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Cloudy with a Good Chance of Increased Global Warming

Environmental

As more of our computing moves to the cloud, and the physical media we used to keep locally, like CDs, DVDs, etc., is replaced by virtual cloud counterparts, I got curious: What does that mean for the environment?

As lawyers, you will be shocked (shocked, I tell you!) to learn that the answer is pretty … cloudy.

- The National Renewable Energy Laboratory (NREL) tells us that by 2020 data centers (including cloud centers) will consume about 73 billion kilowatt-hours, or approximately two percent of the overall US energy consumption.
- Cloud computing is generally more efficient than on-premise data centers. Research funded by Google and conducted by Lawrence Berkeley National Laboratory (in conjunction with Northwestern University) projects that transitioning commonly used software applications to the cloud would cut energy use by 87 percent. The saved energy could be used to power Los Angeles for a year.
- A survey conducted by Accenture, Microsoft, and WSP, the Canadian business management firm, calculated that by using cloud computing, large companies could lessen per-user carbon footprint by 30 percent and up to 90 percent for small enterprises.

- A CDP report contends that cloud services could reduce annual carbon emissions by 85.7 million metric tons.
- In addition, cloud “dematerialization,” which refers to the replacement of high-carbon physical products with virtual equivalents, results in using fewer machines and hardware that use less energy and have a lower impact on the environment.

While cloud computing generally seems like a win compared to the alternative, things are rarely all sunshine and rainbows; cloud computing has a number of ramifications we ought to consider from an environmental perspective.

One is that because digital storage is so cheap and easy (and invisible), we tend to store more things in the cloud than we ever would on physical media.

You know it’s true from your own business and personal experience. How many companies have been arguing for years about whether to purge old and irrelevant emails and digital files from data centers only to have those efforts fail because the costs of retention seemed too low to warrant the purging effort? If you had to pay to store all that in physical media, the debate might conclude very differently.

And how many of you bother to go through your personal iCloud or OneDrive or Dropbox accounts on a regular basis to purge things you will never use? We tend to be a bit lackadaisical about this because we have so much storage for such a small cost.

The amount of digital content keeps growing exponentially:

- Social media is a huge factor — there are almost 300 million new social media users each year, all posting pictures, videos, and other items, at no apparent cost to the users; and companies like Facebook encourage them to post more and more.
- Email is no better. The Email Statistics Report 2019-2023 by the Radicati Group calculates that 293 billion emails are sent each day, and this is expected to grow by 4.2 percent yearly to 347 billion by 2023. According to the same report, there are 3.9 billion email users in 2019 and that number will increase to 4.4 billion by the end of 2023. And again, not many users are rigorous about purging, because, why bother?
- The amount of mobile data is also blowing up — at the start of 2014, mobile phones/tablets uploaded and downloaded around 2 exabytes (1 exabyte = 1 billion gigabytes) of data. At the start of 2017, data created on mobile devices quadrupled to over 8 exabytes.

So, the piles of shiny bits and bytes just keep growing, hidden in a labyrinth of irrelevant information that nobody bothers to examine.

This obviously has tremendous environmental implications. In 2016, it was reported that the world’s data centers used more than Great Britain’s total electricity consumption — 416.2 terawatt hours, significantly higher than the United Kingdom’s 300 terawatt hours. At three percent of the global electricity supply, and accounting for about two percent of total greenhouse gas emissions, data centers have the same carbon footprint as the aviation industry. Recent predictions state that the energy consumption of data centers is set to account for 3.2 percent of the total worldwide carbon emissions by 2025, and they could consume as much as a fifth of global electricity. Server data is on track to create 14 percent of the world’s emissions by 2040, around the same proportion as the entire United States does today.

Two main factors seem to contribute to the way cloud data centers, which are composed of many server banks in close quarters, impact the environment. First, they get tremendously hot and need to be cooled. According to studies, around 40 percent of the total energy data centers consume goes to cooling the equipment. Second, they also obviously use tremendous amounts of additional electricity.

Some cloud providers have been tackling these issues. In the area of cooling, for example, Google in 2009 opened one of its data centers in the far northern town of Hamina, Finland, where the cooler temperatures substantially reduced the energy needed to cool the installation. Microsoft took that one step further. In 2016, it submerged an entire data center under the North Sea near Orkney. That center not only needs less energy to cool its servers, also but uses tidal turbines to generate the electricity it needs, killing two birds with one stone.

And cloud providers have come up with other ingenious solutions to the heat problem. German-based Cloud&Heat takes the water used to cool its servers and uses it to heat several residential areas in Germany, including the former European Central Bank. This trick eliminates the need for those areas to maintain separate heat pumps. Cloud&Heat recently announced that it plans to expand this program into California. Other companies are following suit: In 2018, Nordic data center operator DigiPlex pledged to use the waste heat from its facility in Ulven, Oslo, to warm 5,000 apartments in that city.

On top of that, we're also seeing cloud providers shift toward using hydro, wind, and solar power as part of their energy supply. Apple, for instance, has committed to powering its iCloud servers exclusively through renewable energy. Apple has built the country's largest privately-owned solar farms at its North Carolina data centers and is powering its Nevada data centers with geothermal and solar energy. Apple also uses wind energy for its Oregon and California data centers. Google has invested US$3 billion in renewable energy projects and purchases 100 percent renewable energy to match the consumption from their data.

Since energy is one of their biggest expenses, all the big cloud companies are motivated to reduce energy use as much as possible. But many of these companies will cut costs by buying the cheapest, not necessarily the cleanest, energy when the market dictates. Going forward, it will be important to keep pressure on them to do as little harm to the environment as possible, and to find out ways to avoid having our data habits contribute to any kind of environmental apocalypse.

Of course, advances in technology may provide much better options. For example, some people believe that in the relatively near future we will be able to store enormous amounts of data on things like DNA, with none of the environmental impacts we have been considering.

Like many things, cloud computing is somewhat of a mixed blessing. But since we are not likely to reverse direction when it comes to using the cloud, we should at least have some perspective on the broader horizon — which may be cloudy.

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