# An Introduction to HPC and Scientific Computing
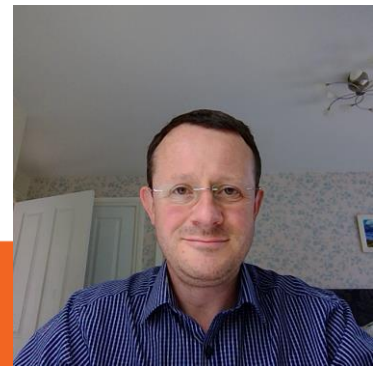
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# Aims and learning outcomes

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. |

**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. |

# Lectures

# 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.

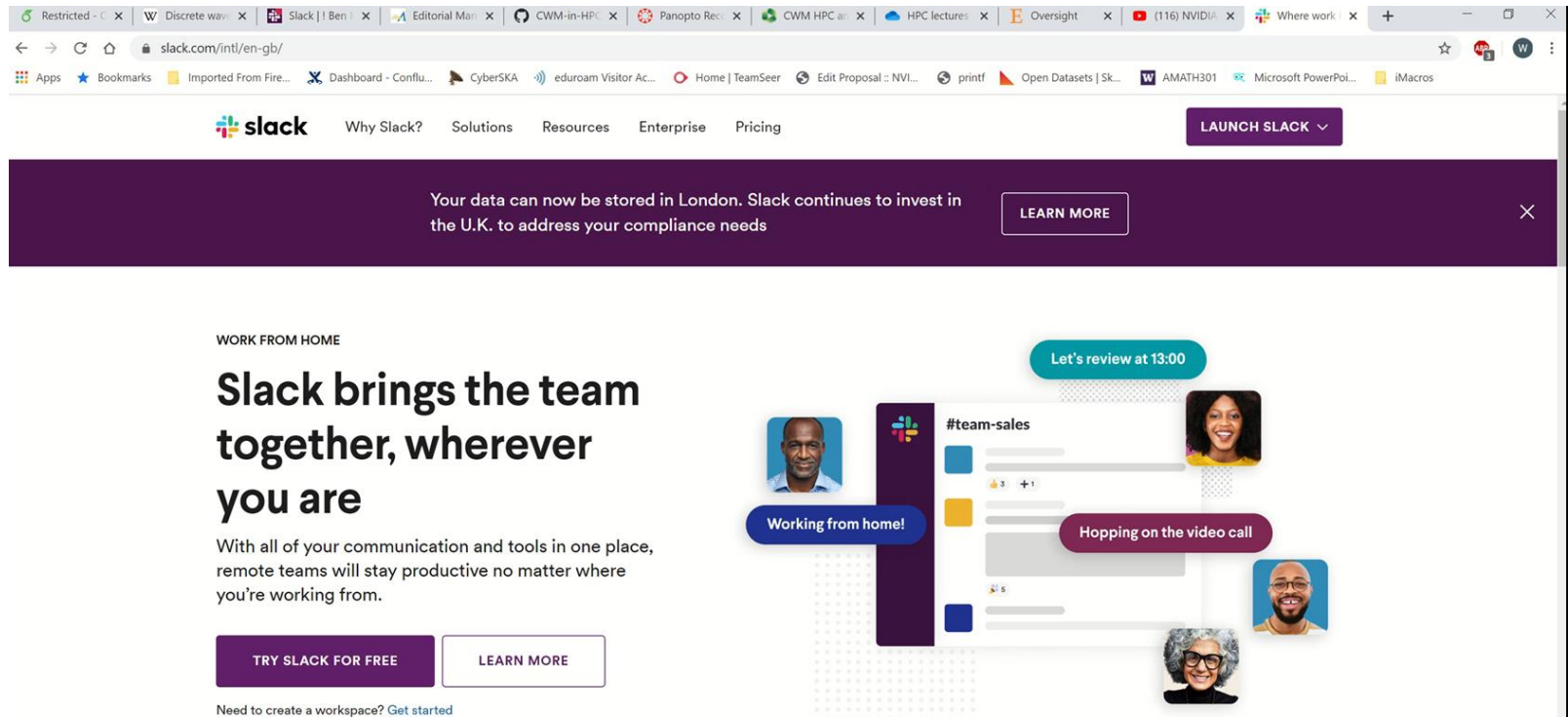**Thursday**

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

# 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. |

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