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**Cloud Computing**

Cloud computing comes into focus when you think about what IT always needs: a way to increase capacity or add capabilities on the fly without investing in new infrastructure, training new personnel, or licensing new software. Cloud computing is the platform for the next generation of computing, it has various characteristics, its own layers, many deployment models, a nice architecture, great advantages and, because nothing cannot be perfect, some disadvantages too.

The term "cloud" is used as a metaphor for the Internet, based on the cloud drawing used in the past to represent the telephone network, and later to depict the Internet in computer network diagrams as an abstraction of the underlying infrastructure it represents. According to “www.cloudcomputingdefined.com” cloud computing is defines as the storing and accessing of application and computer data through a web browser rather than running installed software on your personal computer or office server (Cloud Computing Defined*)*. In other words, basically cloud computing is the ability of accessing everything you will normally buy like software, storage space or resources, you can now “rent” them, just like you do with your utilities, you do not care how electricity comes to you house or how you got gas for a hot shower, you just now that they are there when you need them, and you just pay for what you use.

Cloud computing has a set key of characteristics that make it a really attractive form of business: Rapid Scalability, this means any modification and enhancement in the services are very easy and fast, you can easily add up required bandwidth, processing speed and data storage or number of licenses in very short time. Measured Services, it can be provided as much service as needed to the customer, you can get the specified number of user license for any type of software or a definite data space and network bandwidth which is suitable to your demands, this characteristic makes the service very well defined and predictable cost. Broad Network Access, cloud computing provides the users with a variety of services on the network with broader data spaces, multiple value added services, many new software, many advanced processing techniques and much more accessibility to a highly rich and capable network. On-Demand Self Service, this is a very crucial characteristic because the customer is always in the driving seat regarding its present and future needs, the customer has just to demand for more services which are provided just on a demand note. Resources Pooling, The software or hardware resources are parked under a pool which can be used by any customer on demand and as soon as one user releases the resources, that resource can be allocated to another user; thus increasing the capacity of the system and better capacity-utilization of resources available for the business. Pay per Use, Capabilities are charged using a metered, fee-for-service, or advertising based billing model to promote optimization of resource use. ("Cloud Computing Characteristics.")

The Cloud Computing stack also involves different layers of functionality and usability. The layers begin with Clients at the top, followed by Application, then Platform, then Infrastructure, and finally Servers at the very bottom of the stack. Client layer, a cloud client generally consists of computer software or computer hardware that relies on the use of cloud computing for the delivery of applications, or that is designed specifically for the delivery of cloud services, a cloud client indicates that the software or hardware is completely useless without the presence of cloud computing; examples of clients include Android, Windows Mobile and the iPhone, also Google Chrome, Mozilla Firefox, and Cherry Pal. Application layer, Cloud applications leverage the use of cloud computing in their software architecture, and this typically eliminates the underlying need to run the application on the user’s own computer alleviating the trouble of maintenance of software, ongoing operation and ongoing support; examples include web applications, peer to peer applications, SaaS (Software as a Service), examples of these are Skype, Facebook, YouTube, Google Apps Engine, and SalesForce. Platform layer, Cloud platforms deliver a Solution Stack as a service that consume cloud infrastructure while supporting cloud applications, they facilitate the deployment of many applications without the same complexity and cost of purchasing and managing whatever underlying layers of hardware and software would be required; examples include OpenID, Google Checkout, PayPal, Alexa, Yahoo! BOSS, Google Apps Engine. Infrastructure layer, Cloud computing infrastructure involves the delivery of a computer infrastructure as a service, such as a platform virtualization environment, cloud infrastructure includes compute, network and storage, and both physical machines and virtual machines; some examples of infrastructure in the cloud computing environment include Amazon EBS and Amazon VPC, Go Grid, Softlayer, Amazon Cloud Watch and Right Scale. Server layer, the cloud computing services layer generally consists of computer software or computer hardware products that are solely and specifically designed to be used for delivering cloud services; an example of this layer is Cisco USC for fabric computing. ("Cloud Model / Cloud Layer.")

Each company chooses a deployment model for a cloud computing solution based on their specific business, operational, and technical requirements. There are four primary cloud deployment models: public cloud, community cloud, private cloud, and hybrid cloud. Public Cloud, describes cloud computing in the traditional mainstream sense, resources are dynamically provisioned on a fine-grained, self-service basis over the Internet, via web services, from an off-site third-party provider who shares resources and bills on a fine-grained utility computing basis; The cloud infrastructure is owned by a cloud vendor, and is accessible to the general public or a large industry group. Community Cloud, refers to cloud computing environment shared and managed by several organizations that have similar requirements and are sharing the infrastructure in order to realize some of the benefits of cloud computing, with the costs spread over fewer users than a *public cloud* this option is more expensive but may offer a higher level of privacy, security and/or policy compliance; It may be managed by the company or a third party and can exist on or off premise. Private Cloud, the infrastructure is managed and operated exclusively for one company in order to keep a consistent level of security, privacy, and governance control; it can exist on or off premise, and can be managed by a company or a third party. Hybrid Cloud consists of multiple clouds (private, community, or public) and is the typical cloud deployment model for most enterprises, by integrating multiple cloud services users may be able to ease the transition to public cloud services while avoiding issues such as PCI compliance, in this cloud computing deployment model, an organization provides and manages some resources in-house and has others provided externally; the main benefit of the hybrid cloud is that it provides the scalability and low costs of a public cloud without exposing mission-critical applications and data to third-party. (Jason)

Cloud architecture, the systems architecture of the software systems involved in the delivery of cloud computing, typically involves multiple cloud components communicating with each other over a loose coupling mechanism such as a messaging queue. We have the intercloud which is an interconnected global "cloud of clouds" and an extension of the Internet "network of networks" on which it is based. The Intercloud scenario is based on the key concept that each single cloud does not have infinite physical resources. If a cloud saturates, the computational and storage resources of its infrastructure, it would not be able to satisfy further requests for service allocations sent from its clients. The Intercloud scenario aims to address such a situation, and in theory, each cloud can use the computational and storage resources of the infrastructures of other clouds. Such forms of pay-for-use may introduce new business opportunities among cloud providers if they manage to go beyond the theoretical framework. (Matter, Greg)

In order to benefit the most from cloud computing, developers must be able to refactor their applications so that they can best use the architectural and deployment paradigms that cloud computing supports, and when this is done correctly you can enjoy the great benefits of cloud computing. Reduced Costs, Cloud computing reduces your hardware (computers, software (all those downloaded programs), networking management and overall IT expenses. In addition, with cloud computing, you pay for what you use. Scalability, you can scale your business storage needs seamlessly rather than having to go out and purchase expensive programs or hardware or worry about overloading your servers. Automatic Updates, There is no need for IT to worry about paying for your future updates in terms of software and hardware. Remote Access, employees, partners and clients can access, and update information wherever they are, rather than having to run back the office. Ease of Implementation, implementing cloud services is as easy as, well, setting up a LinkedIn page. Response Time, Cloud computing accomplishes a better response time in most cases than your standard server and hardware. “Lego”, Children have been playing with Lego since 1916 because Lego allows them to build whatever their imagination designs, cloud apps allow your business to select what your company needs, when you need it and use it how you want to; you can select an intranet as your platform, email and CRM from InfoStreet, email marketing tools from Topica, financial services from yet another vendor because in the end you use and pay for only what you need. (Hoffman, Marcy)

While cloud computing and storage is a great innovation in the field of computing, severe business risks and challenges are involved to retrieve the promised business advantages of cloud computing, here are some disadvantages. Requires a constant Internet connection, cloud computing is impossible if you can't connect to the Internet since you use the Internet to connect to both your applications and documents, if you don't have an Internet connection you can't access anything, even your own document;. A dead Internet connection means no work, and in areas where Internet connections are few or inherently unreliable, this could be a deal-breaker because when you're offline, cloud computing simply doesn't work. Security Breaches, if there is a compromise of the server where your data is stored, your personal information may be exposed to the world, there’s also a good chance that more than just your information may be affected, possibly millions of other users. Outages, have you ever been unable to access your email due to your provider being down? Now, imagine if you needed a document for an important business meeting or presentation and your storage provider’s site was down, this always happens at the most inconvenient times. Storage limits, while your local hard drive may be able to hold 500GB or more of data, unfortunately a remote server may only allow you to freely store about 5GB. If you want more room, you’ll have to pay. Still, even with a paid account, it can’t begin to touch the amount of room you have locally. There also may be a limit on the size of the data that can be stored. Slow speeds, Uploading and downloading of large documents may take a long time. Limited features, if you use remote software that is provided by the storage service to manipulate and modify your data, it usually lacks the features of a program running locally. (Morris, Kenn)

Cloud computing is being used in the industry too, as companies slowly join cloud computing, like Netflix that last year decided that over the next couple of years, it would move most of its Web technology, customer movie queues, search tools and the like, over to the computer servers of Amazon.com. Cloud providers, large ones like Amazon, Microsoft, Google and AT&T, and smaller ones like Rackspace and Terremark, aim to convince other companies to give up building and managing their own data centers and to use their computer capacity instead. Led by Amazon, most cloud services have largely been aimed at start-ups, like the legion of Facebook and iPhone applications developers who found they could rent a first-class computing infrastructure on the fly. Now cloud providers are trying to bring these types of flexible services to the more conservative and lucrative world of large corporations. Companies have also used Amazon as a backup system, either to handle sudden spikes in computing demand or to keep information in a secondary spot in case of a disaster. In another cloud model, advocated by companies like VMware and I.B.M., tech companies help large businesses develop “private clouds” in their own data centers, so that various departments and employees can rent computing capacity as they need it without making big budget commitments. Government agencies are looking at it too. NASA’s Jet Propulsion Lab currently runs various experiments on the computers of Amazon, Microsoft and Google, but NASA executives also tell of the seven months it took to reach its licensing agreement with Amazon, because NASA wanted, among other things, to be able to inspect the hardware it was using, Amazon declined. When given a clean slate, many new companies have chosen a full embrace of the cloud model, figuring the technology industry has matured to the point where these types of services make basic business sense. For example, Arista Networks, a five-year-old company that makes networking equipment, runs its sales software with a cloud software company called NetSuite, its corporate e-mail on Google Apps, and other Web infrastructure with Amazon.com. (Stone, Brad, and Ashlee Vance)

Also cloud computing is being used in education; Over a half million students and educators have access to a cloud platform on IBM hardware servers. Universities and K-12 schools now have high tech networks in place and there is a need to integrate with them in a flexible way by utilizing IBM technologies. Now, IBM has announced that it is offering a cloud-computing service that will allow universities and colleges to build custom private clouds that can be integrated into public cloud services. IBM also has a similar program for K-12 schools. The service is called 'The IBM SmartCloud for Education. ' The service is built on IBM hardware servers and uses open software from the Virtual Computing Lab which is built by and for education under a collaboration project which was initiated a few years ago with North Carolina State University. The IBM Virtual Computing Lab Cloud Solutions for Education provide enhanced services and tools to enable a cloud computing environment as an on-campus private cloud or a ‘hybrid’ cloud connected to the IBM SmartCloud. The goal of IBM's SmartCloud for Education is to work with universities to design cloud services that could help them better handle tasks such as: identifying students at risk of failing, analyzing student enrollment and retention, managing financial aid, and manage campus security, IBM new cloud services will deliver computer lab resources, advanced software, and services to students and researchers at colleges, schools, and universities, without requiring the advanced IT expertise at those locations. ("Educational Institutions Using Cloud Computing.")

In conclusion, Cloud computing will have an enormous impact. It can be compared to the way personal computers and servers shook up the world of mainframes and minicomputers, because cloud computing has good characteristics, very neat layers, different deployment models for different necessities, its advantages surpass its disadvantages. Also most of the big technology companies have cloud computing initiatives of some sort, some aimed at the business market, some at the end user via the internet, but in the end little by little cloud computing is being used more and more in the industries and also in education. The attractions of cloud-based computing, including scalability and lower cost, are very real, and if you work in application development, whether for a software vendor or an end user, expect the cloud to play an increasing role in your future, because the next generation of application platforms is here.

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