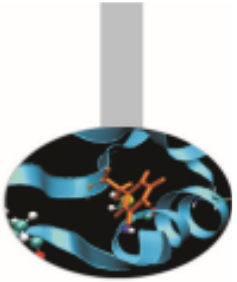
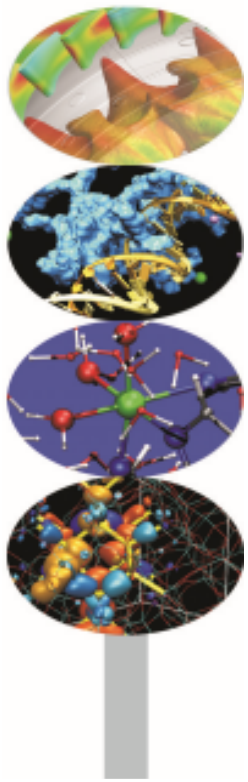
CINECA SCAI
SuperComputing Applications and Innovation



Advanced MPI

- *exercises* -



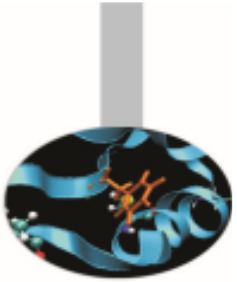
Introduction to Parallel Computing with MPI and OpenMP

M.Cremonesi

May 2015

CINECA

Startup notes



To access the server:

```
ssh a08tra??@login.eurora.cineca.it
```

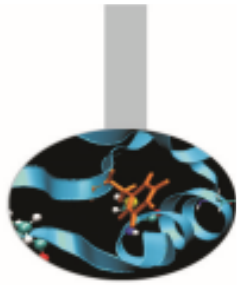
To reserve space on the server:

```
qsub -I -A train_cmpM2015 -l select=1:ncpus=4:mpiprocs=4 \
       -l walltime=3:00:00
```

To configure the MPI environment:

```
module load autoload openmpi
```

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

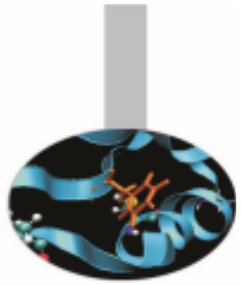
To start parallel execution on one node only:

```
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



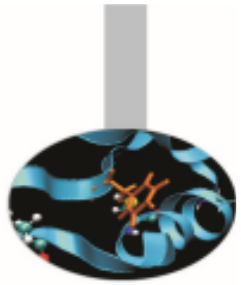
You can find a list of useful exercises at the address:

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/rows*

MPI exercises

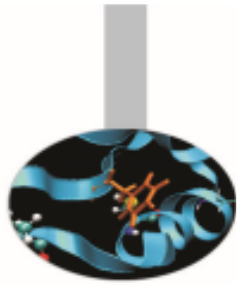


Exercise 12: *again on matrix data; send and receive buffers do not need to be of the same type. The flag* -std=c99 *should be used to compile the C solution program with gcc*

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