Green Gown Awards 2014
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finalist's case study

University of Salford

Carbon reduction

State of the Art Carbon Savings

University of Salford MANCHESTER

Profile

- HEI
- 20,000 students (includes full and part time students)
- 2500 staff
- Urban

Category supported by

SALIX
SOLVING ENERGY EFFICIENCY FINANCE IN THE PUBLIC SECTOR

Section 1 About the project

Summary

An energy-saving system created by the University of Salford has not only saved an incredible 70 tonnes of carbon and £25,000 per year, it's also enabled the university to expand its world-class research in areas including post-traumatic stress disorder (PTSD) and space exploration.

Section 2 The results

The problem

Octave is one of the world's most advanced multi-modal display systems. Users enter the eight-sided projection space wearing special 3d goggles – which are much more technical than the type you wear in the cinema – and become immersed in a virtual reality. The user will experience being inside the images being played out and also be able to move and manipulate the objects they see using a variety of interaction devices including their own bodies. The Octave differs from other similar systems as it has a 132 channel wave field synthesis acoustic system spread over 270 speakers, giving the user a full acoustic experience while they're immersed in the images. The overall effect is a compellingly real sensation of experiencing all the sights and sounds of another place, whether it's a marketplace in Iraq or an operating theatre or the surface of Mars. Until January this year, Octave required a huge amount of hardware to keep it running. Sixteen workstations, each with a 2kW power supply unit, were running 24 hours a day to keep the system live. Each machine was using around 800W even when the system wasn't under heavy use, but with the additional air conditioning load this rose to around 1800W per machine day and night.

The approach

Research Facilities Manager, John O'Hare initially had no idea just how energy-intensive the system was until he was approached by the finance team who asked him to assess the energy use for accounting purposes. He has always had in the back of his mind that things could be improved, but that conversation prompted him to look into everything properly. He was shocked when he discovered just how much it was costing to run, so he did some initial research into how things could be improved.

The system was being run on what is called a genlocked cluster. This means that each of the 16 machines were connected with a series of dedicated wires to keep the timing between frames completely precise. This timing synchronisation could take a little while to achieve from a cold start, and demos could be requested by management at very short notice, so things had to be kept running and in sync constantly. Operating a cluster in this way also decreased the 'mean time between failure' which helped give better reliability. The downside was that the power had to remain on 24 hours a day. The problem was that there was no other proven way of

operating the Octave. There are many similar systems across the world running as clusters, and all those that have active stereo glasses like ours would feel the same pressures.

John spent the next six months developing a single system that would do the work of 16 workstations. When he had workable designs, industry partner Paradigm created the single machine from John's specifications, while software company MiddleVR created a piece of middleware – a system which acts as a go-between between hardware and software to allow them to communicate and work together.

Our goals

- Develop a solution to reduce energy consumption and costs of a unique system while not affecting performance
- Contribute to University carbon reduction and cost savings targets

Obstacles and solutions

The cables that were needed to run the system didn't exist in a form that was long enough or fast enough for what was needed	Working with the external partners and internal Estates team, a simple solution was found to move the computer from a side room into the ceiling above the Octave.

Performance and results

After six months of development, University of Salford's research facilities manager for Octave, John O'Hare, and business partners Paradigm AV and MiddleVR, had created a single system that not only uses less than two kilowatts per day; it can also be turned off when it's not in use. This will save a huge 70 tonnes of carbon every year. That's the equivalent of 210,000 miles in a car or 35 flights from London to Sydney, and is enough electricity to heat a semi-detached house for nearly six years.

The huge energy savings have been matched by financial and time savings. Projects that used to take a month now take just days; using just one system to run Octave, rather than 16, means developer tools designed for single PCs can be used so that tasks which used to require writing reams of complicated code by hand, which then had to be communicated between 16 PCs, can now be prototyped with just a few clicks. Licence costs have also been drastically reduced; previously, software licences had to be purchased for each machine and at around £2,000 a time, that's a hefty bill. Now, with just one machine, there's often just one licence fee.

There's also been a huge increase in accessibility because of the increased functionality. This system has enabled the use of the Unity games engine which is already taught at the University. Unity is a games development toolkit which is cross platform, from Android and iPhone and iPad right up to immersive systems like Octave. This gives the opportunity to scale research and commercial work in a way that just wasn't possible before. Now Unity is being used in Octave development is much faster allowing much more to be done with the time available. Current students across Computer Science and Software Engineering are able to choose to do their final year projects on it, so they're learning a skill that they otherwise wouldn't have. Unity skills are increasingly in demand in industry.

And as well as the benefits to the university and its students, the implications for research and development are huge. Thanks to the increased functionality brought about by the new system, the University is able to offer a huge amount more than previously; Octave can be used for medical training, working on shared CAD

like jet engines or F1 cars, even exploration on Mars. There is even a big project with the European Space Agency, where Mars is recreated from the images that were taken up there and all the scientists get together using virtual reality so they can all explore it at the same time and talk to each other.

Any situation where you had to get a group of specialists together and put them on a plane, you can potentially do using Octave. You could set up an operating theatre and have a surgeon operating on a rubber cadaver in research into new surgery, and he could be looking right into the eyes of an anaesthetist in Mexico and speak to him. Or you could have a molecular chemist looking at folding proteins who wants to stand next to another molecular chemist folding proteins and they can both see what each other is doing. Sound and vision combined allow you to explore things in a more precise way.

The upgrade has enabled a whole new tranche of research, as well as doubling the life span of Octave. Approximately £3300 was spent on each of the original machines back in 2007, and well over £30,000 was spent on running them. The new system cost £15,000, but it paid for itself within seven months and will save us £25,000 every year. All these benefits are in addition to the huge energy savings that prompted the change.

Section 3 The future

Lessons learned

This project shows what can be achieved when facility managers, estates teams and finance departments work collaboratively and get involved with the technical aspects of the university

Sharing our project

We have discussed this technology configuration with our research partners at UCL and internally to the University across the Thinklab and Egg systems. They all have similar technical scope and may be able to benefit.

Our research partner University of Southern California is assisting us in modifying their commercial therapeutic software system for research purposes under the new configuration.

Our partners Nvidia and SimulationDisplays now have European experience (through this case study) of rolling out this advanced new configuration.

MiddleVR (our software partner) estimate that they will be supporting around 10 configurations like this by the end of the year.

We have worked closely with all the partners to qualify this configuration so as to make it part of their knowledge bases.

What has it meant to your institution to be a Green Gown Award finalist?

We are delighted to receive a Green Gown Award for this project. It provides well earned recognition for the staff involved and highlights the benefits we can achieve by different teams working together, both internally and externally. This also helps demonstrate commitment towards our strategic carbon reduction objective.

Further information

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http://www.salford.ac.uk/computing-science-engineering/facilities/octave-technical-information