

## Pre-requisites

### You should already know:

- how to setup and submit jobs on Raijin
- basic C programming
- how to use the Linux shell (Bash)
- how to use a terminal text editor

## Objectives

### Do you need to:

- parallelise your serial program
- run programs across multiple nodes
- use OpenMP and MPI
- use makefiles
- compile software from source
- debug your program

This training aims to provide programmers with the skills and knowledge necessary to parallelise their serial C/C++ programs, build and run them across multiple CPU cores on multiple nodes of Raijin using the programming models OpenMP and MPI.

## Learning outcomes

### At the completion of this training you should have the skills and knowlege to:

- write a shared memory parallel program
- write a distributed memory parallel program
- install software from source in personal space
- use makefiles to build your programs
- link your programs against external libraries
- use tools to debug your code

## Topics Covered

### Key topics covered in this training include:

- **Compiling programs**
  - using makefiles
  - compiler optimisation options
  - different compilers available
  - installing software from source
  - linking against libraries
  - walltime limits and exceptions
  - hands-on exercises
- **Debugging**
  - using gdb to debug your code
  - using ddt
  - hands-on exercises
- **Basics of parallel programming**
  - scalability of parallel programs
  - memory organisation
- **Shared memory parallel programming**
  - introduction to threads OpenMP
  - running across multiple CPU cores using OpenMP parallel regions
  - loop scheduling
  - synchronisation
  - OpenMP tasks
  - hands-on exercises
- **Distributed memory parallel programming**
  - introduction to MPI
  - message passing communication
  - send/receive
  - collective operations
  - hybrid MPI+OpenMP introduction
  - using MPI input/output to read/write files in parallel
  - hands-on exercises