

# Seonmyeong Bak

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## TECHNICAL INTERESTS

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**High Performance Computing, Parallel Computing, Task-level Parallelism, Parallel Programming Models, Runtime Systems, Resource Management, Computer Architecture**

## EDUCATION

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**Georgia Institute of Technology, GA, USA** May. 2018 - Dec 2020

*Ph.D in Computer Science* (Advisor: [Prof. Vivek Sarkar](#))

- Ph.D. Thesis: Runtime Approaches to Improve the Efficiency of Hybrid and Irregular Applications

**University of Illinois at Urbana-Champaign, IL, USA (Transferred to Georgia Tech)** Sep. 2015 - May. 2018

*Ph.D Student in Computer Science* (Transferred to Georgia Tech, Advisor: [Prof. Laxmikant Kale](#))

- Worked on the integration of Charm++/AMPI and OpenMP runtime for intra-node load balancing on multicore nodes

**Seoul National University, Seoul, Korea** Sep. 2012 - Aug. 2014

*Master of Science in Electrical Engineering and Computer Science* (Advisor : [Prof. Jaejin Lee](#))

- Masters Thesis: Lightweight and block-level concurrent sweeping for JavaScript garbage collection

**SungKyunKwan University, Seoul, Korea** Mar. 2006 – Aug. 2012

*Bachelor of Science in Computer Engineering / Bachelor of Economics (Dual Degree)*

- Total Credit: 148, GPA : 4.01 / 4.5 (upper 4.16 / 4.5)
- Major Credit of Computer Science: 52 , GPA 4.13 / 4.5

## SKILLS & EXPERTISE

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**Programming Languages:** C, C++, Python, OpenMP, MPI, Charm++, OpenCL, CUDA

**Open Source Projects Used for Research:** WebKit, GNU/LLVM OpenMP, Charm++/AMPI, Boost, HCLib

**HPC Tools:** CrayPat, Vtune, NVProf, PAPI, OProf (Profilers), LSF, PBS, SLURM (Job schedulers)

**Supercomputers Used:** BlueWaters(CrayXE/XK), Stampede1/2, Cori / Theta(CrayXC), Summit, Cori-GPU

**Tools:** Git, GDB, LLDB, Bash, Mercurial, Redmine, Gerrit

## EXPERIENCES

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**Teaching Assistant, Georgia Institute of Technology** Jan. 2020 – May. 2020

- CS 4240 Compilers & Interpreters, Spring 2020

**[ASTRO](#) Intern, CSR Group, Oak Ridge National Laboratory** Aug. 2019 - Dec. 2019

- Extension of OpenMP for SLATE library requirements on Summit/Frontier

**Visiting Student, MCS Division, Argonne National Laboratory** May. 2018 - Aug. 2018

- Design and Implement user defined scheduling API for OpenMP runtime

**Internship in OpenMP Team, Software Service Group, Intel Corporation** May. 2017 – Aug. 2017

- Design and Implement the composability of **Intel OpenMP** runtime library
- Optimized OpenMP so that multiple external instances call libraries written in OpenMP runs efficiently without contention on resources
- Evaluated the composability with commercial python frameworks: **Tensorflow**, DASK

**Internship in ICT Institute, SK Telecom** Jun. 2014 – Aug. 2014

- Developing web framework and applications based on WebRTC

**Internship in Business of Mobile communication, Samsung Electronics**

Jun. 2011 – Aug. 2011

- Developing a tool to analyze logs in Bada OS (variation of RTOS)

**Sergeant, Military Service in the Army of the Republic of Korea**

Mar. 2008 – Jan. 2010

- Mandatory Service for Korean males

**RESEARCH ACTIVITIES**

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**Task Scheduling in Task Graphs for Improved Communication/Synchronization**

Aug 2019 - Dec 2020

- Improved scheduling of tasks with internal communication operations
- Hybrid scheduling of **gang-scheduling** and **work-stealing** and optimized victim selection in work-stealing for improved synchronization and computation/communication overlap, with performance improvements demonstrated for CPU/GPU versions of LU, QR and Cholesky factorization kernels in **SLATE**, the successor of **ScaLAPACK**. This work is under submission

**MPI + Asynchronous Many Task (AMT) Programming Model to Improve Resiliency**

Sep 2018 - Aug 2019

- Using AMT to improve **resiliency** in parallel applications. Especially using HClib for AMT which is a C++ library and enables task parallelism on applications written in C/C++. Published in **Euro-Par `19**
- Extended version which is interoperable with MPI is accepted to **ExaMPI `20** (to appear)

**User-defined scheduling API on OpenMP constructs**

May 2018 - May 2019

- Propose a set of APIs to extend the specification of parallel loops in OpenMP by user-provided functions
- Handling **performance variance** and **load imbalance** incurred by input datasets on irregular iterative applications (Graph, Scientific applications using sparse matrix)
- Implemented in LLVM OpenMP runtime and published in **ICPP `19**

**Integration of OpenMP into Charm++ / Adaptive MPI for Node-Level Parallelism**

Sep 2015 – May 2018

- Comparison of Charm++ and common task-level parallel programming paradigms for node parallelism
- Integrated OpenMP into Charm++/AMPI for improved node-level performance on many-core nodes
  - This work started on GNU OpenMP and has migrated into LLVM OpenMP
  - This feature has been available to the public since Charm++, 6.8.0
  - Published in **ACM ESPM `17** workshop (co-located with SC`17) for the first version
  - Published in **CCGrid `18** with a more optimized version and detailed analysis

**Porting of Rubik, Topology-aware Mapping Framework for Cray Machines**

Sep 2015 – Aug 2016

- Ported Rubik, a Python framework for topology aware mapping to work on Blue Waters (CrayXE/XK hybrid)
- Developed a new compaction scheme to map a logical complete cuboid into a physical torus network, which is not cuboid. Poster presented at **SC 16 ACM SRC**

**TIZEN Memory Management Optimization in Cooperation with Samsung Electronics**

Oct 2012 – Aug 2013

- Analysis of memory usage of WebKit engine. Memory Management Optimization for a JavaScript engine in WebKit (JavaScriptCore). Evaluated on a ARM development device (Tizen development kit)
- Published in **LCTES `14** (co-located with PLDI `14).

**Mini Projects for SnuCL, a distributed OpenCL framework**

July 2012 – Oct 2012

- Porting of AES algorithm from a single-threaded C version to OpenCL
  - Comparison of AES block cipher modes and implemented more optimized version than the AMD reference implementation of AES in OpenCL
- Porting of SnuCL, a distributed OpenCL framework to ARM and Verification of the ported version with OpenCL conformance test on a **ARM** development board (Beagleboard)

## PUBLICATIONS

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[Submitted] Seonmyeong Bak, Oscar Hernandez, Mark Gates, Piotr Luszczek, Vivek Sarkar. [Task-Graph Scheduling Extensions for Efficient Synchronization and Communication](#)

[Euro-Par 19] Sri Raj Paul, Akihiro Hayashi, Nicole Slattengren, Hemanth Kolla, Matthew Whitlock, Seonmyeong Bak, Keita Teranishi, Jackson Mayo and Vivek Sarkar. [Enabling Resilience in Asynchronous Many-Task Programming Models](#). In [Euro-Par '19: 25th International European Conference on Parallel and Distributed Computing](#), August 26-30, Göttingen, Germany. (38/144, acceptance rate 26.4%)

[ICPP 19] Seonmyeong Bak, Yanfei Guo, Pavan Balaji, and Vivek Sarkar. [Optimized Execution of Parallel Loops via User-Defined Scheduling Policies](#). In [ICPP '19: 48th International Conference on Parallel Processing](#), August 5–8, 2019, Kyoto, Japan. ACM, New York, NY, USA, 10 pages. (106/405, acceptance rate 26.2%)

[CCGrid 18] Seonmyeong Bak, Harshitha Menon, Sam White, Matthias Diener, and Laxmikant Kale. [Multi-level Load Balancing with an Integrated Runtime Approach](#). In [CCGrid '18: Eighteenth IEEE/ACM International Symposium on Cluster, Cloud and Grid Computing](#), May 1-4, 2018, Washington DC, USA (52/250, acceptance rate 20.8%)

[ESPM2 17] Seonmyeong Bak, Harshitha Menon, Sam White, Matthias Diener, and Laxmikant Kale. [Integrating OpenMP into the Charm++ Programming Model](#). In [ESPM2'17: Third International Workshop on Extreme Scale Programming Models and Middleware](#), November 12–17, 2017, Denver, CO, USA

[SC 16 SRC] Seonmyeong Bak, Nikhil Jain, Laxmikant Kale [Mapping applications on Irregular allocations](#). Poster presented in [SC '16 ACM SRC: Proceedings of the International Conference for High Performance Computing, Networking, Storage and Analysis](#), Salt Lake City, United States, November 2016.

[LCTES 14] Honjune Kim, Seonmyeong Bak, Jaejin Lee. [Lightweight and block-level concurrent sweeping for JavaScript garbage collection](#). In [LCTES '14: Proceedings of the 2014 SIGPLAN/SIGBED conference on Languages, Compilers and Tools for Embedded Systems](#), pp. 155-164, Edinburgh, United Kingdom, June 2014. (16/51, acceptance 31.3%)

## HONORS & AWARDS

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### Academic Excellence Scholarship

- SungKyunKwan University, Korea (2006 Fall, 2011 Spring, 2011 Fall, 2012 Spring)

### Student Research Competition Poster Grant in SC '16

- Grant for hotel, transportation (ground, flight), registration and meals. 26 posters accepted out of 63 submissions

### Student Volunteer in SC' 17

- Grant for hotel accommodation and registration, and opportunities to talk with mentors with HPC expertise

### IEEE CCGrid '18 Travel Grant Award

- Grant for hotel and airfare. 15 awardees selected