MPI (Message Passing Interface)

Outline

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Structure of MPI code

- #include <mpi.h>
- ...
- ierr=MPI_Init(&argc, &argv);
- ierr=MPI_Comm_size(MPI_COMM_WORLD,&npes);
- ierr=MPI_Comm_rank(MPI_COMM_WORLD,&iam);
- ...
- ierr=MPI_Finalize();

Structure of MPI Code

- A parallel “Hello, World” program
- – Initialize MPI
- – Have each node print out its node number
- – Quit MPI

- #include <mpi.h>
- …
- ierr=MPI_Init(&argc, &argv);
- ierr=MPI_Comm_size(MPI_COMM_WORLD,&npes);
- ierr=MPI_Comm_rank(MPI_COMM_WORLD,&iam);
- …
- ierr=MPI_Finalize();

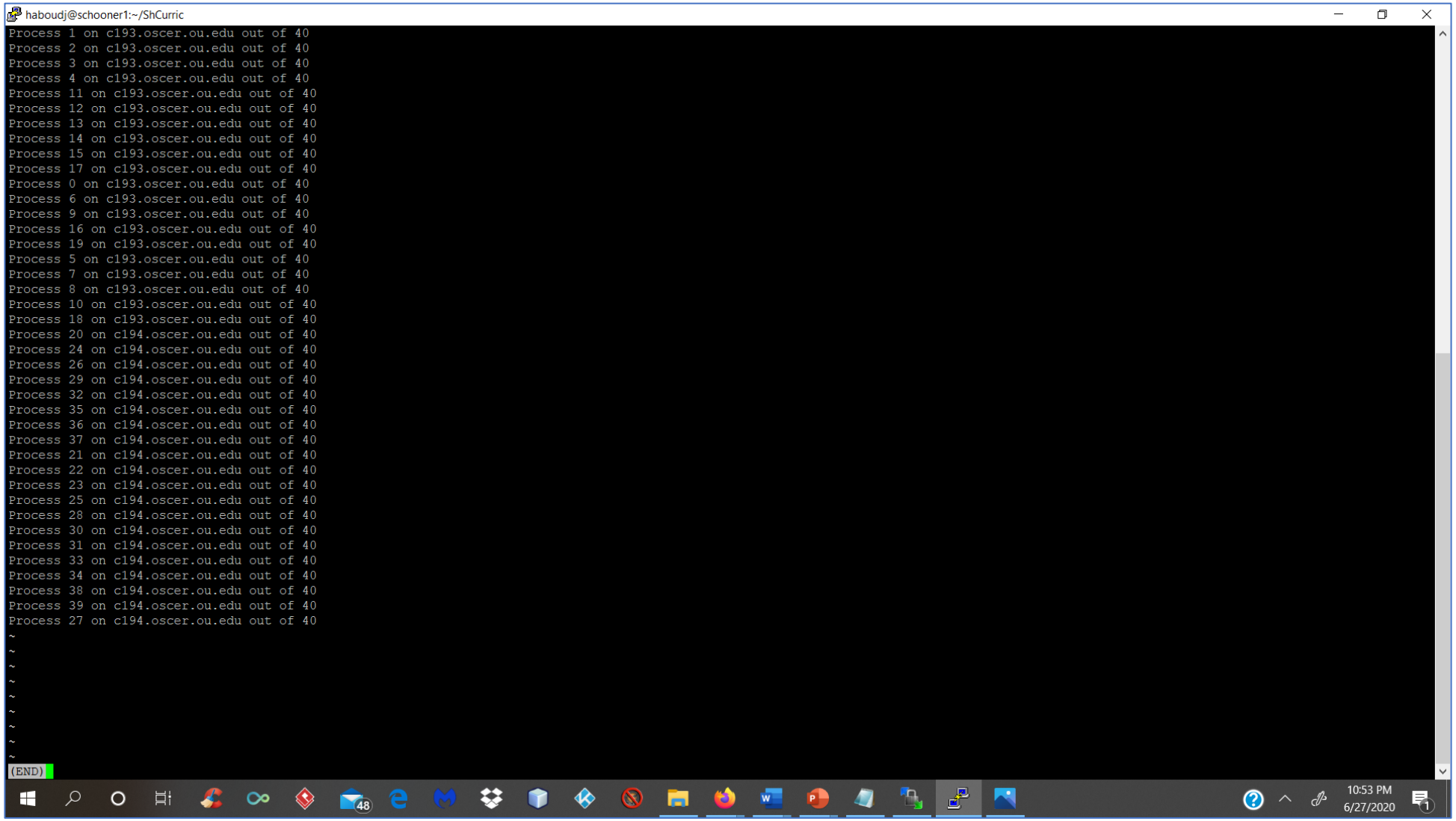
Load the module (software application)

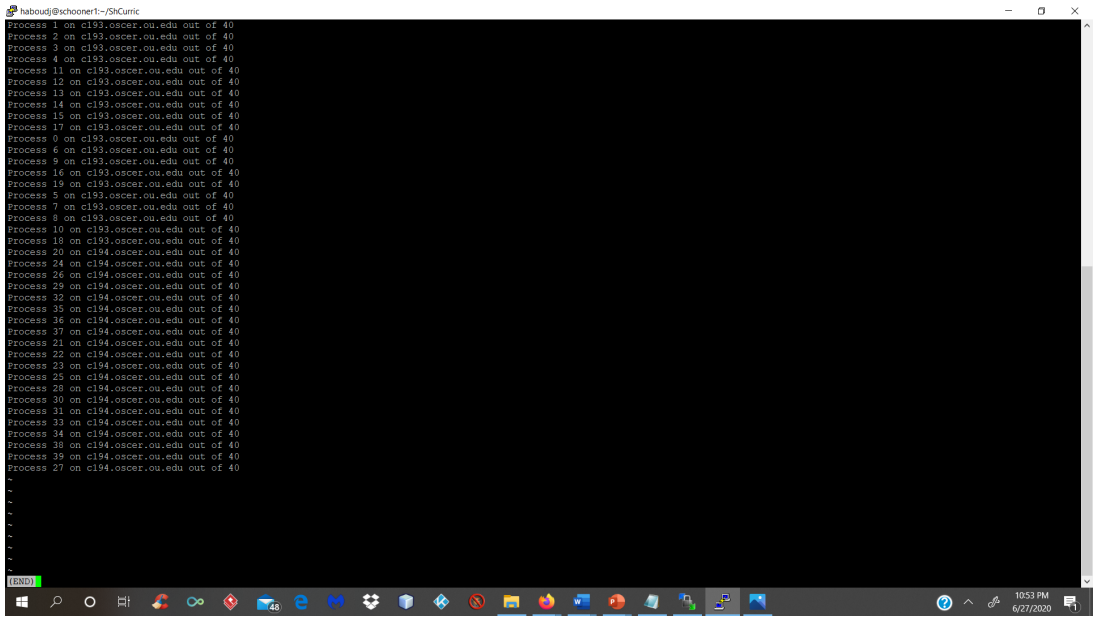
- module load OpenMPI
- sbatch myJobScript
- squeue –u haboudj

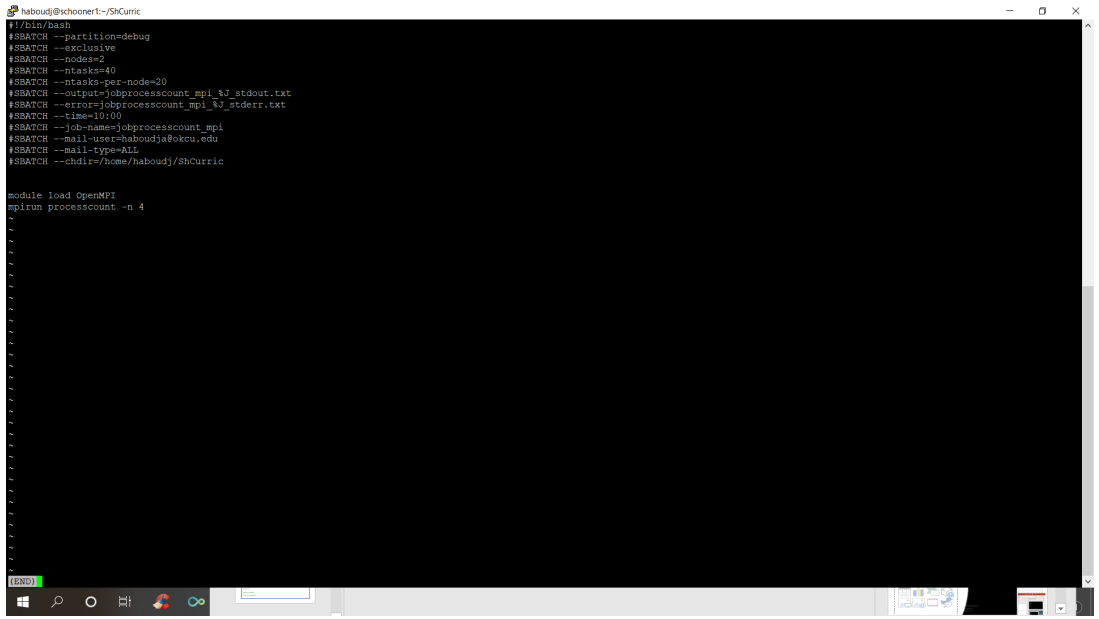
Job Script Code (SLURM)

Run the job script

Screenshots of example of program codes run




haboudj@schooner1:~/ShCurric
Process 1 on c193.oscer.ou.edu out of 40
Process 2 on c193.oscer.ou.edu out of 40
Process 3 on c193.oscer.ou.edu out of 40
Process 4 on c193.oscer.ou.edu out of 40
Process 11 on c193.oscer.ou.edu out of 40
Process 12 on c193.oscer.ou.edu out of 40
Process 13 on c193.oscer.ou.edu out of 40
Process 14 on c193.oscer.ou.edu out of 40
Process 15 on c193.oscer.ou.edu out of 40
Process 17 on c193.oscer.ou.edu out of 40
Process 0 on c193.oscer.ou.edu out of 40
Process 6 on c193.oscer.ou.edu out of 40
Process 9 on c193.oscer.ou.edu out of 40
Process 16 on c193.oscer.ou.edu out of 40
Process 19 on c193.oscer.ou.edu out of 40
Process 5 on c193.oscer.ou.edu out of 40
Process 7 on c193.oscer.ou.edu out of 40
Process 8 on c193.oscer.ou.edu out of 40
Process 10 on c193.oscer.ou.edu out of 40
Process 18 on c193.oscer.ou.edu out of 40
Process 20 on c194.oscer.ou.edu out of 40
Process 24 on c194.oscer.ou.edu out of 40
Process 26 on c194.oscer.ou.edu out of 40
Process 29 on c194.oscer.ou.edu out of 40
Process 32 on c194.oscer.ou.edu out of 40
Process 35 on c194.oscer.ou.edu out of 40
Process 36 on c194.oscer.ou.edu out of 40
Process 37 on c194.oscer.ou.edu out of 40
Process 21 on c194.oscer.ou.edu out of 40
Process 22 on c194.oscer.ou.edu out of 40
Process 23 on c194.oscer.ou.edu out of 40
Process 25 on c194.oscer.ou.edu out of 40
Process 28 on c194.oscer.ou.edu out of 40
Process 30 on c194.oscer.ou.edu out of 40
Process 31 on c194.oscer.ou.edu out of 40
Process 33 on c194.oscer.ou.edu out of 40
Process 34 on c194.oscer.ou.edu out of 40
Process 38 on c194.oscer.ou.edu out of 40
Process 39 on c194.oscer.ou.edu out of 40
Process 27 on c194.oscer.ou.edu out of 40
(END)
10:53 PM
6/27/2020


haboudj@schooner1:~/ShCurric
#!/bin/bash
#SBATCH --partition=debug
#SBATCH --exclusive
#SBATCH --nodes=2
#SBATCH --ntasks=40
#SBATCH --ntasks-per-node=20
#SBATCH --output=jobprocesscount_mpi_%J_stdout.txt
#SBATCH --error=jobprocesscount_mpi_%J_stderr.txt
#SBATCH --time=10:00
#SBATCH --job-name=jobprocesscount_mpi
#SBATCH --mail-user=haboudja@okcu.edu
#SBATCH --mail-type=ALL
#SBATCH --chdir=/home/haboudj/ShCurric
module load OpenMPI
mpirun processcount -n 4
(END)

Steps to Use a Super Computer (Example Template)

- **ssh username@hostname.ncsa.illinois.edu<ENTER>**
- **git clone \ https://github.com/aaronweeden/pi2018-submitting.git<ENTER>**
- **cd pi2018-submitting<ENTER>**
- **cc -o test.exe test.c<ENTER>**
- **cat test.pbs<ENTER>**
- **#!/bin/bash**
- **#PBS -l nodes=2:ppn=32:xe**
- **#PBS -l walltime=00:05:00**
- **#PBS -N test**
- **cd $PBS_O_WORKDIR**
- **aprun -n 4 ./test.exe|sort**

Running Job Script

- **cat test.pbs<ENTER>**
- **#!/bin/bash**
- **#PBS -l nodes=2:ppn=32:xe**
- **#PBS -l walltime=00:05:00**
- **#PBS -N test**
- **cd $PBS_O_WORKDIR**
- **aprun -n 4 ./test.exe|sort**

Error and Output Files

References

1. https://people.sc.fsu.edu/~jburkardt/c_src/laplace_mpi/laplace_mpi.html
2. Please see the TACC_CS395_COURSE_MATERIALS s1.
3. https://www.mpi-forum.org/docs/mpi-1.1/mpi1-report.pdf