Umakant Kulkarni

Current Address
West Lafayette, IN 47906 USA

Contact
Email : ukulkarn@purdue.edu

RESEARCH INTERESTS

Cellular Networks, Cloud Computing, Networking Systems, SDN-NFV, Network Slicing, Objective QoE, Packet Data Gateways, Wi-Fi Networks, Network Security, Reinforcement Learning, LLMs

EDUCATION

Ph.D., Computer Science
Purdue University, West Lafayette, USA — Jan 2021 - Present
GPA 4.0

Master of Science, Computer Systems Networking
Northeastern University, Boston, USA — Sep 2015 - May 2017
GPA 3.71

Bachelor of Engineering, Electronics and Telecommunication
University of Pune, India — Aug 2011 - May 2015
First Class with Distinction

PROFESSIONAL EXPERIENCE

Affirmed Networks/Microsoft, Acton MA USA

Principal Software Engineer — Sep 2018 – Dec 2020

- Developed stateless, containerized telecommunication software based on 5G standards for core network functions AMF, SMF, UPF, N3IWF, PCF and UDM that can be deployed via docker and/or kubernetes to achieve scalability, resiliency and redundancy.
- Implemented Istio service-mesh features into 5G NFs for observability, security and traffic management.
- Designed a build environment to define, install and upgrade applications on kubernetes using Helm.
- Developed DPDK containerized UE-gNB simulator for testing different data-plane functionality.
- Built pyATS-enabled automation infrastructure and integrated it with JIRA and Jenkins for simulating CI/CD model of cloud-native microservice architecture.

Software Quality Assurance Engineer — Jun 2017 – Aug 2018

- Contributed towards architectural development and quality assurance for Virtualized ePDG (evolved Packet Data Gateway), 'Security-Gateway' and T-WAG (Trusted - Wireless Access Gateway) network functions from 4G Evolved Packet Core.
- Wrote test plans and automated call-flows related to AAA, PCRF and OFCS Servers, GTP-Path Management, X.509 Security Certificates over S2x, SWm, STa and SWu interfaces, in Tcl and Python.
- Performed system, regression, functional, performance and redundancy testing on Affirmed Network's Mobile Cloud Content using manual and automation methods.

Fizzible Tech Pvt. Ltd, Pune India

Telecommunication Engineer — Jun 2015 – Aug 2015

- Designed indoor ray tracing propagation model for implementing rate adaptation algorithm to adopt different channel coding rates between wireless mobile ad hoc network-modules.

RESEARCH EXPERIENCE

Purdue University, West Lafayette, IN USA Jan 2021 – Present

- Graduate Research Assistant in Prof. Sonia Fahmy's research group
- Working on a zero trust security solution for 5G core networks
- Exploring optimizations for peer-to-peer volumetric video streaming applications

Indian Institute of Science, Education and Research, Pune India May 2013 – Jul 2013

- Contributed towards development of Atomic Force Microscopy for Nano and Pico level measurements to study various aspects of molecular mobility, dynamics and mechanical response at single molecular scale.

TEACHING EXPERIENCE

Purdue University, West Lafayette, IN USA Jan 2021 – Dec 2021

- Graduate Teaching Assistant for the course 'Computer Architecture (CS 250)'

Northeastern University, Boston, MA USA Jan 2017 – May 2017

- Graduate Teaching Assistant for the course 'Telecommunication Architecture and Systems (TELE 5320)' for 2 sections.

INTERNSHIPS

Hewlett Packard Enterprise, Milpitas CA USA

Research Associate Intern May 2022 – Dec 2023

- Characterized QoE of volumetric video streaming over enterprise Wi-Fi networks, analyzing the impact of Wi-Fi control parameters and comparing QoE with traditional 2D video applications.
- Proposed an adaptive method for Wi-Fi resource allocation to maximize the overall system QoE and QoE fairness.

Affirmed Networks, Inc. Acton MA USA May 2016 – Jan 2017

- Laid the foundation for ePDG and T-WAG automation infrastructure; Built the 'smoke' as well as 'sanity' frameworks to automate the end-to-end workflow.
- Modified open-source libraries and configured StrongSwan module onto a linux box as well as Raspberry Pi to support different Wi-Fi calling features over IPsec.

Thuse Elektronics Pvt. Ltd., Pune India Nov 2013 – Dec 2013

- Worked on the processes transformer manufacturing, PCB design, PCB assembling in line production, quality and rework management, process quality control, wave soldering on RoHS and non RoHS sections, automatic optical inspection and surface mount technology.

CERTIFICATIONS

Certified Telecommunication Engineer (Reg. No. – S13PUN128)
by Bharat Sanchar Nigam Limited (BSNL), Govt. of India

- Platinum Level - Mobile Communication, IP Networking and Cyber Security Jul 2014
- Gold Level - Broadband Technology, Optical Fiber Technology Jan 2014
- Silver Level - Digital Switching and Transmission System, Telecom Support Infrastructure Jul 2013

PUBLICATIONS

- Maestro: QoE-Aware Dynamic Resource Allocation in Wi-Fi Networks
  Umakant Kulkarni, Khaled Diab, Lianjie Cao, Faraz Ahmed, Shivang Aggarwal, Puneet Sharma, Sonia Fahmy
  Accepted, Proc. ACM Netw. 3, CoNEXT1, Article 4, 24 pp., March 2025

- Securing the Cloud-Native 5G Control Plane
  Umakant Kulkarni, Sonia Fahmy
  IEEE MILCOM Workshop on Secure FutureG Wireless Communications and Networked Systems, 6 pp., October 2024

- Understanding the Impact of Wi-Fi Configuration on Volumetric Video Streaming Applications
  Umakant Kulkarni, Khaled Diab, Shivang Aggarwal, Lianjie Cao, Faraz Ahmed, Puneet Sharma, Sonia Fahmy
  ACM SIGCOMM Workshop on Emerging Multimedia Systems (EMS), 6 pp., September 2023

- Toward QoE-based Routing Path Selection
  Umakant Kulkarni, Yufeng Chen, Patrick Melampy, Sonia Fahmy
  IEEE International Conference on High Performance Switching and Routing (HPSR), 6 pp., June 2023

- Slicure5G: Secure Slicing for 5G (Poster)
  Umakant Kulkarni and Sonia Fahmy
  USENIX Symposium on Networked Systems Design and Implementation (NSDI), 2 pp. April 2023

- Towards A Low-Cost Stateless 5G Core (Poster)
  Umakant Kulkarni, Amit Sheoran, Sonia Fahmy
  IEEE International Symposium on Local and Metropolitan Area Networks (LANMAN), 2 pp., July 2022

- The Cost of Stateless Network Functions in 5G
  Umakant Kulkarni, Amit Sheoran, Sonia Fahmy
  ACM/IEEE Symposium on Architectures for Networking and Communications Systems (ANCS), 7 pp., December 2021

FELLOWSHIPS AND AWARDS

- Received employee merit recognition award under the "High-Profile Projects" category for achieving significant milestones in "Securing 5G for Military Operations" research project at Purdue University
- 3rd Prize in Best-in-class 2022 Summer Interns Project Fair organized by Hewlett Packard Enterprise
- Received "Outstanding Graduate Teaching Assistant Award" for significant accomplishments and highest ratings in teaching and mentoring students in Telecommunication Systems Management at College of Engineering, Northeastern University.
- Awarded by "Kishore Vaigyanik Protsahan Yojana" KVPY Fellowship (English: Young Scientist Incentive Plan) with All India Rank – 5. This research fellowship was given by The Indian Institute of Science, Bangalore and Department of Science and Technology, Government of India.
- Received Best Paper/Research/Poster award at seven regional conferences, India (2011-2015).

TECHNICAL SKILLS

- Languages: C/C++, Golang, Python, Java, Matlab, JavaScript | Scripting: Bash, Tcl/Tk, Perl
- OS: Windows, Linux, UNIX, iOS
- Tools/Technologies: Kubernetes, Docker, Helm, Istio, Fluent-d, Prometheus, Grafana, Kiali, MongoDB, Jaeger, Kibana, AWS, Terraform
- ML: Keras, TensorFlow, PyTorch, CUDA, NumPy, Scikit-Learn, Pandas

WEB PROFILES

Homepage: `https://umakantkulkarni.github.io`

Google Scholar: `https://scholar.google.com/citations?hl=en&user=1v3d0A0AAAAJ`

LinkedIn: `https://www.linkedin.com/in/umakantkulkarni/`

GitHub: `https://github.com/UmakantKulkarni/`

REFERENCES

- Prof. Sonia Fahmy
  Professor of Computer Science, Purdue University
  Email: fahmy@purdue.edu
- Mark Libby
  System Software Manager, Boston Dynamics
  Email: mark@mwlibby.net
- Prof. Peter O'Reilly
  Director, Telecommunication Networks program, Northeastern University
  Email: p.oreilly@northeastern.edu