QAT Global

“The Cloud”

Overview

The purpose of this paper is to introduce the reader to the basics of cloud computing or "the cloud" with the aim of introducing the following aspects:

- Characteristics and usage of the cloud
- Realities and risks of the cloud

Furthermore, the paper aims to provide a means of exploring options available for complementing your enterprise technology needs using cloud computing.

Let's begin our journey by first defining what is meant by "the cloud" or cloud computing. The term cloud computing was inspired by the cloud-shaped symbol often used to represent the Internet/complex infrastructure in system flowcharts and diagrams. Forrester defines cloud computing as:

"A pool of abstracted, highly scalable, and managed computer infrastructure capable of hosting end-customer applications and billed by consumption."

We like to say that cloud computing is a general term for the delivery of hosted services over a network to a community of end-users. These services may include storage capacity, user's data, software and/or raw computing power.

Cloud computing relies on the practical approach of the "reusability of IT capabilities" to achieve economies of scale and ease of consumption much like a utility (think electrical grid) over a network.

Cloud Computing Characteristics

Cloud computing has the following key characteristics:

- **On-demand self-service:** individuals can set themselves up without needing anyone's help
- **Ubiquitous network access:** available through standard Internet-enabled devices, protocols, and APIs
- **Location independent resource pooling:** processing and storage demands are balanced across a common infrastructure
- **Rapid elasticity:** consumers can increase or decrease capacity at will
- **Pay per use:** consumers are charged fees based on their usage of a combination of computing power, bandwidth use and/or storage

Cloud Computing Services

Cloud computing services are broadly divided into three categories:

- **Infrastructure as a Service (IaaS)**
  Infrastructure as a Service provides basic storage and computing capabilities as standardized services over the network. Servers, virtual machines, storage systems, networking equipment, data center space, etc. are pooled and made available to handle workloads. The customer would typically deploy their own software on this infrastructure. The pricing model for IaaS is a pay per use/pay per go subscription based model. IaaS has become a defacto standard in many enterprises because, with the quick availability of IaaS services, organizations are freed up to focus their time and resources in bringing innovations to business applications and solutions.

- **Software as a Service (SaaS)**
  Cloud-based applications or Software as a Service provides the consumer a complete application as a service on demand. A single instance of the application runs on the cloud, and multiple end users are serviced. On the customers' side, there is no need for upfront investment in servers or software licenses, while on the provider's side, the costs are lowered, since only a single application needs to be hosted and maintained. This model eliminates the need to install and run the application on the cloud customer's own computers simplifying maintenance and support.

SaaS is a very broad market. Services can be anything from web-based email to enterprise resource planning (ERP) packages and database processing. The pricing model for SaaS applications is typically a monthly or yearly flat fee per user. Examples of SaaS include Microsoft Office 365, Google Apps, Quickbooks Online, SAP, and Salesforce.com.

What makes a cloud application different from other applications is its elasticity. Elasticity can be achieved by cloning tasks onto multiple virtual machines at run-time to meet the changing work demand. Load balancers distribute the work over the set of virtual machines. This process is invisible to the cloud user who sees only a single access point.

The popularity of SaaS is steadily increasing because it simplifies deployment and reduces customer acquisition costs. In addition, customers are turning to hosted (SaaS) products as a way to offload management of applications to reduce overall IT costs. Because the subscription-based SaaS pricing model keeps ever tightening and/or shrinking IT, budget costs consistent or lower than packaged or home-grown software.

- **Platform as a Service (PaaS)**

The PaaS model fills a void between a basic IaaS infrastructure and a full SaaS stack. In this model, the provider delivers the infrastructure, tools and backend architecture that empowers businesses to develop, deploy, integrate, store, host and manage software applications via a provider's platform over a network. The customer has the freedom to build their own applications, which run on the providers' infrastructure, without having to worry about managing the IT dependencies underneath. Put another way, PaaS provides developers a stable starting point in developing a custom solution many steps ahead of where they were at if they were building custom software from the ground up.

For example, Java developers wouldn't, have to worry about installing, patching, configuring, monitoring, load balancing, and generally managing the middleware and runtime environment. They simply create Java applications to the specifications of the PaaS cloud platform and deploy it to the cloud.

To meet manageability and scalability requirements of the applications, PaaS offerings are a predefined combination of OS, programming execution environment, data storage, and application servers, such as LAMP platform (Linux, Apache, MySql, and PHP), Spring, Groovy, and Ruby to name a few. The pricing model for PaaS is typically subscription-based. Google's App Engine, Force.com (an outgrowth of Salesforce.com), CloudFoundry, OpenShift, Stratos, and Azure are some of the popular PaaS examples.

A good PaaS infrastructure moves the ball forward in allowing IT to bring more business agility to an enterprise. Creating PaaS applications deliver a much greater time to value because the application can not only be created faster but also deployed faster. A PaaS solution reduces the

amount of moving parts in the infrastructure. A standardized, highly scalable, self-managing delivery platform is a huge advantage for the application developer and enterprise application deployment.

PaaS can also reduce TCO (Total Cost of Ownership) because there is no need to buy the system, software, platforms, tools and kits needed to build, run and deploy the application. Customers only rent them for the period for which services will be used. It changes the cost structure from capital expense to operational expense for an enterprise.

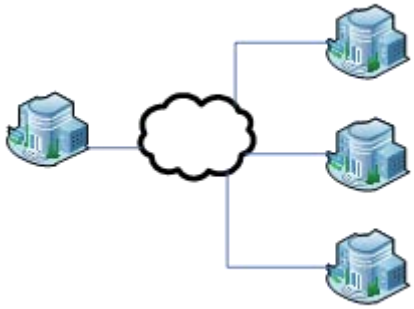
To take full advantage of PaaS, not only from costs point of view but also development perspective, enterprises need to establish development standards, tools, processes and governance around this platform. In addition, we highly recommend using PaaS as a way of transforming your development organization into a highly agile business differentiator by reducing your technology stack or stacks of your enterprise so that most of your future applications and modernization projects are geared towards the PaaS.

Cloud Computing Deployment Models

Enterprises can choose to deploy applications on public, private or hybrid clouds. Cloud Integrators can play a vital part in determining the right cloud path for each organization.

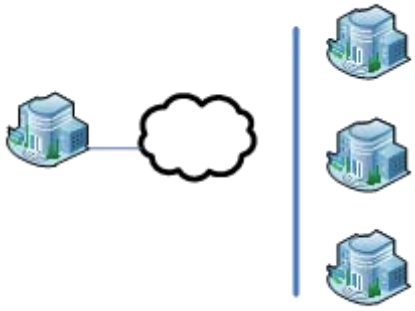
- **Public Cloud**

  Public clouds are owned and operated by third parties and are made available to the general public; they deliver superior economies of scale to customers, and as the infrastructure costs are spread among a mix of users, they offer each client an attractive low-cost, "Pay-as-you-go" model. All customers share the same infrastructure pool with limited configuration, security protections, and availability variances. These are managed and supported by the cloud provider. One of the advantages of a public cloud is that they may be larger than an enterprises' data center, thus providing the ability to scale seamlessly, on demand.



- **Private Cloud**

  Private clouds are built exclusively for a single enterprise. They aim to address concerns about data security and offer greater control, which is typically lacking in a public cloud. There are two variations to a private cloud:



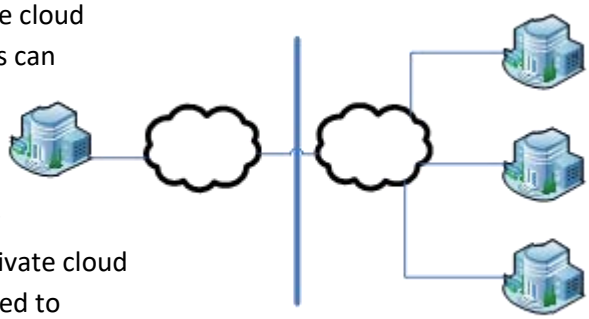
  - On-premise Private Cloud: On-premise private clouds, also known as internal clouds are hosted within the enterprise's own data center. This model provides a more standardized process and protection but is limited in aspects of size and scalability. IT departments would also need to incur the capital and operational costs for the physical resources. This is best suited for applications which require complete control and configurability of the infrastructure and security.
  - Externally hosted Private Cloud: This type of private cloud is hosted externally with a cloud provider, where the provider facilitates an exclusive cloud environment with a full guarantee of privacy. This is best suited for enterprises that do not want to utilize a public cloud due to sharing of physical resources.

  Some key characteristics of private clouds are following:

  - A self-service interface that controls common services, allowing IT staff to quickly provision, allocate and deliver on-demand IT resources.
  - Highly automated management of resource pools for everything from computing capability to storage, analytics, BPM, and middleware.
  - Technology stack and governance designed for a company's specific requirements.
  - Security and governance designed for a company's specific requirements.

- **Hybrid Cloud**

  Hybrid clouds combine both public and private cloud models. With a hybrid cloud, service providers can utilize third-party cloud providers fully or partially thus increasing the flexibility of computing. The hybrid cloud environment is capable of providing on-demand, externally provisioned scale. The ability to augment a private cloud with the resources of a public cloud can be used to manage any unexpected surges in workload.



Cloud Computing Benefits

Enterprises will need to align their applications, best practices, and technology stacks, in order to exploit the architecture models that Cloud Computing offers. Some of the typical benefits are listed below:

- **Reduced Costs**

  There are a number of reasons that Cloud Computing help businesses reduce IT capital expense (CapEx) investments. Some cost savings reasons are listed below:
  - Reduced costs from economies of scale and resource pooling.
  - Pay-for-use—costs based on metered service usage.
  - Reduced costs because there is no development software to purchase, install, update or maintain.

- **Agility**

  Agility is extremely important for today's enterprise. With enterprises having to adapt, even more rapidly to changing business conditions speed to delivery is critical. Below are some key benefits that make cloud technology revolutionary in this area:
  - On demand and elastic services—quickly scale up or down.
  - Self-service, automated provisioning, and de-provisioning.
  - Develop applications and get to market faster
  - Deploy new web applications to the cloud in minutes
  - Reduce complexity with middleware as a service
  - You can sign up and start using cloud apps in minutes; Apps and data are accessible from any connected computer; No data is lost if your computer breaks, as data is in the cloud.

- **Increased Computing Capacity**

  With the massive infrastructure that is offered by cloud providers today, computational resources, storage and maintenance of large volumes of data is a reality. Sudden workload spikes are also managed effectively and efficiently since the cloud can scale dynamically. All of this available with a pay-as-you-go model and extremely short notice for today's agile enterprises.

The figure above illustrates the compelling benefits that are key factors which allow businesses to reduce IT expenses while gaining the ability to adopt new capabilities quickly and drive fundamental business innovation.

Cloud Computing Challenges

Despite the benefits of cloud development in the speed and cost savings, it can offer to the business; many companies still view it as too unstable and unreliable to be trusted to host their infrastructures. In our opinion, the benefits outweigh the drawbacks, and the model is worth exploring. Some common challenges are:

- **Security**
  Security is a crucial element that warrants much scrutiny and causes many reservations. Enterprises are reluctant to buy any assurances of business or data security from vendors. They fear losing data to competition and the data confidentiality of consumers. In many instances, the actual storage location is not disclosed, adding onto the security concerns of enterprises. Because of this many organizations just aren't comfortable shifting all of their corporate data to a public cloud; they instead opt to design private ones. Customers should choose an established cloud solution provider that places system controls on the movement of sensitive data (PII/PCI/HIPAA are examples) within their cloud network. For instance, if sensitive data ends up on servers outside of the United States, it can create serious legal issues. Beyond PII/PCI/HIPAA, many companies run the risk of exposing their own intellectual property or other trade secrets. Companies should require their cloud providers to implement and follow strict data controls that are routinely checked by independent auditors. Auditors exist to validate reporting to make sure procedures are in place to protect PII/PCI/HIPAA and other sensitive data. Performing thorough reviews of physical and logical access controls, auditors can proactively alert companies to security holes before there is a data breach. Auditors can review if background checks aren't performed or are not completed properly. Backup procedures for customer data are also intensely scrutinized. Maintaining optimal security in the cloud is a two-step process: first, outline data requirements regarding privacy and user access; and second, vet the right solution provider that can implement both technical and philosophical strategies to minimize risks.

- **Reliability**
  All business applications have service level agreements that are stringently followed. Operational teams play a key role in the management of service level agreements and runtime governance of applications. In production environments, operational teams support:
  - Appropriate clustering and failover
  - Data Replication
  - System monitoring (Transactions monitoring, logs monitoring, and others)
  - Maintenance (Runtime Governance)
  - Disaster recovery
  - Capacity and performance management

If any of the services mentioned above are under-served by a cloud provider, the damage and impact could be severe to the enterprise. The key to developing applications in the cloud is to be smart about how to approach it. It is not something one can just dive into, and it should be approached the same way as any other considerable IT investments - with a backup plan in place. Companies need to prepare their architectures for cloud development in a way that allows for the application to run regardless of any outage that may occur. This includes building out comprehensive disaster recovery plans that will ensure development can continue if resources do become unavailable at any given time in the process. As most companies already have such plans in place for their current, on-premise systems, it's simply a matter of applying these same disaster recovery planning processes to their investments in the cloud.

Cloud Computing Conclusion

The most important thing to remember about the cloud is not to expect perfection right off the bat. The cloud is not perfect. It is, however, the most promising advancement in software development to come along in years. The benefits of the cloud are clear and real. The advantages it offers in terms of speed and cost-savings will eventually change the minds of reluctant IT executives worried about security and reliability issues. Make no mistake; it is the future of web, application, and mobile development. If you've been considering harnessing the power of the cloud for your own application development efforts, there's no time like the present to get started.

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