Tech gets energy efficient

April 12 2013

Credit: AI-generated image (disclaimer)

'Information and communications technologies' (ICT) use energy as well as helping to save it - more energy-efficient ICT could help make further savings and reduce CO2 emissions. An EU-funded project has developed a plug-in for data centres that consolidates workloads among servers and switches off unused machines to save energy.

We like to think that modern technology can save us from the brink of

environmental crisis; better telecommunications mean we can cut down on travel and the internet puts knowledge at our fingertips - saving millions of trees from being pulped into paper.

But we often overlook a startling fact: ICT uses energy too. Every time you search the web, put in a mobile call or watch catch-up TV, computer hardware consumes electricity to deliver what to you seems just a simple click away.

According to Datacenter Dynamics' Global Industry Census, global energy consumption by data centres at the end of 2011 was 31 GW - enough energy to power all the households in the UK, France or Italy - and was expected to grow by nearly 20 % during 2012.

'The good news is that data centres want to save energy,' explains María Pérez Ortega from Spanish IT services and consultancy firm GFI. 'Saving energy means saving money and that's a good enough incentive these days for any data centre.'

'Most data centres already have various energy saving features built into the building infrastructure or the data centre management software and systems,' Mrs Pérez continues. 'But we have created something that any data centre - large, medium or small, virtual data centres of distributed systems connected in the Cloud, supercomputing facilities, or traditional service providers - could install with immediate benefit.'

Plug in for energy savings

Partners in the 'Federated IT for a sustainable environmental impact' (Fit4green) project developed the software so that any data centre could install it, irrespective of their hardware, type or the proprietary management tools.

The 'plug-in' software monitors the workload of every server in the data centre, then calculates how to redistribute the work more efficiently and temporarily shut down any surplus servers. 'If you can consolidate machines' workload you can switch off servers whilst you do not need them, it's as simple as that,' states Mrs Pérez, who coordinated the EU-funded project. 'Your servers will use less energy, but you will also generate less heat and use less energy for cooling. The Fit4green tool is "platform agnostic". It plugs in to any system. If you are running several platforms across multiple sites, Fit4green will still work and it will still save you money.'

The Fit4green solution relies on energy-saving optimisation algorithms which the project partners developed using data collected from a variety of real data centres. These algorithms suggest actions that lead to considerable energy savings, taking into consideration key, continuously monitored parameters, such as the current and future power consumption, workloads time patterns extracted from monitoring data and the internal temperature of the data centre.

A 'power calculator' estimates the power consumption of servers and cooling systems and how the active servers will affect both the overall energy consumption of the data centre and the related CO2 emissions.

Optimisation algorithms then work out the best way to allocate workloads across available servers. These calculations exploit a technique known as 'constraint programming', which separates how the problem is modelled from its actual solution. According to Mrs Pérez, this provides extra flexibility and helps the Fit4green tool run efficiently. 'On the one hand we can adapt it easily to new data centres with their own business models; on the other hand we can experiment with new solving algorithms without having to redefine the set of constraints of the data centre.'

Proof in numbers

Fit4green has been trialled in three quite different settings: a typical corporate data centre, a supercomputing centre and a data centre distributed through the cloud.

Tests have shown that Fit4green reduces overall energy consumption by 10-50 %, with an average of 25 %. The plug-in can also work across several sites (i.e. federated data centres) and deliver some of its best savings figures thanks to the additional workload flexibility that federation provides.

'We ran Fit4green in a simulation of the facilities of a project partner who has two data centres, one in Rome and one in Milan,' Mrs Pérez recounts. 'For this simulation we considered that the data centre in Rome is much newer, with more efficient servers, but the climate in Rome is much hotter and cooling is more costly. The older data centre in Milan is less energy efficient, but the ambient temperatures are cooler, especially in winter.'

By federating these two data centres, Fit4green cut overall energy consumption by 35 %.

'At its simplest, you move as much workload as possible to the Rome site in winter, but maximise server usage in Milan in the summer,' Mrs Pérez continues. 'However, Fit4green is cleverer than that: it also works out the energy cost of transferring the workload. If the cost of making the transfer is higher than the overall energy saved then it isn't worth doing. We are also responding to feedback from users. Some are worried about a tool which automatically powers down servers, so we have built in options where Fit4green just makes recommendations to the data centre operators and lets them decide whether to follow the advice.'

Quick savings

Mrs Pérez claims that it is relatively easy for data centres to deploy Fit4green. 'It is open source software. Of course, there needs to be a period of consultancy and analysis to find out how much [energy](link) Fit4green could save and calculate the return on investment. But deployment should be relatively straightforward, because all you need to do is connect Fit4green into the data centre's management systems so it can pull out all the data it needs, and we have already developed three different connectors.'

Several commercial organisations and project partners are already adding Fit4green to their existing and new data centres. 'There is a big drive for [saving energy](link) because of the spiralling costs. Data centre managers tend to be very conservative,' Mrs Pérez admits, 'but we think Fit4green will convince them that it is worthwhile.'

More information: - ['Federated IT for a sustainable environmental impact' project website](link)
- [Fit4green project videos](link)

Provided by CORDIS