Taylor Cash Rose

Gopal Dayaneni

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The True Cost of The Cloud

The cloud may seem like a figurative space, a theoretical buzzing field above our heads that is an endless frontier for data. In reality, it's none of those things. The cloud has a very tangible reality and traceable impact on our environment.

To understand the externalities and impacts of the cloud we must first understand how it works. Essentially, data is stored on servers all around the world and we can retrieve that data through the internet. In actuality, the cloud is more complicated than that but for our purposes understanding the basic function and physical nature will help position the relationships of the cloud to finite resources, energy usage, physical location, and the future of technology.

Externalities, Relationships, and Impacts

Accessing the cloud is essentially the only abstract part of it. The servers that house cloud databases look more like futuristic factories in terms of space. Amazon

Web Services (AWS) has approximately 1.2 million servers that live in data centers around the world. When it comes to hardware, servers are typically made of three main components: a central processing unit, random access memory, and a motherboard. Like most electronics, there are rare earth minerals that are necessary to fabricate the hardware. A few of the rare-earth metals used in electronics include: lanthanum, cerium, neodymium, samarium, europium, terbium, and dysprosium. These metals are in increasingly high demand and have harsh demands of the environment and the workers whose labor sustains these operations. Before a piece of a server even approaches its home as part of the cloud, it already has a rippling ecological footprint.

The buildings where cloud computing takes place have strict requirements. They must be spacious and secure. Perhaps the most important requirement is the temperature. Data centers must be constantly cooled, usually by air conditioning. Tech giants will typically choose the site of their data centers based on the climate. Iceland has the perfect temperature, it's typically cool but rarely freezes, for data centers. Likewise in the United States Virginia draws companies like Amazon to set up shop due to the tepid climate.

Data centers have even been tested at the bottom of the ocean because the ocean can absorb the heat that's given off. Of course, that heat has to go somewhere, so the ocean would heat considerably if this was a prominent option in the future. Also housed in the ocean is 95 percent of the global communications traffic with undersea fiber optic cables. (Yes, your internet comes from an actual giant wire that snakes along the bottom of the ocean into your country. While wireless connection is a large part of

internet access, it requires tethering. During moments of political upheaval countries like Egypt have literally turned off that giant wire. There is of course a lot more to the technical side of that, but you get the picture — there are physical controls around seemingly endless constructs like the internet and cloud computing.) Climate change will impact access points to these fiber optic cables and likely disrupt their transition points on the coast. Even our data clouds have a special relationship with water.

Cloud computing requires massive amounts of energy to keep the servers up and running properly. The problem we run into when trying to understand just how deep of a cut this demand makes on our environment is the impact of cloud computing isn't well measured or regulated. According to Scientific American, data centers use between 1 and 2 percent of the world's electricity. That 2 percent is bigger than it sounds. Google is using the same amount of electricity each year as the entire country of Turkey. Cloud computing saves energy compared to the alternative of every company running its own individual servers, however the electricity it does use is significant and the demand will only increase.

One of the challenges in regulating and understanding the impact of cloud computing (in terms of energy) is there is little to no transparency around green practices. According to The Atlantic, "starting around 2006, power-usage effectiveness (PUE) has been the metric of choice for the data-center industry.... It's a fairly simple measurement of a data center's total power usage to the power usage of its actual IT equipment. It's more a metric of efficiency than of environmental impact." Greenpeace noted in their ClickClean 2016 report that even the language big tech companies are

using to describe their commitment to clean energy usually doesn't have teeth. For example the report pointed out that "in addition to 100% renewable commitment in 2014, AWS offers to customers the option of being hosting by four "Carbon Neutral" regions. No definition of carbon neutral or details of how it has achieved its definition are provided." Also, many companies use the phrase "clean energy" without defining it to clarify that "clean" should not include nuclear energy or natural gas. The lack of consistency from big tech corporations and likewise effective ways to measure environmental impact of cloud computing prevents us from creating strong regulations to protect the future.

Big tech is at a turning point where they have the muscle to back up renewable energy. "In North Carolina, Google pressured Duke Energy to create a new renewable-energy program," according to The Atlantic. "In Iowa, MidAmerican Energy's decision to cancel a nuclear-power project conveniently coincided with Facebook's investment in wind power in the state." Companies like these are often keystone consumers for power companies, and therefore can work with them to create renewable systems like wind or solar.

Like most hardware, data servers have a forced obsolescence, especially with acquiring faster servers as they are developed. This creates an "end of life" problem for the outdated hardware. Where does it go and what impact does it have there? In 2018, 50 million metric tons of e-waste was created across the world. This waste often ends up in superfund sites, three of which are located just an hour south of the author's home. Bloomington, Indiana has three superfund sites that are the result of hardware

production. The Neals Landfill site covers 18 acres and seeps into the well water of residents who live within a mile of it. We are just beginning to understand the health risks of mixed rare earth minerals. At the Neals Landfill there are electrical capacitors containing polychlorinated biphenyls that have leached into the neighboring creeks and soil systems since 1962.

Continuing Connections

A cloud of transient and theoretical endless possibilities has a measurable relationship to place. The internet today is built over the ghosted paths of the railroad in the United States, hubs of the railroad becoming data centers and fiber optic lines tracing tracks. When a data center is built it rarely bodes of plentiful jobs in an area. Typically they require very few but very skilled workers. Environment deeply impacted by the accessing and storing of our data.

Cloud computing is the next step toward a technological landscape that carefully accounts for its physiological impact. It’s more important than ever that we set standards for ourselves. The rise of artificial intelligence alone will require a dramatic increase in cloud computing and may account for 10 percent of the world’s electricity by 2025. We just have to make sure our ecological footprint with that step is minimal.

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