



Introduction to Cloud Computing

Executive Summary

A common understanding of ‘cloud computing’ is continuously evolving, and the terminology and concepts used to define it often needs clarification. Media coverage can be vague or may not fully capture the extent of what cloud computing represents, sometimes reporting how companies are making their solutions available in the ‘cloud’ or how ‘cloud computing’ is the way forward, but not examining the characteristics, models, and services involved in understanding what is cloud computing.

This white paper introduces internet-based cloud computing, exploring the characteristics, service models, and deployment models in use today, as well as the benefits and challenges associated with cloud computing.

What is Cloud?

Cloud computing is receiving a great deal of attention, both in publications and among users. Yet it is not always clearly defined. Cloud computing is a subscription-based service where you can subscribe networked storage space and computer resources based on your requirement. For example, you can consider your experience with email. Your email client, if it is Yahoo!, Gmail, Hotmail, and so on, takes care of housing all of the hardware and software necessary to support your personal email account. When you want to access your email you open your web browser, go to the email client, and log in. The most important part of the equation is having internet access. Your email is not housed on your physical computer; you access it through an internet connection, and you can access it anywhere. If you are on a trip, at work, or down the street, you can check your email as long as you have access to the internet. Your email is different than software installed on your computer, such as a word processing program. When you create a document using word processing software, that document is saved in your device you used to make it unless you physically move it. An email client is similar to how cloud computing works. Except instead of accessing just your email, you can choose what information you have access to within the cloud.

How can you use the Cloud?

The cloud enables you to access your information from anywhere at any time. While a traditional computer setup requires you to be in the same location as your data storage device, the cloud takes away that step. The cloud removes the need for you to be in the same physical location as the hardware that stores your data. Your cloud provider can both own and house the hardware and software necessary to run your home or business applications.

Typically, this is helpful for businesses that cannot afford the same amount of hardware and storage space as a bigger company. Small companies can store their information in the cloud, thus eliminating the cost on hardware devices. Additionally, because you only need to buy the amount of storage space that you require, a business can purchase more space or reduce their subscription according to their needs.

The main requirement is that you must have an internet connection in order to access the cloud. This means that if you want to access a specific document that you have housed in the cloud, you must first establish an internet connection either through a wireless or wired internet or a mobile broadband connection. The benefit is that you can access the same document from wherever you are with any device, such as desktop, laptop, tablet, or phone that can access the internet. This can also help your business to function smoothly because anyone who can connect to the internet and your cloud can work on documents, access software, and store data. You can imagine picking up your smartphone and downloading a PDF document to review it instead of having to stop by the office to print it or upload it to your laptop. This is the main advantage that cloud provides for you or your organization.

Types of Clouds

Cloud computing is a subscription-based service. There are different types of clouds that you can subscribe to depending on your needs. As a home user or small business owner, you can most likely use public cloud services. Following are the different types of clouds:

- **Public Cloud** - A public cloud can be accessed by any subscriber with an internet connection and access to the cloud space.
- **Private Cloud** - A private cloud is established for a specific group or organization and the access is restricted to just that specific group.

- **Community Cloud** - A community cloud is shared among two or more organizations that have similar cloud requirements.
- **Hybrid Cloud** - A hybrid cloud is essentially a combination of at least two clouds, where the clouds included are a mixture of public, private, or community.

Choosing a Cloud Provider

Each provider serves a specific function, giving users more or less control over their cloud depending on the type. When you choose a provider, compare your needs to the cloud services available. Your cloud needs will vary depending on how you intend to use the space and resources associated with the cloud. If it is for your personal home use, you will need a different cloud type and provider than the cloud type used for businesses. Note that your cloud provider will be pay-as-you-go, which means that at any point when your technological needs change you can purchase more storage space (or less for that matter) from your cloud provider.

The following are the three types of cloud providers that you can subscribe to: **SaaS** (Software as a Service), **PaaS** (Platform as a Service), and **IaaS** (Infrastructure as a Service). These three types differ in the amount of control that you have over your information, and conversely, how much you can expect your provider to do for you. Briefly, here is what you can expect from each type.

- **SaaS** - SaaS is a software licensing and delivery model in which software is licensed on a subscription basis and is centrally hosted. It is also referred to as "on-demand software". SaaS has become a common delivery model for many business applications, including office and messaging software, payroll processing software, DBMS software, management software, development software, virtualization, accounting, collaboration, customer relationship management (CRM), management information systems (MIS), enterprise resource planning (ERP), human resource management (HRM), antivirus software, etc. With SaaS it becomes easier to have the same software on all your devices at once by accessing it on the cloud. But in a SaaS agreement, you will have least control over the cloud.
- **PaaS** - A PaaS system goes a level above the Software as a Service setup. PaaS is a category of cloud computing services that provides a platform allowing customers to develop, run, and manage applications without the complexity of building and maintaining the infrastructure typically associated with developing and launching an app. PaaS can be delivered in two ways: as a public cloud service from a provider, where the consumer

controls software deployment with minimal configuration options, and the provider provides the networks, servers, storage, OS, 'middleware' (i.e.; java runtime, .net runtime, integration, etc.), database and other services to host the consumer's application; or as a private service (software or appliance) inside the firewall, or as software deployed on a public infrastructure as a service.

- **IaaS** - IaaS is a form of cloud computing that provides virtualized computing resources over the internet. In an IaaS model, a third-party provider hosts hardware, software, servers, storage and other infrastructure components on behalf of its users. IaaS platforms offer highly scalable resources that can be adjusted on-demand. This makes IaaS well-suited for workloads that are temporary, experimental or change unexpectedly. Other characteristics of IaaS environments include the automation of administrative tasks, dynamic scaling, desktop virtualization and policy-based services. IaaS customers pay on a per-use basis, typically by the hour, week, or month. This pay-as-you-go model eliminates the capital expense of deploying in-house hardware and software. However, users should monitor their IaaS environments closely to avoid being charged for unauthorized services.

When compared to SaaS, PaaS and IaaS subscribers gain more control over what they can do within the space of the cloud. The cloud provider has less control in an IaaS system than with a SaaS agreement.

Cloud allows you to choose your level of control over your information and types of services that you want from a cloud provider. For example, if you are starting your own small business but you cannot afford to purchase and store all of the hardware and software necessary to stay on the cutting edge of your market, you can subscribe to an IaaS cloud and you can maintain your new business with as much computational capability as an established company, while only paying for the storage space and bandwidth that you use. However if you are a home user, you will most likely look for free or low-cost cloud services (such as web-based email) and will not be as concerned with many of the complex cloud features.

Security

The information housed on the cloud is often valuable for individuals with malicious intent. There is a lot of personal information and potentially secure data that people store on their computers, and this information is now being transferred to the cloud. This makes it critical for you to understand the security measures that your cloud provider has in place, and it is equally important to take personal precautions to secure your data.

Most importantly you must look into the security measures that your cloud provider already has in place. These vary from provider to provider and among the various types of clouds. You must look into the encryption methods and the methods of protection that the providers have in place for the actual hardware where your data is stored. Also you need to check if they have backups of your data and whether they have firewalls set up. If you have a community cloud, then they need to have barriers in place to keep your information separate from other companies. Many cloud providers have standard terms and conditions that may answer these questions, but home users will probably have little negotiation room in their cloud contract. A small business user may have slightly more room to discuss the terms of their contract with the provider and will be able to ask these questions during that time. Therefore it is important to choose a cloud provider that considers the security of your data as a major concern.

No matter how careful you are with your personal data, by subscribing to the cloud you will be giving up some control to an external source. This distance between you and the physical location of your data creates a barrier. It may also create more space for a third party to access your information. On the converse, keep in mind that most cloud providers will have a great deal of knowledge on how to keep your data safe. A provider likely has more resources and expertise than the average user to secure their computers and networks.

Conclusions

To summarize, the cloud provides many options for the everyday computer user as well as large and small businesses. It opens up the world of computing to a broader range of uses and increases the ease of use by giving access through any internet connection. However, with this increased ease also come drawbacks. You have less control over who has access to your information and no knowledge of where it is stored. You also must be aware of the security risks of having data stored on the cloud. The cloud is a big target for malicious individuals and may have disadvantages because it can be accessed through an unsecured internet connection.

If you are considering using the cloud, be certain that you identify what information you will be putting out in the cloud, who will have access to that information, and what you will need to make sure it is protected. Additionally, know your options in terms of what type of cloud will be best for your needs, what type of provider will be most useful to you, and what the reputation and responsibilities of the providers you are considering are before you sign up.