

Concurrency and Parallel Programming

DAS4 instructions

November 3, 2017

1 Accessing DAS-4

For the practical assignments you will be working on the DAS-4. During the first practical session you should have received an account per team. The DAS-4 consist of several clusters. For example, DAS-4/VU and DAS-4/UvA. You will be using the VU cluster, which head node is named fs0.das4.cs.vu.nl. To access the cluster, you have to use SSH:

```
$ ssh -X USERNAME@fs0.das4.cs.vu.nl
```

Where USERNAME should be the user account you received. The -X flag is optional, but enables X11-forwarding. This way, you open graphical applications through ssh. To transfer files from your own machine to DAS-4, you can use scp.

```
$ scp file USERNAME@fs0.das4.cs.vu.nl:
```

To synchronize files you can use rsync. rsync is a file synchronization program that minimizes network data transfer. To synchronize folder A on your machine with folder A on DAS you can run:

```
$ rsync -avz -ssh /home/$USER/A USERNAME@fs0.das4.cs.vu.nl:/home/$USER
```

Or mount your home directory with sshfs.

```
$ mkdir ~/das4  
$ sshfs USERNAME@fs0.das4.cs.vu.nl: ~/das4
```

Now all files in your DAS-4 home directory are accessible in the directory /das4. Lastly, you can also use a version control system like git, and pull your files on DAS-4.

2 running jobs

Once on the head node, you can edit and compile your program. In order to use prun you should first load the prun module.

To see the available modules you can type:

```
$ module avail
```

To load the prun module type:

```
$ module load prun/default
```

When you are ready to test your program, you can schedule your job in the queue using prun.

```
$ prun -v -np 2 <programname>
```

For example you can try:

```
$ prun -v -np 2 date
```

Here, -np 2 means you want two node. Each node contains two cpus with each 4 cores. Sometimes all nodes are busy, and your job will have to wait in the queue. You can check the queue using the command qstat. There are 74 nodes in the VU cluster.

Note: If you name you program test and want to execute it you should specify its absolute path. That is because there is a command in /usr/bin/test. So assuming your program is in your home directory instead of typing:

```
$ ./test
```

you should type:

```
$ $HOME/test
```

3 MPI

To add MPI to your environment type:

```
$module load openmpi/gcc
```

If everything is ok you should be able to run:

```
$which mpicc
```

To compile and run mpi code use the following:

```
$ mpicc -O2 -o <output> <sourcefile>  
$ mpirun -np 2 <output>
```

Here, -np 2 means you want two processes to run. you can also submit with prun, which is the preferred way by typing:

```
$prun -np 1 -v -2 -sge-script $PRUN_ETC/prun-openmpi 'pwd' /<output>
```

Here, -np 1 means you want one node and -V -2, two processes to run. If you have -np 2 and -V -2 this means that on each node youll get 2 processes.

4 GPU programming

GPUs on DAS-4 can be programmed using CUDA and OpenCL.

To add CUDA 5.5 to your environment type:

```
$module load cuda55/toolkit
```

If all is ok, you should be able to run the CUDA compiler try:

```
$nvcc --version
```

For running CUDA jobs, you can use:

```
$prun -v -np 1 -native '-l gpu=GTX480' <programname>
```

For example you can try:

```
$prun -v -np 1 -native '-l gpu=GTX480' \  
$CUDA_SDK/bin/x86_64/linux/release/deviceQuery
```

5 Remote access

If you want to work on the assignment from home, you cant directly connect to the DAS-4. In order to work from home, you have to use UvA-VPN. For more information see <https://linux.datanose.nl/index.php/UvAvpn>

6 More information

A more comprehensive explanation can be found on the DAS-4 website: <http://www.cs.vu.nl/das4/home.shtml>. Here you will find more information about both the machines itself, and how to use them.