Effective Performance Variance Detection on Large-Scale HPC Systems

Friday, February 15, 2019, 1:00 pm
Location: SEH B1220

Abstract
Performance variance becomes increasingly challenging on current large-scale HPC systems. Even using a fixed number of computing nodes, the execution time of several runs can vary significantly. Many parallel programs executing on supercomputers suffer from such variance. Performance variance not only causes unpredictable performance requirement violations, but also makes it unintuitive to understand the program behavior. Despite prior efforts, efficient on-line detection of performance variance remains an open problem.

In this talk, I will talk about a novel approach for light-weight and on-line performance variance detection, called vSensor. The key insight is that, instead of solely relying on an external detector, the source code of a program itself could reveal the runtime performance characteristics. Specifically, many parallel programs contain code snippets that are executed repeatedly with an invariant quantity of work. Based on this observation, we use compiler techniques to automatically identify these fixed-workload snippets and use them as performance variance sensors (v-sensors) that enable effective detection. We evaluate vSensor with a variety of parallel programs on large-scale HPC systems. Results show that vSensor can effectively detect performance variance on HPC systems. The performance overhead is smaller than 4% with up to 16,384 processes on the Tianhe-2 system.

Biography
Jidong Zhai is an Associate Professor in the Computer Science Department of Tsinghua University. He was a Visiting Professor of Stanford University (2015-2016) and a Visiting Scholar of MSRA (Microsoft Research Asia) in 2013. He received the Ph.D. degree in Computer Science from Tsinghua University in 2010, with the Excellent Ph.D. Graduate Student Award of Tsinghua University. His research interests include high performance computing, fault tolerance, heterogeneous computing, compiler, and performance evaluation. He has published more than 40 papers in prestigious refereed conferences and top journals including IEEE TC, IEEE TPDS, SC, PPOPP, ASPLOS, ICS, ATC, and MICRO. His research received a Best Paper Finalist at SC’14. He is the advisor of Tsinghua Student Cluster Team. The team led by him has achieved 8 international champions in student supercomputing challenges at SC, ISC, and ASC. In 2015 and 2018, the team led by him swept all three champions at SC, ISC, and ASC. He was a program co-chair of NPC 2018 and a program co-chair of ICPP PASA 2015 workshop. He served or is now serving TPC member or reviewer of IEEE TC, IEEE TPDS, IEEE TCC, SC, ICS, PPOPP, ICPP, NAS, LCPC, and HPCC. He is a recipient of Siebel Scholar, 2010 CCF outstanding doctoral dissertation award, and NSFC Young Career Award 2017.

Hosted by Dr. Howie Huang, howie@gwu.edu