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Fields of Research Interest

- General research areas are computer systems and software, operating systems, computer architecture, embedded systems, high performance computing and cloud computing.
- Research interests include operating systems, memory systems, file systems, I/O, virtualization, performance modeling, analysis and tuning, scheduling, data processing and management, application tools development, parallel processing, and power and thermal management.

Education

- **PhD - Computer Science and Engineering** 2004-2009
Dissertation: Design Challenges for Enterprise Class Storage Systems Employing Hard Drives and NAND Flash based Solid-state Drives
Advisor – Anand Sivasubramaniam (co-advisor: Bhuvan Urgaonkar)
Pennsylvania State University, University Park, PA, USA
- **MS - Computer Science** 2001-2003
Dissertation: Performance Enhancement of Fault-Tolerant Software Distributed Shared Memory Systems (DSM) with Message Logging
Advisor: Seungryoul Maeng
Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Republic of Korea
- **Bachelor of Engineering (hons.) – Computer Science and Engineering** 1995-2001
College of Engineering, Sogang University, Seoul, Republic of Korea

Work Experience

- R&D Associate Staff Member (I/O Systems Computational Scientist), National Center for Computational Sciences, US Department of Energy's Oak Ridge National Laboratory, Oak Ridge, TN, USA, 09/14/09-onwards.
- Adjunct Professor, School of Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, GA, USA, 10/01/11-onwards (appointed by 09/30/14).
- Research Engineer, Embedded Operating Systems (OS) Team, Embedded Software Center, Electronics and Telecommunications Research Institute (ETRI), Daejeon, Republic of Korea, 08/03-07/04.
- Research Assistant/Teaching Assistant, Department of Computer Science and Engineering, Pennsylvania State University, University Park, PA, USA, 08/04-08/09.
- Research Assistant/Teaching Assistant, Department of Computer Science, KAIST, Daejeon, Republic of Korea, 09/01-07/03.

Honors, Awards, and Scholarships

- Nominated for the best paper award in ISPASS-2011.
- Nominated for the best paper award in HPCA-2007.
- Harry G. Miller Fellowship, Pennsylvania State University. (Award for Fall '06 to Spring '07.)
- College of Engineering Fellowship, Pennsylvania State University. (Awarded for Fall '05 to Spring '06.)
- Fred A. and Susan Breidenbach Graduate Fellowship, Penn State University. (Awarded for Fall '04 to Spring '05.)
- Korean Government IT Scholarship, Ministry of Information and Communication. (Awarded for Fall '04 to Spring '06.) -- 45 students selected nationwide.
- Student Travel Grants, ASPLOS '09, WISH '09, and HPCA '06.
- Korea National Full Scholarship, KAIST. (Awarded for Fall '01 to Spring '03.)
- Undergraduate graduation honors (Magna cum laude), Sogang University, August 2001.
- Honors Scholarship (AAA), Sogang University. (Awarded for Fall '99 and Fall '00.) -- 1-2 recipients awarded among the entire department.
- Honors Scholarship (AA), Sogang University. (Awarded for Spring '95, Fall '95, Spring '00, and Spring '01.)

Publications: Book Chapters

1. Y. Kim, S. Gurumurthi, and A. Sivasubramaniam, Dynamic Thermal Management for High-Performance Storage Systems. Handbook of Energy-Aware Green Computing edited by Ishfaq Ahmad and Sanjay Rank. ISBN: 978-143-985-040-4, Publisher: Chapman and Hall/CRC Press Taylor and Francis Group LLC, January 2012. (Extends the JEP'08 and HPCA'06.)

Publications: Refereed Journal Articles

(Submitted and Currently in Review)

1. Y. Kim, A. Gupta, B. Urgaonkar, A Temporal Locality-aware Page-Mapped Flash Translation Layer. Submitted to ACM Transactions on Embedded Computing Systems (ACM TECS)
 - 1st submission for review made on Dec. 2011.
2. J. Lee, Y. Kim, G. Shipman, S. Oral, J. Kim, Preemptive I/O Scheduling of Garbage Collection for Solid-state Drives. Submitted to IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (IEEE TCAD) for review on February 2012. (*Dr. Kim is a corresponding author.*)
 - 1st submission for review made on Feb. 2012.

(In Revision)

3. Y. Kim, J. Lee, S. Oral, G. Shipman, D. Dillow, F. Wang, Coordinating Garbage Collection for Arrays of Solid-state Drives. Revision recommended for a second round of reviews in IEEE Transactions on Computers (IEEE TC).
 - 1st submission for review made on Feb. 2012. Decision made on May 6th 2012 (*recommended revision for a second round of reviews*). Authors are currently revising the paper according to reviewers' comments.
4. M. Jeon, Y. Kim, J. Hwang, E. Seo, Workload Characterization and Performance Implications of Large-Scale Blog Servers. Accepted in minor revision in ACM Transactions on the Web (TWEB) on Feb. 2012.
 - 1st submission for review made on Oct. 2011. Decision made on Feb. 9th 2012 (*accepted in minor revision*). Authors are improving the manuscript according to reviewers' comments.

(Published)

5. S.-Y. Park, Y. Kim, J. Lee, B. Urgaonkar, E. Seo, A Comprehensive Study of Energy-Efficient Flash-based Storage System. In Elsevier Journal of Systems (JSA 2011), Volume 57, Issue 4, April 2011, Pages 354-365.
 - 12th rank in the top 25 most downloaded articles for 2011 from Elsevier's Sciverse Sciencedirect

6. Y. Kim, J. Choi, S. Gurumurthi, A. Sivasubramaniam, Managing Thermal Emergencies in Disk-Based Storage Systems. In ASME Transactions on Electronic Packaging (ASME JEP 2008), Volume 130, Issue 4, and December 2008.
7. J. Choi, Y. Kim, A. Sivasubramaniam, J. Srebric, Q. Wang, J. Lee, CFD-based Tool for Studying Temperature in Rack-mounted Servers. In IEEE Transactions on Computers (IEEE TC 2008), Volume 57, Issue 8, Pages 1129-1142, August 2008.
8. S. Gurumurthi, Y. Kim, A. Sivasubramaniam, Using STEAM for Thermal Simulation of Storage Systems. In IEEE Micro Special Issue on Computer Architecture Simulation and Modeling (IEEE MICRO 2006), Vol. 26, No. 4, PP. 43-51, July/August 2006.

Publications: Refereed Conference and Workshop Papers

1. S.-H. Lim, J.-S. Huh, Y. Kim, G. Shipman C. Das, D-Factor: A Quantitative Model of Application Slow-Down in Shared Service Systems with Multiple Resources. In Proceedings of the ACM International Conference on Measurement and Modeling of Computer Systems (SIGMETRICS 2012), London, United Kingdom, June 2012.
 - **Acceptance rate: 15.2%** (31 accepted out of 203 submissions)
2. C. Wang, S. Vazhkudai, X. Ma, F. Meng, Y. Kim, C. Engelmann, NVMalloc: Exposing an Aggregate SSD Store as a Memory Partition in Extreme-Scale Machines. In Proceedings of the 26th IEEE International Parallel and Distributed Processing Symposium (IPDPS 2012), Shanghai, China, May 2012.
 - **Acceptance rate: 20.7%** (118 accepted out of 569 submissions)
3. G. Shipman, D. Dillow, S. Oral, Y. Kim, D. Fuller, J. Simmons, J. Hill, A Next-Generation Parallel File System Environment for the OLCF. In Proceedings of the Cray User Conference (CUG 2012), Stuttgart, Germany, May 2012.
4. S. Boboila, Y. Kim, S. Vazhkudai, P. Desnoyers, G. Shipman, Active Flash: Out-of-core Data Analytics on Flash Storage. In Proceedings of the 28th IEEE Symposium on Massive Storage Systems and Technologies (MSST 2012), Pages 1-12, Monterey, California, April 2012.
 - **Acceptance rate: 24.5%** (14 accepted out of 57 submissions)
 - Mr. Boboila was a summer intern at ORNL during the summer of 2011. Dr. Kim was her technical mentor.
5. J. Lee, Y. Kim, S. Oral, G. Shipman, D. Dillow, F. Wang, Comparing Coordinated Garbage Collection Algorithms for Arrays of Solid-state Drives. In Proceedings of the 3rd Non-Volatile Memories Workshop (NVMW 2012), San Diego, CA, March 2012.
 - **Acceptance rate: 55.0%** (33 accepted out of 60 submissions)
 - Mr. Lee was a summer intern at ORNL during the summer of 2011. Dr. Kim was his technical mentor.
6. S. Boboila, Y. Kim, S. Vazhkudai, P. Desnoyers, G. Shipman, Performance-Energy Tradeoffs for Out-of-Core Processing on Non-Volatile Memory Devices. Poster in the 3rd Annual Non-Volatile Memories Workshop (NMW 2012), San Diego, CA, March 2012.
 - **Acceptance rate: 55.0%** (33 accepted out of 60 submissions)
 - Mr. Boboila was a summer intern at ORNL during the summer of 2011. Dr. Kim was her technical mentor.
7. D. Dillow, G. Shipman, S. Oral, Z. Zhang, Y. Kim, Enhancing I/O Throughput via Efficient Routing and Placement for Large-scale Parallel File Systems. In Proceedings of the 30th IEEE International Performance Computing and Communications Conference (IPCCC 2011), Pages 1-9, Orlando, FL, November 2011.
 - **Acceptance rate: 27.9%** (36 accepted out of 129 submissions)
8. S.-H. Lim, J.-S. Huh, Y. Kim, C. Das, Migration, Assignment, and Scheduling of Jobs in Virtualized Environment. In Proceedings of the 3rd USENIX Workshop on Hot Topics in Cloud Computing (HOTCLOUD 2011), Portland, OR, June 2011.

- **Acceptance rate: 31.9%** (23 accepted out of 72 submissions)
9. Y. Kim, A. Gupta, B. Urgaonkar, P. Berman, A. Sivasubramaniam, HybridStore: A Cost-Efficient, High-Performance Storage System Combining SSDs and HDDs. In Proceedings of the 19th IEEE International Symposium on Modeling, Analysis and Simulation of Computer and Telecommunication Systems (MASCOTS 2011), Pages 227-236, Singapore, July 2011.
 - **Acceptance rate: 26.1%** (41 accepted out of 157 submissions)
 10. Y. Kim, S. Oral, G. Shipman, J. Lee, D. Dillow, F. Wang, Harmonia: A Globally Coordinated Garbage Collector for Arrays of Solid-state Drives. In Proceedings of the 27th IEEE Symposium on Massive Storage Systems and Technologies (MSST 2011), Pages 1-12, Denver, Colorado, May 2011.
 - **Acceptance rate: 23.8%** (15 accepted out of 63 submissions)
 - The same idea of this paper has been filed for U.S. Patent Application 61,370,908 on August 5, 2010.
 - i. Provisional Acceptance on September 2010.
 - ii. Full application filed in the USPTO on January 28, 2011.
 11. R. Prabhakar, S. Vazhkudai, Y. Kim, A. Butt, M. Li, M. Kandemir, Provisioning a Multi-Tiered Data Staging Area for Extreme-Scale Machines. In Proceedings of the 31st International Conference on Distributed Computing Systems (ICDCS 2011), Pages 1-12, Minneapolis, MN, June 2011.
 - **Acceptance rate: 15.4%** (87 accepted out of 565 submissions)
 - Ms. Prabhakar was a summer intern at ORNL during the summer of 2010. Dr. Kim was her technical mentor.
 12. J. Lee, Y. Kim, G. Shipman, S. Oral, F. Wang, J. Kim, A Semi-Preemptive Garbage Collector for Solid State Drives. In Proceedings of the Eleventh IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS 2011), Pages 12-21, Austin, TX, April 2011.
 - **Nominated for the best paper award** (6.3%, 4 nominated out of 64 submissions.)
 - Mr. Lee was a summer intern during the summer of 2010. Dr. Kim was his technical mentor. This project was started when she was at ORNL.
 13. Y. Kim, J. Lee, G. Shipman, Pathological Behavior of SSDs and Application in HPC Storage. In Proceedings of the Second Annual Non-Volatile Memories Workshop (NVMW 2011), San Diego, CA, March 2011.
 - **Acceptance rate: 51.0%** (32 talks selected out of 63 submissions)
 14. Y. Kim, R. Gunasekaran, G. Shipman, D. Dillow, Z. Zhang, B. Settlemeyer, Workload Characterization of a Leadership Class Storage. In Proceedings of the 5th Petascale Data Storage Workshop (PDSW 2010), New Orleans, LA, November 2010.
 15. M. Li, S. Vazhkudai, A. Butt, F. Meng, X. Ma, Y. Kim, C. Engelmann, G. Shipman, Functional Partitioning to Optimize End-to-End Performance on Many-Core Architectures. In Proceedings of the ACM/IEEE Supercomputing Conference (SC 2010), Pages 1-12, New Orleans, LA, November 2010.
 - **Acceptance rate: 20.1%** (51 out of 253 submissions)
 16. M. Jeon, J. Hwang, Y. Kim, J.-W. Jang, J. Lee, E. Seo, Measurement, Modeling, and Analysis of a Large-scale Blog Server Workload. In Proceedings of the IEEE International Symposium on Social Computing Applications (SCA 2010), Pages 558-563, Minneapolis, MN, August 2010.
 - **Invited paper, only 15% selected from SocialCom-10 submissions**
 17. A. Gupta, Y. Kim, and B. Urgaonkar, DFTL: A Flash Translation Layer Employing Demand-based Selective Caching of Page-level Address Mapping. In Proceedings of the 14th International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS 2009), Pages 229-240, Washington DC, March 2009.
 - **Acceptance rate: 25.6%** (29 out of 113 submissions)

18. Y. Kim, B. Tauras, A. Gupta, B. Urgaonkar, FlashSim: A Simulator for NAND Flash-based Solid-State Drives. In Proceedings of the 1st International Conference on Advances in System Simulation (SIMUL 2009), Pages 125-131, Porto, Portugal, September 2009.
 - **Acceptance rate: 31.0%**
19. Y. Kim, J. Choi, S. Gurumurthi, A. Sivasubramaniam, Graceful Operation of Disk Drives under Thermal Emergencies. In Proceedings of the 1st International Conference on Thermal Issues in Emerging Technologies Theory and Application (THETA 2007), Cairo, Egypt, January 2007.
 - **Invited for Journal Publication in ASME Transactions on Electronic Packaging**
20. J. Choi, Y. Kim, A. Sivasubramaniam, J. Srebric, Q. Wang, J. Lee, Modeling and Managing Thermal Profiles of Rack-mounted Servers with ThermoStat. In Proceedings of the 13th IEEE International Symposium on High Performance Computer Architecture (HPCA 2007), Pages 205-214, Phoenix, Arizona, February 2007.
 - **Acceptance rate: 16.1% (28 out of 174 submissions)**
 - **Nominated for the best paper award**
21. Y. Kim, S. Gurumurthi, A. Sivasubramaniam, Understanding the Performance-Temperature Interactions in Disk I/O of Server Workloads. In Proceedings of the 12th IEEE International Symposium on High Performance Computer Architecture (HPCA 2006), Pages 176-186, Austin, Texas, February 2006.
 - **Acceptance rate: 15.1% (26 out of 172 submissions)**
22. Y. Kim, S. Park, S. Maeng, Practical Schemes Using Logs for Lightweight Recoverable DSM. In Proceedings of the IASTED International Conference on Parallel and Distributed Computing and Systems (PDCS 2003), Marina del Rey, CA, November 2003.
 - Extends MS thesis
23. S. Park, Y. Kim, S. Maeng, Lightweight Logging and Recovery for Distributed Shared Memory over Virtual Interface Architecture. In Proceedings of the Second International Symposium on Parallel and Distributed Computing (ISPDC 2003), Pages 199-206, Ljubljana, Slovenia, October 2003.

U.S. Patents

1. Coordinated Garbage Collection for RAID Array of Solid State Disks.
Inventors (*Alphabetic order*): D. Dillow, Y. Kim, S. Oral, G. Shipman, and F. Wang
 - U.S. Patent Application 61,370,908, filed August 5, 2010; Provisional Acceptance on September 2010; Full application filed in the USPTO on January 28, 2011.
 - Technical paper of this patent has been published in IEEE MSST 2011.

Technical Reports: Unpublished Manuscripts

1. Z. Zhang, Y. Kim, X. Ma, G. Shipman, Y. Zhou, Multi-level Hybrid Cache: Impact and Feasibility. Technical Report, ORNL/TM-2010/297, National Center for Computational Sciences, Oak Ridge National Laboratory, (ORNL TR '10), February 2012.
2. Y. Kim, S. Oral, D. Dillow, F. Wang, D. Fuller, S. Poole, G. Shipman, An Empirical Study of Redundant Array of Independent Solid-State Drives (RAIS). Technical Report, ORNL/TM-2010/61, National Center for Computational Sciences, Oak Ridge National Laboratory, (ORN TR '10), March 2010. (12 pages)

Referred Korean Journal and Conference Publications

1. S. Park, Y. Kim, S. Maeng, Implementation of Fault Tolerant Software Distributed Shared Memory with Remote Logging. In Journal of Korea Information Science Society: Computer Systems and Theory, Vol. 31, No. 5, 2004.
2. Y. Kim, S. Park, S. Maeng, Enhancing the Performance of Fault-Tolerant Software Distributed Shared Memory. In Proceedings of the 30th Korea Information Science Society, April 2003.
3. S. Park, Y. Kim, S. Maeng, Remote Logging for Fault-Tolerant Software Distributed Shard Memory. In Proceedings of the 30th Korea Information Science Society, April 2003.
4. S. Park, Y. Kim, S.-K. Lee, S. Maeng, Design and Implementation of Software Distributed Shared Memory System based on VIA (Virtual Interface Architecture). In Proceedings of the 29th Korea Information Science Society, April 2002.

Selected Talks

1. Towards Hybrid Data Storage Systems for Extreme-Scale Machines.
 - University of Pittsburg, Dept. of Computer Science Departmental Colloquium, September 20, 2011.
 - UNIST (Ulsan National Institute of Science and Technology), Research Seminar, November 1, 2011.
2. SSD and Application in HPC.
 - Georgia Institute of Technology, Graduate Class and Lecture, March 2011.
3. Design Challenges on HPC Storage Cluster using SSDs.
 - Seoul National University, Dept. of Computer Science and Engr., Departmental Colloquium, July 2011.
 - Samsung Electronics, Research Seminar in Memory Division, July 2011.
 - KISTI Supercomputing Center, Korea, July 2011.

Substantial Software Developed

1. FlashSim: Developed flash based SSD simulator framework by extending DiskSim3.0, such as Flash layout and FTL, Garbage Collector and Wear-leveler etc. (<http://csl.cse.psu.edu/hybridstore>)
2. HybridSim: Extended FlashSim for HybridSim to provide hybrid storage simulator employing flash based SSDs and HDDs by integrating the FlashSim with DiskSim3.0. (<http://csl.cse.psu.edu/hybridstore>)
3. STEAM: Developed thermal-performance disk simulator by integrating time-based thermal simulator written in Fortran into event-driven performance simulator in C.
4. ThermoStat: Developed a detailed 3-dimensional computational fluid dynamics (CFD) based ThermalModeling Tool based on Phoenix CFD tool. (<http://csl.cse.psu.edu/?q=node/115>)
5. Fault-Tolerant Software DSM: Developed fault-tolerant software distributed share memory systems with pthreads and user-level DMA operations supported by modern communication protocols under Linux environment.
6. Multiprocessor Cache Protocol: Implemented cache coherency protocols (MESI and Dragon) for multiprocessor architectures in Simics tool.
7. LinuxBios: Developed efficient BIOS using Assembly language for fast booting of the server.

Professional Activities and Service

- Grand Proposal Review Activities
 - SBIR 2010 by U.S. Department of Energy (DOE), Phase I on Cloud & Storage.
 - Global Research Network Program by National Research Foundation of Korea (NRF), 2011.
 - Korea and US Collaborative Research (KORUS Tech), 2011.
- Journal Peer Review Activities
 - IEEE Computer Society Magazine IT Professional

- IEEE Transactions on Computer (TC)
- IEEE Transactions on Parallel and Distributed Systems (TPDS)
- IEEE Embedded Systems Letters (ESL)
- ACM Transactions on Storage (ACM TOS)
- ACM Transactions on Design Automation of Electronic Systems (ACM TODAES)
- ACM Transactions on Embedded Computing Systems (ACM TECS)
- Journal of Virtual Reality – Springer
- Journal of Zhejiang University Science C (Computers & Electronics) (JUSC)
- Journal of Computer Science and Technology (JCST)
- International Journal on Advances in Software
- Conference Program Committee
 - International Conference on Parallel and Distributed Computing and Networks (PDCN 2013)
 - IEEE International Conference on Networking, Architecture, and Storage (NAS 2012)
 - International Conference on Advanced Engineering Computing and Application in Sciences (ADVCOMP 2011)
 - International Conference on Parallel and Distributed Computing and Systems (PDCS 2010, 2011, 2012)
 - International Conference on GREEN IT (2010, 2011)

Advising: PhD Students

- Devesh Tiwari, PhD student, North Carolina State University.
 - Summer Intern at ORNL in 2012. (Role: Mentoring student with Dr. Sudharshan)
- Junghee Lee, PhD student, Georgia Institute of Technology.
 - Summer Intern at ORNL in 2010. (Role: Mentor)
 - Summer Intern at ORNL in 2011. (Role: Mentor)
- Simona Boboila, PhD student, Northeastern University.
 - Summer Intern at ORNL in 2011. (Role: Mentoring student with Dr. Sudharshan)
- Fei Meng, PhD student, North Carolina State University.
 - Research Intern at ORNL in September 2010-May 2011. (Role: Mentoring student with Prof. Xiaosong and Dr. Sudharshan)
- Ramya Prabhakar, PhD Student, Pennsylvania State University.
 - Summer Intern at ORNL in 2010. (Role: Mentoring student with Dr. Sudharshan)
- Seung Hwan Lim, PhD student, Pennsylvania State University.
 - Research Collaboration in September 2009-onwards. (Role: Technical Mentor)

---- Last updated: May 15th, 2012 ----