# 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** — Boston, MA
  *Ph.D. in Computer Engineering* — *Jan 2021 - August 2025(expected)*
- **Southern Illinois University Carbondale** — Carbondale, IL
  *Masters of Science in Electrical and Computer Engineering* — *Jan 2018 - July 2020*

## 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.
  - 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.
  - 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.
  *ACM IMC 2025*
- **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.
- 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