

Sangtae Ha

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Research Interests

My research focuses on building and deploying practical systems that span multiple disciplines, including networks and distributed systems, internet protocols and algorithms, video streaming, storage systems, and wireless networks. I co-founded DataMi, a startup on wireless networks, in 2012, and served as the founding CTO/VP Engineering. DataMi is disrupting the mobile advertisement industry and currently serving over 50 million smartphone users. I also co-founded Zoomi, which develops an artificial intelligence (AI) learning platform. Zoomi was recently named in the "Top 20 Learning Delivery Companies" by TrainingIndustry.com. I serve as the technical advisor for Myota Inc., a storage startup spun off from my recent research in secure and reliable storage.

Education

- November, 2009 **Ph.D., Computer Science, North Carolina State University, USA**
Thesis: Improving TCP Congestion Control for High Bandwidth and Long Distance Networks
Advisor: Prof. Injong Rhee (Now the VP of IoT, Google)
- February, 2001 **M.S., Computer and Communication Engineering, POSTECH, Korea**
Thesis: Design and Implementation of High-Speed Internet Gateway
Advisor: Prof. James W. Hong
- February, 1999 **B.E., Computer Science and Engineering, Kyung Hee University, Korea**

Academic Appointments

- 08/2014 - Current **Assistant Professor** of Computer Science & ITP, University of Colorado Boulder
- 11/2010 - 05/2013 **Associate Research Scholar**, Princeton University
Associate Director, the Princeton EDGE Lab, Princeton University
Mentor: Prof. Mung Chiang (Now the Dean of Engineering at Purdue University)
- 11/2009 - 11/2010 **Postdoctoral Research Associate**, Princeton University
Associate Director, the Princeton EDGE Lab, Princeton University
Mentor: Prof. Mung Chiang (Now the Dean of Engineering at Purdue University)

Work Experience

- 08/2017 - Current Technical Advisory Board for Myota Inc.
<http://www.myotainc.com>.
- 09/2012 - Current Co-Founder and Consulting IT architect for Zoomi Inc.
<http://www.zoomiinc.com>.
- 05/2013 - 07/2014 Co-Founder (Founding CTO) and VP of Advanced Technology, DataMi Inc.
<http://www.datami.com>.
- 05/2008 - 08/2008 Summer Research Intern, Cisco Systems, San Jose, CA
- 07/2002 - 07/2004 Senior Research Engineer, Telson I&C Research Center, Seoul, Korea

03/2001 - 06/2002 (Part-time) Linux Consultant and Writer, Linux@Works, Seoul, Korea
11/2000 - 03/2002 Senior Research Engineer (Linux Kernel), Netstech R&D Center, Seoul, Korea

Awards and Honors

2018 AT&T Faculty Research Award (VURI)
2017 Samsung 2017 GRO Award
2017 AT&T Faculty Research Award (VURI)
2017 IEEE INFOCOM'17 Distinguished TPC Member Award
2014 INFORMS ISS Design Science Award
2013 Princeton IP Accelerator Fund Winner, Princeton, NJ
2011 Princeton Innovation Competition Finalist, Princeton University
2011 Vodafone Wireless Innovation Competition Finalist, "TUBE-ing Over Digital Divide."

Teaching, Mentoring and Advising

Courses Taught

2018 Fall CSCI 4273/5273: Network Systems
86 Graduate and Undergrad Students

2018 Fall TLEN 5330: Data Communications 1
38 Graduate Students

2017 Fall CSCI 4273/5273: Network Systems
(001): 85 Graduate and Undergrad Students, FCQ (Course: 4.69, Instructor: 5.04)
(001B): 29 Graduate Students, FCQ (Course: 4.82, Instructor: 4.88)

2017 Fall TLEN 5330: Data Communications 1
48 Graduate Students, FCQ (Course: 4.49, Instructor: 4.11)

2016 Fall CSCI 4273/5273: Network Systems,
92 Undergraduate Students, FCQ (Course: 4.7, Instructor: 4.7)
22 Graduate Students, FCQ (Course: 4.6, Instructor: 4.6)

2016 Fall TLEN 5330: Data Communications 1,
47 Graduate Students, FCQ (Course: 5.4, Instructor: 5.1)

2016 Spring CSCI 7000-010: Advanced Internet Protocols,
9 Graduate Students, FCQ (Course: 5.2, Instructor: 5.7)

2015 Fall CSCI 4273/5273: Network Systems,
89 Undergraduate Students, FCQ: (Course: 4.1, Instructor: 4.1)
19 Graduate Students, FCQ: (Course: 5.5, Instructor: 5.2)

2015 Fall TLEN 5330: Data Communications 1,
87 Graduate Students, FCQ (Course: 4.9, Instructor: 4.5)

2014 Fall TLEN 5330: Data Communications 1,
48 Graduate Students, FCQ: (Course: 3.8, Instructor: 3.7)

Current Postdoctoral Advisees

1. Dr. Jinsung Lee, Postdoctoral Associate, Computer Science, University of Colorado (18S - Present)
2. Dr. Jihoon Lee, Research Associate, Computer Science, University of Colorado(17F - Present)
3. Dr. Youngbin Im, Postdoctoral Associate, Computer Science, University of Colorado (15S - Present)

Current PhD Dissertation Advisees

1. Ayad Ibrahim, 2015 Fall - Present. ITP, University of Colorado Boulder
2. Insoo Lee, 2017 Fall - Present. Computer Science, University of Colorado Boulder
3. Zhang Liu, 2015 Fall - Present. ITP, University of Colorado Boulder
4. Parisa Rahimzadeh, 2016 Spring - Present. Computer Science, University of Colorado Boulder
5. Prasanth Prahlanan, 2017 Fall - Present. Computer Science, University of Colorado Boulder
6. Siqi Chen, 2018 Fall - Present. Computer Science, University of Colorado Boulder
7. Jaeyoung Oh, 2018 Fall - Present. Computer Science, University of Colorado Boulder
8. Hyoyoung Lim, 2018 Fall - Present. Computer Science, University of Colorado Boulder

Current MS Thesis Advisees

1. Gyuhong Lee, 2018 Spring - Present. Computer Science, University of Colorado Boulder

Thesis and PhD Exam Committee

1. Oliver Michel, Computer Science PhD Proposal Exam Committee, 2018 Winter
2. Waleed Almarshedi, ITP PhD Preliminary Exam Committee, 2018 Spring
3. Eric Lobato, ITP PhD Preliminary Exam Committee, 2018 Spring
4. Nadia Yoza-Mitsuishi, ITP PhD Preliminary Exam Committee, 2018 Spring
5. Dewang Gedia, ITP PhD Preliminary Exam Committee, 2018 Spring
6. Jason Schnitzer, ITP PhD Preliminary Exam Committee, 2018 Spring
7. Parisa Rahimzadeh, Computer Science PhD Preliminary Exam Committee, 2018 Spring
8. Zaid Al-Ali, Computer Science PhD Preliminary Exam Committee, 2018 Spring
9. Michael Coughlin, Computer Science PhD Thesis Defense Committee, 2018 Spring
10. Xinyang Zhou, ITP PhD Thesis Defense Committee, 2018 Spring
11. Azzam Alsudais, Computer Science PhD Preliminary Exam Committee, 2018 Spring
12. Ehab Ababneh, Computer Science PhD Thesis Defense Committee, 2017 Summer
13. Murad Kablan, Computer Science PhD Thesis Defense Committee, 2017 Summer
14. Mark Lofquist, ITP PhD Preliminary Exam Committee, 2017 Spring

15. Syed F Shamim, ITP PhD Preliminary Exam Committee, 2017 Spring
16. Zhang Liu, ITP PhD Preliminary Exam Committee, 2017 Spring
17. Irena Stevens, ITP PhD Preliminary Exam Committee, 2017 Spring
18. Andre Rosete, ITP PhD Preliminary Exam Committee, 2017 Spring
19. Joe McManus, ITP PhD Preliminary Exam Committee, 2017 Spring
20. Blake Caldwell, Computer Science PhD Proposal Exam Committee, 2017 Spring
21. Oliver Michael, Computer Science PhD Preliminary Exam Committee, 2016 Fall
22. Ehab Ababneh, Computer Science PhD Proposal Exam Committee, 2016 Fall
23. Xinyang Zhou, ITP PhD Proposal Exam Committee, 2016 Fall
24. Andy Sayler, Computer Science PhD Thesis Defense Committee, 2016 Spring
25. Lei Tian, Computer Science PhD Thesis Defense Committee, 2016 Spring
26. Christopher G. Brinton, Thesis Reader, EE, PhD, Princeton University, 2016 Spring
27. Martin Saint, ITP PhD Preliminary Exam Committee, 2016 Spring
28. Eric Goodman, Computer Science PhD Proposal Exam Committee, 2015 Fall
29. Daniel Hembree, ITP PhD Preliminary Exam Committee, 2015 Summer
30. Blake Caldwell, Computer Science PhD Preliminary Exam Committee, 2015 Spring
31. Xinyang Zhou, ITP PhD Preliminary Exam Committee, 2015 Spring
32. Ibrahim Ayad, ITP PhD Preliminary Exam Committee, 2015 Spring
33. Andy Sayler, Computer Science PhD Proposal Exam Committee, 2015 Spring
34. Lei Tian, Computer Science PhD Proposal Exam Committee, 2015 Spring
35. Felix Ming Fai Wong, Thesis Reader, EE, PhD, Princeton University, 2015 Spring
36. Abhiram Yarlagadda, ITP MS Thesis Committee, ITP, MS, 2014 Fall

Independent Study

1. Hyun Sub Kim, Computer Science M.S. Student, 2018 Spring
2. Sandesh Dhawaskar Sathyanarayana, Computer Science M.S. Student, 2018 Spring
3. Sumeet Khule, ECEE M.S. Student, 2017 Summer
4. Won Cheol Song, Computer Science M.S. Student, 2017 Spring
5. Tae-Gu Kim, Computer Science M.S. Student, 2017 Spring
6. Shyam Ramamoorthy, Computer Science M.S. Student, 2015 Fall
7. Prithvi Manikonda, ITP M.S. Student, 2015 Spring

8. Sesha Chetlur, Computer Science M.S. Student, 2015 Spring

Visitors

1. Stefan Ruediger Rill, now an Engineering Manager at Google, 2016 Fall - 2017 Fall
2. Trung Hieu Nguyen, Aalto University, Finland, 2015 Fall - 2016 Spring
3. Dr. Seung Eun Hong, ETRI, South Korea, 2015 Fall - 2016 Spring
4. Dr. Kyuyong Shin, Korea Military Academy, South Korea, 2014 Fall - 2015 Summer

Mentoring

1. Hayeong Song, Computer Science M.S. Student, 2016 Fall - 2018 Spring
2. Hyunsub Kim, Computer Science M.S. Student, 2016 Fall - 2018 Spring
3. Brett Shouse, Computer Science M.S. Student, 2015 Fall - 2018 Spring
4. Won Cheol Song, Computer Science M.S. Student, 2015 Fall - 2017 Spring
5. Tae-Gu Kim, Computer Science M.S. Student, 2015 Fall - 2017 Spring
6. Varun Kaundinya, ITP M.S. Student, 2014 Fall - 2015 Spring
7. Prithvi Manikonda, ITP M.S. Student, 2015 Spring
8. Sesha Chetlur, Computer Science M.S. Student, CS, 2015 Spring

Guest Lectures

2014 Spring Optimization of Communication Systems (Graduate), Princeton University
2012 Fall Networks: Friends, Money, and Bytes (Undergrad.), Princeton University
2011 Spring Optimization in Communication Systems (Graduate), Princeton University

Professional Service

Fog Computing/Networking

TPC Co-Chair Fog World Congress 2017

Organizing Committee IEEE DSN 2017

Publicity Co-Chair ACM SEC 2017

TPC IEEE ICDCS 2017

TPC IEEE INFOCOM 2018, 2017, 2016

Co-Chair Software Infrastructure Working Group, OpenFog Consortium, 2016 - Current

Guest Editor IEEE Comm. Magazine Feature Topic on Fog Computing and Networking, Sept 2016

Panelist NSF Edge Workshop, Oct, 2016

TPC Co-Chair Asia-US Forum on Fog Networking for 5G and IoT, 2015

General Co-Chair IEEE SECON Workshop on Fog Networking For 5G and IoT, 2015

Associate Editor IEEE Internet of Things Journal 2013 - Current

Smart Data Pricing

General Co-Chair IEEE INFOCOM Smart Data Pricing Workshop 2017, 2016, 2013

TPC IEEE INFOCOM Smart Data Pricing Workshop 2015, 2014

Guest Editor IEEE Network Magazine special issue on Smart Data Pricing, Aug 2015

Co-Editor Book "Smart Data Pricing", John Wiley & Sons, 2014

Miscellaneous

TPC International Teletraffic Congress (ITC), 2016

Editorial Board IEEE ComSoc Technology News (CTN) 2012 - 2014

Panelist NSF NeTS Small and Medium Panel 2017, 2016, 2015

Reviewer NSF CREST, 2018

TPC IEEE GLOBECOM 2016, 2014, 2013

TPC IEEE SECON 2015

TPC MobileSoft ACM Student Research Competition, 2015

TPC IEEE PIMRC 2014, 2013

TPC WiOPT 2014, 2013, 2012, 2011

TPC IEEE VTC 2014

TPC IEEE IPCCC 2014, 2012

TPC The International Workshop on Smart Complex Engineered Networks (SCENE 2014)

TPC IEEE Workshop on Green Multimedia 2013

TPC IEEE NAS 2012

TPC PFLDNeT 2010

Session Chair CISS 2012, 2010

Panel List Smart Data Pricing Forum, Princeton, July, 2012

Judge Princeton Undergraduate Research Symposium, May, 2011

Membership IEEE Senior member, ACM Member

Reviewer IEEE/ACM Transactions on Networking, IEEE JSAC Networking Challenges in Cloud Computing Systems and Applications 2013, IEEE JSAC SI-NetEcon 2012, IEEE WCNC 2013, Mobile Computing and Communications Review 2013

Adhoc Reviewer IEEE/ACM Transactions on Networking, IEEE Transactions on Mobile Computing, IEEE Transactions on Communications, IEEE Transactions on Multimedia, IEEE Journal on Selected Areas in Communications, Elsevier Computer Networks, Computer Communications, IEEE Communications Letters, ACM Multimedia, IEEE INFOCOM, IEEE ICDCS, IWQoS, PFLDNeT, CISS, WiOPT, IEEE SECON, IEEE Networking, ACC, CDC, ICCCN, IMSA, MILCOM, IJCAS

Campus Service

Departmental Service

- 2018F – 2019S Faculty Search Committee, Computer Science, University of Colorado Boulder
- 2016F – Computing Co-Chair, Computer Science, University of Colorado Boulder
- 2016F – 2017S Faculty Search Committee, Computer Science, University of Colorado Boulder
- 2014F – 2016S Graduate Committee, Computer Science, University of Colorado Boulder
- 2014F – Ph.D. Committee, Interdisciplinary Telecom Program (ITP), University of Colorado Boulder

University Service

- 2016F – Cloud Working Group, University of Colorado Boulder
- 2014F Faculty Student Mentorship Program (FSMP), University of Colorado Boulder

Publications

Internet Drafts

- 11 Injong Rhee, Lisong Xu, **Sangtae Ha**, Alexander Zimmermann, Lars Eggert and Richard Scheffenegger, “[RFC8312] CUBIC for Fast Long-Distance Networks,” DOI: 10.17487/RFC8312, Feb., 2018.

Books

- B1 Soumya Sen, Carlee Joe-Wong, **Sangtae Ha**, Mung Chiang, eds., *Smart Data Pricing*, Wiley & Sons, 536 pages, Sept., 2014 (available at Amazon).

Book Chapters

- BC1 Jaeyoon Chung, Carlee Joe-Wong and **Sangtae Ha**, “Extending the Cloud to Fog: Highly Available Elastic Fog,” to appear in *Fog and Fogonomics: Challenges and Practices of Fog Computing, Networking, Strategy and Economics*, Wiley, 2019.
- BC2 Carlee Joe-Wong, Liang Zheng, **Sangtae Ha**, Soumya Sen, Chee Wei Tan, and Mung Chiang, “Smart Data Pricing in 5G Systems,” *Key Technologies for 5G Wireless Systems*, Cambridge University Press, pp. 478-500, April, 2017.
- BC3 Carlee Joe-Wong, **Sangtae Ha**, Zhenming Liu, Felix Ming Fai Wong, and Mung Chiang, “Mind Your Own Bandwidth,” *Fog for 5G and IoT*, Wiley & Sons, ch. 2, pp. 24–51, April, 2017
- BC4 Soumya Sen, Carlee Joe-Wong, **Sangtae Ha**, and Mung Chiang, “Human Factors in Smart Data Pricing,” in *Smart Data Pricing*, Wiley & Sons, pp. 127-166, Sept., 2014,
- BC5 Soumya Sen, Carlee Joe-Wong, **Sangtae Ha**, and Mung Chiang, “Smart Data Pricing (SDP): Economic Solutions to Network Congestion,” in *SIGCOMM eBook on Recent Advances in Networking*, Volume I, Chapter 5 (54 pages), Aug., 2013.

Journals Published/Accepted

- J1 Christopher Brinton, Swapna Buccapatnam, Liang Zheng, Da Cao, Andrew Lan, Felix Wong, **Sangtae Ha**, Mung Chiang, and Vince Poor, “On the Efficiency of Online Social Learning Networks,” *IEEE/ACM Transactions on Networking*, vol. 25, issue 5, pp. 2076–2089, Oct. 2018.
- J2 Carlee Joe-Wong, Soumya Sen, and **Sangtae Ha**, “Sponsoring Mobile Data: Analyzing the Impact on Internet Stakeholders,” *IEEE/ACM Transactions on Networking*, vol. 26, no. 3, pp. 1179-1192, June 2018.
- J3 Ibrahim Ayad, Youngbin Im, Eric Keller, and **Sangtae Ha**, “A Practical Evaluation of Rate Adaptation Algorithms in HTTP-based Adaptive Streaming,” *Computer Networks*, vol. 133, pp. 90-103, 2018.

- J4 Mung Chiang, **Sangtae Ha**, Chih-Lin I, Fulvio Risso, and Tao Zhang, "Fog Computing and Networking: Part 2 [Guest editorial]," *IEEE Communications Magazine*, vol. 55, no. 8, pp. 13, Aug. 2017.
- J5 Mung Chiang, **Sangtae Ha**, Chih-Lin I, Fulvio Risso, and Tao Zhang, "Clarifying Fog Computing and Networking: 10 Questions and Answers," *IEEE Communications Magazine*, vol. 55, no. 4, pp. 18–20, Apr. 2017.
- J6 Mung Chiang, **Sangtae Ha**, Chih-Lin I, Fulvio Risso, and Tao Zhang, "Fog Computing and Networking: Part 1 [Guest editorial]," *IEEE Communications Magazine*, vol. 55, no. 4, pp. 16–17, Apr. 2017.
- J7 Kyuyong Shin, Carlee Joe-Wong, **Sangtae Ha**, Yung Yi, Injong Rhee and Douglas Reeves, "T-Chain: A General Incentive Scheme for Cooperative Computing," *IEEE/ACM Transactions on Networking*, vol. 25, no. 4, pp. 2122–2137, Aug. 2017.
- J8 Liang Zheng, Carlee Joe-Wong, Chee-Wei Tan, **Sangtae Ha**, and Mung Chiang, "Customized Data Plans for Mobile Users: Feasibility and Benefits of Data Trading," *IEEE JSAC Special Issue on Human-In-The-Loop Mobile Networks*, vol. 35, no. 4, pp. 949–963, Apr. 2017.
- J9 Ioannis Kamitsos, **Sangtae Ha**, Lachlan Andrew, Jasika Bawa, Dana Butnariu, Hongseok Kim, and Mung Chiang "Optimal Sleeping: Models and Experiments for Energy-Delay Tradeoff," *International Journal of Systems Science*, pp. 1–16, May, 2016.
- J10 Youngbin Im, Carlee Joe-Wong, **Sangtae Ha**, Soumya Sen, Taekyoung Kwon and Mung Chiang, "AMUSE: Empowering Users for Cost-Aware Offloading with Throughput-Delay Tradeoffs," *IEEE Transactions on Mobile Computing*, vol. 15, no. 5, pp. 1062–1076, May 2016.
- J11 Matthew Andrews, Mung Chiang, **Sangtae Ha**, Jianwei Huang, and Soumya Sen, "Innovation in Network Pricing [guest editorial]," *IEEE Network*, vol. 30, no. 2, pp. 4–5, Mar. 2016.
- J12 Soumya Sen, Carlee Joe-Wong, **Sangtae Ha**, and Mung Chiang, "Smart Data Pricing: Using Economics to Manage Network Congestion," *Communications of the ACM*, vol. 58, no. 12, pp. 86–93, Dec. 2015.
- J13 Ioannis Kamitsos, Paschalis Tsiaflakis, **Sangtae Ha**, and Mung Chiang, "Stable Sleep Mode Optimization for Energy Efficient DSL Broadband Access," *IEEE Transactions on Communications*, vol. 63, no. 12, pp. 5116–5127, Dec. 2015.
- J14 Jaeyoon Chung, **Sangtae Ha** and James Won-Ki Hong, "A Management Architecture for Client-Defined Cloud Storage Services," *International Journal of Network Management*, vol. 25, no. 6, pp. 435–453, July 2015.
- J15 Carlee Joe-Wong, Ioannis Kamitsos, and **Sangtae Ha**, "Inter-Datacenter Job Routing and Scheduling with Variable Costs and Deadlines," *IEEE Transactions on Smart Grid*, vol. 6, no. 6, pp. 2669–2680, Nov. 2015.
- J16 Christopher Brinton, Ruediger Rill, **Sangtae Ha**, Mung Chiang, Robert Smith and William Ju, "Individualization for Education at Scale: MIIC Design and Preliminary Evaluation," *IEEE Transactions on Learning Technologies*, vol. 8, no. 1, pp. 136–148, Jan. 2015.
- J17 Carlee Joe-Wong, Soumya Sen, and **Sangtae Ha**, "Offering Supplementary Network Technologies: Adoption Behavior and Offloading Benefits," *IEEE/ACM Transactions on Networking*, vol. 23, no. 2, pp. 355–368, Apr. 2015.
- J18 Amitabha Ghosh, **Sangtae Ha**, Edward Crabbe and Jennifer Rexford, "Scalable Multi-Class Traffic Management in Data Center Backbone Networks," *IEEE Journal on Selected Areas in Communications*, vol. 31, no. 12, pp. 2673–2684, Dec. 2013.
- J19 Soumya Sen, Carlee Joe-Wong, **Sangtae Ha**, and Mung Chiang, "A Survey of Smart Data Pricing: Past Proposals, Current Plans, and Future Trends," *ACM Computing Survey*, vol. 46, no. 2, pp. 15:1–15:37, Nov. 2013.
- J20 Soumya Sen, Carlee Joe-Wong, **Sangtae Ha**, and Mung Chiang, "Incentivizing Time-Shifting of Data: A Survey of Time-Dependent Pricing for Internet Access," *IEEE Communications Magazine*, vol. 50, no. 11, pp. 91–99, Nov. 2012.
- J21 Carlee Joe-Wong, Soumya Sen, **Sangtae Ha**, and Mung Chiang, "Optimized Day-Ahead Pricing for

the Smart Grid with Device-Specific Scheduling Flexibility," *IEEE Journal on Selected Areas in Communications: Smart Grid Communications Series*, vol. 30, no. 6, pp. 1075–1085, July 2012.

- J22 Hongseok Kim, **Sangtae Ha**, Mung Chiang, Dae Kyung Kang, and Jin Hee Kim, "Iterative Resource Pooling for Bandwidth Allocation in TDM-PON: Convergence Results and Experimental Evaluation," *IEEE Photonic Network Communications*, vol. 24, no. 2, pp. 138–150, Oct. 2012.
- J23 **Sangtae Ha** and Injong Rhee, "Taming the Elephants: New TCP Slow Start," *Elsevier Computer Networks*, vol. 55, no. 9, pp. 2092–2110, 2011.
- J24 Han Cai, Do Young Eun, **Sangtae Ha**, Injong Rhee, and Lisong Xu, "Stochastic Convex Ordering for Multiplicative Decrease Internet Congestion Control," *Elsevier Computer Networks*, vol. 53, no. 3, pp. 365–381, 2009.
- J25 **Sangtae Ha**, Injong Rhee, and Lisong Xu, "CUBIC: A New TCP-Friendly High-Speed TCP Variant," *ACM SIGOPS Operating Systems Review*, vol. 42, no. 5, pp. 64–74, 2008.
- J26 **Sangtae Ha**, Long Le, Injong Rhee, and Lisong Xu, "Impact of Background Traffic on Performance of High-Speed TCP Variant Protocols," *Elsevier Computer Networks*, vol. 15, no. 4, pp. 852–865, 2007.

Conferences Published/Accepted

- C1 Youngbin Im, Parisa Rahimzadeh, Brett Shouse, Shinik Park, Carlee Joe-Wong, Kyunghan Lee and Sangtae Ha, "I Sent It: Where Does Slow Data Go to Wait?," *EuroSys 2019* (21.7% acceptance rate).
- C2 Shinik Park, Jinsung Lee, Junseon Kim, Jihoon Lee, **Sangtae Ha**, and Kyunghan Lee, "ExLL: An Extremely Low-Latency Congestion Control for Mobile Cellular Networks," *ACM CoNEXT*, Heraklion/Crete, Greece, 2018 (17.3% acceptance rate).
- C3 Youngbin Im, Prasanth Prahaldan, Tae Hwan Kim, Yong Geun Hong, and **Sangtae Ha**, "SNN-Cache: A Practical Machine Learning-based Caching System Utilizing the Inter-relationships of Requests," *CISS 2018*, Princeton, NJ, 2018.
- C4 Gueyoung Jung, Parisa Rahimzadeh, Zhang Liu, **Sangtae Ha**, Kaustubh Joshi, and Matti Hiltunen, "Virtual Redundancy for Active-Standby Cloud Applications," *IEEE INFOCOM 2018* (19.2% acceptance rate).
- C5 Taeyeol Jeong, Jaeyoon Chung, James Won-Ki Hong, and **Sangtae Ha**, "Towards a distributed computing model for fog," *Fog World Congress*, Santa Clara, CA, Oct 30 - Nov 1, 2017.
- C6 Jincao Zhu, Youngbin Im, Shivakant Mishra, and **Sangtae Ha**, "Calibrating Time-variant, Device-specific Phase Noise for COTS WiFi Devices," *ACM Sensys*, 2017 (17.4% acceptance rate).
- C7 Youngbin Im, Ji Hoon Lee, Jinyoung Han, Yoon Kwon, Carlee Joe-Wong, Ted "Taekyoung" Kwon, and **Sangtae Ha**, "FLARE: Coordinated Rate Adaptation for HTTP Adaptive Streaming in Cellular Networks," in *IEEE ICDCS*, pp. 298–307, June 2017 (16.94% acceptance rate).
- C8 Parisa Rahimzadeh, Carlee Joe-Wong, Kyuyong Shin, Youngbin Im, Jongdeog Lee and **Sangtae Ha**, "SVC-TChain: Incentivizing Good Behavior in Layered P2P Video Streaming," *IEEE INFOCOM*, 2017 (20.93% acceptance rate).
- C9 Carlee Joe-Wong, Youngbin Im, Kyuyong Shin, and **Sangtae Ha**, "A Performance Analysis of Incentive Mechanisms for Cooperative Computing," in *IEEE ICDCS*, pp. 108-117, June 2016 (17.6% acceptance rate).
- C10 Liang Zheng, Carlee Joe-Wong, Christopher Brinton, Cheewei Tan, **Sangtae Ha**, and Mung Chiang, "Viability of Virtual Cloud Providers," in *Proceedings of the ACM SIGMETRICS*, pp. 235–248, 2016 (13.46% acceptance rate).
- C11 Felix Ming Fai Wong, Carlee Joe-Wong, **Sangtae Ha**, Zhenming Liu, and Mung Chiang, "Improving User QoE for Residential Broadband: Adaptive Traffic Management at the Network Edge," in *IEEE/ACM IWQoS*, pp. 105–114, June 2015 (22.5% acceptance rate).
- C12 Kyuyong Shin, Carlee Joe-Wong, **Sangtae Ha**, Yung Yi, Injong Rhee and Douglas Reeves, "T-Chain: A General Incentive Scheme for Cooperative Computing," in *IEEE ICDCS*, pp. 163–174, June 2015

- (12.89% acceptance rate).
- C13 Jaeyoon Chung, Carlee Joe-Wong, **Sangtae Ha**, James Won-Ki Hong, and Mung Chiang, "CYRUS: Towards Client-Defined Cloud Storage," in *Proceedings of the ACM EuroSys*, pp. 17:1–17:16, 2015 (21.33% acceptance rate)
- C14 Carlee Joe-Wong, **Sangtae Ha**, and Mung Chiang, "Sponsoring Mobile Data: An Economic Analysis of the Impact on Users and Content Providers," in *Proceedings of the IEEE INFOCOM*, pp. 1499–1507, Apr. 2015 (19% acceptance rate).
- C15 Liang Zheng, Carlee Joe-Wong, Chee-Wei Tan, **Sangtae Ha**, and Mung Chiang, "Secondary Markets for Mobile Data: Feasibility and Benefits of Traded Data Plans," in *Proceedings of the IEEE INFOCOM*, pp. 1580–1588, 2015 (19% acceptance rate).
- C16 Carlee Joe-Wong, Soumya Sen, and **Sangtae Ha**, "Do Mobile Data Plans Affect Usage? Results from a Pricing Trial with ISP Customers," *Passive and Active Measurement Conference*, pp. 96–108, 2015 (27% acceptance rate).
- C17 Carlee Joe-Wong, Soumya Sen, and **Sangtae Ha**, "Offering Supplementary Wireless Technologies: Adoption Behavior and Offloading Benefits," in *Proceedings of the IEEE INFOCOM*, pp. 1061–1069, Apr. 2013 (17.4% acceptance rate).
- C18 Youngbin Im, Carlee Joe-Wong, **Sangtae Ha**, Soumya Sen, Ted "Taekyoung" Kwon and Mung Chiang, "AMUSE: Empowering Users for Cost-Aware Offloading with Throughput-Delay Tradeoffs," in *Proceedings of the IEEE INFOCOM (mini conference)*, pp. 435–439, 2013 (17.4% acceptance rate).
- C19 Soumya Sen, Carlee Joe-Wong, **Sangtae Ha**, Jasika Bawa and Mung Chiang, "When the Price is Right: Enabling Time-Dependent Pricing of Broadband Data," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, pp. 2477–2486, 2013 (20% acceptance rate).
- C20 **Sangtae Ha**, Soumya Sen, Carlee Joe-Wong, Youngbin Im and Mung Chiang, "TUBE: Time-Dependent Pricing for Mobile Data," in *Proceedings of the ACM SIGCOMM*, pp. 247–258, Helsinki, Finland, 2012 (13% acceptance rate).
- C21 **Sangtae Ha**, Carlee Joe-Wong, Soumya Sen, and Mung Chiang, "Pricing by Timing: Innovating Broadband Data Plans", *SPIE OPTO*, San Francisco, CA, 2012.
- C22 Ioannis Kamitsos, Paschalis Tsiaflakis, Ken Kerpez, **Sangtae Ha**, and Mung Chiang, "Energy Efficient DSL via Heterogeneous Sleeping States: Optimization Structures and Operation Guidelines," in *Proceedings of the IEEE GLOBECOM*, pp. 3128–3134, 2012 (37.7% acceptance rate).
- C23 Joe Wenjie Jiang, Tian Lan, **Sangtae Ha**, Minghua Chen, and Mung Chiang "Joint VM Placement and Routing for Data Center Traffic Engineering," in *Proceedings of the IEEE INFOCOM (mini conference)*, pp. 2876–2880, Orlando, Florida, 2012 (18% acceptance rate).
- C24 Ioannis Kamitsos, Lachlan Andrew, Hongseok Kim, **Sangtae Ha**, and Mung Chiang "Better Energy-Delay Tradeoff via Server Resource Pooling," in *ICNC GCNC (invited)*, pp. 611–616, Jan. 2012.
- C25 Ioannis Kamitsos, Paschalis Tsiaflakis, **Sangtae Ha**, and Mung Chiang, "Stable Sleeping in DSL Broadband Access: Feasibility and Tradeoffs," in *IEEE GLOBECOM*, Dec. 2011 (36.6% acceptance rate).
- C26 Carlee Joe-Wong, **Sangtae Ha**, and Mung Chiang, "Time-Dependent Broadband Pricing: Feasibility and Benefits", in *IEEE ICDCS*, pp. 288–298, June 2011(15.4% acceptance rate).
- C27 Mung Chiang, Prashanth Hande, Hongseok Kim, **Sangtae Ha**, and Robert Calderbank, "Pricing Broadband: Survey and Open Problems," in *International Conference on Ubiquitous and Future Networks*, pp. 303–308, June 2010.
- C28 Ajit Warrier, Sankar Janakiraman, **Sangtae Ha**, and Injong Rhee, "DiffQ: Practical Differential Backlog Congestion Control for Wireless Networks," in *Proceedings of the IEEE INFOCOM*, pp. 262–270, Rio de Janeiro, Brazil, Apr. 2009 (19.65% acceptance rate).
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- WS2 Soumya Sen, Carlee Joe-Wong, **Sangtae Ha** and Mung Chiang, "Time-Dependent Pricing in Mobile Data Plans: Results from a Field Deployment in Alaska," *Workshop on Information Technology and Systems*, 2016.
- WS3 Seungwon Kim, Gun Lee, **Sangtae Ha**, Nobuchika Sakata and Mark Billingham, "Automatically Freezing Live Video for Annotation during Video Conferencing," *Work In Progress, ACM CHI*, 2015.
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- WS5 Soumya Sen, Carlee Joe-Wong and **Sangtae Ha**, "The Economics of Shared Data Plans," *Workshop on Information Technology and Systems (in conjunction with ICIS)*, 2012.
- WS6 Yaogong Wang, Injong Rhee, and **Sangtae Ha**, "Augment SCTP Multi-Streaming with Pluggable Scheduling," *INFOCOM Workshops (Global Internet)*, 2011.
- WS7 Carlee Joe-Wong, **Sangtae Ha**, and Mung Chiang, "Time-Dependent Internet Pricing," *Information Theory and Applications Workshop*, UCSD, Feb., 2011.
- WS8 **Sangtae Ha** and Injong Rhee, "Hybrid Slow Start for High-Bandwidth and Long-Distance Networks," *PFLDNeT*, Manchester, UK, 2008.
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- D2 **Sangtae Ha**, Soumya Sen, Carlee Joe-Wong, and Mung Chiang, "DataMi," *NYC Media Lab Research Summit*, Sept., 2012.
- D3 **Sangtae Ha**, Soumya Sen, Carlee Joe-Wong, Rudiger Rill and Mung Chiang, "Demo: A System for Time-Dependent Pricing," *ACM Mobisys*, Low Wood Bay, UK, 2012.
- D4 **Sangtae Ha**, Soumya Sen, Carlee Joe-Wong, Justin Mifkovich, Rudiger Rill, Youngbin Im, Dana Butnariu, Jasika Bawa and Mung Chiang, "Demo: Pricing by Timing of Mobile Data," *IEEE INFOCOM 2012*.
- D5 **Sangtae Ha**, Carlee Joe-Wong, Soumya Sen and Mung Chiang, "TUBE: Pricing by Timing," *Poster, Celebrate Princeton Invention*, Chancellor Green, Princeton, Dec., 2011.
- D6 **Sangtae Ha** and Soumya Sen, "Princeton TUBE trials: Discussions with US ISPs," *Demo and Poster, NECA (National Exchange Carrier Association) EXPO*, Chicago, Sept., 2011.
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- PP9 Mung Chiang, Carlee Joe-Wong, **Sangtae Ha** and Soumya Sen, System and Methods for Time Dependent Internet Pricing, U.S. Patent Application #13/780941, filed Feb. 2013.
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- ST1 Ioannis Kamitsos, Paschalis Tsiaflakis, Ken Kerpez, **Sangtae Ha**, and Mung Chiang, "G.adsl: Stable Sleep Mode Optimization for Energy Efficient DSL," *ATIS COAST-NAI contribution COAST-NAI-2012-019*, Aug. 22, 2012.
- ST2 Ken Kerpez, Ioannis Kamitsos, Paschalis Tsiaflakis, **Sangtae Ha**, and Mung Chiang, "G.adsl: Proposal to Enable Optimal Sleeping," *ATIS COAST-NAI contribution COAST-NAI-2012-020R1*, Aug. 22, 2012.
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- ST6 Ken Kerpez, Ioannis Kamitsos, Paschalis Tsiaflakis, **Sangtae Ha**, and Mung Chiang, "G.adsl Stable Sleep Mode Optimization for Energy Efficient DSL: Proposal," *ITU-T contribution T09-SG15-C-2057*, 10-21 Sept., 2012.

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- M1 **Sangtae Ha** and Hyunjoon Cha, "Design and Implementation of Embedded Linux," *Programmer's World*, issue 3-1, April, 2001.
- M2 **Sangtae Ha** and Hyunjoon Cha, "Embedded Linux for Network Devices," *Linux@Works*, Nov., 2001.
- M3 **Sangtae Ha** and Hyunjoon Cha, "Compare Embedded Linux with Other Real-Time Operating Systems," *Linux@Works*, Oct., 2001.

Presentations

- PT1 Research Challenges in Fog Networking, *NSF WiFiUS Meeting*, Helsinki, Finland, Aug., 2016.
- PT2 T-Chain: A General Incentive Scheme for Cooperative Computing, *IEEE ICDCS*, Columbus, Ohio, Jun., 2015.
- PT3 TUBE: Time Dependent Pricing for Mobile Data, *ACM SIGCOMM*, Helsinki, Finland, Aug., 2012.

- PT4 Pricing Broadband Access, *ICUFN*, Jeju, Korea, June, 2010.
 PT5 Hybrid Slow Start for High-Bandwidth and Long-Distance Networks, *PFLDNeT*, UK, Mar., 2008
 PT6 Stochastic Ordering for Internet Congestion Control, *PFLDNeT*, ISI, Marina Del Rey, Feb., 2007

Invited Seminars/Lectures

- T1 Combating Internet Latency in the Age of Fog and Cloud Computing, *Invited Talk*, *UNIST*, Ulsan, Korea, Dec. 14, 2018.
 T2 Bridging Theory and Practice: Towards More Accurate Wireless Sensing for Neural Devices, *Invited Talk*, *KAIST*, Daejeon, Korea, Aug. 6, 2018.
 T3 Bridging Theory and Practice: Towards More Accurate Wireless Sensing, *Computer Science Colloquium*, *Colorado School of Mines*, Golden, Colorado, Nov. 16, 2017.
 T4 Linux CUBIC: From Idea to Actual Deployment, *Invited Speaker*, *Samsung Research America*, Richardson, Texas, Nov. 3, 2017.
 T5 Bridging Theory and Practice: Towards More Accurate Wireless Sensing, *Computer Science Colloquium*, *POSTECH*, Pohang, Korea, Oct. 20, 2017.
 T6 Calibrating Time-variant, Device-specific Phase Noise for COTS WiFi Devices, *Invited Speaker*, *The 8th International Conference on ICT Convergence (ICTC)*, Oct. 19, 2017.
 T7 Bridging Theory and Practice: Towards More Accurate Wireless Sensing, *Invited Speaker*, *ETRI Seminar*, Oct. 17, 2017.
 T8 Combating Internet Latency in the Age of Fog and Cloud Computing, *Invited Speaker*, *Samsung Electronics*, Suwon, Korea, Oct. 16, 2017.
 T9 Bridging Theory and Practice: Towards More Accurate Wireless Sensing, *Invited Speaker*, *Hanyang University (ERICA)*, Korea, Oct. 16, 2017.
 T10 Combating Internet Latency in the Age of Fog and Cloud Computing, *Computer Science Colloquium*, *University of Colorado Boulder*, Sep. 28, 2017.
 T11 Fog Networking for IoT: Empowering End-User Devices, *Distinguished Speaker*, *ETRI Seminar*, Daejeon, Korea, Feb., 2016.
 T12 T-Chain: A General Incentive Scheme for Cooperative Computing, *Distinguished Speaker*, *ETRI Seminar*, Daejeon, Korea, Feb., 2016.
 T13 Fog Networking for IoT: Empowering End-User Devices, *Distinguished Speaker*, *IoT World Forum Research and Innovation Forum*, Hosted by Cisco, Dubai, Dec., 2015.
 T14 Fog Networking: Architecture, Algorithms, and Applications, *Invited Speaker*, *Asia-US Forum on Fog Networking for 5G and IoT 2015*, Taipei, Taiwan, Sep., 2015.
 T15 Challenges in Internet of Things, *IEEE SECON Workshop on Fog Networking for 5G and IoT*, Seattle, Washington, Jun., 2015.
 T16 CYRUS: Towards Client-Defined Cloud Storage, *ETRI Invited Seminar*, Daejeon, Korea, Apr., 2015.
 T17 Improving TCP Congestion Control for High Bandwidth and Long Distance Networks, *ITP Seminar*, University of Colorado Boulder, Nov., 2014.
 T18 Smart Data Pricing: From Theory to Practical Deployment, *Computer Science Seminar Talk*, University of Colorado Boulder, May, 2014.
 T19 CUBIC: Algorithm to Practical Deployment, *IT Convergence Division*, *POSTECH*, Korea, Dec., 2012.
 T20 CUBIC: Algorithm to Practical Deployment, *Guest Lecturer*, *ELE 381*, Princeton University, Nov., 2012.
 T21 TUBE: Time Dependent Pricing for Mobile Data - From Economic Theory to Trial Deployment, *Invited Speaker*, Industry (Samsung, ETRI, Korea Telecom), Korea, Dec., 2012.
 T22 TUBE: Time Dependent Pricing for Mobile Data - From Economic Theory to Trial Deployment, *Department Seminar*, Academia (SNU, KAIST, POSTECH, UNIST, Sogang, KHU), Korea, Dec., 2012.
 T23 Better Energy-Delay Tradeoff via Server Resource Pooling, *Invited Speaker*, *ICNC*, Hawaii, Feb., 2012.
 T24 TUBE – Pricing (Mobile Data) by Timing, *CTIF/Aalborg University Meeting*, Princeton Univ., April,

2011

T25 TUBE – Pricing (Mobile Data) by Timing, *Princeton EDGE Lab Open House*, Princeton Univ., April, 2011

T26 TUBE – Pricing (Mobile Data) by Timing, *Guest Lecture*, Princeton University, March, 2011

T27 TUBE – Pricing (Mobile Data) by Timing, *Vodafone Wireless Innovation Competition*, March, 2011

T28 Research Vision on Video-Aware Wireless Networks, *Intel VAWN Workshop*, CA, Apr., 2010.

T29 Improving TCP Congestion Control for High Bandwidth and Long Distance Networks, *Invited Talk*, Electrical Engineering, Princeton University, Oct., 2009

Outreach Seminars/Lectures

O1 Computer Science As Your Career, *Korean Presbyterian Church of Denver (KPCD)*, Arvada, Colorado, Oct. 29, 2017.