Course: Cloud Computing

Week 7: Cloud Deployment and Management

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Lecture Learning Outcome

- At the end of this lecture, you will be able to learn
- The different management aspect in the different cloud type
- Six Stages of Lifecycle management Cloud services;
- The Role of Cloud Brokerage/Cloud Broker in cloud management
- Sub divisions in Cloud Management

Cloud Deployment and Management

- Deployment models are fully user centric, that is, these depend on users' requirement and convenience.
- **Four types of deployment models in the cloud:**
- 1. Private cloud. 2. Public cloud .3. Community cloud .4. Hybrid cloud

Private Cloud

- Private cloud can be defined as the cloud infrastructure that is provisioned for exclusive use by a single organization comprising multiple consumers (e.g., business units). It may be owned, managed, and operated by the organization, a third party, or some combination of them, and it may exist on or off premises

Private Cloud -Suitability

- The organizations or enterprises that require a separate cloud for their personal or official use.
- The organizations or enterprises that have sufficient amount of funds/ resources to manage and maintain the cloud.
- The organizations or enterprises that are handling extremely sensitive data.

Private Cloud -Suitability

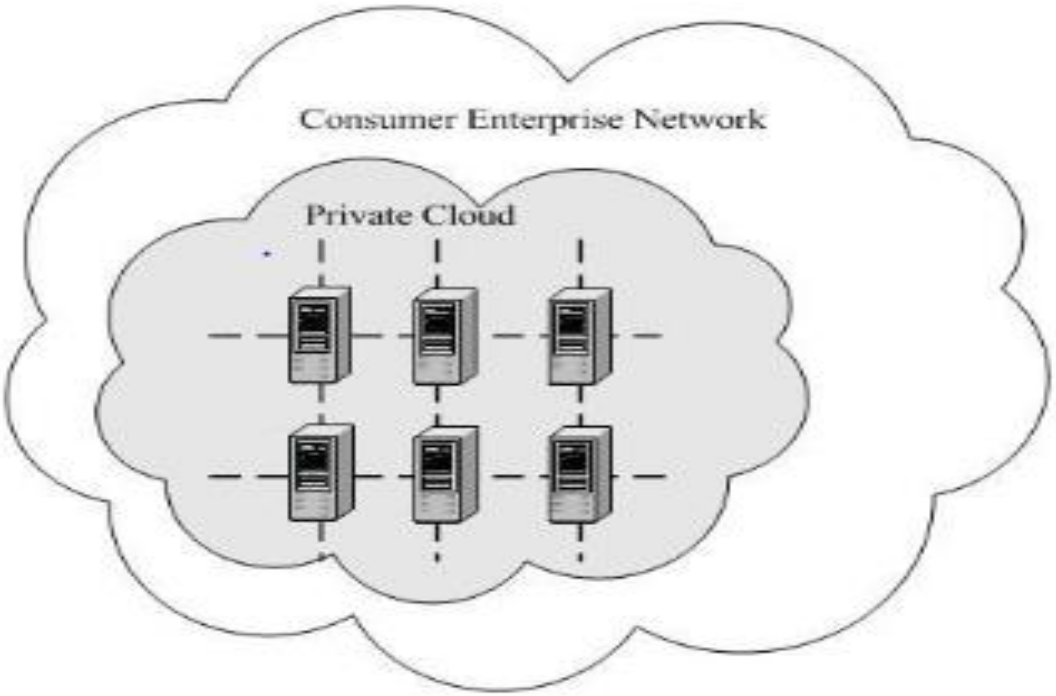
The organizations that want autonomy and complete control over the cloud.

- The organizations that have a less number of users.
- The organizations that have pre-built infrastructure for deploying the cloud and have the capability to manage timely maintenance of the cloud.

Private cloud classification According to NIST

- On-premise private cloud • Outsourced private cloud
- **On-Premise Private Cloud;**
- On-Premise private cloud is solely managed within the boundaries of an organization; the cloud is deployed in the organizational premises and is connected to the organizational network.

On-premise Private Cloud



- (Liu, 2011)

Management Issues

1. Service Level Agreements: SLA plays a very important role in any cloud service deployment model. For a cloud to operate, agreements between different players especially the service providers and the users have to be clearly stipulated. The service provider will agree upon certain terms and conditions regarding the service delivery. These terms and conditions need to be strictly followed; if not, there will be a penalty on the part of the defaulting party.

Management Issues

2. Network: The cloud is totally dependent on the network that is laid out. The network usually consists of a high bandwidth and has a low latency, so the network has to be well managed for effective cloud deployment. This is because the connection is only inside the organization. Network management is easier in this case, and resolving a network issue is easier.

Management Issues

3. Performance: When Cloud resources are well managed, this has a direct implication on performance of a cloud delivery model. Since here the networks are managed internally, the performance can be controlled by the network management team

4. Security and data privacy: Data of the users are solely managed by the company and most of the data would be related to the organization or company, here there is a lesser chance that the data will be leaked to people outside as there are no users outside the organization.

Management Issues

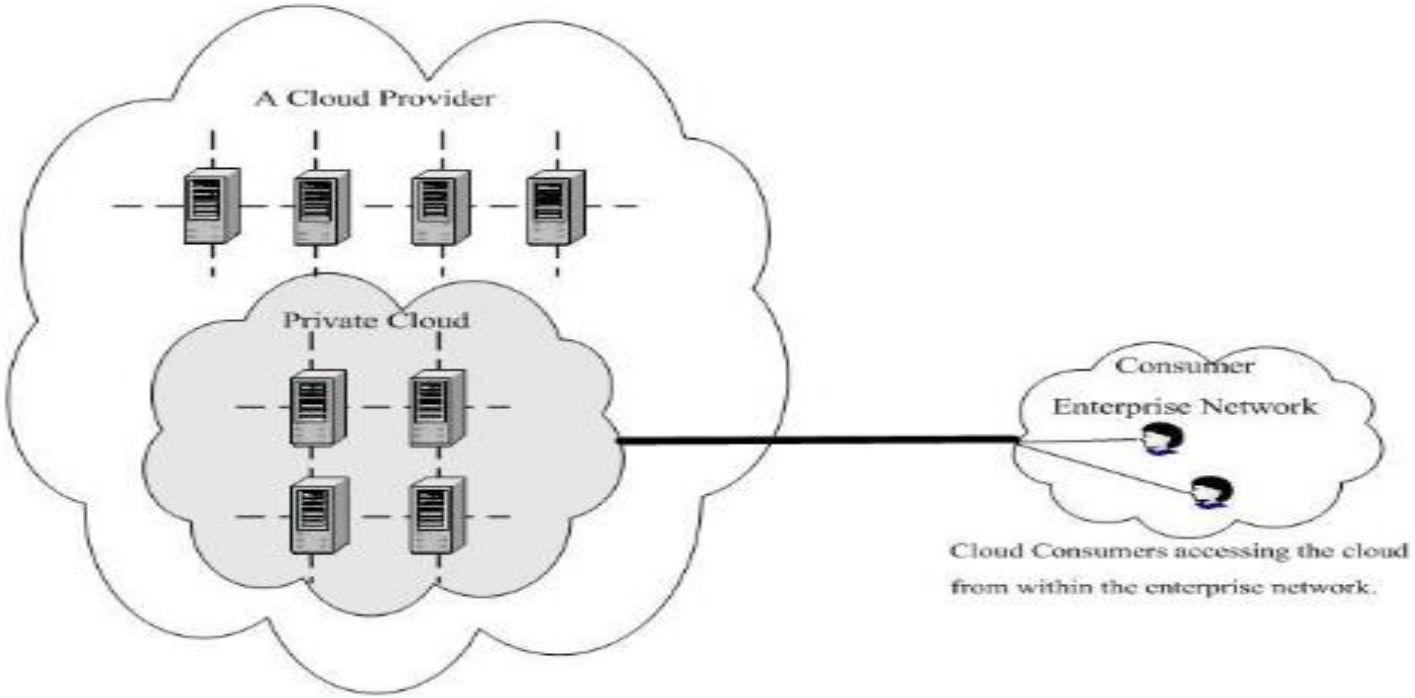
5. Location: In a private cloud, the data are internal and are usually stored with in the organization's premise. If a company has several physical locations, then the cloud is distributed over several places, cloud resources will then be accessed using the Internet (by establishing a virtual private network [VPN] or without a VPN).

6. Cloud management: This involves several tasks such as resource scheduling, resource provisioning, and resource management. The number of users, the network size, and the amount of resources are some of the important parameters that affect the management of the cloud

Management Issues

7. Maintenance: The cloud is maintained by the organization where the cloud is deployed. The defective resources (drives and processors) are replaced with the good resources. The number of resources is less in the private cloud, so maintenance is comparatively easier.

Outsourced Private Cloud



- (Liu, 2011)

Outsourced Private Cloud

- The outsourced private cloud has a cloud outsourced to a third party. A third party manages the whole cloud.
- **Management Issues**

  1. Service Level Agreements: The SLA is between the third party and the outsourcing organization. Here, the whole cloud is managed by the third party that will be usually not available on premise.

Management Issues

2. Network: The cloud is fully deployed at the third-party site. The cloud's internal network is managed by a third party, and the organizations connect to the third party by means of either a dedicated connection or through the Internet.

3. Security and privacy: The cloud is less secure than the on-site private cloud. The privacy and security of the data mainly depend on the hosting third party as they have the control of the cloud

Management Issues

4. Laws and conflicts: If this cloud is deployed outside the country, then the organization will have to comply with the laws of the hosting third party.

5. Location: The private cloud is usually located off site. In case there is a need to relocate, all the data must be transferred securely to the new location.

6. Performance: The performance of the cloud depends on the third party that is outsourcing the cloud.

Public Cloud

- Cloud infrastructure is generally open the public. It may be owned, managed, and operated by a business, academic, or government organization
- **Suitability**
- The requirement for resources is large and varying, that is, there is large user base.
- When an organization has no available physical infrastructure available and is financially constrained, they could opt for the public cloud.

Management Issues

1. Service Level Agreements: Unlike the private cloud, here the number of users is more and so are the numbers of service agreements. The service provider is answerable to all the users. The SLA will cover all the users from all parts of the world

2. Network: The network plays a major role in the public cloud. All users get the services of the cloud through the Internet. Unlike the private cloud where the organization takes responsibility for the network, here the service provider is not responsible for the network.

Management Issues

3. Performance: The service provider has to adequately manage the resources and the network. Increased number of users may affect performance.

4. Multitenancy: The resources are shared among multiple users hence the term multitenant. Due to this property, there is a likely hood of data leakage or a possible unprivileged access.

Management Issues

5. Security and data privacy: A user storing the data outside his or her country has a risk of the data being viewed by other people as that does not come under the jurisdiction of the user's country.

7. Laws and conflicts: The data are stored in different places of the world in different countries. Hence, data centers are bound to laws of the country in which they are located. This creates many conflicts and problems for the service providers and the users.

Management Issues

7. Location: As the public cloud is fragmented and is located in different regions, the access to these clouds involves a lot of data transfers through the Internet.

8. Cloud management: Here, the number of users is more, and so the management is difficult. The jobs here are time critical, and as the number of users increases, it becomes more difficult. Inefficient management of resources will lead to resource shortage, and user service might be affected. It has a direct impact on SLA and may cause SLA violation.

Community Cloud

- The community cloud is the cloud infrastructure that is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns (e.g., mission, security requirements, policy, and compliance considerations).

Suitability

- When an organization wants to operate and within a private cloud but has financial limitations
- When an enterprise does is constrain with the responsibility to maintain a private cloud

Suitability

- When organizations that could be in a similar line of business operation want to establish the cloud in order to collaborate with other clouds
- When an Enterprise wants to have a collaborative cloud with more security features than the public cloud. This cloud is not suitable for organizations that Prefer autonomy and control over the cloud

There are two types of community cloud deployments:

- On-premise community cloud 2. Outsourced community cloud
- **On-Premise Community Cloud:** On-premise community cloud consists of the cloud deployed within the premises and is maintained by the organizations themselves.

Management Issues

- 1. SLA is a little more stringent than the private cloud but is less stringent than the public cloud. As more than one organization is involved, SLA has to be there to have a fair play among the users of the cloud and among the organizations themselves.

Management Issues

2. Network: The private cloud can be there in any location as this cloud is being shared by more than one organization. Here, each organization will have a separate network, and they will connect to the cloud. It is the responsibility of each organization to take care of their own network.

3. Performance: In this type of deployment, more than one organization coordinates together and provides the cloud service. Thus, it is on the maintenance and management team that the performance depends.

Management Issues

4. Multitenancy: There is a moderate risk due to multitenancy. As this cloud is meant for several organizations, the unprivileged access into inter-organizational data may lead to several problems.

5. Location: The location of the cloud is very important in this case. Usually, the cloud is deployed at any one of the organizations or is maintained off site by any third party

Management Issues

6. Security and privacy: Security and privacy are issues in the community cloud since several organizations are involved in it. The privacy between the organizations needs to be maintained.

7. Laws and conflicts: This applies if organizations are located in different countries. If the organizations are located in the same country, then there is no issue, but if these organizations are located elsewhere, that is, in different countries, then they have to abide by the rules of the country in which the cloud infrastructure is present, thus making the process a bit more complex

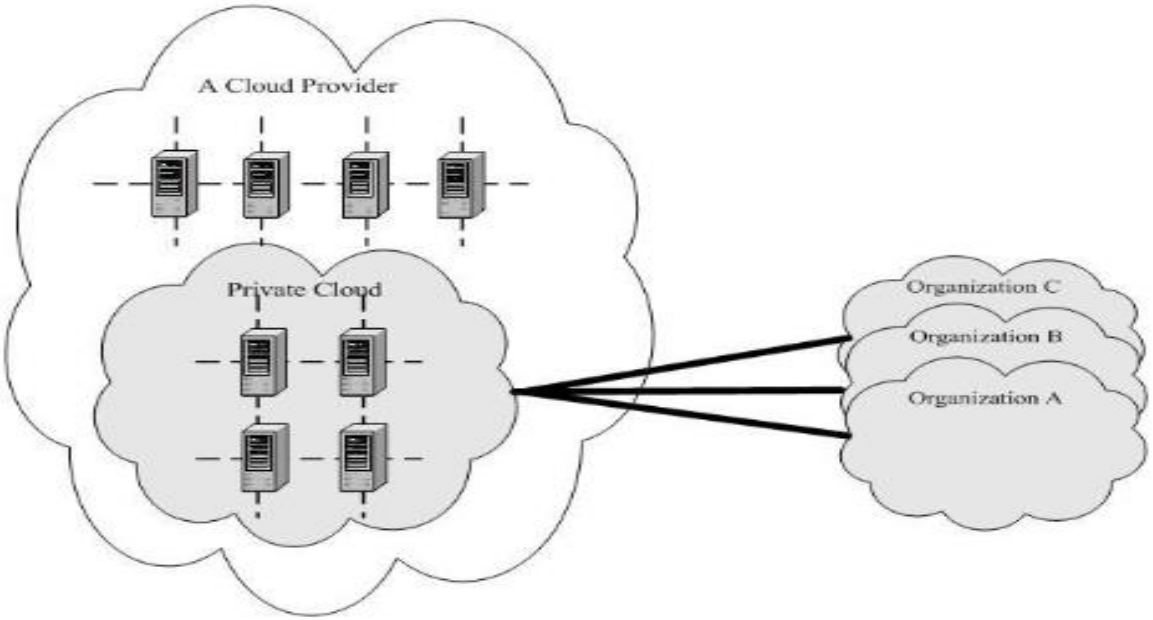
Management Issues

8. Cloud management: Cloud management is done by the service provider, here in this case by the organizations collectively. The organizations will have a management team specifically for this cloud and that is responsible for all the cloud management–related operations.

9. Cloud maintenance: Cloud maintenance is done by the organizations collectively.

- **Outsourced Community Cloud**, the cloud is outsourced to a third party. The third party is responsible for maintenance and management of the cloud.

Outsourced Community Cloud



- (Liu, 2011)

Hybrid Cloud

- Can be defined as the cloud infrastructure that is a composition of two or more distinct cloud infrastructures (private, community, or public) that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability

Management Issues

1. Service Level Agreements: SLA is one of the important aspects of the hybrid cloud as both private and public are involved. There is a right combination of SLAs between the clouds. The private cloud does not have stringent agreements, whereas the public cloud has certain strict rules to be covered.
2. Network: The network is usually a private network, and whenever there is a necessity, the public cloud is used through the Internet;

Management Issues

VPNS come in so handy in a hybrid cloud, the organizations can also use fire walls to filter traffics between the different clouds deployed

3. Performance: The hybrid cloud is a special type of cloud in which the private environment is maintained with access to the public cloud whenever required. This helps extend numerous resources hence improving performance.

Management Issues

4. Multitenancy: Multitenancy is an issue in the hybrid cloud as it involves the public cloud in addition to the private cloud.

5. Location: Like a private cloud, the location of these clouds can be on premise or off premise and they can be outsourced.

6. Cloud management: all management aspects are managed by the private cloud service provider.

Managing the Cloud

- Cloud management refers to the technologies and software that are designed for operating and monitoring applications, data and services that reside in the cloud. Cloud management tools make sure that a company's cloud resources are working properly and kept under control, thus allowing administrators to instead focus on supporting other core business processes.

Six Stages of Lifecycle management Cloud services;

Phase 1: The definition of the service as a template for creating instances (creation, updating and deletion of service templates)

Phase 2. Client interactions with the service, usually through a SLA (Service Level Agreement) contract (manages client relationships and manages service contracts).

Phase 3: The deployment of an instance to the cloud and the runtime management of instances (creation, updating, and deletion of service offerings).

Six Stages of Lifecycle management Cloud services;

Phase 4: The definition of the attributes of the service while in operation and performance of modifications of its properties (service optimization and customization)

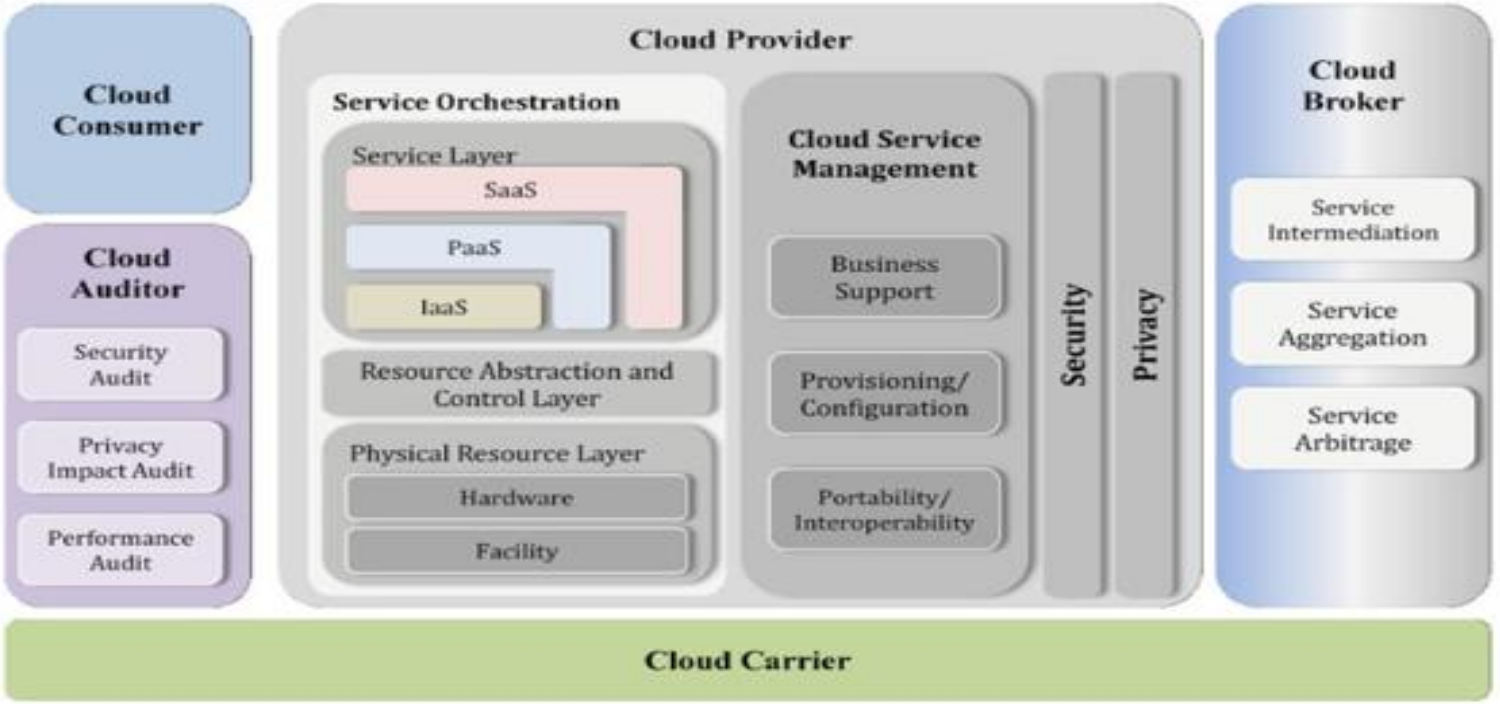
Phase 5: Management of the operation of instances and routine maintenance (monitor resources, track and respond to events, and perform reporting and billing functions).

Phase 6: Retirement of the service: End of life tasks include data protection and system migration, archiving, and service contract termination.

Cloud Brokerage/Cloud Broker:

- The cloud broker is defined as “an entity that manages the use, performance and delivery of cloud services and negotiates relationships between cloud provider s and cloud consumers”.
- The cloud broker “might be software, appliances, platforms or suites of technologies that enhance the base services available through the cloud. Enhancement will include managing access to these services, providing greater security or even creating completely new services

Cloud Brokerage/Cloud Broker:



- (Fortis, 2014)

Cloud Brokerage/Cloud Broker:

- **Cloud service intermediation**: is related with various means for enhancing services, including SLAs and QoS- related activities, security and identity management support, managed access to cloud services, and others.
- **Service aggregation**: The CSB is identified as being able to retrieve, combine and integrate multiple services in one or several services. During the aggregation process, new services could be offered, together with the necessary means for data integration and security between the cloud consumers and multiple cloud providers.

Cloud Brokerage/Cloud Broker:

- **Cloud service arbitrage** In the case of service arbitrage, the cloud broker has the ability to dynamically choose services during the aggregation process. Different agencies and/or service repositories could be used for this process, in relation with some specific selection mechanisms.
- **Resource monitoring:** any cloud management solution must offer the monitoring of the provisioned cloud resources either by using vendor specific APIs to retrieve monitoring information or by installing custom software to achieve it. Monitoring is in close relation with SLA management and application reconfiguration;

Cloud Brokerage/Cloud Broker:

- **SLA management:** involves the storage, modification and retrieval of brokered SLAs which happens upon provisioning, monitoring or reconfiguration of the cloud application;
- Application reconfiguration: is focused on analyzing monitoring information (metrics) and correlating it with information found in SLAs (policies) in order to trigger application reconfiguration: scaling up or down, replacing resources which breached SLAs.

Cloud management divided into sub components

Managing the Cloud Infrastructure

- The infrastructure of the cloud is considered to be the backbone of the cloud.
- The core of cloud management is resource management.
- Resource management involves several internal tasks such as resource scheduling, provisioning, and load balancing.
- Poor resource management may lead to several inefficiencies in terms of performance, functionality, and cost.

Different infrastructure management models/projects

- REST, architectural style for distributed hypermedia systems
- Fundamental principles of REST are:
- each resource is referenced using a uniform resource identifier (URI),
- (ii) resources are manipulated by only four major HTTP methods; GET, PUT, DELETE, and POST,

Different infrastructure management models/projects

- (iii) each interaction with a resource is stateless. REST can enhance existing management systems since resources in REST can model managed elements such as computing/network/storage resources, and the four methods in REST can replace full operation of management systems.

Different infrastructure management models/projects-Papaya

- is an IaaS management platform is based on Eucalyptus, Libvirt management Library, SNMP (Simple Network Management Protocol), Virtual Machine Monitor (VMM) for managing and monitoring cloud. Papaya helps enterprises to manage and monitor physical resources, virtual machines, virtual machine images, virtual machines' status etc. in their private cloud

Different infrastructure management models/projects- OpenNebula

- Virtual Infrastructure Management (VIM), the dynamic orchestration of VMs is a key component to provide users with the same features found in commercial public/private/hybrid clouds. The system VM provides a complete system platform that supports the execution of a complete operating system (OS). The VM life cycle has six phases: create, suspend, resume, save, migrate, and destroy.

Cost of Management

- The cost is a very important criterion as far as the business prospects of the cloud are concerned. On the part of the service providers, if they incur less cost for managing the cloud, then they would try to reduce the cost so as to get a strong user base. Therefore more customers will subscribe at a lower price
- If the cost of resource management is high, then definitely the cost of accessing the resources would be high and the user bears the burden there reducing the number of clients

Managing the Cloud Application

- Business companies are increasingly moving applications on cloud platforms to improve agility or to meet dynamic requirements that exist in the global market. However this shift of applications to the cloud environment brings new complexities.
- The composite nature of cloud applications requires visibility into all the services to determine the overall availability and uptime.

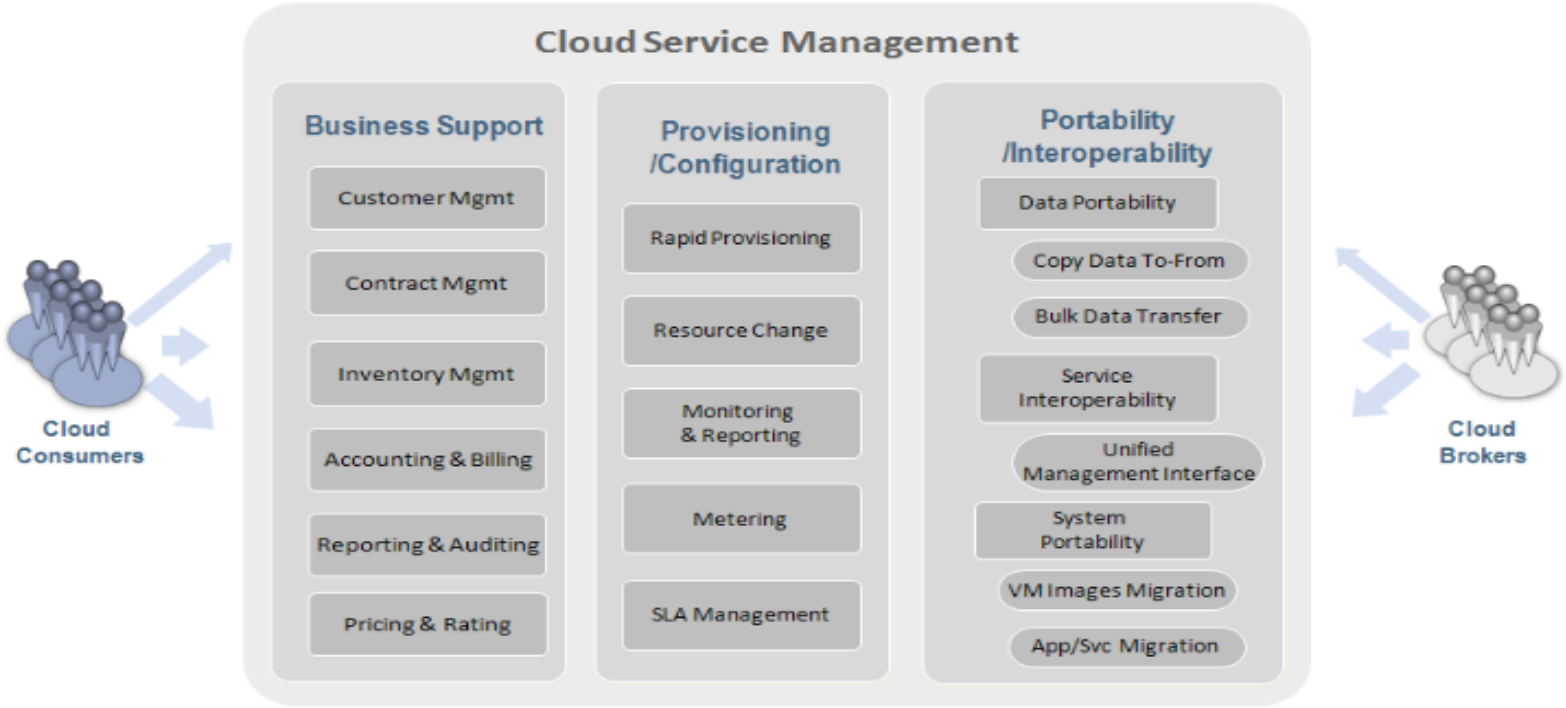
Cloud application management

- is to address these issues and propose solutions to make it possible to have insight into the application that runs in the cloud, as well as implement or enforce enterprise policies like governance and auditing and environment management while the application is deployed in the cloud.

Cloud Service Management

- Cloud Service Management includes all of the service-related functions that are necessary for the management and operation of those services required by or proposed to cloud consumers.
- Cloud service management can be described from the perspective of business support, provisioning and configuration, and from the perspective of portability and interoperability requirements.

Cloud Service Management



- (Liu, 2011)

Business Support

- Business Support entails the set of business-related services dealing with clients and supporting processes.
- Components used to run business operations.
- **Customer management**: Manage customer accounts, open/close/terminate accounts, manage user profiles, manage customer relationships by providing points-of-contact and resolving customer issues and problems, etc.

Cloud Service Management

- **Contract management**: Manage service contracts, setup/negotiate/close/terminate contract, etc.
- **Inventory Management:** Set up and manage service catalogs, etc.
- **Accounting and Billing:** Manage customer billing information, send billing statements, process received payments, track invoices, etc.
- **Reporting and Auditing:** Monitor user operations, generate reports, etc.

Provisioning and Configuration

- **Rapid provisioning:** Automatically deploying cloud systems based on the requested service/resources/capabilities.
- **Resource changing:** Adjusting configuration/resource assignment for repairs, upgrades and joining new nodes into the cloud.
- **Monitoring and Reporting:** Discovering and monitoring virtual resources, monitoring cloud operations and events and generating performance reports.

Provisioning and Configuration

- **Metering:** Providing a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts).
- **SLA management:** Encompassing the SLA contract definition (basic schema with the QoS parameters), SLA monitoring and SLA enforcement according to defined policies.

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