Weathering the Storm: The Policy Implications of Cloud Computing

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ABSTRACT

Throughout the history of computing, there have been several paradigm shifts from main-frames to mini computing to microprocessing to networked computers. On track to be the next major paradigm shift is that of cloud computing. While the definitions are still being debated (see: `http://videos.techielife.com/what-is-cloud-computing/video-online/2008/11/13`), fundamentally, cloud computing can be defined as a push in designing services where information is stored and processed on the Internet (i.e., "the cloud") usually via massive large scale data centers which can be accessed remotely through various clients and platforms [18, 2]. Cloud computing itself has often been referred to as a conglomeration of ideas such as Software as a Service, Web 2.0, grid computing, and utility computing [2]. In essence, cloud computing is an umbrella concept which attempts to synthesize and encapsulate this over arching movement of access anywhere, process anywhere while abstracting the entire process to the user masking it in the cloud.

The advantages of cloud computing is that it offers enormous amounts of power in terms of computing and storage while offering improved scalability and elasticity. Moreover, with efficiency and economics of scale, cloud computing services are becoming not only a cheaper solution but a much greener one to build and deploy IT services [7, 6]. For example, in terms of processing power potential, Google recently used its cloud computing infrastructure to process and sort one petabyte of data in six hours [5]. In terms of time and cost, the New York Times used Amazon Web Services to process and convert an archive of 11 million articles in less than a day and for a fraction of the cost [8].

Cloud computing is quickly taking the IT community by storm as more platforms, applications, and services are being developed for cloud computing. While many users may have never heard of cloud computing, a recent report by Pew Internet Life found that 69% of Internet users are already using a type of cloud computing based application [14]. Furthermore, Microsoft, Amazon, Google, IBM, Yahoo, Oracle, and Salesforce are all heavily investing in cloud computing as the future of computing. Industry experts estimated the current market for cloud computing to be worth $160 billion [2]. Acknowledging its importance, in terms of education, Google and IBM have put forward an academic initiative with six major universities to help explore and foster research in the area of cloud computing, of which four of the six universities are iSchool members [12].

Given this, researchers in the academic community and interested parties in the IT and business world are just now exploring new and exciting ways to harness the true power of the cloud, however key legal and policy questions remain unanswered [10].

These problems include both new policy issues unique to cloud computing and existing technology/policy issues, including:

- **Jurisdiction and regulation** (Where and how will it be governed?)

- **Ownership of Data** (Who owns the data in the cloud?)

- **Data Portability** (Can you migrate between services?)

- **Data Retention/Permanence** (What happens to data over time?)

- **Intellectual Property**

- **Security and Privacy** (How is data secure and protected?)

- **Reliability, Liability and Quality of Service** (What happens when the cloud fails?)

- **Government Surveillance** (How much data can the government get from the cloud?)

- **Monopolization of computing**

- **Net Neutrality**

Moreover while looking at these problems, we need to consider the stakeholders involved in cloud computing. The stakeholders are cloud platform providers, software developers building applications on the cloud, general consumers, researchers, and the government including policy makers.

The primary questions revolve around how cloud computing will be regulated. If the goal of cloud computing is to transcend location of both processing and storage, the obvious quandary is: How will it be regulated and where will the boundaries of jurisdictions form inside the nebulous cloud? While cloud providers tout the feature of "locationlessness", boundaries do not disappear and geography does and will matter in terms of law and regulation. Will the jurisdiction be dictated by where these data centers are located, where the data is temporarily stored, by the contractual agreements cloud users agree to, or something wholly different?

In terms of monopolization of computing, in 1943, Thomas Watson SR, former chairman of IBM, said that the total world market for computers would not exceed five [3]. While five years ago this would seem laughable to many in the IT community, with cloud computing this may no longer be a funny mis-prediction, but some what eerily truthful. Cloud computing data centers, plainly speaking, are massive amounts of computers all functioning together as one supercomputer. With economics to scale and network effects, we may see a future with only a handful of cloud computing providers in which the world will do their computing on [10]. Therefore, there are concerns of the potential for cloud monopolies to form.

This push towards moving the responsibility of processing and storage of information away from the end user has clear ramifications in terms of privacy and data retention [15]. Who owns the data that is uploaded or generated on the cloud and what can the providers of cloud services do with this information? Other concerns, as vocalized by free software advocate Richard Stallman, come from the move towards computing as a service, which pushes data ownership and control towards these service providers [11]. Stallman, has called cloud computing a "trap" that will take control and freedom away from users and force them into an unnecessary dependency. What happens when individuals are no longer the stewards of their own digital environment?

What are the possible ramifications to society and culture as data is amassed, stored, and retained for long periods in the cloud? [13, 15] Cloud computing is, in effect, making supercomputer-like power readily available to anyone. Given its storage and processing power, more data can be stored and processed by everyone. With modern society creating increasingly larger amounts of data, cloud computing could be the ultimate storage answer to this exabyte flood of data [17]. However, what happens now that we have the ability to store more information for indefinite periods of time?

In terms of reliability and liability, technology is not perfect and failures can and have occurred in cloud computing platforms. In February 2008, Amazon's Web Services (specifically Amazons S3 cloud storage infrastructure) went down for several hours, causing data loss and access issues with multiple Web 2.0 services [4]. This type of failure is by no means a unique event [16]. With more services being built on top of cloud computing infrastructures, an outage or failure can create a domino effect, effectively taking down large amounts of Internet services and Internet based applications. In cases of failure, what forms of arbitration exist for stakeholders, and what is the responsibility of cloud providers?

In terms of government intervention, how will cloud computing function with existing regulation such as the Patriot Act, HIPAA (Health Insurance Portability and Accountability Act), COPA (Child Online Protect Act), Sarbanes-Oxley Act, and federal discovery regulation requirements? For example, many countries are leery of using cloud computing services because of the potential for data to be exposed to the US government via clauses of the USA Patriot Act [1]. How will regulations adapt to cloud computing and how will cloud computing evolve to fit existing regulations?

The policy implications may appear to be endless, but solutions do exist. Given the potential impact of cloud computing, these problems will not remain unresolved and will eventually be answered [9]. The question is how? A proactive approach, in the form of education and policy analysis, is necessary to ensure that cloud computing will succeed and that vested stakeholders are protected [10].

Therefore, this poster will provide an overview of cloud computing and its policy implications. In addition the poster will be used as a springboard to discuss the opportunities for research that exist for iSchools.

Keywords
Cloud computing, Information Policy, Information Ethics

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