A Benchmark of Beowulf Cluster for Nuclear Engineering Advanced Computation

Jeong Hwan Park, Nam Zin Cho, and Myun Soo Kim

Korea Advanced Institute of Science and Technology
Department of Nuclear Engineering
373-1 Kusong-dong, Yusong-gu
Taejon, Korea 305-701

Abstract

Network-of-Workstations technology is applied to the challenge of implementing very high performance workstations for nuclear engineering applications. Our Beowulf parallel workstation employs 12 PC-based processing modules integrated with dedicated fast ethernet network.

This paper presents results from a series of computations that measure the scaling characteristics of Beowulf. The evaluation includes the Monte Carlo transport code MCNP4B based on PVM and a FDM code for neutron diffusion equation, which we developed, based on MPI.

In MCNP calculations, the parallel efficiency of $\sim 90\%$ is observed for the shielding problems, and much higher speedups are possible if the number of histories is increased by orders of magnitude. However, only minor additional speedups are expected to be possible for the criticality problems.

In the case of FDM, the parallel efficiency is lower relative to MCNP calculations. But if we increase the problem size or apply the realistic three-dimensional neutron diffusion or transport problems, we will get good parallel efficiency.

Our Beowulf cluster shows that this architecture provides a new operating point in performance to cost for high performance workstations.