Daehyeok Kim

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Research Interests

Computer networks, Distributed systems, Data centers, Cloud computing, Systems security

Education

Carnegie Mellon University — Pittsburgh, PA USA
Ph.D. in Computer Science — August 2016–November 2021
Advisors: Vyas Sekar and Srinivasan Seshan
Dissertation: Towards Elastic and Resilient In-Network Computing
Committee: Vyas Sekar, Srinivasan Seshan, Justine Sherry, Jennifer Rexford, and Jitendra Padhye

Pohang University of Science and Technology — Pohang, South Korea
M.S. in IT Convergence Engineering — March 2010–Feburary 2012
B.S. in Computer Science and Engineering — March 2006–Feburary 2010

Employment History

Microsoft Corporation — Redmond, WA USA
Senior Researcher — March 2021–Present
Researcher — June 2019–Feburary 2021
Research Intern — Summer 2012, 2017, 2018

Korea Advanced Institute of Science and Technology (KAIST) — Daejeon, South Korea
Research Scientist (Fulfillment of military service obligation) — June 2013–July 2016

Honors and Awards

Microsoft Research PhD Fellowship	2019–2021
Facebook PhD Fellowship Finalist	2019
Bronze Award, the 24th Samsung HumanTech Paper Award	2018
Qualcomm Innovation Awards, Qualcomm Korea	2016
College of Natural Sciences Dean's Excellence Award, UT Austin	2012
The Award of Excellence, Microsoft Research Asia	2010, 2012
Best Undergraduate Research Award, POSTECH	2009
Academic Excellence Award, POSTECH	2007, 2008
National Scholarship for Science and Engineering, KOSAF	2006–2010

Peer-reviewed Conference Publications

[C1] Hun Namkung, Zaoxing Liu, **Daehyeok Kim**, Vyas Sekar, and Peter Steenkiste. SketchLib: Enabling Efficient Sketch-based Monitoring on Programmable Switches. In *Proceedings of 19th USENIX Symposium on Networked Systems Design and Implementation (NSDI)*, February 2022.

[C2] **Daehyeok Kim**, Jacob Nelson, Dan Ports, Vyas Sekar, and Srinivasan Seshan. RedPlane: Enabling Fault-Tolerant Stateful In-Switch Applications. In *Proceedings of ACM SIGCOMM Conference (SIGCOMM)*, August 2021.

[C3] Hun Namkung, **Daehyeok Kim**, Zaoxing Liu, Vyas Sekar, and Peter Steenkiste. Telemetry Retrieval Inaccuracy in Programmable Switches: Analysis and Recommendations. In *Proceedings of ACM Symposium on SDN Research (SOSR)*, July 2021.

[C4] **Daehyeok Kim**, Zaoxing Liu, Yibo Zhu, Changhoon Kim, Jeongkeun Lee, Vyas Sekar, and Srinivasan Seshan. TEA: Enabling State-Intensive Network Functions on Programmable Switches. In *Proceedings of ACM SIGCOMM Conference (SIGCOMM)*, August 2020.

[C5] Matthew Mukerjee, Christopher Canel, Weiyang Wang, **Daehyeok Kim**, Srinivasan Seshan, and Alex C. Snoeren. Adapting TCP for Reconfigurable Datacenter Networks. In *Proceedings of 17th USENIX Symposium on Networked Systems Design and Implementation (NSDI)*, February 2020.

[C6] **Daehyeok Kim**, Tianlong Yu, Hongqiang Harry Liu, Yibo Zhu, Jitu Padhye, Shachar Raindel, Chuanxiong Guo, Vyas Sekar, and Srinivasan Seshan. FreeFlow: Software-based Virtual RDMA Networking for Containerized Clouds. In *Proceedings of 16th USENIX Symposium on Networked Systems Design and Implementation (NSDI)*, February 2019.

[C7] **Daehyeok Kim**, Amirsaman Memaripour, Anirudh Badam, Yibo Zhu, Hongqiang Harry Liu, Jitu Padhye, Shachar Raindel, Steven Swanson, Vyas Sekar, and Srinivasan Seshan. HyperLoop: Group-Based NIC-Offloading to Accelerate Replicated Transactions in Multi-Tenant Storage Systems. In *Proceedings of ACM SIGCOMM Conference (SIGCOMM)*, August 2018.

[C8] Jaebaek Seo, **Daehyeok Kim**, Donghyun Cho, Taesoo Kim, and Insik Shin. FlexDroid: Enforcing In-App Privilege Separation in Android. In *Proceedings of 23rd Network and Distributed System Security Symposium (NDSS)*, February 2016.

[C9] Sooel Son, **Daehyeok Kim**, and Vitaly Shmatikov. What Mobile Ads Know About Mobile Users. In *Proceedings of 23rd Network and Distributed System Security Symposium (NDSS)*, February 2016.

[C10] Hyosu Kim, SangJeong Lee, Wookhyun Han, **Daehyeok Kim**, and Insik Shin. SounDroid: Supporting Real-Time Sound Application on Commodity Mobile Devices. In *Proceedings of 36th IEEE Real-Time Systems Symposium (RTSS)*, December 2015.

[C11] Sangki Yun, **Daehyeok Kim**, Xiaofan Lu, and Lili Qiu. Optimized Layered Integrated Video Encoding. In *Proceedings of 34th IEEE International Conference on Computer Communications (INFOCOM)*, April 2015.

[C12] Daehee Jang, Hojoon Lee, Minsu Kim, **Daehyeok Kim**, Daegyeong Kim, and Brent B. Kang. ATRA: Address Translation Redirection Attack against Hardware-based External Monitors. In *Proceedings of 21st ACM Conference on Computer and Communications Security (CCS)*, November 2014.

[C13] Sangki Yun, **Daehyeok Kim**, and Lili Qiu. Fine-grained Spectrum Adaptation in WiFi Networks. In *Proceedings of 20th ACM International Conference on Mobile Computing and Networking (MobiCom)*, September 2013.

[C14] **Daehyeok Kim** and Young-Joo Suh. Multi-rate Combination of Opportunistic Routing and Network Coding. In *Proceedings of 9th IEEE Wireless Communications and Networking Conference (WCNC)*, April 2012.

Peer-reviewed Workshop Publications

[W1] **Daehyeok Kim**, Yibo Zhu, Changhoon Kim, Jeongkeun Lee, and Srinivasan Seshan. Generic External Memory for Switch Data Planes. In *Proceedings of the 17th ACM Workshop on Hot Topics in Networks (HotNets)*, November 2018.

Peer-reviewed Journal Publications

[J1] Kilho Lee, **Daehyeok Kim**, and Insik Shin. REboost: Improving Throughput in Wireless Networks using Redundancy Elimination. *IEEE Communications Letters*, 21(1), January 2017.

[J2] **Daehyeok Kim**, Wan-Seon Lim, and Young-Joo Suh. Multicast Extension to Proxy Mobile IPv6 for Mobile Multicast Services. *Journal of Computing Science and Engineering*, 5(4), December 2011.

Issued Patents

[P1] Group-based data replication in multi-tenant storage systems. US Patent 10,642,779 (July 23, 2020).

Conference and Invited Talks

RedPlane: Enabling Fault-Tolerant Stateful In-Switch Applications
- ACM SIGCOMM conference, Virtual Event (talk video). August 2021
- Princeton University, Remote. July 2021
- Rice University, Remote. July 2021

Unleashing the Potential of In-network Computing
- Seoul National University, Remote. August 2021

TEA: Enabling State-Intensive Network Functions on Programmable Switches
- Princeton University, Remote. April 2021
- University of Wisconsin-Madison, Remote. April 2021
- Duke University, Remote. Feburary 2021
- University of Pennsylvania, Remote. November 2020
- Open Networking Korea, Remote. November 2020
- ACM SIGCOMM conference, Virtual Event (talk video). August 2020

Generic External Memory for Switch Data Planes
- P4 Workshop, Palo Alto, CA (talk video). May 2019
- Dagstuhl Seminar on Programmable Network Data Planes, Wadern, Germany. April 2019
- ACM HotNets, Redmond, WA (talk video). November 2018
- Barefoot Networks, Remote. November 2018

Programmable Data Planes and Its Applications
- Semiconductor Research Corporation E-Workshop, Remote. January 2020

HyperLoop: Group-Based NIC-Offloading to Accelerate Replicated Transactions in Multi-Tenant Storage Systems
- Annual Non-Volatile Memories Workshop, San Diego, CA. March 2019
- Microsoft Research, Redmond, WA. October 2018
- ACM SIGCOMM conference, Budapest, Hungary (talk video). August 2018

FreeFlow: Software-based Virtual RDMA Networking for Containerized Clouds
- USENIX NSDI, Boston, MA (talk video). Feburary 2019
- Intel Labs, Remote. March 2018

Multi-rate Combination of Opportunistic Routing and Network Coding
- IEEE WCNC, Paris, France. March 2012

Reserach Experience

Senior Researcher, Microsoft Corporation June 2019–Present
Mobility and Networking Research group & Office of the CTO at Azure for Operators
- Designing an edge data center architecture for 5G virtualized radio access networks.
- Developing in-network mechanisms for enabling efficient and high-performance 5G virtualized radio access networks and user-plane functions.

Graduate Research Assistant, Computer Science Department, CMU August 2016–November 2021
- Developed new abstractions for high-performance programmable and reconfigurable networks [C1, C2, C3, C4, C5, C6, C7][W1].

Research Intern, Microsoft Research May–August 2018
Mobility and Networking Research group
- Developed an external memory architecture for programmable switch data planes [W1].

Research Intern, Microsoft Research May–August 2017
Mobility and Networking Research group
- Developed new network primitives for accelerating replicated storage transactions with RDMA NIC offloading with the support of non-volatile memory [C7][P1].
- Developed a software-based RDMA virtualization framework for containerized clouds [C6].

Research Scientist, KAIST *(Fulfillment of military service obligation)* June 2013–June 2016
Cyber Security Research Center (Jun. 2013 - Feburary 2015)
Mobile Software Platform Research Center (March 2015 - Jun. 2016)
- Developed an in-app privilege separation mechanism for Android OS [C8].
- Investigated privacy leakages from mobile advertising libraries [C9].
- Discovered a new attack which can bypass hardware-based kernel integrity monitors [C12].

Graduate Research Assistant, Department of Computer Sciences, UT Austin August 2012–May 2013

- Developed a video encoding scheme for wireless video multicast in MIMO environments [C11].
- Developed a mechanism for efficient wireless spectrum utilization in WiFi networks [C13].

Research Intern, Microsoft Research — May–August 2012
Mobility and Networking Research group

- Evaluate benefits of SPDY protocol in mobile applications.

Research Intern, Microsoft Research Asia — September 2011–Feburary 2012
Wireless and Networking group

- Developed a distributed MIMO system to improve wireless capacity.

Research Intern, Microsoft Research Asia — January 2010–March 2010
Wireless and Networking group

- Developed a collaborative relaying system to improve wireless capacity in multi-hop wireless networks.

Research Assistant, POSTECH — March 2010–Feburary 2012

- Developed a novel combination of network coding and opportunistic routing in multi-rate wireless network [C14].

Teaching Experience

Teaching Assistant, 15-441/641 Computer networks, CMU — Spring 2019

Taught about 30 students in weekly recitation sessions. Made homework assignment and exam problems. Held weekly office hours.

Teaching Assistant, 15-440/640 Distributed systems, CMU — Fall 2017

Gave lectures on virtualization. Held weekly tutoring sessions for a group of students for better understanding of course materials. Held recitation sessions for course projects. Held weekly office hours.

Teaching Assistant, CS 302 Computer fluency, UT Austin — Spring 2013

Taught about 100 students for better understanding of basics of computer science and Python programming. Held weekly office hours.

Teaching Assistant, CS 312 Introduction to programming, UT Austin — Fall 2012

Taught about 100 students in weekly recitation sessions. Helped students for better understanding of the course materials and to get familiar with programming in Java. Held weekly office hours.

University Service

Computer Science Department Faculty Hiring Committee, CMU — 2021
Computer Science Department PhD Admissions Committee, CMU — 2019–2020
Research Experiences for Undergraduates (REU) Program Admissions Committee, CMU — 2021

Computer Science Outreach

TEALS volunteer teacher, Intro to Computer Science, Moses Lake High School, WA USA — 2021–Present
TEALS volunteer teacher, Intro to Computer Science, Selah High School, WA USA — 2020–2021

References

Available upon request.