

Crib Sheet: Bridges2 MPI & OpenMP Exercises

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1 Logging on

Use your username and password to access Bridges:

```
[user@laptop ~]$ ssh -p 2222 xsede-username@bridges2.psc.edu
```

Although Bridges2 has high performance filesystems which should be used for large production jobs, here we will just use the home filesystem for simplicity.

2 Obtaining source code

You can obtain the source code from the Learn pages. However, if you download these from a browser then they will end up on your laptop which isn't particularly useful.

If you are using a terminal on a Mac or Linux system then you can copy files using `scp`:

```
[user@laptop ~]$ scp -P 2222 localfile xsede-username@bridges2.psc.edu:
```

(note that for `scp` it is a capital P, not a lowercase p!).

If you are using MobaXterm from Windows you will have access to drag-and-drop file transfer.

3 Compiling code

You have to load a module to access MPI:

```
[user@bridges2 ~]$ module load openmpi
```

The GNU compilers (`gcc` and `gfortran`) are used for the MPI programs via the standard wrappers `mpicc` and `mpifort`.

So, to compile an MPI program in C:

```
[user@bridges2 ~]$ mpicc -o hello hello.c
```

or in Fortran:

```
[user@bridges2 ~]$ mpifort -o hello hello.f90
```

For OpenMP, you pass a special option to the GNU compilers, e.g. for C:

```
[user@bridges2 ~]$ gcc -fopenmp -o hello hello.c
```

For Fortran:

```
[user@bridges2 ~]$ gfortran -fopenmp -o hello hello.f90
```

4 Running on Bridges2

4.1 MPI

You cannot run MPI jobs on the login nodes. The simplest approach for development work on small numbers of processes is to use the `interact` command.

For example, if you want to run on up to 16 processes:

```
[user@bridges2 ~]$ interact -n 16
```

After a small wait you should be allocated resources and see a different prompt. You can then run jobs:

```
[user@r001 ~] mpirun -n 16 ./hello
```

4.2 OpenMP

You can run parallel OpenMP jobs on the login nodes, but you should only do this for small test jobs. For example, to run on 4 threads:

```
[user@bridges2 ~]$ export OMP_NUM_THREADS=4  
[user@bridges2 ~]$ ./hello
```

For compute intensive jobs, use the `interact` command to get access to dedicated resources on the compute nodes as described in the MPI section above.

5 Running jobs during the Summer School

For the actual summer school we will have reservations in place to give you guaranteed access to resources. Instructions on how to access the reservations will be given at the relevant hands-on sessions.