Performance Evaluation of a Supercomputer Made from Discarded PCs

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Computer simulations play a fundamental role in the field of science. However, the necessary calculations require serious computing power, a facility which is often confined to well-funded institutions. If these computing power can be replicated for low budget, it would open a wide range of possibilities to students. Therefore, we investigated the feasibility of building a high-performance cluster from discarded PCs. We made a cluster consisting of fifteen third-generation Core i5 and thirty-two Core 2 Duo, before testing its performance using a simple MPI program that calculates pi. We then moved on to prove that the cluster can execute a practical application by running a resource-consuming “GADGET-2” – a standard N-body simulation code used in the field of astronomy. The time it took to execute the pi program became 97% shorter compared to the time taken by a single core. Further tuning led to a hardware execution efficiency (actual increase in performance / theoretical increase in performance) of 54.7% which gave the measured performance of 644 GFLOPS (Floating-point Operations Per Second). A sample program of GADGET-2 was executed in 10 minutes, significantly faster than the 1.5 hours it took for a laptop to complete the calculation. Even though discarded PCs may not have enough computing power on their own, when assembled into a cluster, they gain the ability to calculate at a speed equivalent to that of today’s high-end PCs. This implies that the students can construct their own high-performance cluster locally, hence the acceleration and divergence of their scientific research.

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