Cloud Computing: A Look Into Cloud-Based Storage in Business Applications

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In the past few years, cloud computing has been gaining popularity in businesses and individual users, and has been heralded as a solution to most large-scale computing problems. Nowadays, leading companies such as Google and Amazon offer cloud storage, software, analytics, servers, databases, and intelligence services that have been implemented in various parts of both large and small businesses. Some, such as cloud gaming platforms from NVIDIA GeForce NOW and cloud storage services from Apple's iCloud, have even permeated into our daily life. This paper will discuss the use of cloud-based storage model from cloud computing services that are used by businesses. Cloud-based storage is considered as one of the foundations of a business as it stores data that are of value and critical to the company and supports the business in their operations and workflow. With more businesses migrating to and becoming more reliant on the cloud in the information age, we should explore the uses and applications of cloud storage, its benefits and limitations, and its future outlook.

Background on the Evolution of Data Storage

Early information storage, prior to the invention of computers, data and information were stored using paper. In 1725, the first type of information recording system was created, known as punch cards. Punch cards were papers that store data by having holes punched into it in predefined places. This technology was only useful for the textile industry and for pianos. With the creation of the Colossus computer in 1943 during WWII, codes on a paper tape were able to be decrypted for use in transmitting messages during the war. Later in 1951, magnetic tapes were created and had the ability to store large amounts of data into a long plastic reel. This technology sped up the recording, storing, and access of data in the 1950s. Magnetic tapes were used well into the 1960s before being taken over by cassette tapes in the 1970s and 1980s. A few years later in 1956, IBM invented the first hard drive, which stored data in a way that the data could be retrieved in any order instead of sequentially. In later decades this technology improved from being able to store only 5 megabytes (MB) of data to now being able

to store from a few gigabytes (GB) to terabytes (TB) of data. In 1961, although John McCarthy introduced cloud computing, the concept was not fully developed yet, thus the cloud was not used commercially until the mid 2000s. In 1971, floppy disks became popular and could store up to 250MB of data. As data storage technology continues to improve and evolve, data and information can be stored in various forms such as images, videos, recordings, and documents. In 1985, CD-ROM (Compact Disc, read-only-memory) was created and was designed to store not only up to 700MB of data, but also graphics and sound. Later in 1995, the DVD (digital versatile disc), a digital optical disc data format, was invented to offer higher storage capacity than the CD-ROM, allowing storage of up to 4.7GB of data. In 2000, a small and portable data storage device known as the Universal Serial Bus (USB) was introduced. The USB, similar to the floppy disc, CD-ROM, and DVD, was compact and had increased data storage, making it popular and still used nowadays. In 2006, Amazon introduced and offered Amazon Web Services (AWS), which started the popularity of the cloud, offering services such as storage, servers, networking, and other functionalities. Nowadays, the cloud is the preferred storage method for various companies, with cloud storage having the capability to store more than 1 exabytes (EB, a billion gigabytes) of data (Backupify: A history of data storage, n.d.).

Understanding How the Cloud Works

To understand cloud storage services, first it is needed to understand how the cloud works and how the service is provided. Cloud computing is the sharing of resources, software, and information through a network. The system is connected by a “front-end” where the client accesses the system and a “back-end” where data servers and systems make up the “cloud.” Services like cloud storage stores information in data centers with massive computer servers and makes it available online through the web, allowing the service users to access the servers at any time over the Internet. Cloud storage needs at least one data server to operate, where users upload their files over the Internet, in which a copy is stored into the data servers. When the service user retrieves the data, they access the server through a web-based interface and

through authorization such as with usernames and passwords, they can download the data to their device. Businesses can choose to host their own cloud infrastructure, albeit not recommended due to high costs, or purchase storage as a service from cloud providers.

Types of Cloud Computing Services

Cloud computing can be categorized into three types of services: Infrastructure as a Service (IaaS), Platform as a Service (Paas), and Software as a Service (SaaS). IaaS is the provisioning of computing resources such as processing power, storage, and networking under a secure data center. PaaS focuses primarily on the delivery of cloud-based services such as web servers and software development kits (SDKs). And lastly, SaaS involves hosting and operating application-level services over the Internet to provide for business needs such as customer relationship management (CRM) and business analytics. In terms of cloud storage, it is usually provided by cloud service vendors as IaaS to enable businesses to have storage resources without having the business purchase, host, and maintain the data center in their own facility.

Types of Cloud Storage

Galloway (2013) mentions four types of cloud: local, private, public, and hybrid. The local cloud is a service provided and managed by a third party that exists and is maintained on premise. Local clouds support the business's physical infrastructure and are made to provide service to multiple users or organizations. Businesses with local cloud can access their data even during downtime, and have more control on the specific security, maintenance, and resource needs. Private clouds function similarly to a local cloud and offer big enterprises more control over their system and security, but private clouds are only to be used by a single organization, the datacenter can be located on-site or off-site, and tend to be more expensive than other options. As private cloud is maintained by a third party, businesses using a private cloud may not access their data during downtime. Community cloud is a variation of private cloud, where the service is offered to specific businesses or communities. Public clouds are

provided off-site, where users of the service can access the cloud through the Internet and do not need to maintain their own system. Public clouds are suitable for small to midsize companies as the service is scalable and affordable, but at the same time, users have little to no control over the cloud's security and maintenance. Lastly, there is the hybrid cloud, where an organization can expand their private cloud and combine it with the public cloud. With hybrid cloud, businesses can not only personalize their cloud and security system, but also divide business functions where the private cloud stores vital data for the business and the public cloud is used for tasks such as information processing (p. 4-6).

Applications

Cloud storage is, as the name suggests, a way to store data in the cloud. It is part of the IT infrastructure in businesses that can replace or add onto on-site data centers and data storage facilities. Cloud storage is often used to back up important data that can ensure business continuity, and can be a part of a business's disaster recovery plan. Apart from business continuity and disaster recovery, cloud storage also allows for employees in a business environment to work on different organizational tasks and processes by having access to cloud storage, and allowing the employees to share files and collaborate on files through their own devices or virtual desktops. This in turn increases productivity, enables remote work, and makes it easier to centralize and distribute resources for businesses.

Cloud storage is also commonly used in combination with or to support other technologies, software, services, and tools. For example, with the rise of technology trends such as virtualization and the existence of Big Data, the amount of information out there has increased in insurmountable numbers. These data can be stored by businesses into the cloud, and later used in tandem with business intelligence, analytics, and management tools to provide useful information and trends for the business.

Benefits and Advantages of Cloud Storage

Scalability

Cloud storage is meant to adapt to the different demands of the organizations and businesses that implement them. Within a few clicks, cloud storage capacity can be scaled up or down quickly to meet the business's needs. When a business is faced with an increase of data volume, being able to acquire more resources for the data is beneficial.

Cost efficiency

One of the main reasons businesses are switching to cloud-based storage is the increased cost to keep data centers and hardware on-site. Cloud storage provides the same functionality as large data centers and other storage technologies at reduced costs and higher performance. Cloud storage providers such as Google, Amazon, and IBM all offer on-demand resources over the Internet with pay-as-you-go pricing, where businesses can replace buying, owning, and maintaining their own data storage infrastructure. Although there may be short term budget overruns, in the long term businesses can save on hardware equipment, power supplies, and maintenance personnel as the business grows.

Ease of Data Access

The most common advantage of cloud storage is being able to access data as needed. Businesses can allow users to access data saved on the cloud on different devices without needing to import data from an external drive, but by only using authorization means such as usernames and passwords. This feature not only improves workflow in the business, but also means that their data is not tied down to one location.

Longevity of Data Storage Technologies

Comparing the lifespan of cloud storage to other types of data storage devices, cloud storage can be determined to perform longer. In terms of the longevity of different types of data storage technologies, magnetic tapes can last for around 30 years if there is no damage, and solid state drives and hard disks may experience problems around 3 to 5 years. Meanwhile,

cloud storage can offer lifetime storage. Even though cloud storage can last for a long time, there are still a variety of ways where data can be lost or destroyed. A few examples are floods which cause damage to the hardware that could potentially lead to a large amount of data being destroyed, an employee deleting the information, the provider discontinuing their service, or the provider experiencing a datacenter failure that leads to the loss. Although, for the entire cloud to just disappear is unimaginable.

Limitations, Challenges, and Risks

Storage Security and Confidentiality

Cloud computing, although heralded as a solution to large-scale computing problems, can have security vulnerabilities depending on the level of encryption, the obscurity of the cloud, and the type of cloud used. Storage in private clouds is usually assumed to be secure since all resources are used by one tenant, meaning fewer people know of its existence. Although private clouds can still be hacked, the main concerns will come from internal threats. In public clouds, the environment is shared by multiple business units or companies. Although the public cloud is secure and storage services provided by well known companies tend to have a high level of encryption, there is also less control compared to the private cloud and more risks. The possibility of leaking highly sensitive data even with the security is high, and there are hundreds or thousands of different businesses that may try to reach the provider for these problems, resulting in not having a timely solution before a huge damage is done. A breach in security can result in the often-seen and reported data leaks that happen nowadays. Due to these security concerns, many businesses tend to have a cloud data protection model or plan in place to secure and protect their data stored in the cloud environment.

Speed Limitations

Cloud storage relies on the Internet to upload and download files. Usually this is a speedy process if there is a good and stable Internet connection. But at times, it is possible for providers to put a speed limit cap on their services. These limits are commonly placed to give a

better user experience, but it may affect the download or upload time of large amounts of data and files that may be critical to a business. Therefore, companies migrating over to cloud-based storage should consider their needs for download speed before buying storage service.

Downtime, Outage, and Network Failure Risks

A risk that cloud storage users face is being inaccessible to the data they need. A cloud vendor's top priority is reliability, and cloud storage, like any other services and systems, needs to be maintained. Maintenance is usually done at times when it is less likely for businesses to use the service, such as late at night. Service level agreements regarding downtime are generally in place between businesses and service providers, but unexpected and uncontrollable situations like datacenter crashes, power outages, or network failure all result in businesses losing the ability to access their data for prolonged amounts of time.

The Future of Cloud-Based Storage and Cloud Computing

The future of the cloud is boundless and shows a great deal of promise. Cloud storage may face tough challenges such as competitive pricing and increasing storage capacity due to data congestion. Improvements in the overall performance, storage capacity, and pricing can bring out a smoother user experience, and tackle some of the storage concerns and Big Data management issues large enterprises experience. At present, most of the users of cloud are still personal or individual users, and midsize to large enterprises or organizations that have integrated private or hybrid cloud into their daily operations and IT infrastructure. In the future, we can see more small businesses implementing some form of cloud storage. At least, the cloud will continue growing and not become obsolete over the next few decades.

Conclusion

Cloud computing is a complex technology that offers a variety of services such as platforms, infrastructure, software, and hardware that can contribute to the success of a company. Throughout the paper we focused on the topic of cloud-based storage and looked into a brief history of data storage, the inner workings of a cloud, the types and uses of a cloud

storage, advantages and limitations, and its future outlook. Cloud-based storage proved to be a flexible and cost efficient way to provide for infrastructure lacking within a business that can store data as demanded by the business. Although, the service may also contain risks associated with data security and confidentiality. But overall, the cloud provides a competitive edge to businesses, allowing for growth and continuous improvement.

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