

# Kyu-Han Kim

Computer Science & Engineering, University of Michigan, Ann Arbor, MI 48109  
Email: kyuhkim@eecs.umich.edu • <http://www.eecs.umich.edu/~kyuhkim> • Phone: 734-272-7799

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## Research Interests

Mobile/Embedded Systems and Wireless Networks with emphasis on QoS, Availability, and Manageability

## Education

### Doctor of Philosophy in Computer Science

Expected April 2009

University of Michigan, Ann Arbor, MI / GPA: 8.0/8.0 (A=8.0)

Dissertation Title: *QoS-Adaptive Self-Managing Wireless Systems*

The focus of my research is to design, implement, and evaluate software systems and network protocols for supporting *QoS* and *manageability* in mobile and wireless systems. Existing mobile and/or wireless systems suffer from poor *QoS* or high management costs, due to changing wireless channel conditions. The primary contributions of my research are (i) to develop system-level techniques and frameworks through which a large-scale wireless systems can self-monitor, self-reconfigure, and self-optimize at the presence of varying wireless link-quality and (ii) to design robot-assisted network management tools through which wireless systems can improve management costs as well as availability significantly.

### Master of Science in Computer Science

2003

Georgia Institute of Technology, Atlanta, GA / GPA: 3.6/4.0 (A=4.0)

The focus of my research was to design, develop, and implement transmission control protocols for *resource-scarce* multi-homed mobile hosts (i) to achieve high network throughput (*e.g.*, bandwidth aggregation) and (ii) to tackle *mobility*-related issues, including hand-off, *QoS*, and energy efficiency.

### Bachelor of Engineering in Computer Science and Engineering

2000

Korea University, Seoul, Korea / GPA: 4.0/4.5 (A+ =4.5, A=4.0)

## Honors and Awards

- Nomination for Honor Competition in CSE, University of Michigan 2006/2007
- Moon-Jung Chung Scholarship, Korean Computer Scientist and Engineer Association, 2007
- Guaranteed Financial Aid Award by EECS, University of Michigan, 2003-07
- Nomination for ACM MobiCom 2006 Student Best Paper Award
- NSF, USENIX, and Rackham Graduate School Student Travel Grants, 2005
- The Ministry of Information & Communication Scholarship, Republic of Korea, 2001-05
- University of Michigan Summer Research Fellowship, 2004
- ACM MobiCom 2003 **Student Best Paper Award**
- The Academic Excellence Scholarship (Top 1–3%), Korea University, 1998-2000

## Publications, Technical Reports, and Patents

### System Support for Self-Managing Wireless Mesh Systems

- *Accurate and Asymmetry-aware Measurement of Link Quality in Wireless Mesh Networks*  
Kyu-Han Kim and Kang G. Shin. To appear in IEEE/ACM Transaction on Networking (ToN), 2009.
- *Self-Reconfigurable Wireless Mesh Networks*  
Kyu-Han Kim and Kang G. Shin. Submitted to IEEE Transaction on Mobile Computing (TMC), 2008.

- *Extended Abstract: Self-Healing Multi-Radio Wireless Mesh Networks*  
Kyu-Han Kim and Kang G. Shin. ACM MobiCom, 2007.
- *On Accurate Measurement of Link Quality in Multi-hop Wireless Mesh Networks*  
Kyu-Han Kim and Kang G. Shin. ACM MobiCom, 2006.  
**Nomination for Student Best Paper Award** (one of four finalists)

### System Support for High-Bandwidth Mobile Systems

- *PRISM: Improving the Performance of Inverse-Multiplexed TCP in Wireless Networks*  
Kyu-Han Kim and Kang G. Shin. IEEE Transaction on Mobile Computing (TMC), 2008.
- *Improving TCP Performance over Wireless Networks with Collaborative Multi-homed Mobile Hosts*  
Kyu-Han Kim and Kang G. Shin. USENIX/ACM MobiSys, 2005.
- *A Receiver-Centric Transport Protocol for Mobile Hosts with Heterogeneous Wireless Interfaces*  
Hung-Yun Hsieh, Kyu-Han Kim, and Raghupathy Sivakumar. ACM/Kluwer WINET, 2005.
- *An End-to-End Approach for Transparent Mobility across Heterogeneous Wireless Networks*  
Hung-Yun Hsieh, Kyu-Han Kim, and Raghupathy Sivakumar. ACM/Kluwer MONET, 2004.
- *A Receiver-Centric Transport Protocol for Mobile Hosts with Heterogeneous Wireless Interfaces*  
Hung-Yun Hsieh, Kyu-Han Kim, Yujie Zhu, and Raghupathy Sivakumar. ACM MobiCom, 2003.  
**Student Best Paper Award**

- *On Achieving Weighted Service Differentiation: An End-to-End Perspective*  
Hung-Yun Hsieh, Kyu-Han Kim, and Raghupathy Sivakumar. IEEE IWQoS, 2003
- *Enhancing TCP for networks with Guaranteed Bandwidth Services*  
Yujie Zhu, O. Oladeji, Kyu-Han Kim, and Raghupathy Sivakumar. IEEE GlobeCom, 2003
- *Think: A Hybrid Thin-/Thick-client Approach to Mobile Information Access* (Poster)  
Tae-Young Chang, Kyu-Han Kim, and Raghupathy Sivakumar. ACM MobiSys, 2003

### Robot-based Autonomous Wireless Systems

- *MARS: A Mobile Autonomous Router System for Multi-Hop Wireless Relays*  
Kyu-Han Kim and Kang G. Shin. Submitted to IEEE Transaction on Mobile Computing (TMC), 2008.
- *MARS: A Mobile Autonomous Router System for Multi-Hop Wireless Relays*  
Kyu-Han Kim, Dragoş Niculescu, and Kang G. Shin. Tech. Report 2007-L166, NEC Lab America, 2007.
- *Autonomous Wireless Systems Using Mobile Robots*  
Kyu-Han Kim, Dragoş Niculescu, and Kang G. Shin. Tech. Report 2007-L136, NEC Lab America, 2007.
- *Mobile Antennas and Access Points*  
Dragoş Niculescu and Kyu-Han Kim. (U.S. Patent pending), NEC Lab America, 2007.

## Research Experience

<b>University of Michigan</b> Graduate Research Assistant Adviser: Prof. Kang G. Shin Projects: QoS-Adaptive Self-Managing Wireless Systems (details are on page 4)	Ann Arbor, MI 2003–current
<b>NEC Laboratories North America</b> Summer Research Intern Mentor: Dr. Dragoş Niculescu Projects: Robot-based Autonomous Wireless Systems	Princeton, NJ 2007
<b>Georgia Institute of Technology</b> Graduate Research Assistant Adviser: Prof. Raghupathy Sivakumar Projects: Transmission Control Protocols for Multi-Homed Mobile Hosts	Atlanta, GA 2002-03

## Industry Experience

**Dacom System Technologies**

*Software Engineer*

Project: Enterprise Application Integration (EAI) for an Enterprise-scale e-Procurement System

Seoul, Korea

2001

## Scholarly Talks

- *Embodying Link-Quality Awareness in Multi-Hop Wireless Networks*  
University of Arizona 2008; IBM T.J. Watson Research 2008; and EECS571 University of Michigan 2008.
- *Self-Healing Multi-Radio Wireless Mesh Networks*  
ACM MobiCom, Montreal, QC, Canada, September 2007.
- *Accurate Measurement of Link Quality in Multi-Hop Wireless Mesh Networks*  
ACM MobiCom, Los Angeles, CA, September 2006.
- *Improving TCP Performance over Wireless Networks with Collaborative Multi-Homed Mobile Hosts*  
ACM/USENIX MobiSys, Seattle, WA, June 2005.

## Services and Activities

- Research mentor for senior undergraduate students through University of Michigan Undergraduate Research Opportunity Program (UROP) 2008
- Participant in external funding proposals: (i) DARPA/IPTO #05-37: Adaptive Cognition-Enhanced Radio Teams (ACERT) 2005, (ii) Office of Naval Research MURI 2007 #06-28: Robust and Resilient Tactical Mobile Ad-Hoc Networks, and (iii) NSF CNS: Core Programs 2008
- Reviewer for ACM MobiCom 2003/2006-08, IEEE InfoCom 2003/2007-08, IEEE ICNP 2004, IEEE WoW-MoM 2007, IEEE TMC 2007, IEEE TOC 2008, IEEE TWC 2008, IEEE/ACM ToN 2008
- Student volunteer for ACM MobiCom 2002, ACM MobiHoc 2003, and RTSN 2006
- Coordinator of a networking research group (of 12 Ph.D Students) at University of Michigan (2004-07)
- Army service in the Republic of Korea (1996-98)

## References

- **Kang G. Shin**, Kevin and Nancy O'Connor Professor of Computer Science  
Electrical Engineering and Computer Science, University of Michigan  
Email: kgshin@eecs.umich.edu
- **Jason N. Flinn**, Associate Professor  
Electrical Engineering and Computer Science, University of Michigan  
Email: jflinn@eecs.umich.edu
- **Dragoş Niculescu**, Research Staff  
Broadband and Mobile Network Group, NEC Laboratories America  
Email: dragos@nec-labs.com
- **Raghupathy Sivakumar**, Associate Professor  
Electrical and Computer Engineering, Georgia Institute of Technology  
Email: siva@ece.gatech.edu
- **Hung-Yun Hsieh**, Assistant Professor  
Electrical Engineering and Computer Science, National Taiwan University  
Email: hyhsieh@cc.ee.ntu.edu.tw

# Research Project Summary

## I. Projects for Robot-based Wireless Systems

### Mobile Spectrum Watchdog Router

(sponsored by NSF and NEC)

Develop a spectrum watchdog router that monitors and assesses the performance of large-scale wireless networks. Design, implement, and evaluate novel spectrum site-survey techniques and software tools that facilitate management costs and that improve network availability against malicious wireless users and devices. Being prepared for submission. (reference: Prof. Kang G. Shin) 2008–present.

### Mobile Wireless Router Systems using Mobile Robots

(sponsored by NSF and NEC)

Studied the feasibility of using mobile robots for wireless end-systems. Designed, developed and evaluated a spatial wireless link-quality measurement tool, an efficient spatial probing algorithm, and an error-tolerant positioning system. Built a hardware prototype (using iRobot and IEEE 802.11-based wireless router) and software implementation in a Linux-based system. Published in NEC Labs technical reports, filed a patent and submitted to IEEE TMC 2008. (reference: Prof. Kang G. Shin and Dr. Dragoş Niculescu, prototype and demonstration video available at <http://kabru.eecs.umich.edu/bin/view/Main/SMART>) 2007.

## II. Projects for Self-Managing Wireless Mesh Systems

### Self-Reconfiguring Multi-Radio Wireless Mesh Networks

(sponsored by NSF and Intel)

Developed novel algorithms and protocols that allow a multi-radio wireless mesh network to locally reconfigure network settings for improving channel utilization and for supporting network QoS. Built a real-life testbed of a multi-radio wireless mesh network in the Computer Science and Engineering building at The University of Michigan. Evaluated the proposed algorithms and protocols. Published in *Proceedings of ACM MobiCom 2007* and submitted to IEEE TMC 2008. (reference: Prof. Kang G. Shin) 2006.

### Efficient and Accurate Wireless Link-Quality Monitor

(sponsored by NSF)

Designed an efficient and accurate link-quality measurement framework for multi-hop wireless mesh networks that captures varying link-quality and wireless link-asymmetry. Built a multi-hop multi-radio wireless mesh network testbed at the Computer Science and Engineering building at The University of Michigan. Implemented and evaluated the proposed framework in the testbed. Published in *Proceedings of ACM MobiCom 2006* and to be appeared in *IEEE/ACM ToN 2009*. (reference: Prof. Kang G. Shin, software release available at <http://kabru.eecs.umich.edu/bin/view/Main/EAR> and downloaded more than 100 times) 2005.

## III. Projects for High-Bandwidth Mobile Devices

### Mobile Collaborative Community

(sponsored by AFOSR)

Developed a mobile resource-sharing framework, called a mobile collaborative community (MC<sup>2</sup>) for a group of multi-homed mobile hosts. Designed, implemented, and evaluated a proxy-based inverse multiplexer, called PRISM, that aggregates multiple wireless WAN links of mobile hosts to improve the performance of a TCP connection. Published in *Proceedings of USENIX/ACM MobiSys 2005* and *IEEE TMC 2008*. (reference: Prof. Kang G. Shin) 2004.

### Transmission Control Protocols for Mobile Hosts

(sponsored by NSF)

Designed and evaluated transport-layer protocols tailored for multi-homed mobile hosts. Solved wireless last-mile problems, including loss recovery, congestion control, differentiated QoS, server migration, and energy efficiency, and extended the protocols to aggregate bandwidth of multiple wireless interfaces of a mobile host. Published in *Proceedings of ACM MobiCom 2003*, *Proceedings of IEEE IWQoS 2003*, *ACM/Kluwer MONET 2004*, and *ACM/Kluwer WINET 2005*. (reference: Prof. Raghupathy Sivakumar and Prof. Hung-Yun Hsieh) 2002-03.