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Cloud Computing Law: An Introduction

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Abstract: Cloud computing is the future of the next generation computing systems in the world. Cloud technology is one of the globally recognized emerging technologies in the new millennium that are most likely to change people's lives. Organizations with not enough resources to build their own infrastructure can now take advantage of the cloud services to suit their specific needs. Cloud computing presents novel challenges to the traditional protections built into the law to ensure security of corporate capital- and knowledge-based assets. Cloud computing law" refers to the legal framework and regulations that govern the use of cloud computing services. This paper introduces readers to cloud computing law.

Keywords: *Law, Cloud Computing Law, Legal Issues*

I. INTRODUCTION

The recent emergence of cloud computing is one of the major advances in the history of computing. Cloud computing is a computing paradigm for delivering computing services (such as servers, storage, databases, networking, software, analytics, and more) over the "the cloud" with pay-as-you-go pricing. The term "cloud" denotes "the Internet," so that "cloud computing" is also called "Internet computing." Cloud computing is a means of pooling and sharing hardware and software resources on a massive scale. Users and businesses can access applications from anywhere in the world at any time. Companies offering these computing services are called cloud providers and typically charge for cloud computing services based on usage [1]. Some features of cloud computing are displayed in Figure 1 [2].

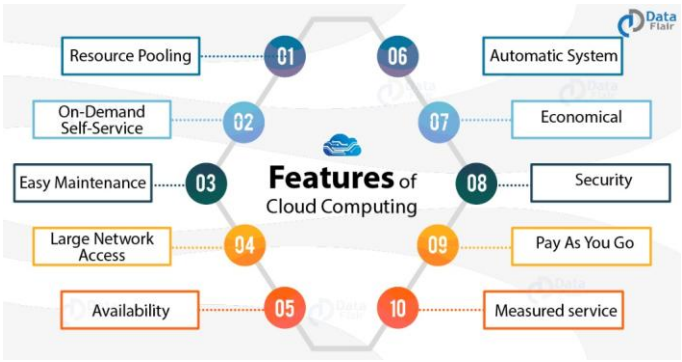

Figure 1: Some features of cloud computing [2].

Rather than building, owning, and maintaining their own IT infrastructure, businesses can use cloud to access technology resources such as computing capacity, storage, and databases on a pay-as-you-go basis. An industry needs the cloud for the following reasons: (1) Mobile workforce: empowering employees to sift real time data and make decisions on the fly, (2) Minimize disruptions: with the right sort of cloud setup problems can be anticipated and solved quickly, (3) Collaboration: with the right technology, collaboration – as well as transparency and accountability – are easily managed, (4) Innovation: product innovation and process innovation are powerful weapons to survive or thrive in such an environment, (5) Lower cost: No hardware procurement, maintenance, or staff is needed to operate the systems.

Keeping your data secure and private is not easy anymore. There is often ambiguity under which jurisdiction your cloud-based data falls to and laws and regulations differ from country to country. Cloud computing exists in a complex and dynamic legal environment, covering both public and private law. There are special considerations that must be undertaken when data flows across borders between organizations that operate in two different jurisdictions.

II. CLOUD COMPUTING BASICS

Cloud computing represents a newly emerging service-oriented computing technology. It is the provision of scalable computing resources as a service over the Internet. It allows manufacturers to use many forms of new production systems such as 3D printing, high-performance computing (HPC), industrial Internet of things (IIoT), and industrial robots. It is transforming virtually every facet of modern manufacturing. It is innovating, reducing cost, and bolstering the competitiveness of American manufacturing [3].

The key characteristic of cloud computing is the virtualization of computing resources and services. Cloud computing is implemented in one of three major formats: software as a service (SAAS), platform as a service (PAAS), or infrastructure as a service (IAAS). These services are illustrated in Figure 2 [4] and explained as follows:

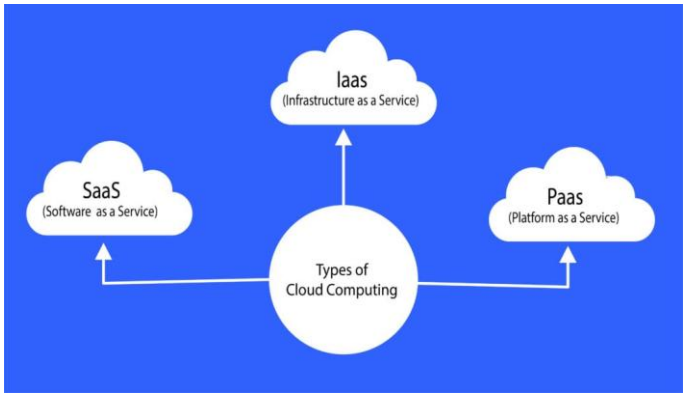

Figure 2: Three types of cloud computing [4].

SaaS: This is a software delivery model in which software and associated data are hosted on the cloud. In this model, cloud service providers offer on-demand access to computing resources such as virtual machines and cloud storage.

PaaS allows the end-user to create a software solution using tools or libraries from the platform service provider. In this model, cloud service providers deliver computing platforms such as programming and execution.

In the IaaS model, cloud service providers can rent manufacturing equipment such as 3D printers. Just like cloud

computing, CM services can be categorized into three major deployment models (public, private, and hybrid clouds) [5]:

- Private cloud refers to a centralized management effort in which manufacturing services are shared within one company or its subsidiaries. A private cloud is often used exclusively by one organization, possibly with multiple business units.
- Public cloud realizes the key concept of sharing services with the general public. Public clouds are commonly implemented through data centers operated by providers such as Amazon, Google, IBM, and Microsoft.
- Hybrid cloud that spans multiple configurations. and is a composed of two or more clouds (private, community or public), offering the benefits of multiple deployment modes.

These models are shown in Figure 3 [6]. Cloud computing finds application in almost every field.

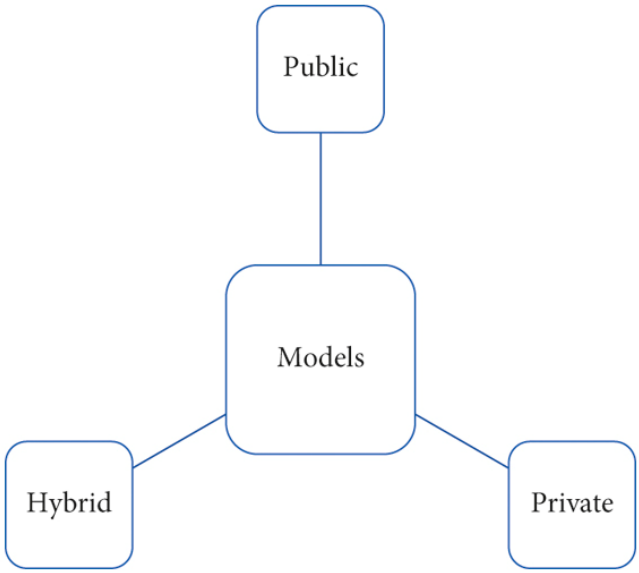

Figure 3: Cloud computing models [6].

CLOUD COMPUTING LAW

Cloud Computing is a new computing paradigm and is often synonymous with Internet computing, cluster computing, grid computing, utility computing, P2P computing, service computing, market-oriented computing, and Web 2.0. It is an emerging technology in which inherent layers of risk exist throughout the value chain. It presents novel challenges to the traditional protections built into the law to ensure security of a corporation's proprietary resources, such as capital- and knowledge-based assets. A major inherent difficulty of policing trade and security issues in a clouding environment arises about the scope and reach of the licenses and contracts across multijurisdictional lines [7].

Governments have not provided a uniform and homogenous information policy regime in which private industry is given clear guidance as to multijurisdictional risk and cyber-terrorism risk.

Governments create laws in the name of security while taking away our rights to privacy. The US does not have one all-encompassing law for data regulation across the country. However, US government makes efforts to protect public safety and combat serious crime, including terrorism. In the UK, the Investigatory Powers Act allows for the government to access and store data of everyone in the country. French law strictly regulates data interception, but is not equipped to deal with storing of data by intelligence agencies. Russia still restricts what is available online to its people; censorship is enforced by the Russian Internet Restriction bill, claiming that it is there to protect citizens from sites that advocate drug abuse, child pornography or anything that is considered a bad influence [8].

Cloud computing law consists of the legal framework and regulations that govern the use of cloud computing services. These laws encompass various aspects such as data privacy, security, intellectual property rights, jurisdictional issues, and contractual agreements between cloud service providers and their clients.

LEGAL ISSUES IN CLOUD COMPUTING

While it is easy to be excited by the benefits of cloud computing, we must also consider some legal issues. Legal issues in cloud computing come under the international law, which consists of the rules that govern relations between nations. It is made up of the following components [9]:

1. International convention, whether general or particular, establishing rules expressly recognized by contesting states
2. International custom, as evidence of a general practice accepted as law
3. The general principles of law recognized by civilized nations
4. Judicial decisions and the teachings of the most highly qualified publicists of the various nations, as a subsidiary, means for the determination of rules of law

The 21st century is regarded as the era of data privacy wherein heated debates over the storage and ownership of public data are common. The common law generally has been relatively slow in creating privacy protection. Any domestic law governing data privacy must align with the globally acceptable standards prevalent in the international perspective. For example, a person in the United Kingdom uploads data to a cloud computing service that is offered by a United States service provider, which set of laws apply to issues associated with the storage? When the laws of different countries differ, a "conflict of laws" is created [10]. Cloud computing is decidedly non-territorial in nature. Legal challenges arise due to the involvement of various jurisdictions in the storage, processing, and sharing of cloud-based data. Micro, Small, and Medium Enterprises (MSMEs) often get entangled in expensive litigations due to the lack of awareness regarding the legal challenges arising from jurisdictional issues of the Cloud Service Provider (CSP). There is no international body to mediate and all the legal issues pertaining to cloud data are resolved bilaterally among the involved parties.

Data protection is one of the most critical legal issues you must consider when using the cloud for your operations. Other major issues in cloud computing include the following [11]:

1. *Privacy*: The user data can be accessed by the host company with or without permission.
2. *Compliance:* To comply with regulations, the user may have to adopt deployment modes that are expensive.
3. *Security:* Cloud-based services involve third-party for storage and security.. Security presents a real threat to the cloud.
4. *Sustainability:* This issue refers to minimizing the effect of cloud computing on the environment.

5. *Abuse:* While providing cloud services, it should be ascertained that the client is not purchasing the services of cloud computing for a nefarious purpose.

Figure 4 shows the legal issues in cloud computing [12].

Figure 4: The legal issues in cloud computing [12].

BENEFITS

Cloud Computing enables decentralized data processing with the centralized storage of data. Such an approach helps mitigate the need to carry storage devices along with the computer. This further lowers the cost of computing devices and makes digital devices much more affordable. Cloud computing is characterized by five attractive benefits companies can leverage in delivering cost-effective services in the long run. These include the following [6]: (i)On-demand self-service helps the customers avail services without a third party's interference. (ii)Broad cloud network provides universal access to all users across the globe in real-time. (iii)Resource pooling aids the Cloud Service Provider (CSP) to reap economy of scale benefits and provide budget cloud services. (iv)Rapid elasticity allows the customer to utilize the cloud data on-demand as and when required. (v)Measured service permits CSPs to implement a Pay-as-you-go model for their customers.

CHALLENGES

Recent years have seen exponential growth in the use of cloud computing to allow greater access to files. While cloud technology offers an impressive range of possibilities, it also creates significant legal challenges for both organizations and individuals. Our laws, largely based on notions of territoriality, struggle to respond to technology in which lines on maps are largely irrelevant. A primary challenge deals with privacy issues associated with the use of data stored in the cloud.

Virtualization is an essential feature of cloud computing. It allows virtual servers, in conjunction with the anonymity feature of the Internet and makes it impossible to track the location of the data hosted on different servers across the globe.

The waging cybersecurity challenges have turned cyberspace into cyber warfare in the form of ransomware, distributed denial of services (DDoS), and spyware.

Now more than ever, organizations are migrating workloads to the cloud so they can rapidly scale their business services in order to meet demand. But moving too quickly can cause long-term challenges. It is important to have the right people, processes, and tools in place to maximize success.

CONCLUSION

Cloud computing is a way of delivering computing resources as a utility service via a network, typically the Internet, scalable up and down according to user requirements. It is here to stay. As cloud computing continues to evolve, lawmakers and regulatory bodies worldwide are continuously updating and adapting legal frameworks to address new challenges and protect the rights and interests of cloud service providers and users.

The era of cloud computing has just begun, and the time is soon approaching when the use of physical memory devices will become obsolete. The right to privacy is a fundamental right that protects cloud-based data from possible data breaches and thefts. One would wish that there were a set of laws for all nations across the globe. This idea will not work as not all countries are democratic, providing their citizens with constitutional rights. There is an urgent need to establish an international body or commission for the global governance of cloud data and adherence to a rule-based order. More information about cloud computing law can be found in books in [13-20] and the following related journals:

- *Journal of Cloud Computing*
- *IEEE Cloud Computing*
- *IEEE Transactions on Cloud Computing*
- *International Journal of Cloud Applications and Computing*
- *International Journal of Cloud Computing and Services Science*
- *i-manager's Journal on Cloud Computing*

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