GREEN-MY-TECH **TIPS 4**

Did you know:

The fuel efficiency of a car depends on how you drive it. Similarly, the energy efficiency of a piece of IT hardware also depends on the way you "drive it".

About 2% of carbon emissions are caused by computer and phone equipment, and this number is on the rise. People around the world are talking about climate change and how they can be more environmentally friendly, or "greener". There are many ways to reduce our ecological footprint, but one that is often overlooked is how we as consumers can use technology in a sustainable way. These fact sheets offer practical information and suggestions on what you can do to "green your tech".

ENERGY EFFICIENCY FOR IT PROFESSIONALS AND DESIGNERS

What can I do as a website designer or editor?

Test your work on different browsers and devices, especially ones that are old and slow. If using it causes even a slight delay, remember there are probably people out there in developing countries using even older and slower hardware and connections.

Some web content is heavy by nature - like images, audio or video. How do I work around uploading large files?

Remember the old rule about page load times and keeping image file size small. On popular articles, link to video rather than embedding it. Many people don't have time to wait for the video to load. Choose streamed low-resolution MP4 or Ogg video or audio, where people can choose the segment they want, rather than Flash or video-sharing sites. This will minimise CPU and bandwidth requirements and the risk of "choppy" sound. Also, Flash, Java and animated GIFs may appeal to some clients, but most users just find them annoying. PDFs should be optimised for web and email, not print quality. Otherwise a few photos can mean a simple brochure takes up megabytes of bandwidth and disk space. Try to include a simple, readable HTML version.

Are some scripts better than others?

You should avoid complex Javascript and Ajax unless absolutely necessary, because it kills the battery on mobile phones. Check the site with the "Noscript" Firefox security add-on. Keep your CSS simple, and aggregate multiple CSS files on the site into one.

What about embedded links to external sites and chat functionalities?

Linking to social media sharing functions is more efficient than embedding external code, and also solves a privacy problem with cookies (the BBC's website is a good example of this). Consider how much interactivity you really need - would a simple email discussion list be easier for users?

What is best in terms of functionality and efficiency?

Try to minimise additional libraries or modules for core functions, particularly when they need to be dynamically loaded. Test and consider efficiency and hardware requirements when choosing between alternative platforms, implementations and libraries. Profile code as early as possible with test data to identify both frequently-used and slow code paths (for instance, using Dprof for Perl). Ask a colleague to review code efficiency during development. If compiling your own software, regularly test with all speed (rather than memory) optimisations.

Are there ways to increase my software's efficiency?

Ensure your software gives helpful efficiency hints to underlying systems, clients and caches. For example, with HTTP, check "Expires", "Cache-Control" and "Revisit-After" headers are set to appropriate values, and also give hints to database servers about how likely a query is to be performed again (eg SQL_CACHE). Consider separating a website into a high-volume easily cachable site for visitors and bots, and a separate resource-intensive site for admins (as Wikipedia and Indymedia do). For websites and interpreted languages use the most efficient code cache available (for instance, xcache for PHP). With a live site, test the effect of any caching facility built into a content-management system in combination with other measures, and monitor the size and efficiency of the cache (some forms of cache can be essential, while others might be worse than useless). And always test actual impact under load (for example with siege), using tools such as top (*nix) or Process Explorer (Windows), on a variety of machines.

Can I reduce energy use on my server?

When acquiring any server for any reason, install a virtualisation system as a first step, for example Xen, VMWare or [VirtualBox]. You may be able to get it to use only half the processors, and you could find space later for a separate application without having to procure and install new hardware. You can move VM images between physical hardware, and systems like Xen allow you to dynamically reallocate memory according to need without even rebooting the virtual machine (domain). You probably want to install maximum RAM in the server for similar convenience.

What do I do about servers I'm not using as much and older servers?

Move underutilised servers onto a virtual server as soon as possible, and shut down the unused machine for later reuse or recycling. Because of its continual use, you can upgrade servers about twice as often as desktops but try calculating the relative energy cost of upgrading versus not before purchasing a new server. Servers should never swap, as it slows performance while demand increases, so ensure the maximum number of processes is limited to available physical RAM.

Is there anything I should consider when buying a new server?

Look at the energy rating and the suitability of CPU and memory resources to your total needs ("right-size" both the server and overall capability). Many cores with a slower clock speed will usually be more energy-efficient because power usage rises with the square of the clock frequency. It's also possible to have two sepa-

rate machines in the same 1U unit, sharing resources. Check that installed packages are optimised for the processor. If upgrades or other changes of circumstance produce performance degradations, investigate as a priority and raise the issue with developers if needed.

Are there any ways to reduce my energy and power usage?

Shut down any unused servers you've identified with a PDU and monitor and graph server variables including temperature, CPU, paging or swapping and performance. Higher temperatures are not just a sign of high use, but also an increase in the power usage of semiconductors.

What options for virtual storage do I have?

Demand spikes create a temptation to use over-provision hardware. Consider the use of a web cache like varnish, use of a content delivery network, edge network or temporary load-balancing servers, and if possible, dynamically reallocate virtual machine resources and discuss resource requirements with users.

But spikes use energy. Can I reduce these spikes?

Not all resource spikes are usage spikes and require any hardware upgrade; many huge spikes may be caused by intermittent software inefficiencies, or interaction with another system such as when a search bot gets stuck on a website or an injection attack. Deploy scripts to log processes and hardware events during peak CPU or memory use that can later be used to identify resource-hogging or blocking processes, requests or queries (for instance in a LAMP environment, iostat, top, apache status, mysqltop). For instance, database indexing and caching generally improves efficiency, but needs to be tested and tuned for live applications, and may benefit from regular maintenance operations like defragmentation. Ensure files are not duplicated on backups and are compressed and incremental wherever possi-

ble. Work with users to exclude large files that may not need regular backup. Deleting large log files and old backups minimises hardware requirements and may be better for data protection.

How can being more secure help lower demand for resources?

Having a good spam filter will ensure your own systems cannot be abused for unsolicited email or backscatter. The carbon cost of email spam has been shown to mostly be in users receiving and dealing with it. Similarly, take action against comment spam (blackhat SEO), which can fill up database tables with gigabytes of rubbish that is hard to remove. [Mollom] An insecure system is likely to be an inefficient one.

Does location affect servers?

Consider where you locate servers. Modern servers may have lower cooling and voltage requirements than some data centres and that should be taken advantage of. Localised aisle cooling may require you to ensure all airflow goes through equipment that needs it. Data centre cooling efficiency may be indicated by Power Usage Effectiveness, certifications like CEEDA or conformance to the EU Code of Conduct, as well as availability of free cooling (such as in Iceland) or heat pumps. Also enquire about the data centre's relationship with renewable energy.

Does all this really make a difference?

Yes! We all make a difference together. It may be an effort to do the work and convince other people now, but it pays off in the long run. Consider how you can make small changes in your life and encourage friends, colleagues or decision-makers to do the same, perhaps using the information in these sheets. Remember, don't break the biosphere -- someone else might want it!