

## Building High Performance Linpack (HPL) with GotoBLAS

1. Before doing this, you **MUST** have already installed GotoBLAS and know the directory that it's in.
2. Open up a web browser and go to your favorite search engine (e.g., Google).
3. Search for:  
    "High Performance Linpack"  
    Be sure to include the double quotes around the phrase.
4. On the HPL benchmark webpage, scroll down and copy the URL of the HPL source code (that is, the URL of `hpl-2.0.tar.gz`).
5. Copy the location of that link.
6. Go into your `NCSIPARI2011_exercises` directory:  
    **cd ~/NCSIPARI2011\_exercises**
7. Create an HPL directory:  
    **mkdir HPL**
8. Go into that directory:  
    **cd HPL**
9. Create a directory named for the implementation of BLAS you're using (in this case, GotoBLAS):  
    **mkdir WithGotoBLAS**
10. Go into that directory:  
    **cd WithGotoBLAS**
11. Create a directory named for the implementation of MPI that you're going to use (in this case, OpenMPI):  
    **mkdir OpenMPI**
12. Go into that directory:  
    **cd OpenMPI**
13. Download the HPL source code using this command:  
    **wget http://www.netlib.org/benchmark/hpl/hpl-2.0.tar.gz**
14. Check to see that you now have the HPL source code:  
    **ls**
15. "Untar" the compressed tar file:  
    **tar zxvf hpl-2.0.tar.gz**
16. Go into the newly created HPL directory:  
    **cd hpl-2.0**
17. Determine your current working directory:  
    **pwd**

18. Read the file named **INSTALL**, which has instructions for how to install HPL:

```
more INSTALL
```

If you're unfamiliar with the `more` command, ask someone for help.

19. Copy an appropriate `Make.something` from the subdirectory named `setup` into the current working directory, naming the new copy with the name of the machine you're on:

```
cp setup/Make.Linux_PII_CBLAS Make.Sooner_GotoBLAS_OpenMPI
```

20. Using your preferred text editor (for example, `vi`, `emacs`, `nano`), edit the new file `Make.Sooner_GotoBLAS_OpenMPI` as follows:

a. Change the value of `ARCH` to the part of this file's name after the dot:

```
Sooner_GotoBLAS_OpenMPI
```

(that is, the name of the file you just created, except without the `Make` and the dot.)

b. Change the value of `TOPdir` to the current working directory.

c. Change the values of `MPdir`, `MPinc` and `MPlib` to be blank (after the equals sign).

d. Change the value of `LAdir` to the directory containing the GotoBLAS libraries.

e. Change the value of `LAlib` to:

```
-L$(LAdir) -lgoto2
```

We've had multiple of instances of that not working properly, usually because of trailing blanks and other subtle syntax errors, so you may need to use this:

```
$(LAdir)/libgoto2.so
```

f. Change the value of `CC` to `mpicc`.

g. Change the value of `LINKER` to `mpif77`.

h. Save the file and quit from your editor.

21. Set the environment variables for the compiler and interconnect driver software.

If the Unix shell that you're using is `tsh` (WHICH IS THE CASE FOR NCSI Intro to Parallelism), that'd be:

```
setenv MPI_COMPILER gnu  
setenv MPI_INTERCONNECT ib  
setenv MPI_VENDOR openmpi
```

If the Unix shell you're using is `bash`, that'd be:

```
export MPI_COMPILER=gnu  
export MPI_INTERCONNECT=ib  
export MPI_VENDOR=openmpi
```

22. Do the build using the following `make` command:

```
nohup make arch=Sooner_GotoBLAS_OpenMPI >& make_output.txt &
```

This will take several minutes.

**NOTE:** `nohup` means “Even if I get logged out, keep going;” the `>&` means “redirect stdout and stderr to the following file;” the ampersand `&` at the end means “do this in background.”

**NOTE:** If anything goes wrong, do the following:

a. Copy your `Make.Sooner_GotoBLAS_OpenMPI` file to your scratch directory:

```
cp Make.Sooner_GotoBLAS_OpenMPI /scratch/yourusername
```

b. Go up to the parent directory:

```
cd ..
```

**NOTE:** The two periods (“dotdot”) at the end of the `cd` command mean “to the parent of this directory” and are **VERY IMPORTANT**.

c. Delete the entire HPL directory:

```
rm -rf hpl-2.0
```

d. Repeat steps 15 - 17, above.

e. Copy the `Make.Sooner_GotoBLAS_OpenMPI` file back into that directory; for example:

```
cp /scratch/yourusername/Make.Sooner_GotoBLAS_OpenMPI .
```

**NOTE:** The period (“dot”) at the end of the `cp` command means “to the current working directory” and is **VERY IMPORTANT**.

f. Edit your `Make.Sooner_GotoBLAS_OpenMPI` to fix whatever caused the problem.

g. Repeat step 22 as needed.

23. Check that the output from the `make` command (in the file named `make_output.txt`) shows that you built HPL properly.