

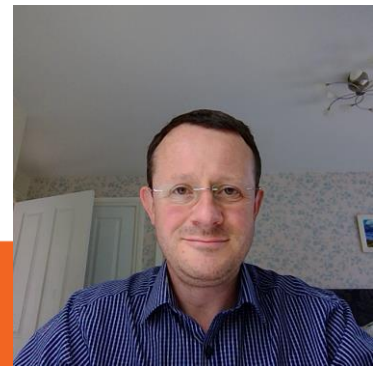
An Introduction to HPC and Scientific Computing

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Oxford e-Research Centre

www.oerc.ox.ac.uk



Aims and learning outcomes

The aims of this CWM are to introduce you to scientific computing and High Performance computing (HPC).

It's more important that you pick up the basics of computing and programming during the week, because these are the building blocks for everything else.

This CWM isn't designed to turn you into a world class HPC programmer, that takes years.

This CWM is designed to give you the skills to continue to learn in this area and for you to have the ability to write your own computer codes and tackle basic problems.

Assessment for this course will focus on the final two practical sessions in the latter half of the week. The aim of the assessment is for you to demonstrate that you've picked up the basics from this course.

The assessment will be light because I'm keen for you to focus on the content rather than worrying about the assessment.

In all I hope you will find this a fun and interesting week long introduction to HPC and Scientific Computing!

Locations and Timetable

Locations

Lectures – these will be pre-recorded, available through canvas and panopto and in the form of MP4 videos or PowerPoint Slideshows (you have the choice).

Practical sessions will online and available through git (more to come on that).

Timetable – Approximately....

09:00 - 10:30 Morning lecture

10:30 - 11:00 break

11:00 - 12:30 Morning practical

12:30 - 13:30 lunch

13:30 - 15:00 Afternoon lecture

15:00 - 15:30 break

15:30 - 17:00 Afternoon practical

Lectures will be delivered by Wes Armour, Jacob Wilkins, Ania Brown and Ian Bush.

Practical's supervised by Wes Armour, Jacob Wilkins, Fred Dulwich, Ania Brown and Ian Bush.

On-line feedback form: <http://bit.ly/OXUNICWM> please, please, please do complete ☺

Lectures

Monday - Here we have three lectures to begin with and finish with a practical session, this is because we'll need to introduce you to several different topics before you can complete a meaningful practical.

Morning lecture:	Introduction to computer architectures.
Morning lecture:	Introduction to the C programming language.
Afternoon lecture:	Introduction to Linux, compilers and build systems.

Tuesday

Morning lecture:	Using repositories and good coding practices.
Afternoon lecture:	A deeper dive into C programming.

Wednesday afternoon

Afternoon lecture:	How to multi-task on CPUs using OpenMP.
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Thursday

Morning lecture:	An introduction to GPUs and how to use them.
Afternoon lecture:	Guest Lecture: Tim Lanfear (NVIDIA)
Second afternoon lecture:	An introduction to the CUDA programming language.

Friday

Morning lecture:	Scientific Computing using the CUDA programming language.
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Lectures

The screenshot displays a web browser window with the Canvas LMS interface. The browser's address bar shows the URL `canvas.ox.ac.uk/courses/17346`. The top of the browser window contains several open tabs, including 'Restricted', 'Discrete w...', 'Slack | I Be...', 'Editorial M...', 'CWM-in-H...', 'A5. Engine...', 'CWM HPC', 'HPC lectur...', 'Oversight', '(116) NVID', 'CWM-in-H...', and others. The Canvas interface features a dark blue sidebar on the left with navigation links: 'Account', 'Dashboard', 'Courses', 'Calendar', 'Inbox', 'Search', and 'Help'. The main content area is divided into sections for different laboratories. The 'Structures and Materials Laboratory' section includes a 'Handout' and a PDF file 'A5 Structures + Materials full lab sheets MT19.pdf'. The 'Dynamics Laboratory' section includes a 'Lab Introduction Video', a PDF '2A5 Dynamics Lab Notes MT19 PDF', a book 'SS Rao Mechanical Vibrations Book', 'MATLAB Files', and a document 'How to find P Paper Course Notes on Canvas'. The 'Communications Laboratory' section includes a PDF 'A5_Communications_lab_2019.pdf'. The 'Thermofluids Laboratory' section includes a PDF '2019-20 A5 Thermofluids Lab - Complete.pdf'. On the right side of the interface, there are buttons for 'Student view', 'New Analytics', and 'View Course Notifications'. Below these, a 'Coming up' section indicates 'Nothing for the next week'. A 'Self Help' button is located on the far right. The bottom of the browser window shows a taskbar with a file named 'OneDrive_1_12-06-...zip' and the University of Oxford logo.

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Discussions 🔒

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Outcomes 🔒

Settings

Structures and Materials Laboratory

Handout

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Communications Laboratory

A5_Communications_lab_2019.pdf

Thermofluids Laboratory

2019-20 A5 Thermofluids Lab - Complete.pdf

Student view

New Analytics

View Course Notifications

Coming up 📅 View calendar

Nothing for the next week

Self Help

OneDrive_1_12-06-...zip

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Practical Sessions

Monday - Here we have one practical in the afternoon.

Afternoon Practical: Linux, compiling C code and using Make.

Tuesday

Morning Practical: Practical examples of using repositories for your projects.

Afternoon Practical: Practical examples using the C programming language.

Wednesday Afternoon

Afternoon Practical: Practical examples of using OpenMP on CPUs.

Thursday

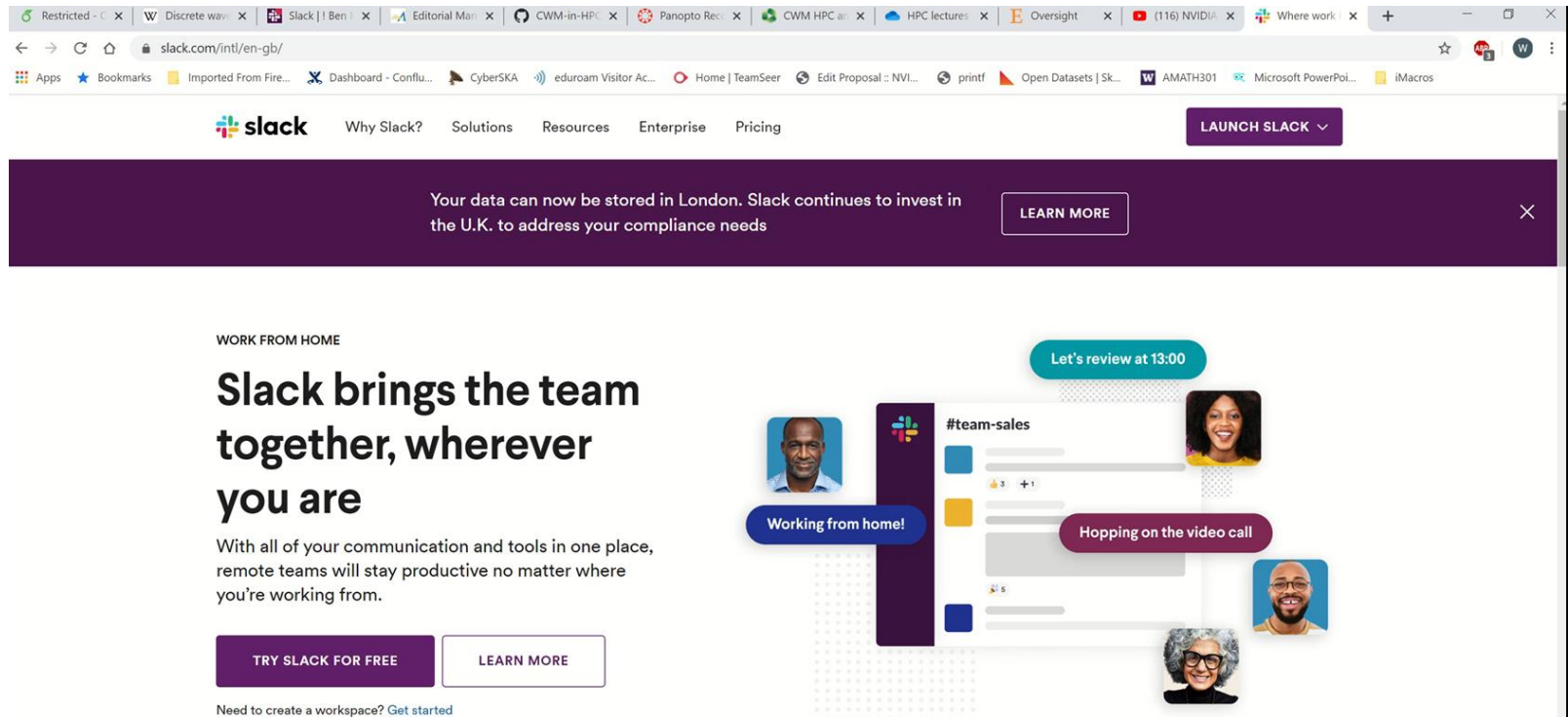
Morning Practical: Practical examples of using GPUs for science and engineering.

Friday

Morning Practical: Examples of CUDA programming.

Afternoon Practical: Assignment (email assignment to wes.armour@eng.ox.ac.uk **AT 17:00!**).

Practical Sessions



The screenshot shows the Slack website homepage. At the top, there's a navigation bar with the Slack logo and links for 'Why Slack?', 'Solutions', 'Resources', 'Enterprise', and 'Pricing'. A 'LAUNCH SLACK' button is on the right. Below this is a purple banner with the text: 'Your data can now be stored in London. Slack continues to invest in the U.K. to address your compliance needs' and a 'LEARN MORE' button. The main content area features the headline 'Slack brings the team together, wherever you are' with a subtext: 'With all of your communication and tools in one place, remote teams will stay productive no matter where you're working from.' Below this are two buttons: 'TRY SLACK FOR FREE' and 'LEARN MORE'. A small link 'Need to create a workspace? [Get started](#)' is also present. To the right, there's a graphic showing a Slack channel interface with a message 'Let's review at 13:00' and a video call overlay with four participants. One participant has a bubble saying 'Working from home!' and another says 'Hopping on the video call'.

WORK FROM HOME

Slack brings the team together, wherever you are

With all of your communication and tools in one place, remote teams will stay productive no matter where you're working from.

[TRY SLACK FOR FREE](#) [LEARN MORE](#)

Need to create a workspace? [Get started](#)

Let's review at 13:00

#team-sales

Working from home!

Hopping on the video call

Break out of the inbox

Working in channels gives everyone in your team a shared view of progress and purpose.

Practical Sessions

Use the following link to join the HPC CWM workspace in slack:

https://join.slack.com/t/hpc-cwm/shared_invite/zt-ey3icmcl-v3pROBZZkpGoHMmuW1_PUg

Ania has prepared the following handout that covers how to use slack, please do read this:

https://canvas.ox.ac.uk/courses/17346/files/1388237?module_item_id=651265

You should see this in the “HPC and Scientific Computing CWM” module section on Canvas – it’s under the header “Handouts and Information”

Practical Sessions



Assignment

This year we will not assign marks, but if you do want to complete the assignment and would like feedback then do send your work in. In previous years the marking scheme has looked like this:

A total of 9 marks.

4 marks will be given for attendance, 5 marks for assignment work.

Assignment marks will be given for:

- | | |
|-----------------------|------------|
| Good coding practices | - 2 marks. |
| Using a build system | - 1 mark. |
| Correct use of C/CUDA | - 1 mark. |
| Working code | - 1 mark. |

On-line feedback form: <http://bit.ly/OXUNICWM> please, please, please do complete ☺