Reinventing cloud computing

A revolutionary take on cloud computing can distribute computational tasks to any device connected to the internet – providing incredible performance and environmental benefits.

UNIVERSITY OF OXFORD

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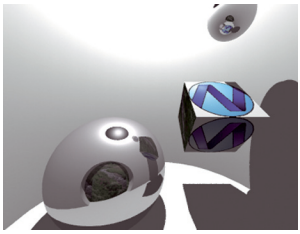
When researchers in the Department of Physics, led by Dr. Jeff Tseng, decided to reassess large-scale scientific computing systems, they started from the ground up. Instead of working within the constraints of existing technology, they questioned previous design assumptions - to make new systems as streamlined as possible, and capable of handling large super-computing tasks efficiently.

To do that, they broadened the cloud computing net, by using the spare capacity of computing resources across the entire internet. Most computers rarely run at full capacity, so their spare processing power can be used for a marginal increase in operating cost. That idea has been used before, in systems like the Berkeley Open Infrastructure for Network Computing (BOINC) - but it has always come with major security short falls. The problem was, then, how to safely, securely and reliably use those spare resources.

The solution, developed in the Department of Physics, is JPC: a software system that emulates an entire PC in a secure Java environment. Creating a virtual computer on each node of the grid allows software to be run without compromising the security of the host device. The other benefit is that, because the software runs in Java, it works on an array of non-traditional platforms as well – even mobile phones.



With a secure container in which code can run safely, the same researchers then developed a way of exploiting remote processing power to undertake super computer-like tasks. They built Nereus, which shares huge computational tasks across computers around the world using JPC or the standard Java Virtual Machine. The Nereus network could use all the world's internet-connected computers – providing an overall capacity 100 times greater than the 500 most powerful supercomputers combined.

But it is not just power that the system can offer. Almost half of the CO_2 emission associated with a computer's lifetime is incurred before the hardware even reaches the consumer, so because Nereus uses existing devices, it is much less environmentally damaging than new supercomputers or clusters.

So far, Nereus has been used to share the workload of processing medical images, analyse astrophysics data, render complex video for animations, and transform databases for a national pension fund. With plans afoot to use the systems for digital archiving and the sophisticated mathematics of finance, the software looks set to make its mark - and because it is all open source, anybody can take advantage.

http://www-nereus.physics.ox.ac.uk
http://www-jpc.physics.ox.ac.uk

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