



EPSRC

Object Oriented Programming with Fortran



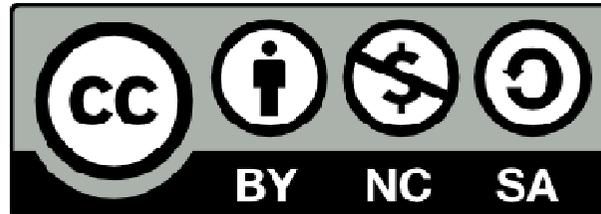
Who am I?

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@adrianjhpc

- I...
 - Help run training for EPCC
 - MSc
 - PRACE Advanced Training Centre
 - ARCHER training programme
 - commercial training
 - ...
 - Also do HPC research
 - new parallel programming models, accelerators, performance, ...



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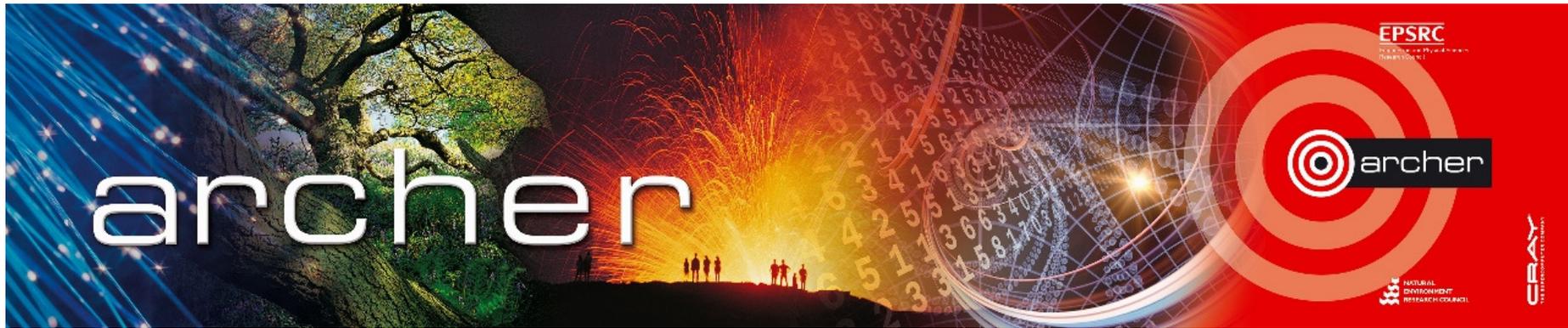


EPSRC

ARCHER Service

Overview and Introduction





- UK National Supercomputer Service, managed by EPSRC
 - housed, operated and supported by EPCC
 - hardware Supplied by Cray
- Training provided by the ARCHER Computational Science and Engineering (CSE) support team
 - 72 days per year at various locations round the UK
 - free to all academics



EPCC's Advanced Computing Facility



ARCHER in a nutshell

- UK National Supercomputing Service
- Cray XC30 Hardware
 - Nodes based on 2×Intel Ivy Bridge 12-core processors
 - 64GB (or 128GB) memory per node
 - 4920 nodes in total (118,080 cores)
 - Linked by Cray Aries interconnect (dragonfly topology)
- Cray Application Development Environment
 - Cray, Intel, GNU Compilers
 - Cray Parallel Libraries (MPI, SHMEM, PGAS)
 - DDT Debugger, Cray Performance Analysis Tools



Storage

- /home – NFS, not accessible on compute nodes
 - For source code and critical files
 - Backed up
 - > 200 TB total
- /work – Lustre, accessible on all nodes
 - High-performance parallel filesystem
 - Not backed-up
 - > 4PB total
- RDF – GPFS, not accessible on compute nodes
 - > 20 PB Long term data storage



What is EPCC?

- UK national supercomputer centre
 - founded in 1990 (originally Edinburgh Parallel Computing Centre)
 - a self-funding Institute at The University of Edinburgh
 - running national parallel systems since Cray T3D in 1994
 - around 65 full-time staff
 - a range of academic research and commercial projects
 - one-year postgraduate masters in HPC www.epcc.ed.ac.uk/msc/
- Get in contact if you want to collaborate
 - many staff are named RAs on research grants
 - joint research proposals
 - European project consortia
 - ...



Key ARCHER Resources

- Upcoming courses
 - <http://www.archer.ac.uk/training/>
- Material from past courses
 - http://www.archer.ac.uk/training/past_courses.php
- Virtual tutorials (online)
 - <http://www.archer.ac.uk/training/virtual/>
- Documentation
 - <http://www.archer.ac.uk/documentation/>



Other Resources

- Please fill in the feedback form!
 - <http://www.archer.ac.uk/training/feedback/>
- General enquiries about ARCHER go to the helpdesk
 - support@archer.ac.uk
- EPCC runs one-year taught postgraduate masters courses
 - ***MSc in HPC*** and ***MSc in HPC with Data Science***
 - awarded by the University of Edinburgh since 2001
 - scholarships available
 - <http://www.epcc.ed.ac.uk/msc/>



Online accredited courses

www.epcc.ed.ac.uk/online-courses

Online distance learning courses

epcc | 25TH ANNIVERSARY

COURSES | APPLYING | FEES & FINANCE | CAREER PROSPECTS

Online courses in Data Science and in High Performance Computing.
Enhance Your Career!

Practical Introduction to Data Science
Data Science is a rapidly emerging, interdisciplinary field bringing together ideas from computer science, mathematics, statistics, software engineering and beyond. This online course introduces the concepts of data science and allows students to gain the basic skills expected of a data scientist. [More](#)

Practical Introduction to High Performance Computing
High Performance Computing (HPC) is a fundamental technology used in solving scientific and commercial problems. The course covers the concepts of HPC and allows students to explore them by running parallel programs on real HPC systems such as the UK national supercomputer ARCHER. [More](#)

- Run from January to May
 - entirely online: www.epcc.ed.ac.uk/online-courses/.
 - each course is 20 credits (c.f. a 180-credit MSc)



Access to ARCHER (during course)

- Guest accounts for duration of course
 - should only be used in the classroom
- Accounts will be closed immediately after the course
 - all files etc will be deleted
- Take copies of all your work before course ends!
- Course materials (slides, exercises etc) available from course web page
 - archived on ARCHER web pages for future reference
- You must agree to the ARCHER terms and conditions:
 - <http://www.archer.ac.uk/about-archer/policies/tandc.php>



Access to ARCHER (longer term)

- Various ways to apply for time on ARCHER
 - see <http://www.archer.ac.uk/access/>
- All require justification of resources
 - Instant Access has the lowest barrier to entry
 - designed for exploratory work, e.g. in advance of a full application
- Or take the “ARCHER Driving Test”
 - www.archer.ac.uk/training/course-material/online/driving_test.php
 - successful completion allows you to apply for an account for 12 months with an allocation of around 80,000 core-hours
 - backed up by online training materials
 - www.archer.ac.uk/training/course-material/online/



Learning Outcomes

- On completion of this course students should be able to:
 - Compile and run Fortran programs on ARCHER
 - Understand basic object-oriented concepts
 - Understand how Fortran features can be used to create object-oriented programs
 - Understand how to create modularised and well designed Fortran programs
 - Understand the performance impacts of the object oriented features in Fortran



Outline Timetable

- **Day 1**

- 09:30 LECTURE: Introduction to Fortran
- 10:15 PRACTICAL: Fortran programming
- 11:00 BREAK
- 11:30 LECTURE: Introduction to Object Oriented Programming
- 12:00 PRACTICAL: Designing an object oriented program
- 12:15 LECTURE: Modules
- 13:00 BREAK: Lunch
- 14:00 PRACTICAL: Modules
- 14:30 LECTURE: Derived types and operators
- 15:00 PRACTICAL: Derived types
- 15:30 BREAK
- 16:00 PRACTICAL: Continuing practicals
- 16:30 CLOSE



Outline Timetable

- **Day 2**

- 09:30 LECTURE: Classes and data visibility
- 10:15 PRACTICAL: Fortran classes
- 11:15 BREAK:
- 11:45 LECTURE: Inheritance and overloading
- 12.30 PRACTICAL: Generic classes and extensions
- 13.00 BREAK: Lunch
- 14.00 LECTURE: Design and performance considerations
- 14.45 PRACTICAL: Continuing practicals
- 15:15 BREAK:
- 15:45 LECTURE: Further features
- 16:15 LECTURE: Summary
- 16:30 CLOSE

