

# 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** | COMPETITIVE ANALYSIS FOR HPC APPLICATIONS TARGETING NVIDIA PRODUCTS

2022 – Present | Senior HPC Architect | GPU Compute Architecture Group @ NVIDIA

Analyze, optimize, and design microarchitectural/system-architectural/SW features of NVIDIA GPU/CPU/Switch • C, C++, Fortran, CUDA, MPI • NVIDIA Hopper GPU, NVIDIA Grace Hopper Superchip, NVIDIA Switch

### **IRIS** | A UNIFIED FRAMEWORK ACROSS MULTIPLE PROGRAMMING PLATFORMS

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

Task-based programming system for HPC/AI • 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, Intel DevCloud, CSCS Ault, ORNL Summit, ORNL Frontier (from Edge to Exascale) • <https://github.com/ORNL/iris>

### **PAPYRUS** | A PROGRAMMING SYSTEM FOR DISTRIBUTED NONVOLATILE MEMORY ARCHITECTURES

2016 – 2019 | Lead Architect | DOE Exascale Computing Project @ ORNL

Key-value store • STL-like C++ templates • Virtual file system • 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 | Lead Architect | DOE X-Stack Software Research @ ORNL

Tightly integrated MPI+OpenACC framework • OpenACC framework for Intel/Altera FPGAs • 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 HETEROGENEOUS CLUSTERS**

2010 – 2016 | Lead Architect | Center for Manycore Programming @ SNU

SnuCL extends the platform model of OpenCL to heterogeneous clusters • 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 | Lead Architect | SNU & Samsung Electronics @ SNU

Khronos Conformant OpenCL Product (Samsung Electronics 2010-02-03 OpenCL\_1\_0) • PACT 2010 • C, OpenCL, Clang/LLVM • IBM Cell-BE, ARM Cortex-A8, TI C64x+ • <http://aces.snu.ac.kr/software/snu-samsung-opencl/>

## **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**

**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: 1.956)

**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: 1.281)

### **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: 3.402)

### **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: 3.402)

## **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, 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.

## ACTIVITIES

### **JOURNAL REVIEWER**

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

### **CONFERENCE ORGANIZING COMMITTEE**

Publications Chair: PPOPP 2022, PACT 2021, PPOPP 2021

### **MEMBERSHIPS**

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

Member, Association for Computing Machinery (ACM)

## SKILLS

### **PROGRAMMING**

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

### **SUPERCOMPUTERS**

NVIDIA Selene, ORNL Frontier, ORNL Summit, ORNL Titan, ANL Theta, ANL Mira, ANL Cooley, NERSC Cori, TACC Stampede, TACC Stampede2, CSCS Grand Tavé