HPC 1 Fall 2003
Homework 4

This is a straightforward exercise to execute matrix-matrix multiplication. Create a NxN matrix A, where N is a power of 2. A is to be 0 except for 2x2 blocks down the identity, which are to be rotation matrices with an angle θ, so

$$A = A(\theta) = \begin{pmatrix} \cos(\theta) & \sin(\theta) & 0 & 0 & .... & 0 & 0 \\ -\sin(\theta) & \cos(\theta) & 0 & 0 & .... & 0 & 0 \\ 0 & 0 & \cos(\theta) & \sin(\theta) & .... & 0 & 0 \\ 0 & 0 & -\sin(\theta) & \cos(\theta) & .... & 0 & 0 \\ & & & ..... & & & \\ & & & & & \cos(\theta) & \sin(\theta) \\ & & & & & -\sin(\theta) & \cos(\theta) \end{pmatrix}$$

Let B = A(-θ).

Write an MPI program that performs the multiplication C=A*B by the pipeline method we talked about last week. Then use the BLAS routine for general matrix-matrix multiplication (dgemm) to perform the same multiplication. Get timings for both approaches.

You should run this on at least a 128x128 matrix. DO NOT use the sparse nature of the matrices – store the full matrix including all the zeros, and do all the multiplications (I choose these matrices to make it easy for you to see that you are getting the correct answer). Do not use that $B=A^T$. Use a convenient angle (not 0). You should run on Young, the Sun cluster, ultimately with 4 processors. Do not use Crosby – we need to see the communication timings here. Young has a hpc course queue for us. The hotpage gives a sample you'll need to link in the sunperf library, which has BLAS. You'll need to look at netlib to see the structure and call sequence for dgemm.

I would like to see a brief description of your pipeline approach, and the timings.

Due: December 2.