Distributed GPGPU Computing

Martin Stumpf

Ste||ar Group, Louisiana State University

September 16, 2014

Table of Contents

Outline

CPU vs GPU

"<IMAGE GPU vs CPU>"

Why GPGPU?

The theoretical calculation power of a GPU is much higher than a CPU.

Example

CPU (Intel Xeon E5-2670 v3):

- 12 Cores, 2.3 GHz, 32 FLOPS/cycle
  - 884 GFLOPS
- Prize: $\sim$ 1500 \$

GPU (NVidia Tesla K40):

- 2880 Cores, 745 MHz, 2 FLOPS/cycle
  - 4291 GFLOPS
- Prize: $\sim$ 4000 \$

So, what computational tasks are actually suitable for GPGPU?

Problems suitable for GPGPU

Every problem that fits the SPMD programming scheme, can benefit greatly from GPGPU.

Examples:

- Fluid Simulations
- Mathematical Vector Operations
- Image Processing
- Stencil Based Simulations

SPMD based Programming Languages:

- CUDA (NVidia)
- OpenCL (Platform independent)

OpenCL

Outline

Distributed GPGPU with MPI

Outline

Advantages over MPI

Affect on distributed GPGPU programming

Outline

Layout

Layout

Getting devices

Writing data to the device

Creating a kernel

Executing the kernel

Reading the result

Outline

bla

Scaling

Parallel Efficiency