

Cloud Computing – Benefits and Challenges

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Abstract

Cloud computing is a set of IT services that are provided to a customer over a network on a leased basis and with the ability to scale up or down their service requirements. Usually cloud computing services are delivered by a third party provider who owns the infrastructure. It offers an on-demand and scalable access to a shared pool of resources hosted in a data centre at providers' site. It reduces the overheads of up-front investments and financial risks for the end-user. The qualitative services and lower cost of services are the key requirements of this technology. Regardless of the fact that cloud computing offers great advantages to the end users, there are several challenging issues that are mandatory to be addressed. This paper highlights the basics of cloud technology along with major benefits and challenges to this upcoming technology.

Introduction

Cloud computing means that instead of all the computer hardware and software you're using sitting on your desktop, or somewhere inside your company's network, it's provided for you as a service by another company and accessed over the Internet, usually in a completely seamless way. Exactly where the hardware and software is located and how it all works doesn't matter to you, the user—it's just somewhere up in the nebulous "cloud" that the Internet represents.

The following definition of cloud computing has been developed by the U.S. National Institute of Standards and Technology (NIST):

Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics, three service models, and four deployment models.

Cloud computing is so named because the information being accessed is found in the "clouds", and does not require a user to be in a specific place to gain access to it. Companies may find that cloud computing allows them to reduce the cost of information management, since they are not required to

own their own servers and can use capacity leased from third parties. Additionally, the cloud-like structure allows companies to upgrade software more quickly.

Most of us use cloud computing all day long without realizing it. For instance, when you sit at your PC and type a query into Google, the computer on your desk isn't playing much part in finding the answers you need: it's no more than a messenger. The words you type are swiftly shuttled over the Net to one of Google's hundreds of thousands of clustered PCs, which dig out your results and send them promptly back to you. When you do a Google search, the real work in finding your answers might be done by a computer sitting in California, Dublin, Tokyo, or Beijing.

Following are the essential characteristics of cloud computing:

1. **On-demand capabilities:** Cloud services are available on-demand and often bought on a "pay-as-you go" or subscription basis. So you typically buy cloud computing the same way you'd buy electricity, telephone services, or Internet access from a utility company. You have access to your services and you have the power to change cloud services through an online control panel or directly with the provider. You can add or delete users and change storage networks and software as needed. Typically, you are billed with a monthly subscription or a pay-for-what-you-use scenario. Terms of subscriptions and payments will vary with each software provider.
2. **Broad network access:** *Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, tablets, laptops, and workstations).* It allows services to be offered over the Internet or private networks. Your team can access business management solutions using their smart phones, tablets, laptops, and office computers. They can use these devices wherever they are located with a simple online access point. This mobility is particularly attractive for businesses so that during business hours or on off-times, employees can stay on top of projects, contracts, and customers whether they are on the road or in the office.
3. **Resource pooling:** Pooled resources means that customers draw from a pool of computing resources, usually in remote data centers. This is an attractive feature for multiple business offices and field service or sales teams that are usually outside the office.

4. **Rapid elasticity:** Users, software features, and other resources can be quickly and easily added or removed.
5. **Measured service:** Cloud have a very affordable nature, you only pay for what you use. You and your cloud provider can measure storage levels, processing, bandwidth, and the number of user accounts and you are billed appropriately. The amount of resources that you may use can be monitored and controlled from both your side and your cloud provider's side which provides transparency.

Classification

Cloud computing is typically classified in two ways:

1. Location of the cloud computing
2. Type of services offered

Cloud computing is typically classified in the following three ways based on the location of the cloud:

1. **Public Cloud** - Generally speaking, services provided by a public cloud are offered over the Internet and are owned and operated by a cloud provider. Some examples include services aimed at the general public, such as online photo storage services, e-mail services, or social networking sites. However, services for enterprises can also be offered in a public cloud.
2. **Private Cloud** - The cloud infrastructure is provisioned for exclusive use by a single organization comprising multiple consumers (e.g., business units). It may be owned, managed, and operated by the organization, a third party, or some combination of them, and it may exist on or off premises. There are two variations of private clouds:
 - **On-Premise Private Cloud:** This type of cloud is hosted within an organizations own facility. A businesses IT department would incur the capital and operational costs for the physical resources with this model. On-Premise Private Clouds are best used for applications that require complete control and configurability of the infrastructure and security.
 - **Externally Hosted Private Cloud:** Externally hosted private clouds are also exclusively used by one organization, but are hosted by a third party specializing in cloud infrastructure.

The service provider facilitates an exclusive cloud environment with full guarantee of privacy. This format is recommended for organizations that prefer not to use a public cloud infrastructure due to the risks associated with the sharing of physical resources.

- 3. Hybrid cloud** - The cloud infrastructure is a composition of two or more distinct cloud infrastructures (private, community, or public) that remain unique entities, but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load balancing between clouds). A hybrid cloud allows a company to maintain critical, confidential data and information within its firewall while leveraging the public cloud for non-confidential data. The private cloud portion of the hybrid cloud is accessed by company employees, both in the company and on the go, and is maintained by the internal technology group. The private cloud part of the hybrid cloud is also accessed by the company employees but is maintained by external service providers. Each portion of the hybrid cloud can connect to the other portion.
- 4. Community cloud** - Community clouds are a hybrid form of private clouds built and operated specifically for a targeted group. These communities have similar cloud requirements and their ultimate goal is to work together to achieve their business objectives. It involves sharing of computing infrastructure in between organizations of the same community. For example all Government organizations within the state of California may share computing infrastructure on the cloud to manage data related to citizens residing in California. *It may be owned, managed, and operated by one or more of the organizations in the community, a third party, or some combination of them, and it may exist on or off premises.*

Classification based upon service provided

Based upon the services offered, clouds are classified in the following ways:

- 1. Infrastructure as a Service (IaaS)** - In the infrastructure as a Service (IaaS) model, consumers are given full freedom to manage their data on the server. Here the service provider is only responsible for raw storage, computing power, networks, firewalls, and load balancers and this is often manifested as a virtual machine. It is a way of delivering Cloud Computing infrastructure – servers, storage, network and operating systems – as an on-demand service. Rather than purchasing servers, software, datacenter space or network equipment, clients instead buy those resources as a fully outsourced service on demand. It

involves offering hardware related services using the principles of cloud computing. These could include some kind of storage services (database or disk storage) or virtual servers. Leading vendors that provide Infrastructure as a service are Amazon EC2, Amazon S3, Rackspace Cloud Servers and Flexiscale.

- 2. Platform as a Service (PaaS)** - In PaaS, an operating system, hardware, and network are provided, and the customer installs or develops its own software and applications. It means you develop applications using Web-based tools so they run on systems software and hardware provided by another company. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment. So, for example, you might develop your own ecommerce website but have the whole thing, including the shopping cart, checkout, and payment mechanism running on a merchant's server. Force.com (from salesforce.com) and the Google App Engine are examples of PaaS.
- 3. Software as a Service (SaaS)** – It includes a complete software offering on the cloud. Users can access a software application hosted by the cloud vendor on pay-per-use basis. This is a well-established sector. Examples are online email providers like Google's Gmail and Microsoft's hotmail, Google docs and Microsoft's online version of office called BPOS (Business Productivity Online Standard Suite). *The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user-specific application configuration settings.* Benefits of using SaaS include: easier software administration, automatic updates and patch management, software compatibility across the business, easier collaboration, and global accessibility.

Benefits

Cloud computing offers innumerable benefits, some of which are given below:

- 1. Flexibility** - Cloud computing allows employees to be more flexible in their work practices. For example, you have the ability to access data from home, on holiday, or via the commute

to and from work (providing you have an internet connection). If you need access to your data while you are off-site, you can connect to your virtual office, quickly and easily.

2. **Disaster recovery** - When companies start relying on cloud-based services, they no longer need complex disaster recovery plans. Cloud computing providers take care of most issues, and they do it faster. Aberdeen Group found that businesses which used the cloud were able to resolve issues in an average of 2.1 hours, nearly four times faster than businesses that didn't use the cloud (8 hours). The same study found that mid-sized businesses had the best recovery times of all, taking almost half the time of larger companies to recover.
3. **Automatic software updates** - Access to automatic updates for your IT requirements may be included in your service fee. Depending on your cloud computing service provider, your system will regularly be updated with the latest technology. This could include up-to-date versions of software, as well as upgrades to servers and computer processing power.
4. **Cap-Ex Free** - Cloud computing services are typically pay as you go, so there's no need for capital expenditure at all. And because cloud computing is much faster to deploy, businesses have minimal project start-up costs and predictable ongoing operating expenses.
5. **Increased collaboration** - Collaboration in a cloud environment gives your business the ability to communicate and share more easily outside of the traditional methods. If you are working on a project across different locations, you could use cloud computing to give employees, contractors and third parties access to the same files. You could also choose a cloud computing model that makes it easy for you to share your records with your advisers (e.g. a quick and secure way to share accounting records with your accountant or financial adviser).
6. **Time saving** - Alongside easy collaboration, Cloud computing also aids the easy access to information. Easy access in this context could be seen in how fast it is to access Gmail, Yahoo mail, mailboxes in general. It is fast and easy in contrast to the time it would take to download and install software..

7. **Scalability** - Your business can scale up or scale down your operation and storage needs quickly to suit your situation, allowing flexibility as your needs change. Rather than purchasing and installing expensive upgrades yourself, your cloud computer service provider can handle this for you. Using the cloud, frees up your time so you can get on with running your business.

8. **Reduced Cost** - Cloud computing puts a stop to the illegal reproduction and distribution of software. Some software on the Cloud is free. For example, most SaaS solutions have a pay-as-you-go pricing model instead of a large up-front investment. Such pricing models allow end users to pay only for what they use thus freeing up resources such as time and money for other more important (core) business activities. Cloud computing is therefore cheaper and less labor intensive for companies. There is no need to buy and install expensive software.

Challenges

Cloud computing is associated with numerous challenges and the major challenges that prevent Cloud Computing from being adopted are as follows:

1. **Security** - Security issue plays the most important role in hindering Cloud computing acceptance. Security issues such as data loss, phishing, botnet poses serious threats to organization's data and software. The fact that the valuable enterprise data will reside outside the corporate firewall raises serious concerns. **Hacking and various attacks** to cloud infrastructure would affect multiple clients even if only one site is attacked. These risks can be mitigated by using security applications, encrypted file systems, data loss software, and buying security hardware to track unusual behavior across servers.

2. **Performance** - According to IDC's survey, performance is the second biggest issue in cloud adoption. The cloud must provide improved performance when a user moves to cloud computing infrastructure. It is prudent for users to benchmark their application in the cloud to determine when you're likely to have peaks in demand and take into consideration the different hosting solutions to suit your requirements.

3. **Reliability and Availability** - Any technology's strength is measured by its degree of reliability and availability. Cloud providers still lack round-the-clock service; this results in **frequent outages**. It is important to monitor the service being provided using internal or third-party tools. It is vital to have plans to supervise usage, SLAs, performance, robustness, and business dependency of these services.

Conclusion

Cloud Computing is a term that doesn't describe a single thing – rather it is a general term that sits over a variety of services from Infrastructure as a Service at the base, through Platform as a Service as a development tool and through to Software as a Service replacing on-premise applications. For organizations looking to move to Cloud Computing, it is important to understand the different aspects of Cloud Computing and to assess their own situation and decide which types of solutions are appropriate for their unique needs. Cloud Computing is a rapidly accelerating revolution within IT and will become the default method of IT delivery moving into the future – organizations would be advised to consider their approach towards beginning a move to the clouds sooner, rather than later.

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