**ABSTRACT**

Title: Parallel Processing with 8 Node Raspberry Pi Cluster

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We will present an eight node Raspberry Pi cluster computer with a distributed memory architecture. Our cluster contains Raspberry Pi 3 Model B's with 1 GB of RAM and a 4x ARM Cortex-A53, 1.2GHz processors. A 3D-printed a case holds the Pis in a single cabinet. One Pi acts as the head node of the cluster and is connected to the school’s Wi-Fi. The head node is connected to seven remaining slave nodes through a 16 port Netgear 10/100 switch. NAT on the head node gives the slave nodes access to the internet. Our primary method of interacting with the cluster is by SSH through the head node.

Raspberry Pis have the potential to be a cost effective educational tool to teach students parallel processing. With our cluster we intend to run experiments using the Message Passing Interface (MPI) standard. Experiments will show how efficiency in computing changes as the number of nodes in the cluster increases. We hypothesize that as the number of nodes increases, the computing efficiency will increase up to a point. Eventually increased network traffic on the 100 Mb Ethernet will become the bottleneck and no more increase in efficiency will be seen. We will test this though running multithreaded computationally intensive tasks on the cluster such as calculating primes and various numerical methods. We will run the experiments for one through eight nodes. For a comparison, we will also run the computations on our personal laptops to determine how the speed of a Raspberry Pi cluster compares to today’s mainstream computers. Our primary goal is to demonstrate how Raspberry Pis are an effective yet comparatively cheap solution for learning parallel processing. We will provide detailed instructions on how to set up a cluster and get started.