**Background:**

A computer cluster is a designed single logical unit that contains multiple computers. These computers are work together through a network and essentially acts as one machine with more power, speed, storage, and data reliability(1). One computer of the cluster holds the software that manages all of the computers(2).

In high-performance clusters, each of the computers perform operations in parallel. This enhances the performance and speed of the applications being ran on them(4).

The TOP500 is a project that ranks the five hundred most powerful supercomputers in the world. These computers perform high-level computations compared the general purpose consumer computers. They rank these by using the LINPACK Benchmark(3).

LINPACK is a software library that performs numerical linear algebra on a computer system, testing every combination of number of cores and size of matrices. It’s designed to fill as much available memory on the eight devices as possible and t use every core of the machine.

As of November 2015, the NUDT’s Tianhe-2 (Milky-Way-2) has been placed at number one of the TOP500 list for the sixth time in a row. The Tianhe-2 holds about 3.1 million cores and performed at 33,862.7 TFlops/s from the LINPACK benchmark. Ten years prior, the top was the IBM’s BlueGene/L with more than 65.5 thousand cores and running at 136.8 TFlops/s. In TOP500’s first list released in 1993 placed Thinking Machines Corporation’s CM-5/1024 as the top supercomputer with only 1024 cores and 59.7 GFlops/s.

In just ten years, the speed of these supercomputers have increased by over two hundred percent.

**-What are they used for?**

**//education**

**Description of what we’ve done**

The purpose of this project was to build an ARM cluster of 6-12 homogeneous single-board computers with the goal to make it the fastest and most efficient in cost and energy with the intention of showing a proof of concept.

We decided the metric to measure efficiency in cost and energy would be the number of float-point operations per dollar per unit of power. Three types of single board computers were chosen to be tested: Raspberry Pi 2B, PcDuino, and ODROID XU4. Before testing took place, the PcDuino was dropped due problems with the operating system. With this knowledge and the cost of $160 per board led to the disqualification of the computer inferring that it would not excel in the tests.

An Open Multi-Processing (OpenMP) benchmark was installed on the ODROID XU4 and Raspberry Pi 2B. This bench mark ran various mathematic equations on all cores. The results are as shown in Figure ##.

<insert table of results>

Even theough the Raspberry Pi 2B performed best in the benchmark, the ODROID XU4 was chosen because the bandwidth potential was higher and it ran 7.4 times faster.

Eight ODROID XU4s were purchased. They were connected in a star topology using an unmanaged switch. <Insert diagram?> It was decided to use LINPACK, a software that performs numerical linear algebra that is commonly used for cluster benchmarking. However, LINPACK benchmarking softwared did not exist for an ARM cluster.

**Results**

**Conclusion**

**Bibliography**

1) <https://www.techopedia.com/definition/6581/computer-cluster>

2) Christensson, P. (2015, April 22). Cluster Definition. Retrieved 2016, Mar 20, from <http://techterms.com>

<http://techterms.com/definition/cluster>

3) http://www.top500.org/resources/frequently-asked-questions/

4) https://www.centos.org/docs/5/html/Cluster\_Suite\_Overview/s1-clstr-basics-CSO.html