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I write about the intersection of science, business and ambition.

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Google Says: Save Energy, Ditch Your Data Center

Mountain View, CA.—If you want to save energy, get rid of your servers, says Urs Hoelzle, senior vice president of technical infrastructure at Google.

Server and data center under-utilization is one of the primary sources of waste and inefficiency in computing, argued Hoelzle, who served as the master of ceremonies at the “How Green is the Internet?” symposium that took place at Google headquarters in Mountain View this week. Former Vice President Al Gore and Google Executive Chairman [Eric Schmidt](#) spoke, but the bulk of the day revolved less on visionary speeches and more on ideas to solve practical problems, like being able to keep a lid on [power consumption](#).



Ule in action. Photo by Daniel Gaines

Simply put, companies that manage their own servers and data centers often only use 10 to 20 percent of their available computing cycles, according to general industry estimates. The rest of those cycles, and the energy required to generate them, go to waste. Even when servers move to idle mode they require power and cooling. Although computers consume far less power in idle mode than they did five years ago, the watts still add up.

By contrast, Google gets up to 80 percent utilization on some of its web indexing servers, said Hoelzle, and achieves utilization rates in the 30 to 50 percent range for other servers. The disparity in utilization will contribute to a shift of more business processes and operations to third party cloud providers, he said.

“You will see millions of businesses with no IT except for their Internet link,” in the future.

If anything, cloud computing could certainly reduce the number of servers in the world, said Eric Masanet, an associate professor of mechanical engineering at [Northwestern University](#) and another speaker at the event. There are approximately 4.9 million servers currently operating in corporate and business environments, Masanet estimates: 3.6 million e-mail servers

and 1.3 million servers dedicated to productivity applications and customer relationship management.

A shift to the cloud could reduce the total number to 85,500. The world would only need 47,700 email servers and 36,800 servers for productivity applications. Not only would there be far fewer data centers, these individual mega data centers would be far more efficient.

“The cloud could reduce energy use in data centers by 87 percent,” he said, adding that the shift would save 300 petajoules a year, or about the same amount of energy consumed by Los Angeles annually. (Masanet’s full study will be posted soon, along with videos from the event.)

Some other interesting highlights from the conference:

–It only takes 0.2 kilowatt hours to send a gigabyte of data, according to Vlad Coroama, a Research Fellow, Center for Industrial Ecology, University of Coimbra, Portugal, who conducted a somewhat compelling experiment to measure the energy efficiencies of videoconferencing. Coroama and his team set up a videoconferencing link between Japan and Davos, Switzerland, a 27,117 kilometer-long link that traveled across 25 routers. They then conducted conference calls at 40 megabits per second and measured the power consumed.

Extrapolating from those findings, Coroama determined that a two hour video conference over a high definition link would take about as much energy as flying three miles.

“Sending bits is more efficient,” he said.

–The Internet uses, roughly, ten percent or less of the world’s electricity, up from an estimate of eight percent in 1999, said Jonathan Koomey, a research fellow at the Steyer-Taylor Center for [Energy](#) Policy and Finance at Stanford University. At the same time, Internet traffic has exploded. In 1986, telephone voice traffic accounted for most of the world’s data traffic. Now, voice constitutes a small sliver of data traffic with the rest coming from the Internet.

The calculation isn’t easy to determine. When you use your laptop to go online, one can easily determine that the energy is being consumed by Internet activity. But if you are working on a spreadsheet, the answer is less clear. The Internet-connected refrigerator? Only a fraction of power from the so-called “Internet of Things” should be counted in the total.

–Still, the predictions about how the Internet would suck up inordinate amounts have luckily been avoided. A [1999 Forbes](#) article predicted that the Internet would drive power demand and stress utilities. Advances in efficiency and devices have prevented that from happening. A smart phone uses around one to two kilowatt hours a year, Koomey added, while a tablet consumes 10 to 12 kilowatt hours. By contrast, a desktop now consumes 200 kilowatt hours. But back in 1999, a PC required [1,000 watts](#).

–The Internet of Things will also be efficient. [Streetline](#) is a company that puts battery-powered sensors in pavement to monitor parking spots. You could wire all 40,000 parking spots in Los Angeles with 15 watts, says Koomey.

–Digital downloads, yes, save energy. In a worse-case scenario, digital song downloads consume 40 percent less power than buying CDs. In a best-case scenario, downloads cut power by 80 percent. But with physical goods, the

picture is less certain. Scott Matthews, a professor of Civil and Environmental Engineering, Carnegie Mellon University, studied the energy consumed by ordering a USB key online versus going to the store and buying it. The online advantages were marginal: those UPS trucks clogging commute hour traffic lanes, after all, are carrying packages from [Amazon](#). Digital downloading, without proper data center management, could likewise erode its advantages.

–Wireless networks are a prime target for energy efficiency. 4G networks are nowhere near as efficient as fixed-line networks, said Kerry Hinton, a senior research fellow at the University of Melbourne. They also generate tremendous amounts of redundant data: he estimated that 1,000 bytes get propagated across a network for every byte of information submitted by a user.

“Five years from now, your phone will switch to WiFi” automatically when indoors, said Hoelzle. It takes energy to connect to an antenna and it will simply be more efficient for phones to link to a WiFi router two meters away than a 4G tower thousands of meters away.

–Could I leave without putting in a few Al Gore quotes for everyone to argue about? Of course not.

“American democracy has been hacked...It really is pitiful. Not a single meaningful reform can be passed unless they get permission from the special interest effected,” he said.

There is also 4 percent more water vapor in the atmosphere than 30 years ago, Gore added.

Class, discuss.

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