Homework I

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30 points, due Feb. 8, 2012

The Assignment

The objective of this assignment is to continue your familiarization with the Open MPI system on the condor cluster. I suggest that you create a separate folder on condor for working on this assignment.

1. Download the `hello1.c` source program. Compile it using `mpicc`:

   ```
   mpicc -o hello1 hello1.c
   ```

   and run four instances of it:

   ```
   mpirun -n 4 hello1
   ```

   Note that each process prints its own message. Take a screenshot of the program's output (see below).

   Run the program a few times. Note that the order of the messages changes from run to run. Explain.

2. Modify `hello1.c` so that the the slave processes send their rank to the master process, which prints a "Hello message" on their behalf. (The slave processes will no longer print anything.) The program output should look something like:

   ```
   Master: Hello slaves, give me your messages.
   Message received from process 1: Hello back.
   Message received from process 2: Hello back.
   Message received from process 3: Hello back.
   ```

   Hint: use C's `sprintf()` function to convert `rank`, which is an integer, to a string. Alternatively, modify the `MPI_Send()` and `MPI_Recv` calls to send/receive an integer.

   Again, run four processes and take a screenshot of the program's output.

3. Modify the program again so that each slave process sends a different message back to the master process. For example:

   ```
   Master: Hello slaves, give me your messages.
   Message received from process 1: Hello, I am John.
   Message received from process 2: Hello, I am Mary.
   Message received from process 3: Hello, I am Susan.
   ```

Again, run four processes and take a screenshot of the program's output.

4. Write an Open MPI program in which the master process sends a single integer to the (one) slave process, which immediately sends the integer back to the master. The master process should record the current time (using `MPI_Wtime()`) just before it sends its message, then record the current time as soon as it has received the message from the slave process, then print the elapsed time.

   Run this program using a hostfile (see the documentation for `mpirun` to learn how to do so) with these two lines:

   ```
   condor
   condor
   ```

   Run the program several times and calculate the average elapsed time.

   Repeat using a hostfile with these two lines:

   ```
   condor
   n0
   ```

   Comment on any differences in the elapsed times.

Taking Screenshots on Condor

The easiest way of taking a screenshot is to use "Take Screenshot" under the Accessories menu. That will save your screenshot as a PNG file, which you can insert into an MS Word document. For more control, you could use "The Gimp" (GNU Image Manipulation Program) under the Graphics menu.

Submitting Your Assignment

Prepare a document showing that you successfully completed all parts of the assignment. This document will include your screenshots, answers to questions posed in the assignment, and your properly documented source code. This document should be emailed to me by the start of class on the 8th.

Condor has OpenOffice Writer installed (look under the Office menu). It is quite similar in operation to MS Word, before Microsoft introduced the "Ribbon." I would suggest you use Writer to prepare your assignment document. One note of caution: By default, Writer saves documents in ODF format. I would suggest you use "Save As" and save your document in MS Word (DOC) format.