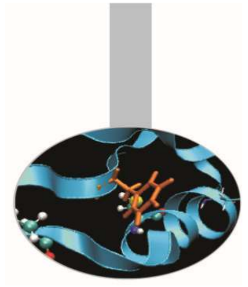
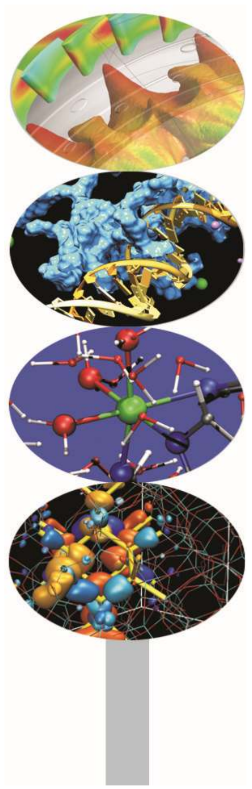


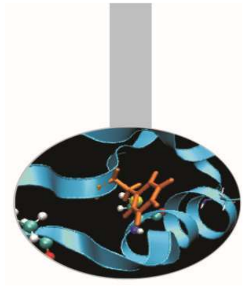
Advanced MPI

- exercises -



M.Cremonesi

May 2016



Startup notes

Access the server and go on scratch partition:

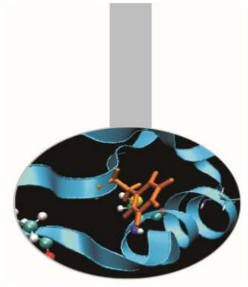
```
ssh a08tra49@login.galileo.cineca.it

cd $CINECA_SCRATCH
```

Create a job file <test.job>:

```
#!/bin/bash
#PBS -A train_cmpD2016
#PBS -l select=1:ncpus=4:mpiprocs=4:mem=32gb
#
cd  $PBS_O_WORKDIR
module load autoload openmpi
rm *.exe
mpicc c_program.c -o c_program.exe
mpif90 f_program.f90 -o f_program.exe
mpirun <program>.exe
exit
```

Startup notes



Other useful PBS flags:

```
#PBS -N test              <- job name

#PBS -j oe                <- join stdout and stderr outputs

#PBS -l walltime=1:00:00           <- max 24 hours
```

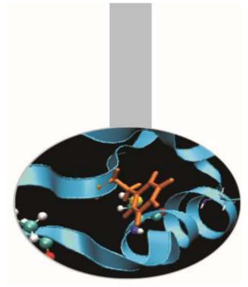
Submit the job to the batch queue:

```
qsub <test.job>
```

Check if the job is running:

```
qstat –n –u a08tra49
```

Compiling notes



To compile programs that make use of MPI library:

```
mpif90/mpicc/mpiCC -o <executable> <file 1> <file 2> … <file n>
```

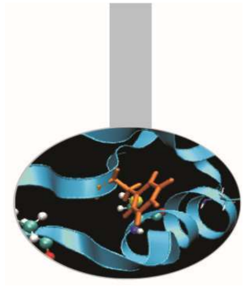
Where:	
`<file n>`	- program source files
`<executable>`	- executable file

To start parallel execution on one node only:

```
mpirun -np <processor_number> <executable> <exe_params>
```

To start parallel execution on many nodes:

```
mpirun -np <processor_number> -machinefile <node_list_file> \
       <executable> <exe_params>
```



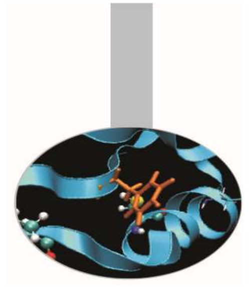
MPI exercises

You can find a list of useful exercises at the address:

http://www.hpc.cineca.it/content/training-mpi

Exercise 10: *create a cartesian topology and try using Cart_shift for neighborhood communications*

Exercise 11: *MPI data types are useful for managing matrix data whenever not-contiguous data are involved. To solve the exercise define a data type that include two columns(in C)/rows(in Fortran)*



MPI exercises

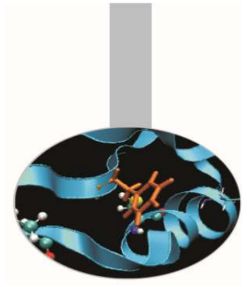
Exercise 12: *again on matrix data: send and receive buffers do not need to be of the same type. The flag* -std=c99 *should be used to compile the C solution program with gcc*

Exercise 13: *I/O functions are used to store and retrieve data; the function File_set_view is used to get File_write_all to store data in the specified order*

Exercise 14: *use of MPI_Dims_create is not mandatory; remember to call File_set_view before using File_write_all and File_read_all.*

Use the flag -std=c99 *to compile with gcc*

MPI exercises



Exercise 15: *the function Alltoall redistribute an array in an ordered fashion; remember that sendcount and recvcount are the dimensions of the sub-blocks to be sent/received to/from single processes*

Exercise 16: *the function Allgather performs collection of distributed data to all processes*