings for Masters in Business Analytics.

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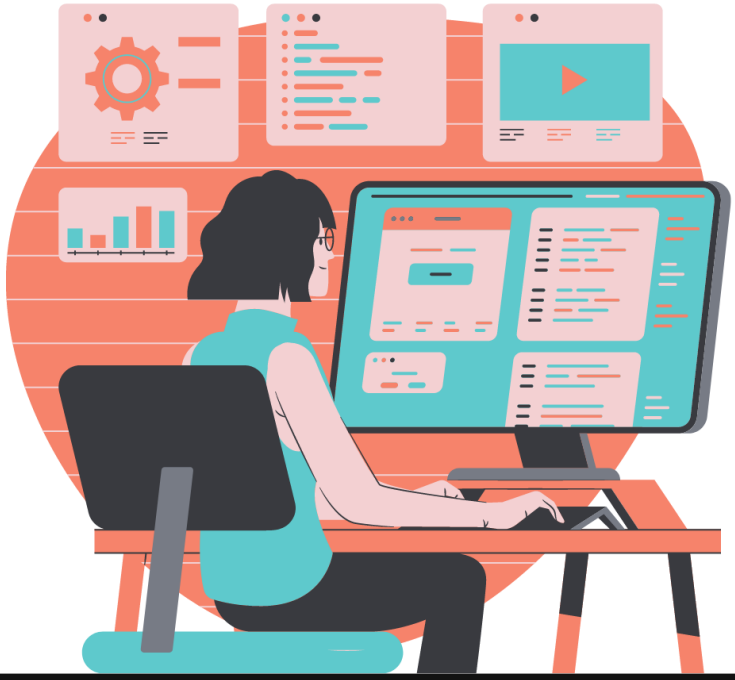

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IIITB COMET Foundation, a Section 8 Company has been established as a Technology Innovation Hub (TIH) in IIITB under the National Mission for Interdisciplinary Cyber-Physical Systems (NM-ICPS), Department of Science and Technology, Government of India to foster research and innovations in the verticals of Advanced Communication Systems (ACS).

The hub has been assigned to mainly focus on Advanced Communication Systems, with respect to present and future needs of our nation as well as international dynamics. The hub focuses on enabling the design and development of fundamental technology building blocks of 5G–advanced (5G+) & 6G systems and networks. The prime focus is on indigenous research leading to intellectual property (IP) generation that includes product IP for commercial usage and development of patents (IPR) that will not only enable product-oriented innovation but also target adoption into the upcoming 5G-advanced and 6G standards. It also focuses on other advanced communication systems R&D which have commercial potential.

IIITB COMET Foundation is Inviting Collaborators !

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2. Entrepreneurship Development
3. Human Resource Development
4. International Collaborations

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- Availability of research infrastructure
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- Tailored technical support
- Technological tools & experimentation facilities
- Tailored Business development support
- Mentoring
- Intellectual Property (IP) trainings
- Access to Capital
- Capacity building and Networking opportunities with industry leaders, angel investors, accelerators etc

TECHNOLOGY DEVELOPMENT

Specific problems picked by IIITB COMET

- Technologies that can be used to mend the gaps in the 5G communication landscape
  Reconfigurable Intelligent Surfaces (Category 1) –to create smart radio environments
- Indigenous development of technologies for telecom sector can help in reducing import dependency
  5G Advanced Base Station (Category 2) – indigenously built 5G Advanced BTS

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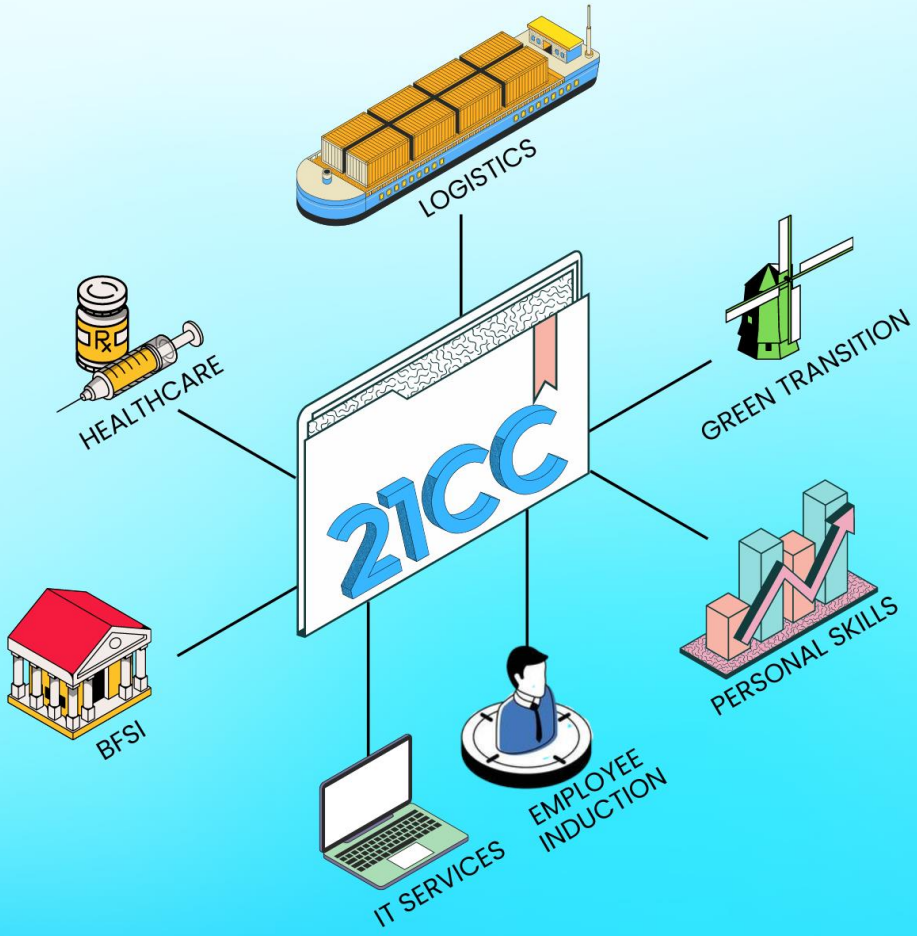

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