

Mostafa Uddin

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About Me

I am a hands-on Senior Research Engineer with a strong passion for understanding systems at their deepest layers. Over the past decade, I have led and contributed to mission-critical projects spanning distributed computing, cybersecurity, wireless/space networking, and programmable infrastructure. My contributions include over 20 publications in renowned conferences and journals, accumulating 500+ citations, and securing 7 patents. I have also contributed to funding proposals for agencies such as the NSF, NRO, DARPA, and SDA. I am particularly drawn to the emerging convergence of AI and systems engineering. My career goal is to continue working at the intersection of AI and system design, developing solutions that are both technically rigorous and operationally impactful.

Education

Old Dominion University, Norfolk, VA, USA
PhD in Computer Science (2011 - 2016)
Advisor: Dr. Tamer Nadeem (nadeem@cs.odu.edu)
Dissertation Topic: Toward Open and Programmable Wireless Network Edge [Defended on May 10]
Dissertation Committee: Dr. Kurt Maly (CS, ODU), Dr. Michele Weigle (CS, ODU), Dr. ChunSheng Xinand (ECE, ODU), Prof. Mahadev Satyanarayanan (CMU)
CGPA 3.98/4.0

Bangladesh University of Engineering and Technology, Dhaka, Bangladesh
B.S. in Computer Science and Engineering, 2006
CGPA 3.72/4.0

Industry Experience

- Senior Research Scientist**, Peraton Labs, NJ **August 2020 - Present**
- **PCTE Project (Customer: DoD)**: Developed a multi-phase AI-driven framework for synthetic user generation to support cyber mission training and range simulations. [language/tools: Python, LangChain, FastMCP]
 - Designed and implemented a multi-step pipeline that generates synthetic organizational structures, role-task maps, and task-tool mappings using LLMs.
 - Integrated structured schema outputs and context-grounded prompt engineering to ensure coherent synthetic populations.
 - Enabled support for thousands of synthetic users with conflict-free, realistic daily schedules aligned with cyber mission goals.
 - Supported prompt-based injection of organization policies, tools preferences, and role behaviors for flexible scenario design.
 - Designed a modular AI agent capable of executing realistic workplace tasks using LLMs and custom tools. [language/tools: Python, LangChain, FastMCP]
 - **OSCAR AI – AURA Engine and Sensor Suite (Customer: Internal IRAD)**: Designed and developed Agentic-AI architecture for RF spectrum analytics and edge inference. [language/tools: Python, LangGraph, ChatOllama, FastMCP, FastAPI]
 - Architected and implemented a modular Agentic-AI framework (AURA Engine) to analyze RF environments and assess emitter behavior in real-time.
 - Integrated LangGraph to orchestrate multi-step agent reasoning, using ChatOllama for local LLM execution with FastMCP-enabled tool invocation.

- Developed tools to interface with FastAPI to support seamless integration with edge-processing sensor platforms and remote operators.
- **MINC Project (Customer: DARPA STO):** Designed and developed Virtualized Edge Function (VEF) frameworks and APIs, significantly enhancing network monitoring and management capabilities. [language/tools: C++, python, docker, xdp/dpdk, ansible]
 - Introduced and integrated Infrastructure and Functional VEFs such as compress/extract, path-split/path-merge, and data de-duplication.
 - Developed user-defined configuration mechanisms for mission-specific flows, paths, and trees, enabling precise VEF policy assignment.
 - Prototyped advanced functionalities including FEC/HEC error correction, traffic shaping, and failover routing.
 - Enhanced scalability and modularity by refining multicast routing, fragmentation reassembly, and containerization strategies.
 - Conducted comprehensive demonstrations and delivered detailed project reports directly to DARPA.
- **ARTEMIS Project (Customer: NRO):** Enhanced MACsec operations in dynamic space-terrestrial networks, handling intermittent connectivity and high variable delays. [language/tools: c/c++, python]
 - Designed simulation frameworks for secure communication protocols in space networks.
 - Developed Optical Inter Satellite Link (OISL) handover and delay estimation models.
 - Demonstrated advanced MACsec Key Agreement (MKA) protocol with optimized key distribution latency.
 - Conducted extensive customer interactions, delivering comprehensive reports and demonstrations directly to NRO.
- **CyberVAN for Space (Customer: NASA):** Extended CyberVAN network simulator to support LEO, GEO, MEO, and Deep Space (Cislunar) satellite constellations. [language: C/C++]
 - Introduced Kepler elements and developed two-body orbital models for satellite mobility.
 - Modeled Optical Communication Terminals (OCT) with laser-based and Ka-band propagation.
 - Designed inter-satellite link management algorithms and MPLS-based source routing.
 - Enhanced Time-Driven Satellite Routing Protocol (TDSRP) supporting unicast, multicast, and anycast routing.
 - Validated orbit and transit modeling modules within Earth-Moon three-body systems for Deep Space Network Simulation.
 - Regularly demonstrated project outcomes and provided detailed reports to leadership and key customers, including NASA, INDOPAC, STARCOM, and NRL.
- **Abstract Network Simulator:** Designed and implemented Abstract-Sim, a multi-threaded simulator enhancing scalability and performance over ns-3 for large-scale CyberVAN scenarios. [language: C/C++]
 - Successfully deployed Abstract-Sim during the Cyber TATANKA exercise, supporting high-traffic scenarios with no performance issues.
 - Regular interaction with the customer, delivering comprehensive demonstrations and detailed simulation reports.

- **GPU Support in CyberVAN:** Developed a cost-effective GPU sharing framework among multiple virtual machines for ML applications. [Programming: C++/CUDA]
 - Extended gVirtuS frontend/backend for CUDA libraries, demonstrating feasibility without performance degradation.
 - Reverse-engineered TensorFlow 'fatBinary' blobs, enabling seamless support for popular Python ML packages.
 - Delivered practical demonstrations and detailed evaluations directly to C5ISR customer.
- **DARPA DCOMP Project:** Developed frameworks for Dispersed Computing in Battlefield environments. [language: C/C++, Python]
 - Integrated task completion prediction models with HEFT scheduling algorithms, significantly reducing task execution time.
 - Enhanced OLSR routing protocol by incorporating bandwidth and process-load metrics.
 - Prepared technical reports and performed demonstrations for DARPA, clearly communicating project results and impact.
- **Synthetic Traffic Generation for Cybersecurity Analysis:** Developed a synthetic user behavior framework for cybersecurity applications. [language: Python, C++]
 - Automated user interaction capture through GTK+Accessibility instrumentation.
 - Analytical models created from the collected data to drive realistic user behavior simulations.
 - Presented project updates, demonstrations, and detailed reports regularly to internal and external stakeholders.

Research Scientist, Nokia Bell Labs, Holmdel, NJ June, 2016 - August, 2020

- **Geo-Location Assisted Mobile Augmented Reality for Industrial Automation:** We propose a novel framework that leverages externally provided geo-location of the objects and IMU sensor information (both of which can be noisy) from the objects to locate them precisely in the Mobile Augmented Reality world. We develop a regenerative particle filter and a continuously improving transformation matrix computation methodology to dramatically improve the positional accuracy of objects in the real and the AR world.
- **IoT Device on boarding:** We design a streamlined process to onboard IoT devices at large numbers using an Augmented Reality (AR)-facilitated app. More details in Publication.
- **IoT Network Infrastructure with SDN capability using P4:** In this project, our objective is to build a SDN-based network infrastructure of IoT devices for enterprise deployment. For the SDN data plane, We introduce a programmable software switch that is transparently inserted between the communicating of IoT devices. We use P4 program to build the switch that defines the headers and parsers for processing native BLE/Zigbee packets, and compile it into OVS code base with the PISCES's datapath compiler.
- **High Availability Distributed Server:** Develop a high availability distributed server system that can seamlessly migrate client request flow from primary server to secondary servers during the failure of the primary server.
- **Indoor tracking system for BLE-based peripheral devices:** Using signal processing and machine learning technique to localize BLE peripheral devices at finer granularity.

- **Fingerprinting IoT device:** Fingerprinting BLE-based IoT devices leveraging their traffic patterns.

Bell Lab Researcher - intern, Bell Labs, Murray Hill, NJ **June, 2015 - August, 2015**

Advisor: **Randeem Bhatia**

- Designed and developed low overhead and adaptive DDoS attack detection technique by enhancing the Open vSwitch (Programming c/c++).
- Developing adaptive and efficient flow sampling actions in the OVS Datapath (Programming c/c++).
- Developing algorithm for detecting any network anomalies or DDoS attacks using the sampled network flow statistics (Programming c/c++).

Research Associate Intern, HP Labs, Palo Alto, CA **July, 2014 - August, 2014**

Mentor: **Kyu-Han KIM**, Senior Researcher and Research Manager

- Leveraging both the cellular (i.e. LTE) and the WiFi interface of the smart-phone for improving the performance of the peer-to-peer real-time interactive applications such as Skype video chat, Google Hangout, Viber voice call etc.
- Hack the network stack of the Nexus 7 tablet (LTE) to implement the Multi-Path UDP(MPUDP) in the transportation layer of the android kernel (Programming Kernel C).
- Experimental evaluation of our system using 2 Nexus 7 tablet (android device) using AT&T vendors

Research Associate Intern, HP Labs, Palo Alto, CA **May, 2013 - August, 2013**

Mentor: **Jeongkeun Lee**, Senior Research Scientist

- Extended the SDN framework to the wireless end devices.
- WLAN virtualization with performance guarantee.
- Implemented customized Qdisc for Linux Network stack (Programming Kernel C).
- Implemented required interaction between WiFi driver and Linux Qdisc (Programming C).
- Deployed open vSwitch in Android platform using cross-platform compiling (Programming: C).

Teaching Experiences

Students I have mentored

- Kittipat Apicharttrisor (UC Riverside), Summer Intern 2020 (Nokia Bell Labs)
- Huanle Zhang (UC Davis), Summer Intern 2018 (Nokia Bell Labs)
- Tianbo Gu (UC Davis), Summer 2017 (Nokia Bell Labs)
- Bashima Islam (University of North Carolina at Chapel Hill), Summer Intern 2017 (Nokia Bell labs)
- Maryam Arab (MS Student at Old Dominion University) 2017
- Ilho Nam (MS Student at Old Dominion University) 2016

Teaching Assistant, Computer Science, ODU, Norfolk, VA **Fall 2011-2013**
I helped the students, and graded their class assignments/projects for following courses

- CS300 - Computer in Society, Fall 2011.
- CS250 - Programming and Problem Solving II, Spring 2012.
- CS495/595 - App Development for Smart Devices, Fall 2012.
- CS495/595 - App Development for Smart Devices, Fall 2013.

Publications:

- Acoustic-WiFi: Acoustic Support for Wi-Fi Networks in Smart Devices
Mostafa Uddin and Tamer Nadeem
IEEE Transactions on Communications, 2022
- MAIDE: Augmented Reality (AR)-facilitated Mobile System for Onboarding of Internet of Things (IoT) Devices at Ease.
Huanle Zhang, Mostafa Uddin, Fang Hao, Sarit Mukherjee, Prasant Mohapatra.
ACM Transactions on Internet of Things, 2022
- GLAMAR: Geo-Location Assisted Mobile Augmented Reality for Industrial Automation. M Uddin, S Mukherjee, M Kodialam, TV Lakshman. 2020 IEEE/ACM Symposium on Edge Computing (SEC, 2020)
- CLAP: Compact Labeling Scheme for Attribute-Based IoT Policy control.
Mostafa Uddin, Murali Kodialam, Fang Hao, Sarit Mukherjee. 2019 15th International Conference on Distributed Computing in Sensor Systems (DCOSS).
- AIDE: Augmented Onboarding of IoT Devices at Ease.
Huanle Zhang, Mostafa Uddin, Fang Hao, Sarit Mukherjee, Prasant Mohapatra. Proceedings of the 20th International Workshop on Mobile Computing Systems and Applications, 2019.
- Extreme SDN Framework for IoT and Mobile Applications Flexible Privacy at the Edge.
Mostafa Uddin, Tamer Nadeem, Santosh Nukavarapu. IEEE PerCom 2019.
- SDN-based multi-protocol edge switching for IoT service automation.
Mostafa Uddin, Sarit Mukherjee, Hyunseok Chang, TV Lakshman. IEEE Journal on Selected Areas in Communications.
- Rethinking Ranging of Unmodified BLE Peripherals in Smart City Infrastructure.
Shahriar Islam, Bashima and Uddin, Mostafa and Mukherjee, Sarit and Nirjon. Proceedings of the 9th ACM Multimedia Systems Conference, 2018.
- SDN-based Service Automation for IoT.
Mostafa Uddin, Sarit Mukherjee, Hyunseok Chang and T.V. Lakshman IEEE ICNP 2017 (acceptance rate 18.6% = 39/209).
- BLESS: Bluetooth Low Energy Service Switching using SDN.
Mostafa Uddin, Sarit Mukherjee, Hyunseok Chang and T.V. Lakshman. IEEE SmartCity 2017.
- EdgeEye: fine grained traffic visibility at wireless network edge.
Mostafa Uddin, Ibrahim Ben Mustafa, Tamer Nadeem. 2016 IEEE/ACM Symposium on Edge Computing (SEC).
- TrafficVision: A Case Scenario of Pushing SDN to Wireless Edges.
Mostafa Uddin, Gowtham Bellala, Jeongkeun Lee, and Tamer Nadeem IEEE MASS 2016.
- Understanding the Intermittent Traffic Pattern of HTTP Video Streaming over Wireless Networks
Ibrahim Ben Mustafa, Mostafa Uddin, and Tamer Nadeem
WINMEE 2016
- Wearable Sensing Framework for Human Activity Monitoring
Mostafa Uddin, Ahmed Salem, Ilho Nam, and Tamer Nadeem
ACM WearSys'15
- Harmony: Content Resolution using Acoustic Channel (acceptance rate 19% = 316/1640) [To appear]
Mostafa Uddin, and Tamer Nadeem
IEEE INFOCOM 2015
- meSDN: mobile extension of SDN
Jeongkeun Lee, Mostafa Uddin, JeanTourrilhes, Souvik Sen, Sujata Banerjee, Manfred Arndt, Kyu-Han Kim, Tamer Nadeem
ACM MCS 2014 (with MobiSys 2014).

- SpyLoc: A Light Weight Localization System for Smartphones.(acceptance rate 19.8% = 68/342)
Mostafa Uddin and Tamer Nadeem
IEEE SECON 2014.
- SmartSpaghetti: Accurate and Robust Tracking of Human's Location
Mostafa Uddin, Ajay Gupta, Kurt Maly, Tamer Nadeem, Sandip Godambe, Arno Zaritsky
IEEE-EMBS International Conferences on Biomedical and Health Informatics, 2014
- SmartSpaghetti: Use of Smart Devices to Solve Health Care Problems (Full Paper acceptance rate=18%)
Mostafa Uddin, Ajay Gupta, Kurt Maly, Tamer Nadeem, Sandip Godambe, and Arno Zaritsky
International Workshop on Biomedical and Health Informatics, BIBM 2013
- RF-Beep: A light ranging scheme for smart devices (acceptance rate 11.2% = 19/170(full paper))
Mostafa Uddin and Tamer Nadeem
IEEE PerCom 2013.
- A2PSM: Audio Assisted Wi-Fi Power Saving Mechanism for Smart Devices(acceptance rate 31.5%)
Mostafa Uddin and Tamer Nadeem
ACM HotMobile 2013.
- MagnoTricorder: What You Need To Do Before Leaving Home
Mostafa Uddin and Tamer Nadeem
ACM HomeSys, UbiComp 2012
- EnergySniffer: Home Energy Monitoring System using Smart Phones [Slide]
Mostafa Uddin and Tamer Nadeem
IEEE IWCMC, 2012.

Articles:

- Report of HotMobile 2012
Igor Pernek, Mostafa Uddin and Jack Fernando Bravo Torres
IEEE Pervasive Computing.
- HotMobile 2012 Poster: MachineSense: Detecting and Monitoring Active Machines using Smart Phone
Mostafa Uddin and Tamer Nadeem
ACM SIGMOBILE MC2R.
- HotMobile 2012 Poster: Audio-WiFi: Audio Channel Assisted WiFi Network for Smart Phones
Mostafa Uddin and Tamer Nadeem
ACM SIGMOBILE MC2R.

Demos/Posters:

- Demo: AIDE: Augmented Onboarding of IoT Devices at Ease.
Huanle Zhang, Mostafa Uddin, Fang Hao, Sarit Mukherjee, Prasant Mohapatra.
Proceedings of the 20th International Workshop on Mobile Computing Systems and Applications, 2019. [**Best Demo runner-up**]
- Poster: Extending SDN for mobile device
Jeongkeun Lee, Mostafa Uddin, Jean Tourrilhes, Souvik Sen, Sujata Banerjee, Manfred Arndt and Tamer Nadeem
ACM HotMobile 2014
- SpyLoc: a Light Weight Localization System for Smartphones [Poster][SRC Presentation]
Mostafa Uddin and Tamer Nadeem
In Proceedings of MobiCom'13

	<ul style="list-style-type: none"> • Audio-WiFi: Audio Channel Assisted WiFi Network for Smart Phones[Demo] Mostafa Uddin and Tamer Nadeem IEEE INFOCOM, 2012 . • EnergySniffer: Home Energy Monitoring System using Smart Phones[Poster] Mostafa Uddin and Tamer Nadeem IEEE INFOCOM, 2012 . • MachineSense: Detecting and Monitoring Active Machines using Smart Phones[Poster] Mostafa Uddin and Tamer Nadeem ACM HotMobile, 2012 .
Patents and Invention Disclosures	<ul style="list-style-type: none"> • Ad Hoc Service Switch-Based Control Of Ad Hoc Networking. M Uddin, S Mukherjee, TV Lakshman, H Chang - US Patent App. 16/498,452, 2021 • Systems and methods for encoding and decoding IoT messages. M Uddin, M Kodialam, F Hao, S Mukherjee - US Patent 10,826,828, 2020 • Augmented onboarding of internet-of-things devices. M Uddin, F Hao, S Mukherjee, H Zhang - US Patent 10,812,963, 2020 • Acknowledgment and packet retransmission for spliced streams. Fang Hao, Hyunseok Chang, Sarit Mukherjee, Mostafa Uddin. Publication Date: 2020/3/5. Application number: 16117749 US. • Splicing concurrent connections into a high availability session. Fang Hao, Hyunseok Chang, Sarit Mukherjee, Mostafa Uddin. Publication date 2020/3/5. Application Number 16117535 US. • SERVICE AUTOMATION FOR IoT DEVICES USING P4. Mostafa Uddin, Hyunseok Chang, TV Lakshman, Sarit Mukherjee. Publication Date 2020/2/13. Application number 16059767 US. • Wireless Software-Defined Networking. Jung Gun Lee, Mostafa Abdulla Zahid Uddin, Jean Tourrilhes, Souvik Sen, Manfred R Arndt. Publication number WO2015065422 A1, Publication date May 7, 2015.
DBLP & Google Scholar	<p>DBLP Profile</p> <p>Google Scholar Profile</p>
News/Media	<p>Researchers develop sound way to improve smartphone battery life(V3 online Magazine)</p>
Awards	<p>Top 10 Inventor in Nokia Bell Labs for year 2018 based on Invention submission.</p> <p>Best Demo Runner-up Award in ACM HotMobile 2019</p> <p>ACM SIGMOBILE Travel grant for attending HotMobile 2015.</p> <p>ACM SIGMOBILE Travel grant for attending HotMobile 2014.</p> <p>Microsoft Research "ACM SRC" Grant Recipient for MobiCom 2013, Miami, FL.</p> <p>NSF Student Travel Grant Recipient for MobiCom 2013, Miami, FL.</p> <p>NSF Travel grant for attending IEEE PerCom 2013.</p> <p>ACM SIGMOBILE Travel grant for attending HotMobile 2013.</p> <p>Outstanding RA (fall 2012) - Computer Science Department.</p> <p>Travel grant for attending HoMobile 2012, INFOCOM 2012, and UbiComp2012(from CS Department of ODU).</p> <p>Dominion Graduate Scholar offered by College of Sciences ODU.</p> <p>Dean's List Scholarship during undergraduate studies at BUET.</p> <p>Placed in top 1% in Higher Secondary Exam (A-level) in Bangladesh.</p>

Placed in top 1% in Secondary School Exam (O-level) in Bangladesh.

**Professional
Services**

Registration Chair ACM HotMobile 2020.
TPC member in IEEE INFOCOM 2018,2019,2020. IEEE SmartEdge 2017,2018,2019,2020.
Invited Reviewer IEEE Internet of Things Journal (IoT), ACM/IEEE Transactions on
Networking (ToN)
Student Volunteer in MobiCom'2013, HotMobile'2013, HotMobile'2014, DriveSense'2014
Reviewer through Advisor: IEEE INFOCOM 2016, IEEE LCN 2015, ACM HotMobile
2015, IEEE SECON 2015, IEEE ICC 2014, IEEE PerCom'2014, IEEE Globecom' 2013,
IEEE IWCMC'2013.

**Membership &
Activities**

ACM SIGMOBILE Student Member
ACM Student Member