

OpenMP Hello World

```
#include <stdio.h>
#include <omp.h>

int main(int argc, char *argv[]) {
    int iam = 0, np = 1;

    #pragma omp parallel default(shared) private(iam, np)
    {
        #if defined (_OPENMP)
            np = omp_get_num_threads();
            iam = omp_get_thread_num();
        #endif
        printf("Hello from thread %d out of %d\n", iam, np);
    }
}
```

Compile: `icpc -openmp -o execfile hello_world.c`

Login to compute nodes: `qsub -I -l walltime=00:01:00 -l nodes=1:ppn=8`

Set number of threads, and run: `export OMP_NUM_THREADS=8
./execfile`

MPI Hello World

```
#include "mpi.h"
#include <stdio.h>

int main(int argc, char *argv[]) {
    int  numtasks, rank;

    MPI_Init(&argc,&argv);
    MPI_Comm_size(MPI_COMM_WORLD,&numtasks);
    MPI_Comm_rank(MPI_COMM_WORLD,&rank);
    printf ("Number of tasks= %d My rank= %d\n", numtasks,rank);

    MPI_Finalize();
}
```

Compile: `mpicc -o execfile_mpi hello_world_mpi.c`

Login to compute nodes: `qsub -I -l walltime=00:01:00 -l nodes=2:ppn=2`

Run: `mpirun -machninfile $PBS_NODEFILE -np 4 ./execfile_mpi`

Using the queue system

`submit.job_omp`

```
#!/bin/bash
#PBS -q hotel
#PBS -N hello
#PBS -l nodes=1:ppn=4
#PBS -l walltime=00:00:30
#PBS -V

export OMP_NUM_THREADS=4

cd $PBS_O_WORKDIR

./execfile > output
```

`submit.job_mpi`

```
#!/bin/bash
#PBS -q hotel
#PBS -N hello
#PBS -l nodes=1:ppn=4
#PBS -l walltime=00:00:30
#PBS -V

cd $PBS_O_WORKDIR

mpirun -np 4 ./execfile_mpi > output
```

To submit your jobs into the queue system (recommended for longer running jobs), use:

`qsub submit.job_omp` —► **OpenMP**

`qsub submit.job_mpi` —► **MPI**

To check your job's status:

```
showq -u "username"
```

Job control in the queue

Option	Description
#PBS -N myJob	Assigns a job name. The default is the name of PBS job script.
#PBS -l nodes=4:ppn=2	Number of nodes and processors per node
#PBS -q queueName	The name of the queue to be used
#PBS -l walltime=00:10:00	Maximum walltime during which this job can run
#PBS -V	Exports all environment variables to the job
#PBS -o out.txt	Name of the output file
#PBS -e err.txt	Name of the error file
#PBS -j oe	Joins and merges error and output files

Frequently used shell commands for jobs in the queue:

command	description	example
qsub	Submit pbs job	qsub submit.job
qstat	Show status of job	qstat 3319689
qdel	Delete Job	qdel 3319689