Special Guest Lectures

Accelerating Gravitational Wave Data Processing on GPU

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Abstract:
We present a Graphics Processing Unit (GPU) accelerated time-domain low-latency algorithm to search for gravitational waves (GWs) from coalescing binaries of compact objects based on the Summed Parallel Infinite Impulse Response (SPIIR) filtering technique. The aim is to facilitate fast detection of GWs with minimum delay to allow prompt electromagnetic follow-up observations. To maximize the GPU acceleration, we apply an efficient batched parallel computing model that significantly reduces the number of synchronizations in SPIIR and optimizes the usage of the memory and hardware resource. Our code is tested on the latest CUDA Fermi architecture in a GTX 480 graphics card and its performance is compared with a single core of Intel Core i7 920 (2.67 GHz). A 47-fold speedup is achieved while giving results in close agreement with the CPU implementation. Our result indicates that it is possible to conduct a full search for gravitational waves from compact binary coalescence in real time with only one desktop computer equipped with a Fermi GPU card for the current generation of GW detectors which would otherwise require more than 100 CPUs.

Speaker's Bio:
Dr. Zhihui Du is an associate professor in the Department of Computer Science and Technology at Tsinghua University. His principal research interests lie in the High Performance Computing, such as parallelizing and optimizing computational science and engineering applications on cluster systems, developing energy efficient scheduling algorithms and energy efficient data migration algorithms for multicore or cluster systems, optimizing the performance of some basic algorithms on GPU, developing resource management algorithms for cloud and grid systems. Professor Du received a Ph.D. in Computer Science from Peking University in 1998. He has published over 100 peer-reviewed papers and seven books in high performance computing and programming language fields. He is an associate editor of Journal of Parallel and Distributed Computing (JPDC), International Journal of Parallel, Emergent and Distributed Systems. He serves as the Vice Chair of IPDPS 2012 and is the member of technical program committee of many IEEE/ACM conferences, such as IPDPS, CCGrid, CSE. He was the PI of 16 research projects and highly involved in more than 30 high performance computing related projects.

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