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Challenges and Benfits of Cloud Computing

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ABSTRACT

Today organisations are performing most of the work through computers and internet. Online application multiplies the business of the organisation with automatic work. Cloud provides the solution of nonstop working of the systems and application around the world and around the clock. Organisations choose cloud as because it is very helpful in fast deployment of the application, secure access and without much more costing on computing environment. No doubt challenges associated with this new buzz. Customer can choose the model according to their requirement and according to their budget.

Keywords: Challenges and Benefits of Cloud, Private Cloud, Public Cloud, Hybrid Cloud, Community cloud, Infrastructure as a service (IaaS), Platform as a service (PaaS), Software as a service (SaaS).

INTRODUCTION

Cloud computing is very hot buzz today. The number of industries using cloud is increasing day by day. Cloud computing basically came from telecommunication companies when the virtual private network (VPN) technologies and services were developed to provide security and lower cost in 1990s. The cloud symbol was first introduced to delimit the function or area between the provider and the users. Later, the cloud extends this boundary and covers the computing services and network infrastructure. In 1997 Chellappa first used the term “Cloud Computing” on the INFORMS.

The main concerned of cloud computing is the sharing and coordinated use of diverse resources in distributed Organizations cloud, which is consisted of different, organizes and systems. Through this technology organization large-scale controlled sharing and interoperation among resources that are dispersedly owned and managed. Security is a major Challenge in any cloud computing infrastructure, because it is necessary to ensure that only authorized access is permitted and secure behavior is accepted.

There are 04 (Four) Development models and 3 (Three) Service models in the cloud environment.

1. Deployment Models of Cloud

Cloud can be deployed in the following ways based on the customer's requirements.

Private cloud

1) The entire cloud based infrastructure is used only for one customer. This is a type of Cloud hosting that is usually chosen and managed by an enterprise. In this the entire cluster of Cloud servers is leased by the enterprise, which can be managed by them or the host depending on a case to case basis.
2) This is a perfect solution for businesses who wishes to use the infrastructure for carrying out companies internal operations. This type of Cloud can be considered to be most secure amongst others as there is no outsider using the cluster.
3) The enterprises can prefer to manage the cluster on their own, where the hardware management part can be taken care by the host. Hence this type of solution is charged higher where the enterprise is charged for the hosting, server, security, power, cooling and other hardware. Hence, only a large company or an enterprise can afford this type of offering.
4) Strict control and compliance can be achieved with a private cloud and the risks incurred due to third parties can be greatly reduced.
5) Scalability being the core features of Cloud can be achieved in this type of solution as well.

Public cloud

1) The cloud infrastructure is for general public or a large industry group
2) In public cloud website, files, applications, data etc. are stored over the infrastructure offered by a hosting provider. The host would charge from customer for using their resources which may usually be in two modes i.e. fixed monthly scheme similar to all other plans or pay-per-use model.
3) In public cloud customer not required to pay an upfront cost for the hardware used. The essential software's are usually pre-installed and are included with the package
4) With a managed Public Cloud, users tend to enjoy multiple benefits such as on-demand technical support, expert guidance, security of our data, flexibility to upgrade or downgrade.
5) Customer gets to avail the incomparable features such as scalability and reliability. Few hosting providers would also offer customer choices between the technologies used over the cloud for example VMware Hosting or Hyper Cloud.

Community cloud

Several customers share the cloud infrastructure and it supports a specific community with the same concerns (e.g., resources and security requirements, policy and compliance considerations, etc).[1]

Hybrid Cloud

Public and Private Cloud solves the requirement for both Internal as well as External solutions. But what if someone wishes to use both the types to suffice the requirements of a business? This can be achieved by opting for a Hybrid Cloud wherein some part of the information can be kept on a private Cloud while information with the least priority can be maintained over the public cloud.[6]

1) Most Hybrid Cloud solutions make use of virtual front end servers and physical database servers.
2) Virtualization techniques can be implemented over the existing infrastructure for reducing the costs and increasing the reliability.
3) The designing, implementation and management of the virtual network over the existing infrastructure needs to be taken care by the enterprise, while having a public cloud from a provider can reduce your costs over employment of trained labor.
4) When choosing the best type of solution, we must identify the requirement of the extent of control we wish to have over our data. If we wish to keep everything on a private network, we may opt for a Private Cloud. But if we wish to keep your expenses low, choosing a Public Cloud can best suffice our requirements. Moreover, if we are too low on budget and have a limited size of data yet wish to host your files over a cloud,

a Shared Cloud can be a perfect choice to suffice the requirements.

Service Models of Cloud

Based on the service provided by the cloud service provider cloud environment can be categorized in the following categories.

Infrastructure as a Service (IaaS)

The capability provided to the consumer is to provision processing storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. (Definition by National Institute of Standards and Technology (NIST)[9].

The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems; storage, deployed applications, and possibly limited control of select networking components (e.g., host firewalls)." Traditionally Organizations incurred very large part of the corporate expense on Computing System Infrastructure. Leasing or purchasing dedicated hardware, software, and internal or consultative expertise consumes a major portion of any company's resources With the help of IaaS Model organization can get scalable Infrastructure that can rapidly respond to demand in a way that traditional IT infrastructure acquisition, implementation, and maintenance cannot. There are so many cloud providers in the world, but in India the main competition is between Amazon and Gogrid.

Platform as a Service (PaaS)

The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages and tools supported by the provider. (Definition by NIST)[2]

Web Application can be developed without having to install the software building tools on their own computer. The developed application can be deployed on the cloud easily.

PaaS encapsulates a layer of software and provides. It as a service that can be used to build higher-level services. The PaaS vendor provides several services for application developers:

1) A virtual development environment
2) Application standards, usually based on the developers' requirements
3) Toolkits configured for the virtual development environment
4) A ready-made distribution channel for public application developers

PaaS provides the capability to build or deploy the applications, like the Microsoft based (i.e. Windows, .NET, IIS, and SQL) or an open source based (i.e. Linux, Apache, MySQL, and PHP).[1]

Software as a Service (SaaS)

As follows: "The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure. The applications are accessible from various client devices through a thin client interface such as a web browser (e.g., web-based e-mail).

In this model customer pays according to the operational expense model (pay per use or subscription agreement). The pay-per-use licensing model is also known as *on-demand licensing*, because the use of the application is upon the customer's choice and the period also decided by them. This model gives customer's freedom from[7]

1) Compatibility with hardware, other software, and operating systems
2) Licensing and compliance issues (unauthorized copies of the software floating around the organization)
3) Maintenance, support, and patch revision processes

In short it can be stated that Software as a Service (SaaS) solutions deliver software applications over the Web. A SaaS provider deploys software to the user on demand, commonly through a licensing model. The provider may host the application on its own server infrastructure or use another vendor's hardware. The application may be licensed directly to an organization, a user or group of users, or through

a third party that manages multiple licenses between user organizations, such as an ASP. The user then accesses the application through any defined and authorized Internet device, most commonly a Web browser. A complete SaaS service should offer a full-featured application productivity suite as a service on demand, serving multiple organizations or individual users running from a single instance of the application on the cloud.

Challenges in Cloud Computing

Challenges associated with Cloud computing environment are as follows:

Security

This is the first challenge faced by cloud environment. Cloud environment should establish a sound security policy as the foundation for design of the cloud environment. It should treat security as an integral part of the overall system design. Cloud provider should clearly delineate the physical and logical security boundaries governed by associated security policies. As the cloud environment provide resources environment services to external systems (different systems, organization, or customers etc). It should be assumed that external systems are insecure. Layered security should be properly implemented to ensure there is no single point of vulnerability. Use boundary mechanisms to separate computing systems and network infrastructures. Authenticate users and processes to ensure appropriate access control decisions both within and across domains. There must be unique identities to ensure accountability. There must be properly identification of potential trade-offs between reducing risk and increased costs and decreases in other aspects of operational effectiveness. Public access systems should be Isolated from mission-critical resources (e.g., data, processes, etc.). Minimize the system elements to be trusted. Implement least privilege.[3]

Software must exhibit the following three properties to be considered secure:

1) **Dependability**
   Software should perform according to predefined and correctly manner in a variety of conditions, including under attack or running on a malicious host.
2) **Trustworthiness**
   Software that contains a minimum number of vulnerabilities or no vulnerabilities or weaknesses that could sabotage the software's dependability. It must also be resistant to malicious logic.
3) **Survivability (Resilience)**
   Software must have the ability to recover as quickly as possible with as little harm as possible.

Cloud Interpretability

The primary goal of interoperability is to realize the seamless flow of data between different clouds and between cloud and local application. The purpose of optimization, an organization may need to outsource a number of marginal functions to cloud services offered by different vendors. Standardization appears to be a good solution to address the interoperability issue. However, as cloud computing just starts to take off, the interoperability problem has not appeared on the pressing agenda of major industry cloud vendors. Presently, each cloud offering has its own way on how cloud clients/applications/users interact with the cloud. Interoperability should perform with the purpose of recourse optimization.

Costing Model

The costing model is another challenge for cloud computing environment. With the use of cloud the cost of transferring an organization's data to and from the public and community cloud and the cost per unit of computing resource used is higher. The problem becomes serious when the customer is using hybrid cloud deployment model where the organization's data is distributed amongst a number clouds.[4]

Charging Model

The elastic resource pool has made the cost analysis a lot more complicated than regular data centers, which often calculates their cost based on consumptions of static computing. Moreover, an instantiated virtual machine has become the unit of cost analysis rather than the underlying physical server.

For SaaS cloud providers, the cost of developing multi tenancy within their offering can be very substantial. These include: re-design and

redevelopment of the software that was originally used for single-tenancy, cost of providing new features that allow for intensive customization, performance and security enhancement for concurrent user access, and dealing with complexities induced by the above changes. Consequently, SaaS providers need to weigh up the trade-off between the provision of multi tenancy and the cost-savings yielded by multi-tenancy such as reduced overhead through amortization, reduced number of on-site software licenses, etc. Therefore, a strategic and viable charging model for SaaS provider is crucial for the profitability and sustainability of SaaS cloud[4]

Service Level Agreement (SLA)

The negotiation of the Service level agreement between customer and the cloud provider is also a challenge for the cloud computing architecture. The Service level agreement is diversify in nature. The very first issue is the definition of SLA specifications in such a way that has an appropriate level of granularity, namely the tradeoffs between expressiveness and complicatedness, so that they can cover most of the consumer expectations and is relatively simple to be weighted, verified, evaluated, and enforced by the resource allocation mechanism on the cloud. In addition, different cloud offerings (IaaS, PaaS, and SaaS) will need to define different SLA meta specifications. This also raises a number of implementation problems for the cloud providers. Furthermore, advanced SLA mechanisms need to constantly incorporate user feedback and customization features into the SLA evaluation framework.

Confidentiality, Integrity, and Availability

These are another challenge for cloud provider and customer of the cloud.

Confidentiality

Confidentiality refers to the prevention of intentional or unintentional unauthorized disclosure of information. Confidentiality in cloud systems is related to the areas of intellectual property rights, covert channels, traffic analysis, encryption, and inference:[5]

Integrity

The concept of cloud information *integrity* requires that the following three principles are met:

1) Modifications are not made to data by unauthorized personnel or processes.
2) Unauthorized modifications are not made to data by authorized personnel or processes.
3) The data is internally and externally consistent — in other words, the internal information is consistent both among all sub-entities and with the real-world, external situation.

Availability

Availability guarantees that the systems are functioning properly when needed. System or the application in a cloud environment should be provided to the end user when it is required. It ensures the reliable and timely access to cloud data or cloud computing resources by the appropriate personnel. In addition, this concept guarantees that the security services of the cloud system are in working proper order and in a prescribed manner. A denial-of-service attack is an example of a threat against availability. The reverse of confidentiality, integrity, and availability is disclosure, alteration, and destruction (DAD).[10]

Expected Benefits

Scalability

Cloud computing provides the solution according to the scale of the organization or customers. The usage of cloud can be decreased or increased according to the user requirement on demand basis. The cloud provider provide facility of scalability to the organizations as they can use expand or decrease their requirement according to their requirement. All expansion and decrease in the cloud usage may be according to their (customer/ end user) requirement. Because the cloud provider operates on a utility model, the client organization has to pay only for the resources it is using at the time. Cloud scalability provides for remote optimization so that computing resources are organized for maximum cost-benefit.

Centralization of Data Storage

The cloud offers larger amount of data in

a centralized place which cannot possible in case of local corporate computing system. The storing capacity may be increased or decreased as the requirement of the organization decreases or increases. The centralization of storage infrastructure results in cost efficiencies in utilities, real-estate, and trained personnel. Data protection is also easier in centralized environment.

This storage might provide an attractive target for hackers or criminal organizations to gain access to critical information by focusing on a central repository. The counter argument is that, if implemented properly, information security can be made stronger and more safeguards employed and monitored in a central data store than in a distributed model.

Cost Reduction

This is the next benefit of the cloud computing environment as capability and resources can be paid for the incrementally without the need for the large investment in computing infrastructure. Therefore, capital costs are reduced and replaced by manageable, scalable operating expenses. Support and maintenance cost reduced, as the support and maintenance services provided by the cloud provider. The need for highly trained and expensive IT personnel is also reduced.[8]

Ultimately customer can be reduce the large investment in computing infrastructure, capital cost, support / maintenance cost, trained IT personnel through using cloud computing as a tool.

Quick Deployment

The deployment of the application over the cloud is also time saving activity. In the cloud environment customer can use powerful computational resources in a short time frame and large amounts of storage without requiring sizeable initial investments in hardware, software, and personnel, they can be used by the user on the pay per use basic. The delivery of the product also improves.

Flexibility and Resiliency

A major benefit of cloud computing is the flexibility that is provided by the following:

1) Freedom from concerns about updating servers
2) Freedom from having to install software patches for updating
3) Automated provisioning of new services and technologies
4) Acquiring increased resources on an as-needed basis
5) Ability to focus on innovation instead of maintenance details
6) Device independence

Cloud service provide offer a choice among a number of computing and storage resource configurations at different capabilities and costs, and the cloud customer will have to adjust his or her requirements to fit one of those models. Resiliency can be achieved with the availability of multiple redundant resources and locations

Disaster Recovery

Disaster recovery and business continuity planning techniques are employed by the cloud provider in comparison to the local computer environment of an organization. Cloud provider employs more dynamic and skilled computer personnel who are master in the disaster recovery process. As the cloud serves to many client at the same time and resources are used by so many users at the same time hence cloud provider adopt more advance technique and skills to handle disaster recovery.

Working around (7x24x365)

This is especially in case of online web application. Application which are running on the cloud environment have lesser chance to failure due to the reason of catastrophic failure, power backups, system crash or any other reason of system failure. Data is saved and application is available as and when needed.

CONCLUSION

Cloud computing helps the modern organization to run their application with minimum chance of failure. With the benefits of the cloud computing there are a lot of challenges faced by

this technology such as security, access control, interpretability etc. With the help of cloud customer can deploy their application in very short time frame but there are risk associated with it also. Cloud infrastructure is prime target of the hackers and intruders. Customer should first understand their requirement and the cloud provider's feedback from the market then only he / she should select the cloud service provider their service model and deployment model offered by the cloud service provider.

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