Sprint Report #1

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Team Overview

Project

ARM Cluster

Members

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Sponser

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Project Overview

The goal of this project to build a cluster of 6-12 single-board computers that has the most Floating Point Operations as possible per U.S. Dollar per Watt. Three single-board computers were tested; ODroid 4xU, Raspberry Pi 2B, PcDuino 8. The best one will be selected and the cluster will be created under a budget of $1,200. Then, alternative modes of communication besides Ethernet will be investigates using other pins and ports. The computers will be linked in a topology that will be determined during this investigation.

Project Environment

Project Context

The project is created on a Linux OS. Github is used to share the materials. The code is written in C++. OpenMP is used to run the code in parallel. A Kill-A-Watt monitor is used to test the power of the running devices.

The following single-board computers are tested:

- ODroid 4xU
- Raspberry Pi 2B
- PcDuino 8

Deliverables

- Mission Statement
- User Stories
- Benchmark Code
- Experiment Reports

- Software Contract
- Design Document
- Benchmark Log

Sprint Report

Work for this sprint included:

- Wrote Mission Statement and Elevator Speech
- Drew up Software Contract
- Chose Christine Sorensen as team lead
- Wrote user stories
- Obtained ODroid 4xU, Raspberry Pi 2B, and PcDuino 8 single-board computers
- Wrote number generating code
- Wrote benchmark code that ran addition, multiplication, division, and sine floating point operations
- Added OpenMP to run the benchmark code on all cores
- Ran the code on the computers
- Logged times
- Calculated the GFlops
- Calculated the GFlops/Dollar/Watts
- Determined best computer for the ARM Cluster

Work that is carried over into Sprint 2 is as follows:

- Order more of the computers that proved best from Sprint 1 and maintain the given budget of $1,200.

Experimentation

Testing

Benchmark code was written that tested the length of time to add, multiply, divide, and sine two arrays consisting of 100,000 random floating point numbers that were generated in a seperate number generated program outputting numbers between one and one thousand. The code ran on all cores of the devices.

Results

The PcDuino 8 was not working correctly so it was removed from our selection. This did not cause a huge effect in the project considering each PcDuino costs about $160 and therefore was not a front runner in our experimentation.

The Raspberry Pi 2B with 4 cores and the ODrioid 4xU with 8 cores were tested. The results were as follows:

Length of Time (seconds)				
Device	Addition	Multiplication	Division	Sine
ODroid 4xU	29.925	31.341	37.032	227.40
Raspberry Pi 2B	221.645	221.034	297.204	1468.63

Gigaflops				
Device	Addition	Multiplication	Division	Sine
ODroid 4xU	0.311	0.297	0.251	0.0410
Raspberry Pi 2B	0.0420	0.0421	0.0313	0.00634

Gigaflops per Dollar per Watts				
Device	Addition	Multiplication	Division	Sine
ODroid 4xU	0.00028	0.000268	0.000226	0.0000369
Raspberry Pi 2B	0.0003	0.0003	0.000224	0.0000453

Conclusion

The Raspberry Pi 2B proved to be be better than the ODroid 4xU, however they were very close. We are inconclusive as to whick one will be used for the cluster. In the following Sprint 2, we will look into the ordering parts and our budget to make a choice as to which of the two single-board computers we will use.