Mien Nguyen, CSCI 5593

2/5/2019

**Report for “The Stencil Processing Unit: GPGPU Done Right”**

This report was focusing on energy-efficiency of exascale computing systems, by introducing a new GPU-like (General Purpose Computing) accelerator called Stencil Processing Unit (SPU). Exascale super computer needs to perform a billion billion (i.e. a quintillion) calculations per second, subsequently encounters the challenge of energy consumption.

The report found that the ‘current’ GPGPU (General Purpose computing on Graphics Processing Units) has enabled the fastest running supercomputers in the world but involved in making multiple kernel calls, also communicated across the kernel calls. Unfortunately, the off-chip communications consume at least two orders of magnitude more energy [3, 10]. Even the energy consumption of on-chip communication grows linearly with distance. Hence, this comes at a significant energy cost.

The method to avoid the energy cost was to use Stencil Processing Unit which:

1) Propose a parallelization strategy to reduce the energy consuming. The report compared the energy consuming with other computing systems by examining Matrix Multiplication, Dependent Computations.

2) Propose architecture of SPUs, a simple, almost trivial, extension to GPU architectures. The changes must provide extremely energy-efficient communication and synchronization (using Mesh Topology, Instantaneous Communication)

**Reference**

**The Stencil Processing Unit: GPGPU Done Right**  
Sanjay Rajopadhye, Guillaume Iooss, Tomofumi Yuki, Dan Connors   
2013 High Performance Computing on Graphics Processing Units (hgpu.org)

http://www.cs.colostate.edu/TechReports/Reports/2013/tr13-103.pdf