The Basics of Cloud Computing

Alexa Huth and James Cebula

What is the cloud?

Cloud computing is receiving a great deal of attention, both in publications and among users, from individuals at home to the U.S. government. Yet it is not always clearly defined.[1] Cloud computing is a subscription-based service where you can obtain networked storage space and computer resources. One way to think of cloud computing is to 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 getting coffee, 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 stays on the 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 makes it possible for 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.

This is especially 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, removing the cost of purchasing and storing memory devices. Additionally, because you only

---

[1]For more information please see *The NIST Definition of Cloud Computing* at
http://csrc.nist.gov/publications/drafts/800-145/Draft-SP-800-145_cloud-definition.pdf.

need to buy the amount of storage space you will use, a business can purchase more space or reduce their subscription as their business grows or as they find they need less storage space.

One requirement is that you need to have an internet connection in order to access the cloud. This means that if you want to look at a specific document 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 that same document from wherever you are with any device that can access the internet. These devices could be a desktop, laptop, tablet, or phone. This can also help your business to function more smoothly because anyone who can connect to the internet and your cloud can work on documents, access software, and store data. Imagine picking up your smartphone and downloading a .pdf document to review instead of having to stop by the office to print it or upload it to your laptop. This is the freedom that the cloud can provide for you or your organization.

Types of clouds

There are different types of clouds that you can subscribe to depending on your needs. As a home user or small business owner, you will most likely use public cloud services.

1. Public Cloud - A public cloud can be accessed by any subscriber with an internet connection and access to the cloud space.
2. Private Cloud - A private cloud is established for a specific group or organization and limits access to just that group.
3. Community Cloud - A community cloud is shared among two or more organizations that have similar cloud requirements.
4. 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 will be for personal home use, you will need a different cloud type and provider than if you will be using the cloud for business. Keep in mind that your cloud provider will be pay-as-you-go, meaning that if your technological needs change at any point you can purchase more storage space (or less for that matter) from your cloud provider.

There are three types of cloud providers that you can subscribe to: Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). 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.

1. Software as a Service - A SaaS provider gives subscribers access to both resources and applications. SaaS makes it unnecessary for you to have a physical copy of software to install on your devices. SaaS also makes it easier to have the same software on all of your devices at

once by accessing it on the cloud. In a SaaS agreement, you have the least control over the cloud.
2. Platform as a Service - A PaaS system goes a level above the Software as a Service setup. A PaaS provider gives subscribers access to the components that they require to develop and operate applications over the internet.
3. Infrastructure as a Service - An IaaS agreement, as the name states, deals primarily with computational infrastructure. In an IaaS agreement, the subscriber completely outsources the storage and resources, such as hardware and software, that they need.

As you go down the list from number one to number three, the subscriber gains 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 an SaaS agreement.

What does this mean for the home user or business looking to start using the cloud? It means you can choose your level of control over your information and types of services that you want from a cloud provider. For example, imagine you are starting up your own small business. You cannot afford to purchase and store all of the hardware and software necessary to stay on the cutting edge of your market. By subscribing to an Infrastructure as a Service cloud, you would be able to maintain your new business with just as much computational capability as a larger, more established company, while only paying for the storage space and bandwidth that you use. However, this system may mean you have to spend more of your resources on the development and operation of applications. As you can see, you should evaluate your current computational resources, the level of control you want to have, your financial situation, and where you foresee your business going before signing up with a cloud provider.

If you are a home user, however, you will most likely be looking at free or low-cost cloud services (such as web-based email) and will not be as concerned with many of the more complex cloud offerings.

After you have fully taken stock of where you are and where you want to be, research into each cloud provider will give you a better idea of whether they are right for you.

Security

The information housed on the cloud is often seen as valuable to 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.

The first thing you must look into is the security measures that your cloud provider already has in place. These vary from provider to provider and among the various types of clouds. What encryption methods do the providers have in place? What methods of protection do they have in place for the actual hardware that your data will be stored on? Will they have backups of my data? Do they have firewalls set up? If you have a community cloud, what barriers are in place to keep your information separate from other companies? Many cloud providers have standard terms and conditions that may answer these questions, but the home user 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. There are many questions that you can ask, but 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. However, to take advantage of the benefits of the cloud, you will have to knowingly give up direct control of your data. 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 little to 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.

Further Reading

1. Lewis, Grace. *Cloud Computing: Finding the Silver Lining, Not the Silver Bullet*. http://www.sei.cmu.edu/newsitems/cloudcomputing.cfm (2009).

2. Lewis, Grace. *Basics About Cloud Computing*. http://www.sei.cmu.edu/library/abstracts/whitepapers/cloudcomputingbasics.cfm (2010).

3. Jansen, Wayne & Grance, Timothy. *Guidelines on Security and Privacy in Public Cloud Computing*. National Institute of Standards and Technology, 2011.

4. Strowd, Harrison & Lewis, Grace. *T-Check in System-of-Systems Technologies: Cloud Computing* (CMU/SEI-2010-TN-009). Software Engineering Institute, Carnegie Mellon University, 2010. http://www.sei.cmu.edu/library/abstracts/reports/10tn009.cfm