epcc

EPCC at the **University of Edinburgh** is a large supercomputing centre. We host a range of Supercomputers, which are used to help improve the world we live in.

What is a Supercomputer?

A supercomputer is an extremely fast computer, usually millions of times faster than the tablets, smartphones, laptops and desktop PCs you might see every day.

It is made by using the same types of parts that you would find inside normal computers and connecting very large numbers of these together. Lots of processing cores, the brains of the computer that processes instructions, are connected together using a series of cables and switches called the interconnect.

millions of times **faster** than your smartphones

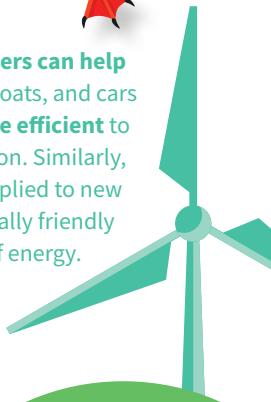
Why are Supercomputers important?

Supercomputers allow us to understand things that are too difficult to see or measure in real life. They may be too big, too small, too dangerous, too quick, too slow or too expensive to simulate. Understanding these things help us stay healthy and safe.

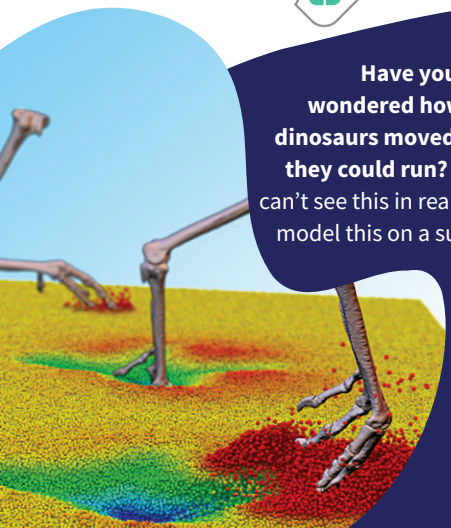
For example, you will all have seen a **weather forecast**, but did you know this was obtained using a supercomputer? You want to be able to forecast tomorrow's weather quickly so you know the answer in advance, and not after it's already happened!

Or how about new medicines?
By simulating how potential medicines interact with the body, we can significantly speed-up the time it takes to create new medicines.

Supercomputers can help make planes, boats, and cars **safer and more efficient** to reduce pollution. Similarly, this can be applied to new environmentally friendly sources of energy.



Have you ever wondered how different dinosaurs moved and how fast they could run? We obviously can't see this in real life, but we can model this on a supercomputer.



Challenge

Have a go at our science demo on our suitcase-sized, model supercomputer, Wee Archie. Can you see why this is useful?

How do you use Supercomputers?

Challenge

Try one of our puzzles, the way you solve these is similar to the way we solve programming challenges. Or have a go at being a supercomputer and solve our hands-on practical parallel algorithm.

An **algorithm** is a set of step-by-step instructions, like a recipe, but to be performed by a computer. These need to be followed in the correct order or things could go wrong.

In a very similar way to the way you use a home computer. **You start with real world observations**, formulate a model and then create a computer algorithm to solve a particular problem, and then write this in a programming language.

For a supercomputer, parallel algorithms are required. **Parallel algorithms allow several instructions to be carried out at the same time**, or in parallel, on different compute cores.

In the same way people use languages to communicate with each other, **programming languages allow you to communicate with a computer**. They allow you to tell the computer what to do through a series of instructions.

The challenge is to break up the problem between the different compute cores in a way that keeps all the cores busy and makes sure they all have the information they need.

What is Archer2?

ARCHER2 is the UK's main supercomputer used by scientists to carry out simulations that help improve people's lives and the environment around us.

The ARCHER2 system has **750,080 cores**. A processor on the system contains 64 of these cores and two of these processors form what is called a node. Four of these nodes are grouped on to a blade, which resemble a drawer in a chest of drawers. These blades can be slotted in a cabinet which is similar in height and width to a traditional phone box.

The ARCHER2 system has 23 of these cabinets in 3 rows, with a further 6 smaller cabinets containing equipment to help cool the system.

ARCHER2's processing cores are **2.25GHz**, which means they can do **2.25 billion calculations every second**. But that is just a single core: if you use all of the 750,080 cores of ARCHER2 you could carry out over **1.5 quadrillion calculations per second** – that's a lot of sums done at the same time!

How does ARCHER2 store information?
All these calculations mean there are a lot of results to store. ARCHER2 has **over 15 petabytes of storage** do this. If we assume an average 300 page book, ARCHER2 could store over 18,000 million books!

How much power does ARCHER use? When ARCHER is idle it uses approximately **400 kW of power**, the equivalent of 100-200 kettles boiling at the same time. This **increases to 1200 kW of power** when it is being used heavily.

How do we keep ARCHER cool?
All this energy and hard work means **ARCHER generates a lot of heat**. It is kept cool by pumping water through the cabinets in cooling pipes. Most of the time we keep this water cool naturally through cooling towers on our roof. The chilly Scottish climate is a benefit here!

www.archer2.ac.uk

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Challenge

Handle a real supercomputer, look at the insides and get an idea of the scale of the system.