

Jungwon Kim

COMPUTER SCIENTIST · OAK RIDGE NATIONAL LABORATORY

One Bethel Valley Road, P.O. Box 2008 MS-6173, Oak Ridge, TN 37831, USA

✉ kimj@ornl.gov | 🏠 jungwon.kim | 🌐 jungwonkim | 📺 jungwon-kim | 📞 0000-0001-6594-6225

Research Interests

High-performance computing, compilers, runtime systems, storages, and programming models

Positions

Oak Ridge National Laboratory

COMPUTER SCIENTIST IN FUTURE TECHNOLOGIES GROUP AT COMPUTER SCIENCE AND MATHEMATICS DIVISION

Oak Ridge, TN, USA

2016 - present

Oak Ridge National Laboratory

POSTDOCTORAL RESEARCH ASSOCIATE IN FUTURE TECHNOLOGIES GROUP AT COMPUTER SCIENCE AND MATHEMATICS DIVISION

Oak Ridge, TN, USA

2014 - 2016

Education

Seoul National University

PHD IN ELECTRICAL ENGINEERING AND COMPUTER SCIENCE, SUPERVISED BY PROF. JAEJIN LEE

- Thesis: An OpenCL Framework for Heterogeneous Clusters

Seoul, South Korea

2006 - 2013

Seoul National University

BS IN COMPUTER SCIENCE AND ENGINEERING

Seoul, South Korea

1998 - 2006

Research Experience

Papyrus: Programming Systems for Distributed Nonvolatile Memory Architectures

EXASCALE COMPUTING PROJECT @ OAK RIDGE NATIONAL LABORATORY

2016 - 2019

- Key-value store, STL-like C++ templates, virtual file system for distributed NVM architectures
- IJHPCA 2019, SC 2018, SC 2017, IPDPS 2017
- C++, Fortran, MPI, UPC, NVMe, SSD, Burst Buffer, OLCF Summitdev, NERSC Cori, ALCF Theta, TACC Stampede, TACC Stampede2, CSCS Grand Táv
- Open source (<https://code.ornl.gov/eck/papyrus>)

OpenACC Frameworks

X-STACK SOFTWARE RESEARCH @ OAK RIDGE NATIONAL LABORATORY

2014 - 2019

- OpenACC-based unified programming model for heterogeneous cluster, MPI+OpenACC framework, OpenACC framework for FPGAs
- SC 2018, PARCO 2018, ICS 2018, AsHES 2017, HPDC 2016, IPDPS 2016, PPOPP 2015
- C++, OpenCL, CUDA, MPI, OpenMP, OpenACC, LLVM Clang, NVIDIA GPU, AMD GPU, Intel Xeon Phi KNC, Altera FPGA, OLCF Titan, ALCF Mira, ALCF Cooley, NERSC Cori, UTK Beacon

SnuCL: An OpenCL Framework for Heterogeneous Clusters

CENTER FOR MANYCORE PROGRAMMING @ SEOUL NATIONAL UNIVERSITY

2010 - 2016

- SnuCL extends the platform model of OpenCL to heterogeneous clusters
- PLDI 2016, TPDS 2015, ICS 2012, PPOPP 2012, PACT 2011, LCPC 2011, PPOPP 2011, US10097618, US9485303, US9396033
- C, C++, OpenCL, CUDA, MPI, LLVM Clang, NVIDIA GPU, AMD GPU
- Open source (<http://snucl.snu.ac.kr/>), Khronos OpenCL Resources, AMD Developer Central, IWOCL OpenCL Libraries

SNU-SAMSUNG OpenCL Framework

SEOUL NATIONAL UNIVERSITY & SAMSUNG ADVANCED INSTITUTE OF TECHNOLOGY

2009 - 2010

- An OpenCL framework targeting IBM Cell-BEs, ARM CPUs, and TI DSPs
- PACT 2010
- C, OpenCL, IBM Cell-BE, ARM Cortex-A8, TI C64x+
- Open source (<http://aces.snu.ac.kr/>), Khronos Conformant Products (Samsung Electronics 2010-02-03 OpenCL_1_0), IWOCL OpenCL Implementations

Publications

CONFERENCES

- ICS 2018** Jacob Lambert, Seyong Lee, Jungwon Kim, Jeffrey S. Vetter, and Allen D. Malony. “Directive-Based, High-Level Programming and Optimizations for High-Performance Computing with FPGAs”. In *Proceedings of the 32nd ACM International Conference on Supercomputing*, Beijing, China, June 2018. (36/193, 18.7%)
- SC 2017** Jungwon Kim, Seyong Lee, and Jeffrey S. Vetter. “PapyrusKV: A High-Performance Parallel Key-Value Store for Distributed NVM Architectures”. In *Proceedings of the International Conference for High Performance Computing, Networking, Storage and Analysis*, pages 57:1–57:14, Denver, Colorado, USA, November 2017. (61/327, 18.6%)
- IPDPS 2017** Jungwon Kim, Kittisak Sajjapongse, Seyong Lee, and Jeffrey S. Vetter. “Design and Implementation of Papyrus: Parallel Aggregate Persistent Storage”. In *Proceedings of the 31st IEEE International Parallel and Distributed Processing Symposium*, pages 1151–1162, Orlando, Florida, USA, May 2017. (116/508, 22.8%)
- PLDI 2016** Junghyun Kim, Gangwon Jo, Jaehoon Jung, Jungwon Kim, and Jaejin Lee. “A Distributed OpenCL Framework using Redundant Computation and Data Replication”. In *Proceedings of the 37th ACM SIGPLAN conference on Programming Language Design and Implementation*, pages 553–569, Santa Barbara, California, USA, June 2016. (48/304, 15.8%)
- HPDC 2016** Jungwon Kim, Seyong Lee, and Jeffrey S. Vetter. “IMPACC: A Tightly Integrated MPI+OpenACC Framework Exploiting Shared Memory Parallelism”. In *Proceedings of the 25th ACM International Symposium on High-Performance Parallel and Distributed Computing*, pages 189–201, Kyoto, Japan, May 2016. (20/129, 15.5%)
- IPDPS 2016** Seyong Lee, Jungwon Kim, and Jeffrey S. Vetter. “OpenACC to FPGA: A Framework for Directive-based High-Performance Reconfigurable Computing”. In *Proceedings of the 30th IEEE International Parallel and Distributed Processing Symposium*, pages 544–554, Chicago, Illinois, USA, May 2016. (114/496, 22.9%)
- ICS 2012** Jungwon Kim, Sangmin Seo, Jun Lee, Jeongho Nah, Gangwon Jo, and Jaejin Lee. “SnuCL: An OpenCL Framework for Heterogeneous CPU/GPU Clusters”. In *Proceedings of the 26th ACM International Conference on Supercomputing*, pages 341–352, Venice, Italy, June 2012. (36/161, 22.3%)
- PACT 2011** Jun Lee, Jungwon Kim, Junghyun Kim, Sangmin Seo, and Jaejin Lee. “An OpenCL Framework for Homogeneous Manycores with no Hardware Cache Coherence”. In *Proceedings of the 20th ACM/IEEE/IFIP International Conference on Parallel Architectures and Compilation Techniques*, pages 56–67, Galveston Island, Texas, USA, October 2011. (36/221, 16.3%)
- LCTES 2011** Choonki Jang, Jungwon Kim, Jaejin Lee, Hee-Seok Kim, Dong-Hoon Yoo, Sujkin Kim, Hong-Seok Kim and Soojung Ryu. “An Instruction-Scheduling-Aware Data Partitioning Technique for Coarse-Grained Reconfigurable Architectures”. In *Proceedings of the ACM SIGPLAN/SIGBED 2011 International Conference on Languages, Compilers, and Tools for Embedded Systems*, pages 151–160, Chicago, Illinois, USA, April 2011. (17/51, 33.3%)
- PPoPP 2011** Jungwon Kim, Honggyu Kim, Joo Hwan Lee, and Jaejin Lee. “Achieving a Single Compute Device Image in OpenCL for Multiple GPUs”. In *Proceedings of the 16th ACM Symposium on Principles and Practice of Parallel Programming*, pages 277–287, San Antonio, Texas, USA, February 2011. (26/165, 15.6%)
- PACT 2010** Jaejin Lee, Jungwon Kim, Sangmin Seo, Seungkyun Kim, Jungho Park, Honggyu Kim, Thanh Tuan Dao, Yongjin Cho, Sung Jong Seo, Seung Hak Lee, Seung Mo Cho, Hyo Jung Song, Sang-Bum Suh, and Jong-Deok Choi. “An OpenCL Framework for Heterogeneous Multicores with Local Memory”. In *Proceedings of the 19th ACM/IEEE/IFIP International Conference on Parallel Architectures and Compilation Techniques*, pages 193–204, Vienna, Austria, September 2010. (46/266, 17.3%)
- HPCA 2010** Jaejin Lee, Jun Lee, Sangmin Seo, Jungwon Kim, Seungkyun Kim, and Zehra Sura. “COMIC++: A Software SVM System for Heterogeneous Multicore Accelerator Clusters”. In *Proceedings of the 16th IEEE International Symposium on High Performance Computer Architecture*, pages 329–340, Bangalore, India, January 2010. (32/175, 18.3%)
- PACT 2008** Jaein Lee, Sangmin Seo, Chihun Kim, Junghyun Kim, Posung Chun, Zehra Sura, Jungwon Kim, and Sangyong Han. “COMIC: A Coherent Shared Memory Interface for Cell BE”. In *Proceedings of the 17th International Conference on Parallel Architecture and Compilation Techniques*, pages 303–314, Toronto, Canada, October 2008. (30/159, 18.9%)

JOURNALS

- IJHPCA 2019** Jungwon Kim and Jeffrey S. Vetter. “Implementing Efficient Data Compression and Encryption in a Persistent Key-Value Store for HPC”. *The International Journal of High Performance Computing Applications*, accepted, 2019. (IF: 2.015)
- PARCO 2018** Michael Wolfe, Seyong Lee, Jungwon Kim, Xiaonan Tian, Rengan Xu, Barbara Chapman, and Sunita Chandrasekaran. “The OpenACC Data Model: Preliminary Study on Its Major Challenges and Implementations”. *Parallel Computing*, Volume 78, pages 15–27, 2018. (IF: 0.938)
- TPDS 2015** Thanh Tuan Dao, Jungwon Kim, Sangmin Seo, Bernhard Egger, and Jaejin Lee. “A Performance Model for GPUs with Caches”. *IEEE Transactions on Parallel and Distributed Systems*, Volume 26, Issue 7, pages 1800–1813, 2015. (IF: 4.181)

TPDS 2015 Gangwon Jo, Jeongho Nah, Jun Lee, Jungwon Kim, and Jaejin Lee. “Accelerating LINPACK with MPI-OpenCL on Clusters of Multi-GPU Nodes”. *IEEE Transactions on Parallel and Distributed Systems*, Volume 26, Issue 7, pages 1814-1825, 2015. (IF: 4.181)

WORKSHOPS

IPDPSW 2017 Michael Wolfe, Seyong Lee, Jungwon Kim, Xiaonan Tian, Rengan Xu, Sunita Chandrasekaran and Barbara Chapman. “Implementing the OpenACC Data Model”, *In Proceedings of the 31st IEEE International Parallel and Distributed Processing Symposium Workshops (IPDPSW), 7th International Workshop on Accelerators and Hybrid Exascale Systems*, pages 663-672, Orlando, Florida, USA, May 2017. (9/9, 100%)

LCPC 2011 Jungwon Kim, Sangmin Seo, Jun Lee, Jeongho Nah, Gangwon Jo, and Jaejin Lee. “OpenCL as a Programming Model for GPU Clusters”. *In Proceedings of the 24th International Workshop on Languages and Compilers for Parallel Computing*, pages 76-90, Fort Collins, Colorado, USA, September 2011. (19/52, 36.5%)

POSTERS

SC 2018 Jungwon Kim and Jeffrey S. Vetter. “Implementing Efficient Data Compression and Encryption in a Persistent Key-Value Store for HPC”. *The International Conference for High Performance Computing, Networking, Storage and Analysis*, Dallas, Texas, USA, November 2018. Top 5 Finalist of Best Poster Award (5/93).

SC 2018 Seyong Lee, Jacob Lambert, Jungwon Kim, Jeffrey S. Vetter, and Allen D. Malony. “OpenACC to FPGA: A Directive-Based High-Level Programming Framework for High-Performance Reconfigurable Computing”. *The International Conference for High Performance Computing, Networking, Storage and Analysis*, Dallas, Texas, USA, November 2018.

PPoPP 2015 Jungwon Kim, Seyong Lee, and Jeffrey S. Vetter. “An OpenACC-Based Unified Programming Model for Multi-Accelerator Systems”. *In Proceedings of the 20th ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming*, pages 257-258, Bay Area, California, USA, February 2015.

GTC 2014 Jungwon Kim, Seyong Lee, and Jeffrey S. Vetter. “PMAS: A Unified Programming Model for Multi-Accelerator Systems”. *GPU Technology Conference*, San Jose, California, USA, March 2014.

PPoPP 2012 Jungwon Kim, Sangmin Seo, Jun Lee, Jeongho Nah, Gangwon Jo, and Jaejin Lee. “OpenCL as a Unified Programming Model for Heterogeneous CPU/GPU Clusters”. *In Proceedings of the 17th ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming*, pages 299-300, New Orleans, Louisiana, USA, February 2012.

Presentations

SC 2018 Jungwon Kim and Jeffrey S. Vetter. “Implementing Efficient Data Compression and Encryption in a Persistent Key-Value Store for HPC”. Poster presentation, *International Conference for High Performance Computing, Networking, Storage and Analysis*, Dallas, Texas, USA, November 2018.

ORNL 2018 Jungwon Kim. “PapyrusKV: A High-Performance Parallel Key-Value Store for Distributed NVM Architectures”. Invited talk, *ORNL TechInt Lunch & Learn*, Oak Ridge, Tennessee, USA, May 2018.

SC 2017 Jungwon Kim, Seyong Lee, and Jeffrey S. Vetter. “PapyrusKV: A High-Performance Parallel Key-Value Store for Distributed NVM Architectures”. Paper presentation, *International Conference for High Performance Computing, Networking, Storage and Analysis*, Denver, Colorado, USA, November 2017.

IPDPS 2017 Jungwon Kim, Kittisak Sajjapongse, Seyong Lee, and Jeffrey S. Vetter. “Design and Implementation of Papyrus: Parallel Aggregate Persistent Storage”. Paper presentation, *31st IEEE International Parallel and Distributed Processing Symposium*, Orlando, Florida, USA, May 2017.

SNU 2016 Jungwon Kim. “OpenACC for Heterogeneous Computing”. Invited talk, *Seoul National University*, Seoul, South Korea, June 2016.

HPDC 2016 Jungwon Kim, Seyong Lee, and Jeffrey S. Vetter. “IMPACC: A Tightly Integrated MPI+OpenACC Framework Exploiting Shared Memory Parallelism”. Paper presentation, *25th ACM International Symposium on High-Performance Parallel and Distributed Computing*, Kyoto, Japan, May 2016.

PPoPP 2015 Jungwon Kim, Seyong Lee, and Jeffrey S. Vetter. “An OpenACC-Based Unified Programming Model for Multi-Accelerator Systems”. Poster presentation, *20th ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming*, Bay Area, California, USA, February 2015.

GTC 2014 Jungwon Kim, Seyong Lee, and Jeffrey S. Vetter. “PMAS: A Unified Programming Model for Multi-Accelerator Systems”. Poster presentation, *GPU Technology Conference*, San Jose, California, USA, March 2014.

ICS 2012 Jungwon Kim, Sangmin Seo, Jun Lee, Jeongho Nah, Gangwon Jo, and Jaejin Lee. “SnuCL: An OpenCL Framework for Heterogeneous CPU/GPU Clusters”. Paper presentation, *26th ACM International Conference on Supercomputing*, Venice, Italy, June 2012.

PPoPP 2012 Jungwon Kim, Sangmin Seo, Jun Lee, Jeongho Nah, Gangwon Jo, and Jaejin Lee. “OpenCL as a Unified Programming Model for Heterogeneous CPU/GPU Clusters”. Poster presentation, *17th ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming*, New Orleans, Louisiana, USA, February 2012.

- LCPC 2011** Jungwon Kim, Sangmin Seo, Jun Lee, Jeongho Nah, Gangwon Jo, and Jaejin Lee. "OpenCL as a Programming Model for GPU Clusters". Paper presentation, *24th International Workshop on Languages and Compilers for Parallel Computing*, pages 76-90, Fort Collins, Colorado, USA, September 2011. (19/52, 36.5%)
- PPoPP 2011** Jungwon Kim, Honggyu Kim, Joo Hwan Lee, and Jaejin Lee. "Achieving a Single Compute Device Image in OpenCL for Multiple GPUs". Paper presentation, *16th ACM Symposium on Principles and Practice of Parallel Programming*, San Antonio, Texas, USA, February 2011.

Patents

- US10097618** Jaejin Lee, Jungwon Kim, and Junghyun Kim. "Cluster System and Communication Method in Cluster System". *US Patent 10097618B2*, October 2018.
- US9485303** Jaejin Lee and Jungwon Kim. "Cluster System Based on Parallel Computing Framework, and Host Node, Computing Node and Method for Executing Application Therein". *US Patent 9485303B2*, November 2016.
- US9396033** Jaejin Lee and Jungwon Kim. "Method of Executing Parallel Application on Manycore Cluster System and the Manycore Cluster System". *US Patent 9396033B2*, July 2016.
- US8395701** Jungwon Kim, Jaejin Lee, Kyu-Won Kim, and Sung-Kwan Heo. "Method for Scaling Voltage in Mobile Terminal". *US Patent 8395701B2*, March 2013.

Professional Activities

Referee

- Journal of Parallel and Distributed Computing (JPDC): 2018, 2017, 2016
- ACM Transactions on Parallel Computing (TOPC): 2018
- ACM Transactions on Architecture and Code Optimization (TACO): 2016
- Parallel Computing (PARCO): 2016

External Review Committee Member

- ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming (PPoPP): 2013

Memberships

- Member, Institute of Electrical and Electronics Engineers (IEEE) and IEEE Computer Society
- Member, Association for Computing Machinery (ACM)

Industry Experience

Naver Corporation

Seoul, South Korea

SOFTWARE ENGINEER

2003 - 2005

- Developed a middleware for communication between the main database and the customer service center.
- Java, Oracle

NCubic

Seoul, South Korea

WEB PROGRAMMER

2002 - 2003

- Developed web applications.
- Java, Oracle

Jinisoft (Startup)

Seoul, South Korea

LEAD PROGRAMMER

2000 - 2002

- Developed a Java virtual desktop framework.
- Java

Skills

C, C++, Java, Fortran, CUDA, OpenCL, OpenACC, OpenMP, MPI, LLVM