

JUNGWON KIM

Senior HPC Architect • NVIDIA

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INTERESTS

HIGH PERFORMANCE COMPUTING, ARCHITECTURES, COMPILERS, RUNTIME SYSTEMS, PROGRAMMING MODELS

APPOINTMENTS

NVIDIA | SENIOR HPC ARCHITECT

Jan 2022 - Present | GPU Compute Architecture Group | Santa Clara, CA, USA

OAK RIDGE NATIONAL LABORATORY | COMPUTER SCIENTIST

May 2016 - Jan 2022 | Programming Systems Group | Oak Ridge, TN, USA

OAK RIDGE NATIONAL LABORATORY | POSTDOCTORAL RESEARCH ASSOCIATE

Apr 2014 - Apr 2016 | Future Technologies Group | Oak Ridge, TN, USA

NAVER CORPORATION | SOFTWARE ENGINEER

Dec 2003 - Feb 2005 | Seoul, South Korea

NCUBIC | SOFTWARE ENGINEER

Dec 2002 - Dec 2003 | Seoul, South Korea

JINISOFT (STARTUP) | SOFTWARE ENGINEER

Jul 2000 - Dec 2002 | Seoul, South Korea

EDUCATION

SEOUL NATIONAL UNIVERSITY | PHD IN ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

Aug 2013 | Seoul, South Korea

Dissertation: An OpenCL Framework for Heterogeneous Clusters • Advisor: Jaejin Lee

SEOUL NATIONAL UNIVERSITY | BS IN COMPUTER SCIENCE AND ENGINEERING

Aug 2006 | Seoul, South Korea

PROJECTS

END-TO-END HPC | HW/SW CODESIGN IN HPC FOR NVIDIA GPUs

2022 - Present | HPC Architect | GPU Compute Architecture Group @ NVIDIA

C, C++, Fortran, Python, CUDA, MPI • NVIDIA Rubin/Blackwell/Hopper/Ampere GPU • NVIDIA Eos, NVIDIA Selene

IRIS | A UNIFIED FRAMEWORK FOR CROSS-PLATFORM ACCELERATED COMPUTING

2020 - 2022 | Tech Lead | DOD/DARPA Domain-Specific System on Chip @ ORNL

TPDS 2024, AMTE 2022, AMTE 2021, HPEC 2021 • C, C++, Fortran, Python, CUDA, HIP, OpenCL, Level Zero, Hexagon, OpenACC, OpenMP, Clang/LLVM, Polly, PyTorch, TensorFlow • Intel CPU, AMD CPU, Arm CPU, POWER CPU, NVIDIA GPU, AMD GPU, Intel GPU, Qualcomm GPU, Intel FPGA, Xilinx FPGA, Qualcomm DSP • Qualcomm Snapdragon, NVIDIA Jetson, NVIDIA DGX, CSCS Ault, ORNL Summit, ORNL Frontier • <https://github.com/ORNL/iris> • R&D 100 Awards

PAPYRUS | A DISTRIBUTED KEY-VALUE STORE FOR BURST BUFFER ARCHITECTURES

2016 - 2019 | Tech Lead | DOE Exascale Computing Project @ ORNL

IJHPCA 2019, SC 2018, SC 2017, IPDPS 2017 • C, C++, Fortran, MPI, UPC • NVMe, SSD, Burst Buffer • ORNL Summit, NERSC Cori, ANL Theta, TACC Stampede, TACC Stampede2, CSCS Grand Tavé, ORNL Summit, ORNL Frontier • Extreme-Scale Scientific Software Stack (E4S) • <https://github.com/ORNL/papyrus>

MPI+OPENACC | A SOFTWARE FRAMEWORK FOR SCALABLE HETEROGENEOUS COMPUTING

2014 - 2018 | Tech Lead | DOE X-Stack Software Research @ ORNL

PARCO 2018, ICS 2018, HPDC 2016, IPDPS 2016, PPOPP 2015 • C, C++, OpenCL, CUDA, MPI, OpenMP, OpenACC, Clang/LLVM • NVIDIA GPU, AMD GPU, Intel Xeon Phi KNC/KNL, Altera FPGA • ORNL Titan, ANL Mira, ANL Cooley, NERSC Cori, UTK Beacon

SNUCL | AN OPENCL FRAMEWORK FOR NVIDIA/AMD GPU CLUSTERS

2010 - 2016 | Tech Lead | Center for Manycore Programming @ SNU

PLDI 2016, TPDS 2015, ICS 2012, PPOPP 2012, PACT 2011, LCPC 2011, PPOPP 2011, US10097618B2, US9485303B2, US9396033B2 • C, C++, OpenCL, CUDA, MPI, Clang/LLVM • NVIDIA GPU, AMD GPU, Intel Single-Chip Cloud • SNU Chundoong • Khronos OpenCL Resources • <http://snucl.snu.ac.kr>

SNU-SAMSUNG OPENCL | AN OPENCL FRAMEWORK FOR IBM CELL-BES, ARM CPUs, AND TI DSPs

2009 - 2010 | Tech Lead | SNU & Samsung Electronics @ SNU

PACT 2010 • C, OpenCL, Clang/LLVM • IBM Cell-BE, Arm Cortex-A8, TI C64x+ • Khronos Conformant OpenCL Product (Samsung Electronics 2010-02-03 OpenCL_1_0) • https://thunder.snu.ac.kr/?page_id=64&page=8

PUBLICATIONS

CONFERENCES

HPEC 2021 | IRIS: A PORTABLE RUNTIME SYSTEM EXPLOITING MULTIPLE HETEROGENEOUS PROGRAMMING SYSTEMS

Jungwon Kim, Seyong Lee, Beau Johnston, and Jeffrey S. Vetter. In Proceedings of the 25th IEEE Conference on High Performance Extreme Computing, Waltham, Massachusetts, USA, September 2021.

HPEC 2021 | TOWARD PERFORMANCE PORTABLE PROGRAMMING FOR HETEROGENEOUS SYSTEMS ON A CHIP: A CASE STUDY WITH QUALCOMM SNAPDRAGON SoC

Anthony Cabrera, Seth Hitefield, Jungwon Kim, Seyong Lee, Narasinga Rao Miniskar, and Jeffrey S. Vetter. In Proceedings of the 25th IEEE Conference on High Performance Extreme Computing, Waltham, Massachusetts, USA, September 2021.

ICS 2018 | DIRECTIVE-BASED, HIGH-LEVEL PROGRAMMING AND OPTIMIZATIONS FOR HIGH-PERFORMANCE COMPUTING WITH FPGAS

Jacob Lambert, Seyong Lee, Jungwon Kim, Jeffrey S. Vetter, and Allen D. Malony. In Proceedings of the 32nd ACM International Conference on Supercomputing, pages 160-171, Beijing, China, June 2018. (36/193, 18.7%)

SC 2017 | PAPYRUSKV: A HIGH-PERFORMANCE PARALLEL KEY-VALUE STORE FOR DISTRIBUTED NVM ARCHITECTURES

Jungwon Kim, Seyong Lee, and Jeffrey S. Vetter. 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 | DESIGN AND IMPLEMENTATION OF PAPYRUS: PARALLEL AGGREGATE PERSISTENT STORAGE

Jungwon Kim, Kittisak Sajjapongse, Seyong Lee, and Jeffrey S. Vetter. 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 | A DISTRIBUTED OPENCL FRAMEWORK USING REDUNDANT COMPUTATION AND DATA REPLICATION

Junghyun Kim, Gangwon Jo, Jaehoon Jung, Jungwon Kim, and Jaejin Lee. 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 | IMPACC: A TIGHTLY INTEGRATED MPI+OPENACC FRAMEWORK EXPLOITING SHARED MEMORY PARALLELISM

Jungwon Kim, Seyong Lee, and Jeffrey S. Vetter. 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 | OPENACC TO FPGA: A FRAMEWORK FOR DIRECTIVE-BASED HIGH-PERFORMANCE RECONFIGURABLE COMPUTING

Seyong Lee, Jungwon Kim, and Jeffrey S. Vetter. 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 | SNUCL: AN OPENCL FRAMEWORK FOR HETEROGENEOUS CPU/GPU CLUSTERS

Jungwon Kim, Sangmin Seo, Jun Lee, Jeongho Nah, Gangwon Jo, and Jaejin Lee. In Proceedings of the 26th ACM International Conference on Supercomputing, pages 341-352, Venice, Italy, June 2012. (36/161, 22.3%)

PACT 2011 | AN OPENCL FRAMEWORK FOR HOMOGENEOUS MANYCORES WITH NO HARDWARE CACHE COHERENCE

Jun Lee, Jungwon Kim, Junghyun Kim, Sangmin Seo, and Jaejin Lee. 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 | AN INSTRUCTION-SCHEDULING-AWARE DATA PARTITIONING TECHNIQUE FOR COARSE-GRAINED RECONFIGURABLE ARCHITECTURES

Choonki Jang, Jungwon Kim, Jaejin Lee, Hee-Seok Kim, Dong-Hoon Yoo, Sujkin Kim, Hong-Seok Kim and Soojung Ryu. 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 | ACHIEVING A SINGLE COMPUTE DEVICE IMAGE IN OPENCL FOR MULTIPLE GPUS

Jungwon Kim, Honggyu Kim, Joo Hwan Lee, and Jaejin Lee. In Proceedings of the 16th ACM SIGPLAN Annual Symposium on Principles and Practice of Parallel Programming, pages 277-287, San Antonio, Texas, USA, February 2011. (26/165, 15.6%)

PACT 2010 | AN OPENCL FRAMEWORK FOR HETEROGENEOUS MULTICORES WITH LOCAL MEMORY

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. 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 | COMIC++: A SOFTWARE SVM SYSTEM FOR HETEROGENEOUS MULTICORE ACCELERATOR CLUSTERS

Jaejin Lee, Jun Lee, Sangmin Seo, Jungwon Kim, Seungkyun Kim, and Zehra Sura. 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 | COMIC: A COHERENT SHARED MEMORY INTERFACE FOR CELL BE

Jaein Lee, Sangmin Seo, Chihun Kim, Junghyun Kim, Posung Chun, Zehra Sura, Jungwon Kim, and Sangyong Han. 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

TPDS 2024 | IRIS: A PERFORMANCE-PORTABLE FRAMEWORK FOR CROSS-PLATFORM HETEROGENEOUS COMPUTING

Jungwon Kim, Seyong Lee, Beau Johnston, and Jeffrey S. Vetter. IEEE Transactions on Parallel and Distributed Systems, Volume 35, Issue 10, pages 1796-1809, 2024. (IF: 5.6)

IJHPCA 2019 | IMPLEMENTING EFFICIENT DATA COMPRESSION AND ENCRYPTION IN A PERSISTENT KEY-VALUE STORE FOR HPC

Jungwon Kim and Jeffrey S. Vetter. The International Journal of High Performance Computing Applications, Volume 33, Issue 6, pages 1098-1112, 2019. (IF: 3.5)

PARCO 2018 | THE OPENACC DATA MODEL: PRELIMINARY STUDY ON ITS MAJOR CHALLENGES AND IMPLEMENTATIONS

Michael Wolfe, Seyong Lee, Jungwon Kim, Xiaonan Tian, Rengan Xu, Barbara Chapman, and Sunita Chandrasekaran. Parallel Computing, Volume 78, pages 15-27, 2018. (IF: 2.0)

TPDS 2015 | A PERFORMANCE MODEL FOR GPUS WITH CACHES

Thanh Tuan Dao, Jungwon Kim, Sangmin Seo, Bernhard Egger, and Jaejin Lee. IEEE Transactions on Parallel and Distributed Systems, Volume 26, Issue 7, pages 1800-1813, 2015. (IF: 5.6)

TPDS 2015 | ACCELERATING LINPACK WITH MPI-OPENCL ON CLUSTERS OF MULTI-GPU NODES

Gangwon Jo, Jeongho Nah, Jun Lee, Jungwon Kim, and Jaejin Lee. IEEE Transactions on Parallel and Distributed Systems, Volume 26, Issue 7, pages 1814-1825, 2015. (IF: 5.6)

WORKSHOPS

AMTE 2022 | A PORTABLE AND HETEROGENEOUS LU FACTORIZATION ON IRIS

Pedro Valero-Lara, Jungwon Kim, Jeffrey Vetter. In Proceedings of the Euro-Par 2022 International Workshops, pages 17-31, Glasgow, Scotland, UK, August 2022.

AMTE 2021 | OPENMP TARGET TASK: TASKING AND TARGET OFFLOADING ON HETEROGENEOUS SYSTEMS

Pedro Valero-Lara, Jungwon Kim, Oscar Hernandez, Jeffrey Vetter. In Proceedings of the Euro-Par 2021 International Workshops, pages 445-455, Lisbon, Portugal, August 2021.

IWOCL 2021 | TOWARDS EVALUATING HIGH-LEVEL SYNTHESIS PORTABILITY AND PERFORMANCE BETWEEN INTEL AND XILINX FPGAS

Anthony M Cabrera, Aaron Young, Jacob Lambert, Zhili Xiao, Amy An, Seyong Lee, Zheming Jin, Jungwon Kim, Jeremy Buhler, Roger Chamberlain, Jeffrey Vetter. In Proceedings of the 9th International Workshop on OpenCL, article 7, pages 1-9, Munich, Germany, April 2021. (8/33, 24.2%)

IPDPSW 2017 | IMPLEMENTING THE OPENACC DATA MODEL

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

LCPC 2011 | OPENCL AS A PROGRAMMING MODEL FOR GPU CLUSTERS

Jungwon Kim, Sangmin Seo, Jun Lee, Jeongho Nah, Gangwon Jo, and Jaejin Lee. 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 | IMPLEMENTING EFFICIENT DATA COMPRESSION AND ENCRYPTION IN A PERSISTENT KEY-VALUE STORE FOR HPC

Jungwon Kim and Jeffrey S. Vetter. The International Conference for High Performance Computing, Networking, Storage and Analysis, Dallas, Texas, USA, November 2018. Top 5 Finalists of Best Poster Award (5/93).

SC 2018 | OPENACC TO FPGA: A DIRECTIVE-BASED HIGH-LEVEL PROGRAMMING FRAMEWORK FOR HIGH-PERFORMANCE RECONFIGURABLE COMPUTING

Seyong Lee, Jacob Lambert, Jungwon Kim, Jeffrey S. Vetter, and Allen D. Malony. The International Conference for High Performance Computing, Networking, Storage and Analysis, Dallas, Texas, USA, November 2018.

PPOPP 2015 | AN OPENACC-BASED UNIFIED PROGRAMMING MODEL FOR MULTI-ACCELERATOR SYSTEMS

Jungwon Kim, Seyong Lee, and Jeffrey S. Vetter. The 20th ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming, Bay Area, California, USA, February 2015.

GTC 2014 | PMAS: A UNIFIED PROGRAMMING MODEL FOR MULTI-ACCELERATOR SYSTEMS

Jungwon Kim, Seyong Lee, and Jeffrey S. Vetter. NVIDIA GPU Technology Conference 2014, San Jose, California, USA, March 2014.

PPOPP 2012 | OPENCL AS A UNIFIED PROGRAMMING MODEL FOR HETEROGENEOUS CPU/GPU CLUSTERS

Jungwon Kim, Sangmin Seo, Jun Lee, Jeongho Nah, Gangwon Jo, and Jaejin Lee. The 17th ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming, New Orleans, Louisiana, USA, February 2012.

PATENTS

US10097618B2 | CLUSTER SYSTEM AND COMMUNICATION METHOD IN CLUSTER SYSTEM

Jaejin Lee, Jungwon Kim, and Junghyun Kim. US Patent 10097618B2, October 2018.

US9485303B2 | CLUSTER SYSTEM BASED ON PARALLEL COMPUTING FRAMEWORK, AND HOST NODE, COMPUTING NODE AND METHOD FOR EXECUTING APPLICATION THEREIN

Jaejin Lee and Jungwon Kim. US Patent 9485303B2, November 2016.

US9396033B2 | METHOD OF EXECUTING PARALLEL APPLICATION ON MANYCORE CLUSTER SYSTEM AND THE MANYCORE CLUSTER SYSTEM

Jaejin Lee and Jungwon Kim. US Patent 9396033B2, July 2016.

US8395701B2 | METHOD FOR SCALING VOLTAGE IN MOBILE TERMINAL

Jungwon Kim, Jaejin Lee, Kyu-Won Kim, and Sung-Kwan Heo. US Patent 8395701B2, March 2013.

HONORS AND AWARDS

R&D 100 AWARDS | IRIS-SDK: INTELLIGENT RUNTIME SYSTEM FOR EXTREMELY HETEROGENEOUS COMPUTER ARCHITECTURES

R&D World Magazine, Oak Ridge National Laboratory, August 2024.

ACTIVITIES

JOURNAL REVIEWER

CAL 2024, TACO 2022, JPDC 2019, JPDC 2018, TOPC 2018, JPDC 2017, JPDC 2016, PARCO 2016, TACO 2016

CONFERENCE COMMITTEE MEMBER

PPoPP 2022, PACT 2021, PPoPP 2021

WORKSHOP COMMITTEE MEMBER

RSDHA 2023, RSDHA 2022, RSDHA 2021

MEMBERSHIPS

Member, Association for Computing Machinery (ACM)

Member, Institute of Electrical and Electronics Engineers (IEEE) Computer Society

SKILLS

PROGRAMMING

C, C++, Python, Java, Fortran, CUDA, HIP, OpenCL, oneAPI, OpenACC, OpenMP, MPI, Clang/LLVM

SUPERCOMPUTING

NVIDIA Eos/Selene, ORNL Frontier/Summit/Titan, ANL Theta/Mira/Cooley, NERSC Cori, TACC Vista/Stampede2/Stampede, CSCS Grand Tave