First Light of the Earth Simulator and Its PC Cluster Applications

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Abstract

The Earth Simulator (ES) is the largest parallel vector processor in the world that is mainly dedicated to large-scale simulation studies for global change. The development of the ES system started in 1997 and was completed in the end of February, 2002. The system consists of 640 processor nodes that are connected via a very fast single-stage crossbar network (12.3GB/s). The total peak performance and the main memory of the system are 40TFLOPS and 10TB, respectively.

Studies to evaluate the performance of the ES were made by using an atmospheric circulation model Afes (Atmospheric General Circulation Model for ES) and LINPACK Benchmark Test. The sustained performance of the Afes for T1279L96 (the equivalent horizontal resolution given by T1279 is about 10km and the total number of layers is 96) was as high as 14.5 TFLOPS on a half system of the ES with 2,560 PEs (320 nodes). The sustained-to-peak performance ratio was 70.8%. Also, the ES achieved a LINPACK world record of 35.86 TFLOPS. This rating exceeded the previous record, set by the ASCI White, by about 5 times.

Now, the Earth Simulator is running. Huge amounts of output data will arise from the huge computer system. For example, the data volume of simulation results from the Afes is of the order of 10-100 TB. In the phase of operation,

- *management of huge output data files, and*
- *interactive visual monitoring of many terabytes of simulation results*

are extremely important for the ES. The ES has introduced a prototype PC cluster to seek the best solution to these problems. The PC cluster comprises 64 PCs that are interconnected with a Myrinet2000 switch. Each PC has a Pentium III (1GHz) , 1GB of main memory and 120 GB of disk space.

An outline of the Earth Simulator system, recent results on performance evaluation using real applications and LINPACK benchmark test, and an outline of the PC cluster system will be presented at the conference.

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