SVU will be acquiring a 32-processor Pentium 4 Xeon-based Linux cluster to add to our array of compute servers. With the installation of this cluster, SVU users will be able to run parallel programs using the installed parallel libraries and tools in the new system. This system will add another 108 GFlops ($10^3$ floating point operations per second), to SVU’s compute capabilities.

The Linux cluster will be based on the popular Rocks cluster configuration tool, similar to an earlier cluster used for Academic Computing. The cluster will be made up of 16 2-processor Pentium systems, each acting as a compute node. A major component of the system is the parallel infrastructure, which enables high-speed communications between compute nodes. The cluster interconnect is a specialised set of high-speed, low-latency network communication hardware that is built to increase the speed and the volume of data transferred between compute nodes. Three candidates were considered during the purchase evaluation, namely, Gigabit Ethernet (GE), Myrinet and Quadrics. While each of the choices have their own pros and cons, SVU decided to go for Myrinet for their cost (more than GE but much cheaper than Quadrics), flexibility (Myrinet supplied the appropriate 24-port switch suitable to the number of nodes that we have) and space savings considerations (Myrinet uses common fibre cables that are smaller and thus uses less rack space).

As the cluster system is a distributed memory system, programming for the system will be slightly different, but tools will be made available to help users make full use of the hardware. The de-facto standard for programming a cluster system is to use message passing, and MPI (Message Passing Interface) is a popular set of tools and libraries for this purpose. Some commercially available software in SVU are already making use of the MPI libraries, as some users may have realised. One of these is Fluent, a computational fluid dynamics application software.

In a distributed memory environment, memory management is a critical part of the programming exercise. One of the concepts of cluster programming is scalability. To accommodate a large computational model (i.e., a large array of variables), the model has to be partitioned into smaller arrays, which can then be distributed to different compute nodes. It is also important to have a balanced load on all compute nodes, so that all the nodes will not have to be idle while waiting for other nodes to complete their computations. The parallel nature of the system also adds to the complexity of other aspects of programming such as debugging and profiling. Fortunately, there are tools developed to help a programmer in programming for the cluster system. MPI is a standard for programming in message passing and many compiler developers have support for this.
Our cluster will be using the Portland Group, Inc. (PGI) compilers which have tools and libraries to assist programmers in the parallel programming tasks mentioned above. Among their tools are the Fortran and C compilers, graphical MPI and OpenMP debugging and profiling tools, MPI-CH libraries and utilities and ScaLAPACK parallel math libraries.

In addition, the Myrinet interconnect hardware also comes with programming libraries to access the high-speed capabilities of the hardware. One of the features of the interconnect is its ability to bypass the operating system for faster data transfer. Users can make use of the libraries to access this and other features of the interconnects.

**HPC Cluster Programming Workshop**

To help users make use of the new cluster system, SVU will be inviting Dr. Putchong Uthayopas, a renowned researcher from Kasetsart University, Thailand to conduct a 3-day training session in SVU. Dr Putchong, who obtained his PhD at the Centre for Advanced Compute Studies at the University of Louisiana, is an expert in the field of Cluster Computing and Parallel and Distributed Environments. The registration for the workshop will be opened when the cluster is released within the next 2 months.