

Kangle(Phil) Mu

5th-year Ph.D. Candidate in Wireless Communications | Northwestern University

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EDUCATION

- 2022-2027(Expected): Ph.D., Northwestern University, GPA: 3.98/4
- 2020-2022: M.S., University of Michigan, Ann Arbor, GPA: 3.92/4
- 2016-2020: B.S., Xidian University, GPA: 3.90/4

AWARDS

- (First author) Best Paper Award @ IEEE International Symposium on Dynamic Spectrum Access Networks (DySPAN) 2024
- (First author) Best Paper Award @ IEEE The 22nd International Symposium on Modeling and Optimization in Mobile, Ad hoc, and Wireless Networks (WiOPT)

Patents (Provisional Application)

[RAN2 \(RRC and MAC\) @ Northwestern University](#)

- (First inventor) Dynamic Backoff Mechanisms for Collision Resolution in Random Access Systems

[RAN1 \(PHY\) @ Samsung Research America \(SRA\)](#)

- (First inventor) Downlink Wake-Up Signal Based on Zadoff-Chu Sequence
- (First inventor) Downlink Wake-Up Signal Based on Gold Sequence
- (First inventor) Downlink Wake-Up Signal Based on M Sequence
- (Co-inventor) Sequence Generation for a Synchronization Signal
- (Co-inventor) Resource Mapping for Downlink Wake-Up Signal

Experience

Internship @ Samsung Research America (2026.06-2026.09)

- Project: sequence design of downlink wake-up signal (DL-WUS) for 6GR cellular system
- Studied multiple sequence candidates for DL-WUS; optimized sequence pool generation for each sequence family; developed link-level simulator for DL-WUS
- 3 first-inventor DOIs and 2 co-inventor DOIs filed

RESEARCH

Improving Group Handover in 5G NR and Modeling of 5G RACH

Keywords: [5G-NR](#), [PRACH](#), [RRC](#), [MAC](#), [RAN2](#)

- Studied current 3GPP 5G-NR standards (TS 38.331/38.211/38.212/38.213) for UE attachment (RRC) and contention-based RACH (MAC).
- Developed an analytical model to characterize handover delay when large UE groups contend on PRACH; derived the expected backoff delay.
- Proposed a practical method for PRACH tuning (e.g., backoff-window settings) to mitigate access congestion.
- Proposed two dynamic random backoff algorithms with applicability to NR and future releases; invention disclosure filed

Machine Learning-based Adaptive Mobile Video Streaming

Keywords: [AI/ML](#), [Deep Reinforcement Learning](#)

- Designed a Deep RL-based agent for adaptive video streaming. Explored a novel playback speed adaptation (nearly imperceptible) alongside with the traditional bitrate adaptation for video streaming applications.
- Implemented A3C (deep reinforcement learning) using Tensorflow. Video demo [\[Link\]](#)
- Presented at IEEE INFOCOM 2021, and published on IEEE Transactions on Mobile Computing.

Enhancing Efficiency of Intermittent Wireless Spectrum

Keywords: [Spectrum Sharing](#), [CBRS](#), [Economics](#)

- Explored two solutions to mitigate the impact of intermittency on shared spectrum (e.g., the CBRS band):
 - (1) allowing reduced incumbent protection and
 - (2) pooling multiple intermittent bands to decrease overall intermittency.
- Developed economic models for these approaches and analyzed potential market outcomes.
- Presented at IEEE ICC 2024, NSF Spectrum Week 2024, and IEEE DySPAN 2024 ([Best Paper Award](#)).

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PUBLICATIONS [Google Scholar](#)

1. **K. Mu**, R. Berry et al., "Analysis and Optimization of 5G Random Access for Massive Handover with Spectrum Sharing," IEEE International Symposium on Spectrum Innovation (DySPAN), 2026.
2. **K. Mu**, R. Berry et al., "Compete or Coordinate? Analysis of Spectrum Sharing Strategies for Local Wireless Services," IEEE International Symposium on Dynamic Spectrum Access Networks (DySPAN), 2025.
3. W. Lehr, R. Berry, C. Caicedo, I. Kadota, **K. Mu**, Z. Xie, I. Tamin "Automating spectrum sharing: A bottom-up approach and research agenda," Telecommunications Policy, 2025.
4. **K. Mu**, R. Berry et al., "Impact of Geographical Separation on Spectrum Sharing Markets," IEEE International Symposium on Modeling and Optimization in Mobile, Ad hoc, and Wireless Networks (WiOpt), 2024.
[BEST PAPER AWARD](#)
5. W. Lehr, R. Berry, C. Caicedo, I. Kadota, **K. Mu**, Z. Xie, I. Tamin "Automating Spectrum Sharing from the Ground Up," Research Conference on Communications, Information & Internet Policy (TPRC), 2024.
6. **K. Mu**, R. Berry, "Market Impacts of Relaxed Incumbent Protection in Spectrum Sharing," IEEE ICC Workshop - Next Generation Spectrum Sharing Technology, 2024.
7. **K. Mu**, R. Berry, "Market Impacts of Pooling Intermittent Spectrum," IEEE International Symposium on Dynamic Spectrum Access Networks (DySPAN), 2024.
[BEST PAPER AWARD](#)
8. N. Khan, **K. Mu**, V. Subramanian, "Backward and Forward Inference in Interacting Independent-Cascade Processes: A Scalable and Convergent Message-Passing Approach," arXiv, 2023.
9. J. Zheng, Y. Zhang, T. H. Luan, **K. Mu**, G. Li, M. Dong, Y. Wu, "Digital twin enabled task offloading for IoVs: A learning-based approach", IEEE Transactions on Network Science and Engineering, 2023.
10. **K. Mu**, T. H. Luan et al., "AMIS-MU: Edge Computing based Adaptive Video Streaming for Multiple Mobile Users," IEEE Transactions on Mobile Computing, 2022.
11. J. Zheng, **K. Mu**, T. H. Luan et al., "Device Placement for Autonomous Vehicles using Reinforcement Learning," IEEE International Conferences on Internet of Things, 2021.
12. **K. Mu**, T. H. Luan et al., "AMIS: Edge Computing based Adaptive Mobile Video Streaming," in Proceedings of IEEE INFOCOM, 2021.