VSCSE summer school - short course

Introduction to CUDA

Lecture 8
Installing and using the CUDA toolkit

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Objective

- To learn how to install the CUDA toolkit
- To become aware of the various tools installed with the CUDA toolkit
- To understand how to use them effectively
  - nvcc
  - cuda-memcheck
  - cuda-gdb
  - cudaprof
  - occupancy calculator (spreadsheet)

nvcc

- nvcc is a compiler driver

- It breaks a cuda program into host and device code
    - Device code is compiled to ptx
    - Host code is compiled by your host compiler (gcc / VS)

- Can be used like gcc
    - `nvcc -c file1.cu`
    - `g++ -c file2.cc`
    - `g++ -o exe file1.o file2.o`
        `-L/usr/local/cuda/lib —lcudart`

- I recommend CMake to simplify things

useful command line options for nvcc

- --ptxas-options -v
  - Prints register, smem, and lmem usage for each kernel
- --keep
  - Saves all intermediate files in the directory
  - Makes a mess, but is an easy way to look at the ptx assembly. Only recommended for out of source builds
- -arch=sm_13 / -arch=sm_20
  - sm_13 enables support for G200 & double precision
  - sm_20 enables support for Fermi
- -g –G
  - Enable debug symbols on the host and device

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cuda-memcheck

- cuda-memcheck checks for any out of bounds memory reads/writes in your kernels
  - like valgrind
  - Available in linux and mac
  - Nexus on windows has a similar feature

- Usage
  - `cuda-memcheck [your-program] [your-program-options]`
  - No need to compile in debug mode
  - your program will run slowly

cuda-gdb

- cuda-gdb is a full hardware debugger for CUDA programs
  - works like gdb
  - Available on linux only
  - Nexus on windows has a similar feature set w/ GUI

- Usage
  - Beyond the scope of this presentation
  - Dr Dobbs has a nice tutorial: http://www.drdobbs.com/high-performance-computing/220601124
  - GUI debuggers for linux are becoming available, but are not free

cudaprof

- cudaprof
  - Tracks time spent in every kernel launch
  - Also gives access to numerous hardware counters
  - Available on all platforms

- Usage
  - Launch profiler
  - Setup session
  - Run session
  - Modify code
  - Setup/run session2
  - ...

Conclusion