

# MPI on the Data Analytic Cluster

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# Access

- `ssh -Y user@login.rdf.ac.uk`
- You can access the ARCHER systems using ssh from anywhere
  - Trivial for Linux
  - Mac: enable the X server (xquartz) to display any graphics
  - Windows: need to install an X server program, e.g. xming (which is free!)

# Compiling MPI Programs on the DAC

- Load correct version of MPI
  - `module switch openmpi openmpi-x86_64`
- Use default GNU compilers
  - `module unload gcc`
- Fortran programmers use `mpif90`
- C programmers use `mpicc`
- C++ programmers use `mpicxx`
- There is nothing magic about these MPI compilers!
  - simply wrappers which automatically include various libraries etc
  - compilation done by standard (here GNU) compilers: `gcc` and `gfortran`

# Running interactively

- Timings will not be reliable
  - shared with other users, many more processes than processors
  - but **very useful** during development and for debugging
- `mpirun -n 4 ./mpiprogram.exe`
  - runs your code on 4 processes

# Compiling and running Hello World!

- Set modules on DAC (not needed on most systems)

```
module switch openmpi openmpi-x86_64
module unload gcc
```

- Get the source code using wget or curl

```
wget http://www.archer.ac.uk/training/courses/2018/01/OnlineMPI/Exercises/hello.c
curl -O http://www.archer.ac.uk/training/courses/2018/01/OnlineMPI/Exercises/hello.c
```

- Compile

```
mpicc -o hello hello.c
```

- Run

```
mpirun -n 3 ./hello
Hello World!
Hello World!
Hello World!
```

- Other languages

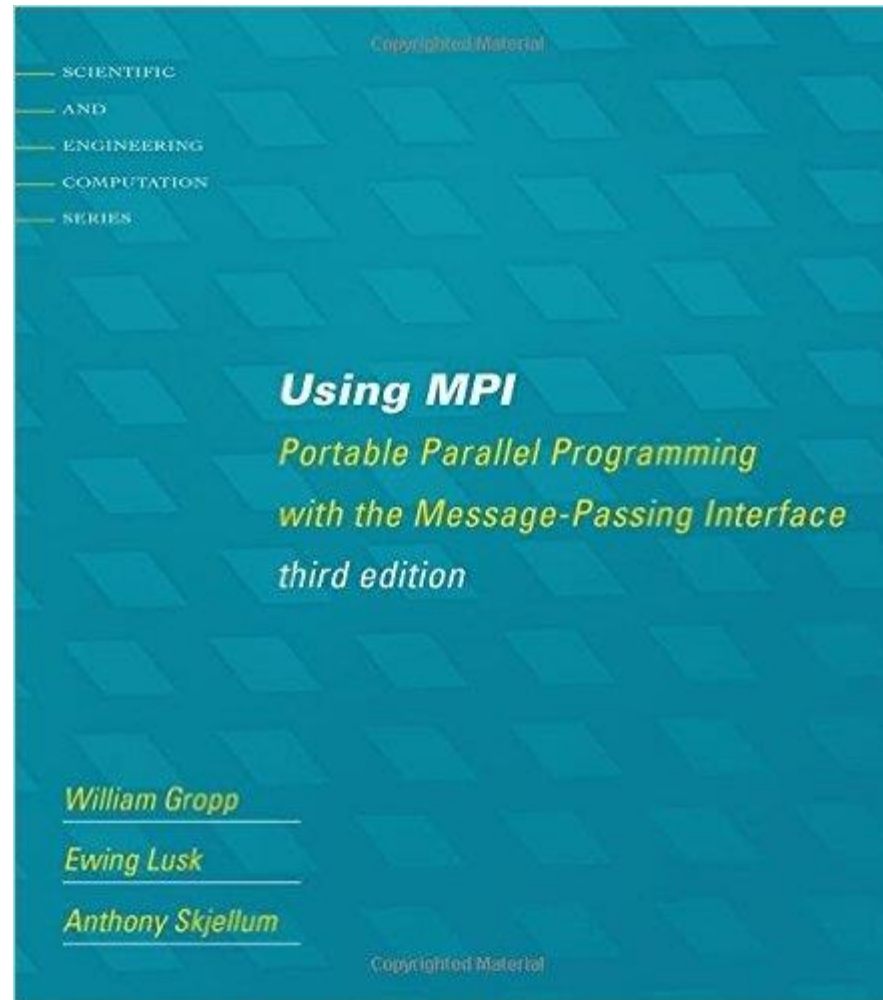
- for Fortran use `hello.f90` and `mpif90`
- for C++ use `hello.cc` and `mpicxx`

# Documentation

- ▶ MPI Standard available online
  - See: <http://www.mpi-forum.org/docs/>
  - currently version 3.1
- ▶ Available in printed form
  - <http://www.hlrs.de/mpi/mpi31/>
- ▶ Man pages available on CP-Lab and ARCHER
  - must use the C style of naming: `man MPI_Routine_name`, e.g.:
  - `user@computer$ man MPI_Init`



# MPI Books



# Exercise: Hello World

## The minimal MPI program

- See Exercise 1 on the exercise sheet
- Write an MPI program that prints a message to the screen
- Main purpose is to get you compiling and running parallel programs
  - also illustrates the SPMD model and use of basic MPI calls



# C++ Interface

- MPI is not an OO interface
  - however, can be called from C++
- Originally had different function calls, eg:
  - `MPI::Intracomm comm;`
  - `...`
  - `MPI::Init();`
  - `comm = MPI::COMM_WORLD;`
  - `rank = comm.Get_rank();`
  - `size = comm.Get_size();`
- Compiler is called `mpicxx`
  - see `hello.cc`

C++ interface is  
now removed

Must therefore  
cross-call to C