

High Performance Computing
EECE5640
Prof. Kaeli

Final Project description:

For your project, you can select one of the following project options, or you can propose your own (to be approved by Prof. Kaeli).

OPTION A: This option involves evaluating the performance of two scientific or engineering workloads on a parallel hardware/software platform. The applications studied should present significant computing challenges and should require high performance to achieve good throughput. Some examples of applications include image processing, gene sequencing, video tracking, heat flow modeling, autonomous navigation, and weather modeling. A key element will be identifying an appropriate dataset that you can use in your analysis.

Before starting the project, you should submit a project proposal, which includes the following information:

1. The workloads you will evaluate (e.g., I will study algorithm foo and bar).
2. The input datasets you will use (e.g., I will use the XYZ data set from the ABC repository).
3. The platform you will use in the study (e.g., I use MPI and evaluate a multi-GPU implementation on Explorer using multiple nodes).
4. Experiments you will run (e.g., I will generate timing data on the platform, as well as consider the accuracy of the solution. I will use 3 different input data sets).
5. The results you will generate, and the associated grade you would expect to receive. For example:

A = two workloads evaluated, 3 different inputs used on the platform, all results reported and analyzed thoroughly in the project writeup.

A- = two workloads evaluated, 3 different inputs used on the platform, all results reported, but little analysis of the data included in the project writeup.

B+ = one workload evaluated, 3 different inputs used on the platform all results reported and analyzed thoroughly in the project writeup.

etc.....

OPTION B: This option asks you to evaluate the performance of a machine learning algorithm on two different GPUs. The application studied should present significant computing challenges and should require high performance to achieve good throughput. A key element will be identifying an appropriate dataset that you can use in your analysis.

Before starting the project, you should submit a project proposal, which includes the following information:

1. The workload you will evaluate (e.g., I will study the foobar algorithm using the ABC machine learning framework).
2. The input datasets you will use (e.g., I will use the XYZ data set from the foobar repository).

3. The platform you will use in the study (e.g., I will evaluate performance on a NVIDIA p100 and v100). The courses-gpu partition on Explorer offers two different versions of the p100 GPU and v100 GPUs).
4. Experiments you will run (e.g., I will generate timing data on the platform, as well as report the accuracy/precision/recall as a function of batch size for the machine learning algorithm. I will use 3 different input data sets).
5. The results you will generate, and the associated grade you would expect to receive. For example:

A = 1 workload evaluated, 3 different inputs used on 3 different platforms, all results reported and analyzed thoroughly in the project writeup.

A- = 1 workloads evaluated, 3 different inputs used on 3 different platform, all results reported, but little analysis of the data included in the project writeup.

B+ = 1 workload evaluated, 2 different inputs used on 2 different platform all results reported and analyzed thoroughly in the project writeup.

etc.....

OPTION C: Select a research topic in the field of high-performance computing. The topic could focus on hardware, software or middleware. Complete a literature review on that topic, carefully characterizing and comparing a minimum of 10 different papers related to the topic. The project write-up should include 1-page summaries of each paper, following by a 7-10 page discussion comparing the various approaches and suggesting what future directions should be considered on this research problem. It is expected that the paper will include more than 20 cited papers in the citation list. The write-up should be single-spaced and use 12pt font.

GENERAL:

You can work individually on any option, or in teams of 2 or 3 on options 1 and 2, but of course, a team of 2 should produce 2.25X as much output, and a team of 3 should produce 3.5X as much output. All team members will receive the same project grade.

When you are done with your project, you should submit your completed project in a report. Your report should include the original proposal, as well as a well-written description of the work completed and a thorough analysis of the results obtained. We will leave time during the last 2 classes of the semester for students to give a 10-minute presentation on their project.

Please pay close attention to citing your sources, documenting any tools or work that you use in your project, and produce a document that could be shared with a future employer.