Lab 4: Performance Profiling on FPGA and Analysis of Compilation Report

Due Date: See the Blackboard announcement.

rev:03/24/2020

Objectives

- Learn the advanced features in OpenCL programming
- Learn the basics of compiling and executing a kernel binary on a FPGA board.
- Understand the compilation reports generated by Intel FPGA OpenCL compiler.

Description

In this lab, you will use the code you developed in Lab 2 (or lab 1 if you lab 2 is not ready yet).

You need to do the following in this lab:
  (1) Referring to the profiling example in Lab 3, add code to measure the execution time of the kernel function you developed in Lab 2.
  (2) Compile the source code to generate the OpenCL binaries for both host and FPGA [note: the kernel compilation process can take up to a couple of hours];
  (3) Execute the binaries on the FPGA and collect execution results;
  (4) Try to change the size of the problem (e.g. the number of digits in the decimal of π), or the size of global dimension, or local dimension and assess how the changes affect the kernel execution time.
  (5) Read the reports generated during the compilation phase to understand the analytics data about the kernel function realized on FPGA, such as area and memory usages, loop structure and kernel pipeline information.

In this lab, you will practice the commands, and perform the compilation and execution steps in a Linux environment. **You must execute the binary on the FPGA board**, instead of running the program in emulation mode. Please plan your work early so you can have adequate time for FPGA development on Intel DevCloud.

Helpful Notes

Start the lab early.
You can reuse the Makefile in Lab 3.
To build the binary for host, run command "**make**".
To build the binary for FPGA, run the following command: "**make fpga"**

This will trigger the "aoc" compiler command with "--report" option to create report files. The report file will be located in "bin/**<..kernel_file..>**/reports" directory, where "<..kernel_file..>" is the file name of your kernel code. You can copy the entire reports folder to your local computer and then view the file "report.html"

Due date

See the due date posted on Blackboard.

Deliverables

A Lab report that contains the following sections:

1. Description of the lab in your own words
2. Summary of the outcome (final results, working, partial working, etc.). In this lab you will need to capture the outputs from the execution. In addition, you need to choose at least two types of kernel analysis reports (such as area usage and kernel logics) to describe how the compiler attempts to optimize the circuit design on FPGA.
3. Main hurdles and difficulties (expected to include some specifics)
4. Things learned from this lab (valuable takeaways)
5. Suggestions (Optional)

Reference

[1] Lab Assignment materials posted on git repository :
        https://github.com/ACANETS/eece-6540-labs