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Parallel Computation of Interacting Ocean Model and Mesoscale Atmospheric Model in Beowulf Clustering System

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Beowulf is a multi-computer architecture which can be used for parallel computations. It is a system which usually consists of one server node, and one or more client nodes connected together via Ethernet or some other network. The 4 nodes standard NFS system and 1 server, 16 clients diskless system, totally 21 nodes, is composed (Fig. 1). The mechanism that is used for communication is called Message Passing. Message Passing calls are put in the code to send data between the nodes.

In order to run the Princeton Ocean Model on a Beowulf cluster using distributed memory (DM), a technique called Domain-decomposition is used. The idea is to break up the grid into smaller sections. Each section is assigned to a separate process and each process runs the Princeton Ocean Model on its sub-domain. When calculations are performed at the borders of the sub-domain, communication with bordering processes is required to be consistent with the serial code.

MM5 also has been extended for use on DM parallel computers. It also provides an alternative to shared-memory parallel execution on distributed shared memory (DSM) machines. Increased memory and performance from scalable parallel machines will support higher resolution studies over larger domains. For compiling at the Beowulf Clustering System, the Portland Group's fortran compiler is needed for solving binary file problem.

Currently, when running with 16 single-CPU nodes, the parallels model runs about six times faster than the serial models because of memory traffics. Especially the real case of POM is slower because some of these sub-domains have just a small amount of water in them. By changing the decomposition rules it should be possible to create sub-domains with more equal sized areas of water.

Each models, third-generation ocean wave model, the three-dimensional ocean circulation model and mesoscale atmospheric model, are coupled for the comprehensive model for mesoscale air-sea circulation using MPMD (Multi-Processor Multi-Data) method.

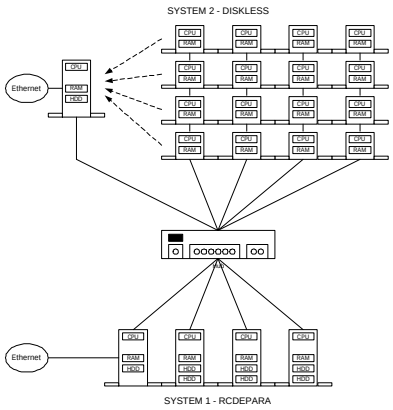

Fig. 1. Beowulf cluster System

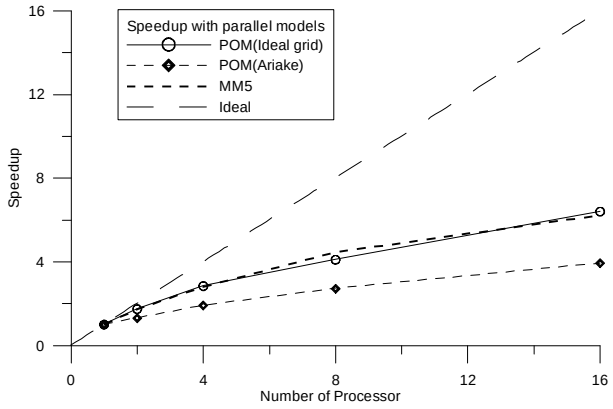

Fig. 2. Speedup with parallel models