PAWSEY
supercomputing centre

PARTNER INSTITUTION

Curtin University

PROJECT LEADER

@curtin.edu.au

SYSTEM
XXX

TIME ALLOCATED
00 HOURS

AREA OF SCIENCE
XXX

APPLICATIONS USED
xx

Freshly found 4.5 billion year old meteorite. Credit_Jonathan Paxman, Desert Fireball Network

CATCHING SHOOTING STARS

Discovering and retrieving newly fallen meteorites can help researchers understand the early workings of the solar system and the origins of our planetary system – including Earth. Over the last fifty years, research attempts to retrieve newly fallen meteorites have met with limited success. Professor Phil Bland, from Curtin University's Faculty of Science and Engineering, is now leading a team of researchers in a collaborative effort using innovative methodology and supercomputing to achieve results. The Desert Fireball Network (DFN) project uses a network of cameras to detect meteorites or "fireballs" as they fall in the Australian desert. Using the world-class infrastructure at Pawsey Supercomputing Centre, the DFN team stores vast amounts of data and completes trajectory and modelling simulations. The research team can then calculate where a meteorite falls to retrieve, analyze, and trace it back to the parent body in the solar system from where it came.

2016

DESERT FIREBALL NETWORK

THE CHALLENGE

In November 2015, an 80-kilogram meteor that had been moving at 50 thousand kilometres per hour entered the atmosphere. It created a fireball that streaked across the sky; becoming what some of us refer to as a shooting star. The meteorite then dropped into a remote area of South Australia as a 1.6 kilogram of mottled rock. The Desert Fireball Network had caught the event on camera. Three weeks later Professor Bland stood in the desert holding the blackish-grey meteorite in his hands.

"What we do is put cameras out in the Australian Desert. We've got about fifty of them covering about 3 million square kilometres of Australia," said Hadrian Devillepoix, a member of the DFN team.

The camera network collects images each evening with the aim to capture fireballs from multiple vantage points. Researchers then triangulate the data to understand how it traveled through the atmosphere. The DFN cameras produce vast amounts of data, approximately 2.5 terabytes every night. Initially, storing the images presented a challenge for Professor Bland and his team.

"Each camera takes about 1000 images per night. So, once we collect the hard drives we need to store all that data," said Mr. Devillepoix.

The DFN project also needed accurate meteorite detection that the cameras network couldn't provide. Tracking down the meteorite on land required computer modelling to calculate the exact location of meteorites in the desert.

"Cameras detect the materials but if you want to detect them all and do a really good job you need some really high computing power. You can't just do this with normal computers. You need an advanced system to weed out fake events and find even fainter ones," said Mr. Devillepoix.

caption needed

"You also need to do modelling because just going from triangulation to where the rock actually landed… you don't want to spend a month walking in the outback to look for a rock. You need some precise modelling for that."

THE SOLUTION

Using state-of-the-art facilities at the Pawsey Supercomputing Centre, Professor Bland and his team are readily able to upload, store, and search their increasingly large catalogue of image data. Currently, over half a petabyte of DFN images are stored at Pawsey; with a full petabyte anticipated by next year. Magnus, the most powerful supercomputer in the Southern Hemisphere, provided the computer muscle for scientific modelling with Pawsey.

"When we re-run the data on the Pawsey data store we get a lot more fireballs out of our data," said Ellie Sansom from the DFN team.

"The trajectory analysis are non-linear equations that we can run on desktop, and it takes about a week. Using the Magnus supercomputer really significantly reduces that time so that means we can get to the meteorites quicker."

OUTCOME

Through the use of the leading-edge supercomputer infrastructure at Pawsey, the DFN team have been able to process the project data to locate and retrieve newly fallen meteorites.

Interest in the project has sparked a multi award-winning innovative Australian citizen science program that connects the community to the DFN research. The program "Fireballs in the Sky" allows people to contribute to fireball sightings via a user-friendly app which has been downloaded 24 000 times globally.

"The Desert Fireball Network can do a lot more than we ever expected. We can track satellites, space debris and rocket launches," said Professor Bland, team leader of the Desert Fireball Network.

"It's the potential for planetary research that gets us excited. Already, we've seen more fireballs than have ever been recorded, giving us a unique window on what's hitting the Earth. As we recover more rocks, we will gradually build a geological map of the inner solar system."