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Linux Clustering
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A computer cluster is a group of tightly coupled computers that work together closely so that in many respects they can be viewed as though they are a single computer. The components of a cluster are commonly, but not always, connected to each other through fast local area networks. Clusters are usually deployed to improve performance and/or availability over that provided by a single computer, while typically being much more cost-effective than single computers of comparable speed or availability.(Wikipedia)

In this presentation a combination of software and hardware was used to get a cluster built and running. A Pi calculator was used and spread out across computers to get a performance increase.

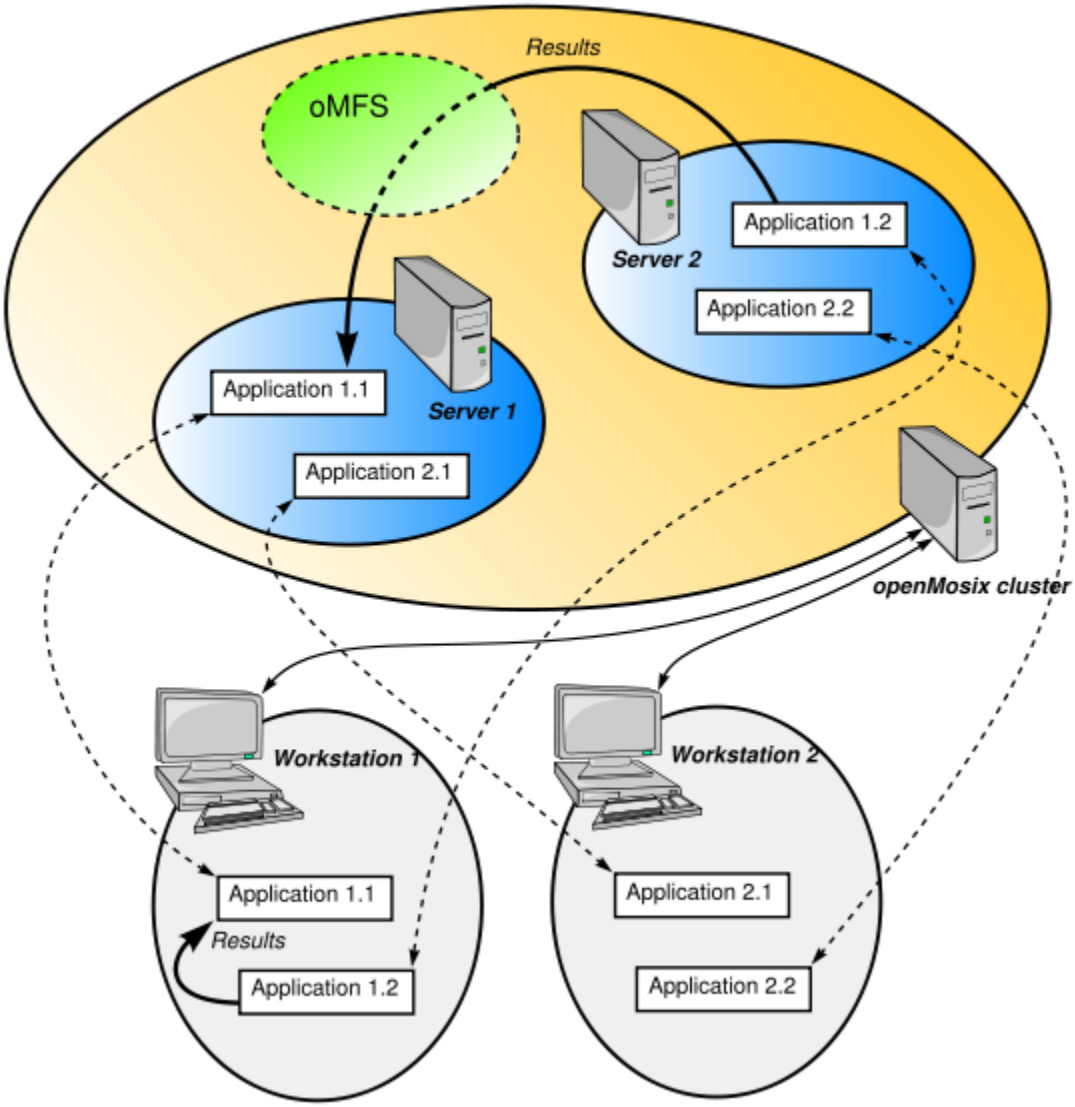
In the world of clustering there are four main types of clusters. High-availability, Load-balancing,High-performance computing (HPC), and grid computing. An HPC cluster was used, as it provided a high performance increase for our mathematical calculations. HPC clusters are implemented primarily to provide increased performance by splitting a computational task across many different nodes in the cluster, and are most commonly used in scientific computing. Such clusters commonly run custom programs which have been designed to exploit the parallelism available on HPC clusters. HPCs are optimized for workloads which require jobs or processes happening on the separate cluster computer nodes to communicate actively during the computation. These include computations where intermediate results from one node's calculations will affect future calculations on other nodes.(Wikipedia)

Hardware

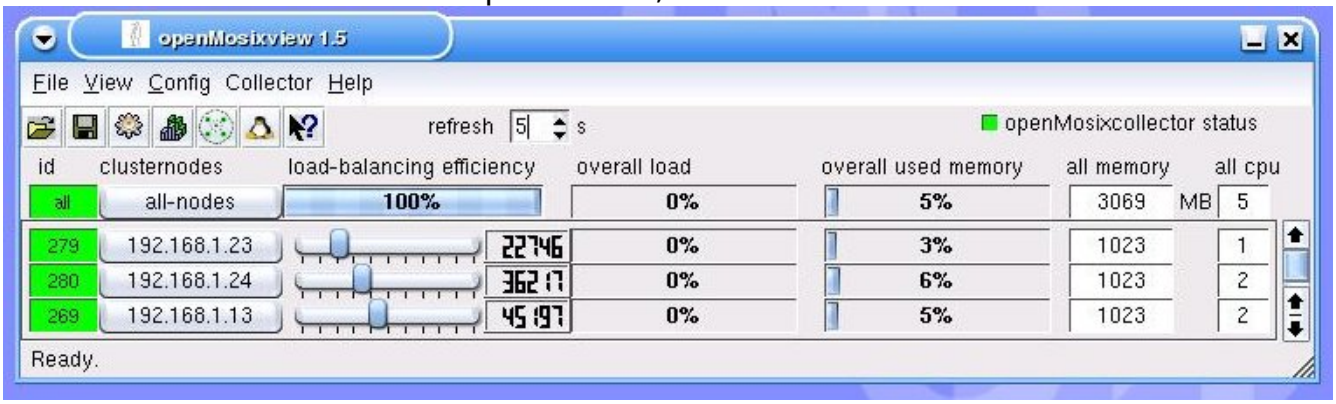
The control hardware used is as follows: 1 – AMD Athlon 3700+ (Overclocked 10%) + 3 GB ram. 3 – Pentium 3 500 mhz with 128 MB ram each. They were all networked via a 100mb switch and attached to a DHCP server. This was the setup for the initial tests. For the demonstration volenteers were used to add more processors to the grid. The presentation environment added 4 more processors to the cluster, including a Core 2 Duo, Core Solo, and an AMD Turion. These were each wired to the existing switch.

Software

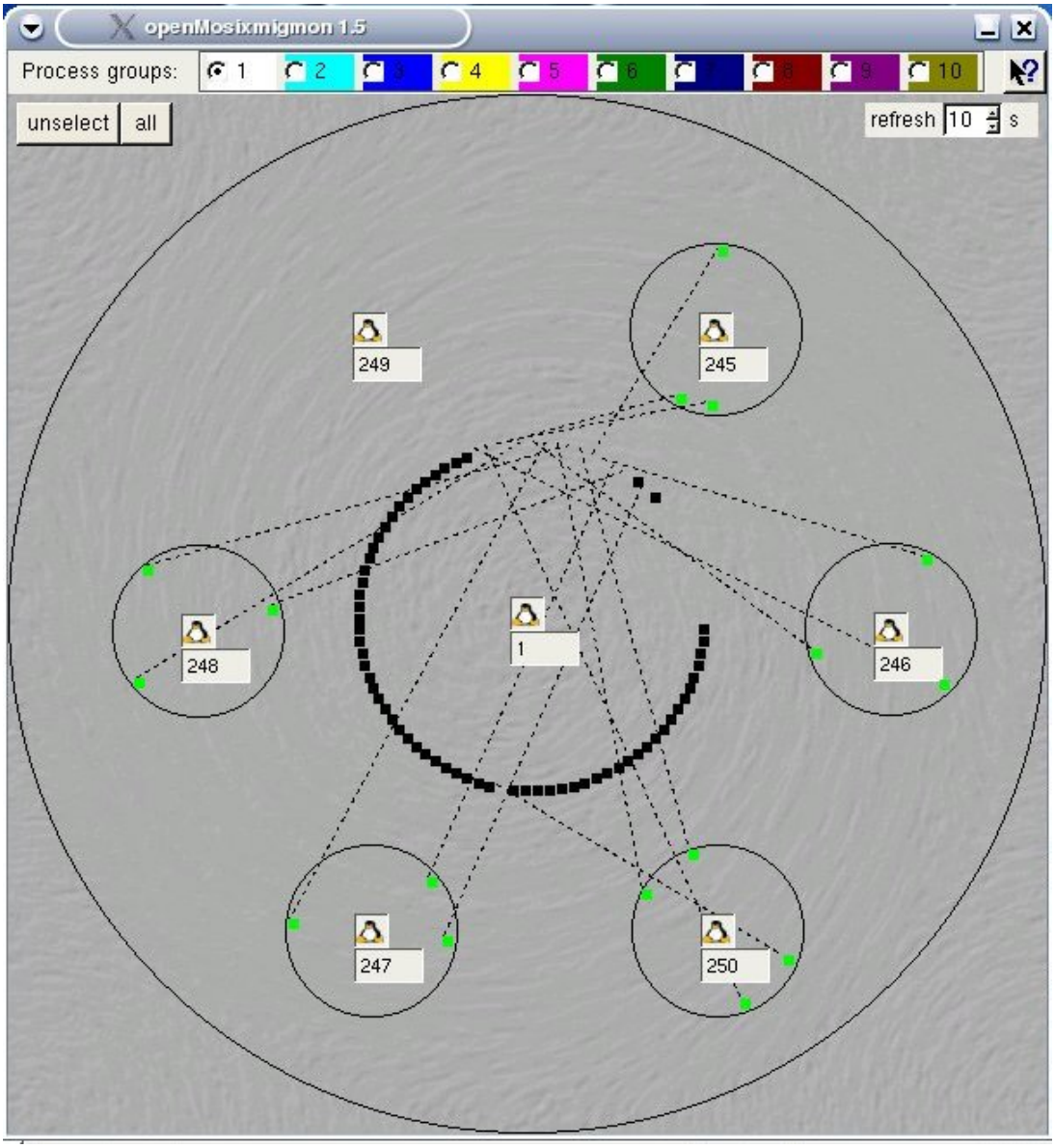
The software that was used to cluster the computers together is called OpenMosix. OpenMosix is a free cluster management system that provides single-system image (SSI) capabilities, e.g. automatic work distribution among nodes. It allows program processes (not threads) to migrate to machines in the node's network that would be able to run that process faster (process migration). It is particularly useful for running parallel and intensive input/output (I/O) applications. (Wikipedia)



The openmosixview program allows for the visual of what the cluster is doing. It shows each system, cluster ID, IP address, load efficientcy, overall load, used memory, overall memory, and CPU's. It also shows the cumulitive cluster totals. This is more informative than productive, as it will run without this.



The processes is what is the important part in this case. OpenMosix distributes these process throughout the cluster. These are automatic when running certain software, but it can also be used to distribute specific processes. Part of the openmosixview lets you select certain processes and assign them to a specific computer. This is useful when you don't have many threads, but still want to assign processes to other clusters. To assign a process to another cluster simply drag a square to another computer, and that computer takes over.



The Pi calculation software was specificly written to be used in a cluster environment. It works by spawning multiple processes and assigning each process a chunk of calculations to do. After each computer process its chunk, it sends a 16 byte file back to the master node. After all the computations are complete, it compiles all the temp files into one complete file. The Pi program uses the Plouffe and Bellard algorith, shown below. The code is written in C++

and can be obtained from:
http://sourceforge.net/project/showfiles.php?group_id=54167&package_id=82888
under the title Plouffe & Bellard v1_om (pi1_f_om.cpp).

$$\pi = \frac{1}{2^6}\sum_{n=0}^{\infty}\frac{(-1)^n}{2^{10n}}\left(-\frac{2^5}{4n+1}-\frac{1}{4n+3}+\frac{2^8}{10n+1}-\frac{2^6}{10n+3}-\frac{2^2}{10n+5}-\frac{2^2}{10n+7}+\frac{1}{10n+9}\right)$$

For the client machines a Knoppix Live-CD was used. It contains all the programs to get a client on the cluster. This works out well, as no installation or configuring is nessisary. Boot the CD, and your on the cluster. The CD is called ClusterKnoppix, and can be found at http://clusterknoppix.sw.be/

Times.

5000 Digits w/out:	72min 42 Sec
5000 Digits w/3 p3 500's:	37min 01 sec
5000 Digits w/7 cpu's:	07min 27 sec

The cluster made a vast improvement in calculation times.

http://projectpi.sourceforge.net/
http://en.wikipedia.org/wiki/OpenMosix
http://en.wikipedia.org/wiki/Computer_cluster
http://openmosix.sourceforge.net/
http://en.wikipedia.org/wiki/ClusterKnoppix
http://clusterknoppix.sw.be/
http://fabrice.bellard.free.fr/pi/

Pi (5000 Digits)

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