Imran Khan

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#### SUMMARY

I'm a researcher dedicated to advancing next-generation cellular and wireless networks, with a focus on 5G and beyond. My work involves creating programmable 5G testbeds, analyzing real-world network performance, and leveraging AI models to enhance network quality for latency-sensitive applications.

#### EDUCATION

Northeastern University Ph.D. in Computer Engineering Boston, MA

Jan 2021 - August 2025(expected)

Carbondale, IL Jan 2018 - July 2020

Southern Illinois University Carbondale

Masters of Science in Electrical and Computer Engineering

## SKILLS SUMMARY

• Languages: Python, C/C++, JAVA/Kotlin, Bash, SQL, HTML, CSS.

- Tools: XCAL-Accuver (5G/LTE signaling message analysing tool), Keysight RuSIM, Spectrum Analyzer, Git, Wireshark, Scikit-Learn, PyTorch, Keras, SoA Machine-Learning Frameworks, Video Streaming tools (Puffer, FFmpeg).
- Platforms: Linux, Android, Docker, Cloud platforms (AWS, GCP).
- Protocols/Standards: NR/LTE 3GPP standards , TCP/MPTCP/UDP protocols and their implementation (Linux Source Codes), IEEE 802.11 ax/ad/ac/b/g/n standards.

#### EXPERIENCE

#### Northeastern University

Boston, MA

 $Graduate\ Research\ Assistant\ --\ Advisor:\ Dimitrios\ Koutsonikolas$ 

Jan 2021 - Present

- Worked on the project X5G: An Open, Programmable Platform to Conquer the 5G and 6G Wireless Spectrum. This project involved combining necessary multi-vendor hardwares and softwares to build an 8-node O-RAN compliant 5G experimental testbed. Contributed to Xn-handover implementation for the X5G.
- o Conducted in-depth measurement studies on user-perceived experience, evaluating network coverage, performance, and quality of experience (QoE) for latency-sensitive 5G applications (e.g., Low-latency live streaming, AR/CAV, 360° video streaming, and online gaming). The study involved analyzing low-level 5G metrics and signaling messages to correlate with application performance.
- o Investigated the feasibility of predicting fine-grained throughput (100 ms granularity) in real-world cellular networks, integrating mixed LTE/5G technologies.
- Worked on performance evolution study of 5G networks. The first phase included developing an Android application to measure 5G bandwidth and latency for building and analyzing a year-long crowd-sourced dataset. The final phase involved analyzing a dataset provided by Ookla ®, comprising over 2.65 million mobile network measurements (4-year period) from 9 major cities across US and Europe.
- Employed bandwidth aggregation (802.11ad, 802.11ac, & Cellular) with MultiPath TCP on smartphones and explored the impact on power consumption and resource utilization. Ported 10K+ lines of Multipath TCP source code into Android Kernels for COTS UE (Asus ROG II, Pixel 5).

## AT&T Labs. Inc

Boston, MA

Research Intern & External Collaborator

June 2021 - May 2022

• Investigated the impact on QoE of low-latency video streaming application over 5G networks.\*

# NOTABLE PUBLICATIONS

- 5G Metamorphosis: A Longitudinal Study of 5G Performance from the Beginning. Imran Khan\*, Omar Basit\*, Moinak Ghoshal, Y. Charlie Hu, Dimitrios Koutsonikolas.
- Performance of Cellular Networks on the Wheels. Imran Khan\*, M. Ghoshal\*, Z. Jonny Kong\*, Phuc Dinh, Jiayi Meng, Y. Charlie Hu, Dimitrios Koutsonikolas. ACM IMC, 2023
- An Open, Programmable, Multi-vendor 5G O-RAN Testbed with NVIDIA ARC and OpenAirInterface. Imran Khan\*, D Villa\*, Florian Kaltenberger, Nicholas Hedberg, Ruben Soares da Silva, Anupa Kelkar, Chris Dick, Stefano Basagni, Josep M Jornet, Tommaso Melodia, Michele Polese, Dimitrios Koutsonikolas. IEEE INFOCOM NG-OPERA, 2024
- On the Predictability of Fine-grained Cellular Network Throughput using Machine Learning Models. Imran Khan\*, Omar Basit\*, Phuc Dinh\*, Z. Jonny Kong\*, Y. Charlie Hu, D. Koutsonikolas, Myungjin Lee, Chaoyue Liu. IEEE MASS 2024

• How Mature is 5G Deployment? A Cross-Sectional, Year-Long Study of 5G Uplink Performance. Imran Khan, Moinak Ghoshal, Joana Angjo, Sigrid Dimce, Mushahid Hussain, Paniz Parastar, Yenchia Yu, Claudio Fiandrino, Charalampos Orfanidis, Shivang Aggarwal, Ana C Aguiar, Ozgu Alay, Carla F. Chiasserini, Falko Dressler, Y. Charlie Hu, Steven Y. Kox, Dimitrios Koutsonikolas, Joerg Widmer. IFIP Networking 2024

• Handover Configurations in Operational 5G Networks: Diversity, Evolution, and Impact on Performance. Moinak Ghoshal, Imran Khan, Phuc Dinh, Z. Jonny Kong, Omar Basit, Sizhe Wang, Yufei Feng, Y. Charlie Hu, Dimitrios Koutsonikolas.

Under Submission

• A First Large-Scale Study of Operational 5G Standalone Networks.

Moinak Ghoshal, **Imran Khan**, Phuc Dinh, Omar Basit, Sizhe Wang, Jonny Kong, Yufei Feng, Y. Charlie Hu, Dimitrios Koutsonikolas.

Under Submission

An Experimental Study of Low-Latency Video Streaming over 5G.

**Imran Khan**, Tuyen X. Tran, Matti Hiltunen, Theodore Karagioules, Dimitrios Koutsonikolas. *IEEE MeditCom 2024* 

• A Large-Scale Study of the Potential of Multi-Carrier Access in the 5G Era.

Fukun Chen, Moinak Ghoshal, Enfu Nan, Phuc Dinh, **Imran Khan**, Z. Jonny Kong, Y. Charlie Hu , D. Koutsonikolas. *PAM 2025* 

Can 5G mmWave Enable Edge-Assisted Real-Time Object Detection for Augmented Reality?
Moinak Ghoshal, Z Jonny Kong, Qiang Xu, Zixiao Lu, Shivang Aggarwal, Imran Khan, Jiayi Meng, Yuanjie Li, Y Charlie Hu, Dimitrios Koutsonikolas
IEEE MASCOTS, 2023

• Demo: NextG-up: a tool for measuring uplink performance of 5G networks.

Imran Khan\*, Moinak Ghoshal\*, Qiang Xu, Z. Jonny Kong, Y. Charlie Hu, and Dimitrios Koutsonikolas *ACM Mobisys*, 2022

• MuSher: An Agile Multipath-TCP Scheduler for Dual-Band 802.11ad/ac Wireless LANs.

S. Aggarwal, S. K. Saha, **Imran Khan**, R. Pathak, D. Koutsonikolas and J. Widmer *IEEE/ACM Transactions on Networking*, 2022

• An In-Depth Study of Uplink Performance of 5G mmWave Networks.

Moinak Ghoshal, Z. Jonny Kong, Qiang Xu, Zixiao Lu, Shivang Aggarwal, **Imran Khan**, Yuanjie Li, Y. Charlie Hu, Dimitrios Koutsonikolas

ACM SIGCOMM 5G-MEMU, 2022

• Multipath TCP in Smartphones Equipped with Millimeter Wave Radios.

**Imran Khan**, Moinak Ghoshal, Shivang Aggarwal, Dimitrios Koutsonikolas, Joerg Widmer *ACM WiNTECH*, 2021

• Efficient Bandwidth Aggregation with MPTCP for Connected Vehicles.

Imran Khan, K. Chen

IEEE Internet of Things, 2021

• Bandwidth-need driven energy efficiency improvement of MPTCP users in wireless networks.

M. R. Palash, K. Chen, Imran Khan

IEEE Trans. Green Commun. Netw., 2019

## SOURCE CODE AND DATASET

- Dataset for Cross-Sectional, Year-Long Study of 5G Uplink Performance. [IFIP 2024]
- Dataset for Predictability of Fine-grained Cellular Network Throughput using ML Models. [IEEE MASS 2024]
- Dataset for 5G network performance on the wheels. [ACM IMC 2023]
- Android app NextG-UP app for a crowd-sourcing based measurement study of 5G uplink performance evolution.
- MPTCP source code for Pixel-5 Phone.
- $\bullet$  MPTCP source code for an ROG Phone 2, from our WiNTECH 2021 paper.

## PROFESSIONAL SERVICES/AWARDS

- Reviewer: Computer Networks 2024, IEEE Internet of Things 2024, IEEE GLOBECOM 2021, IEEE ICC 2024, COMCOM 2025, IEEE VTC2025, IEEE Transactions on Green Comm. and Networking 2025
- Web Chair: IEEE LANMAN 2024, WoWMoM 2023
- TPC Member: IEEE WCNC [2023, 2024]
- Got selected for NSF Funded Student travel grant for Mobicom'2021
- Got selected for NSF Funded POWDER Network and Wireless Week, Salt Lake City, Utah 2019