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HYBRID CLOUD ARCHITECTURE METHODOLOGY FOR BETTER QUALITY OF SERVICE

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I. INTRODUCTION

It has been observed a huge shift in distributed computing, where virtual machines and enormous data centres have replaced desktops and personal computers as the main players, is cloud computing. The main characteristic of clouds is their infrastructure and ability to deliver services through the internet. Their systems software and hardware in data centres offer these services. With ubiquitous and wireless networking, lower storage costs, and ongoing advancements in web computing software, this makes clouds possible. Customers will have access to value-added services everywhere at lower rates, with optimal resource use, etc. Virtualization is currently used as the technological control mechanism for cloud computing infrastructures and services.

Cloud services in the form of Infrastructure-as-a-Service (IAAS), Platform-as-a-Service (PAAS), or Software-as-a-Service (SAAS) are made available to the clients, and they pay only for what they use. Customers request cloud services, which are then dynamically assigned to them. Because cloud workloads can be managed differently depending on their nature, clouds should be able to do so easily. The architecture of the cloud is made to be adaptable when tuning with loosely coupled CPU clusters. [1]

Pay-per-use services are offered to customers in a cloud computing environment. Shared assets, information, and tools make up the services. Infrastructure, software, platforms, networks, security, and other services are used to deliver these services.

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a) Cloud Service Providers:

In a cloud system, everything is offered as a service. Customers receive each of these services based on their individual needs. Each customer has a unique set of needs. Thus, one of the service providers takes action. The following three service providers operate in a cloud environment:

1. SAAS (Software As A Service): This service provider enables the use of all kinds of software without even requiring that it be installed first.

2. PAAS (Platform As A Service), where a customer can access all platforms without having to build them from the ground up.

3. IAAS (Infrastructure As a Service) is a service provider that offers infrastructure resources such domain servers, email servers, storage, and servers. IAAS on demand can offer a variety of operating systems or software without charging exorbitant licence fees.

b) Cloud Deployment Models:

The following deployment models can be used to deliver the aforementioned services:

1. Private Cloud: This kind of cloud deployment model is created specifically and solely for the company's clients, and no other clients are permitted access. Although it is a very economical model, the majority of customers choose it because of the security it offers.

2. Public Cloud: Any kind of consumer can access public cloud infrastructure anywhere. Midsized businesses adopt this deployment approach for a variety of reasons, despite the fact that security is still a concern.

3. Hybrid Cloud: This cloud deployment paradigm combines one or more private clouds with public clouds in a powerful way. Because it enables data to go from private cloud to public cloud as and when necessary, hybrid cloud might be seen as the greatest answer to the interoperability problem. The best features of both private and public clouds are provided by hybrid clouds, which provide security, dependability, and scalability. The best thing is that hybrid clouds greatly

increase cost advantages.[2] [3]

4. Community Cloud: Public clouds are primarily created to fulfil the needs of the vast majority of users. However, due to security requirements, not every firm can utilise public cloud. Yet not every cloud provider can afford private clouds. Community clouds, in which organisations share cloud service provider services, are a recent shift from private clouds (CSP). Additionally, for security and privacy concerns, every organisation has its own private cloud.

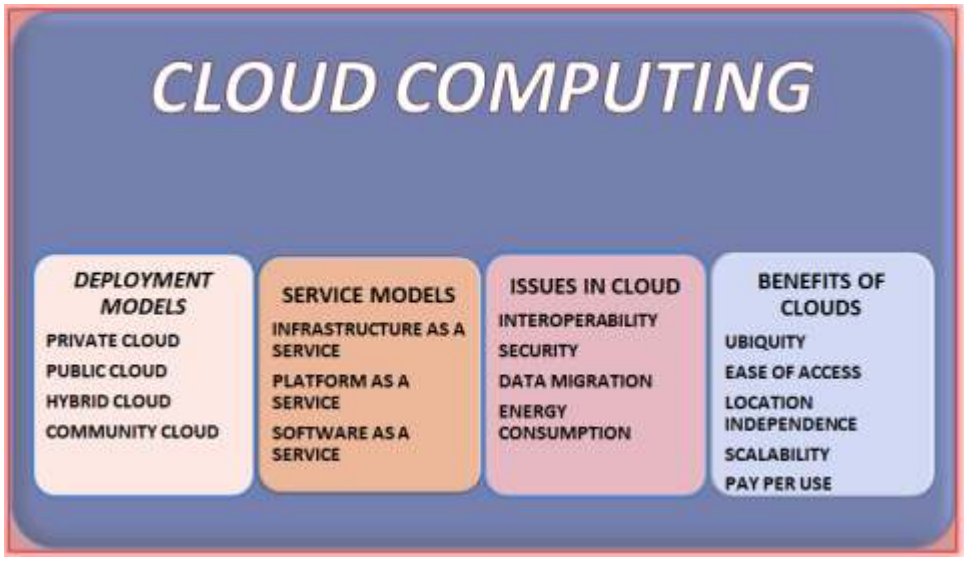

Figure1: Cloud Computing Overview

a) Hybrid Cloud Models: There are several hybrid cloud models as follows:

1. Traditional Hybrid Cloud: This is a combination of public and private cloud that operates independently but communicates with each other through encrypted connection. Organizations can use the public for non-sensitive workloads while maintaining their critical workloads in private cloud effectively.

2. Cloud Bursting: This model enables organizations to scale in their private clouds to public clouds during peak usage through a threshold.

3. Edge Computing : This model enables the organizations to process data closer to the source, reducing latency and improving performance.

4. Multi-Cloud: This model enables organizations to use multiple cloud

providers to achieve cloud interoperability and thereby avoiding vendor lock-in. [4]

Each cloud model has its own benefits and disadvantages and organizations choose to use the above models according to their own requirements and utilizations.

I. REVIEW OF LITERATURE

Guruh Aryotejo et al. in their paper discuss that as some Cloud Service Providers (CSP) could decrypt customer data, the majority of firms have poor levels of awareness regarding data security risks. Because the Hybrid Cloud Deployment Model (HCDM) is open source and one of the secure cloud computing models, it may be able to address data security challenges. Designing, deploying, and evaluating an HCDM as Infrastructure as a Service is the goal of the project (IaaS). A real server and node were constructed during the implementation phase using the Metal as a Service (MAAS) engine as a foundation. Due to its open source nature, the hybrid cloud deployment architecture is one of the most secure cloud computing models. Also, this study will provide as a foundation for subsequent research on the hybrid cloud deployment model, which may be important for resolving significant security concerns of IT-based startup enterprises, particularly in Indonesia. [4]

Ilango Sriram, Ali Khajeh-Hosseini, focused on creating standards and allowing interoperability, and describes ways of designing and building clouds. A deep technical aspects of advances in cloud computing is done here. Technical aspects which contribute to the advent of new technologies in cloud are reviewed here. Advances in introduction of protocols, interfaces and standards also the techniques of modelling clouds along with the use cases of cloud computing are discussed briefly in this paper. Various definitions of cloud computing were discussed and the NIST working definition by Mell and Grance was found to be the most useful as it described cloud computing using a number of characteristics, service models and deployment models.[5]

Menatalla Ashraf Fawzy Kamel in his thesis “Vendor Lock-in the transition to cloud computing platform” focuses on vulnerability issue of vendor lock-in while transition in cloud computing platform. The researcher considers a company

SCANIA IT which faces problem of vendor lock-in in cloud computing. The results are calculated based on a case study of a similar company that moved to another cloud provider specifically Microsoft Azure and also an interview of Microsoft Azure of its view of risks involved in vendor lock-in. The results show that there are various risks involved in vendor lock-in while migrating in clouds. The thesis also provides recommendations to the various problems involved in vendor lock-in.[6]

Alirezi Ghobadi, Koozbeh Karimi, Farnaz Heideri, Masoud Samadi in their paper discussed the advantages of using cloud computing right from resource reuse to secured and varied access to various cloud platforms. But according to the authors view, reliability is the biggest issue while reuse is considered of the resources. According to the authors Reliability, Performance and Security are the three important issues which are still understudied in cloud computing environment. This is a survey paper with respect to reliability, performance, and security and also the solutions discussed till now. [7]

Prof K. K. Joshi, Sunny Nandwani et. al. in the paper thoroughly discussed the major advantages and short coming of cloud computing. The study focuses mainly on the Service Broker Policy with respect to load balancing algorithms. The authors have proposed many solutions by comparing various load balancing algorithms using Cloud Analyst toolkit and studied the response time with respect to load balancing and service broker policy.[8]

Jitendra Singh in the paper "Study of Response Time in Cloud Computing" suggest that response time should be considered as QOS parameter. Response time has dependency on broker service policy, load balancing technique and scheduling algorithm. The research work was done by conducting an experiment to determine the dependency of response time on broker service policy and number of data centres. Results obtained revealed that among three broker service policies i.e. closest data centre, optimum response time and re-configure dynamically with load; closest data centre has the best performance over other broker policies considered. To determine the data centre performance, when we increased the number of data centre, response time reduced proportionally up to a certain level before reaching to almost constant value. Response time can be

substantially reduced by selecting the appropriate type of broker service policy.[9]

A. Shrinivasan et.al. in their paper have done a analytical literature review that also includes talks and proposals about cloud computing and its networks. It introduces cloud computing and details its development as well as its advantages. The study also goes into detail and categorises the cloud computing principles, which sheds light on how far the technology has come and how effective it is in many industries. The research finds a number of industries where cloud computing has been widely accepted, as opposed to other industries that have not yet experienced its benefits. In addition to an in-depth examination of SkyDrive, hybrid cloud computing, and how it works, the article contrasts and analyses a variety of cloud computing tools, including DropBox, Google Drive, and SkyDrive. [10]

II. METHODOLOGIES USED

Cloud computing uses many standard techniques which form basis of cloud modelling. Some of the standard cloud methodologies with respect to modelling cloud are as follows:

1. Virtualization: According to the virtualization technique, the operating system is separated from the hardware's underlying resources and capabilities. One physical computer is divided up into several logical computers through the process of virtualization, each of which can run its own set of guest applications. By adding a thin layer of the hypervisor known as the virtual machine monitor, virtualization can be deployed at the server level. The access to resources is multiplexed by the hypervisor, enabling efficient sharing of the many logical resources. There are many different techniques to implement virtualization, therefore the guest operating system and host operating system do not have to be identical. [11]

2. Intercloud Technology: The Intercloud concept came into existence because of the fact that a single cloud does not have enough physical resources or it does not support ubiquity. A cloud provisions the clients with computational and storage resources in the form of infrastructure and even to clients ubiquitously. Thus cloud enables the users by providing various services in the form of platform,

software, and infrastructure. The Intercloud technology provides solutions to users where the user can take advantage of the host cloud as well as the federated other clouds also. The intercloud architecture works very similar to internet where a service provider would provide services to the user at a definite geographical location with the use of specific Internet routing protocols with other service providers because it has voluntarily established relation to share resources.[12]

3. **Data Migration Techniques**: Data migration is the process of moving data between different types, formats, or computer systems. Data transfer is a crucial element to take into account. To achieve computerised migration, data migration is carried out programmatically, freeing up human resources from laborious duties. Many events, such as server or storage equipment replacements, maintenance or upgrades, application migration, website consolidation, and data centre relocation, result in data migration. Data from the old system is mapped to the new system using a design for data extraction and data loading to accomplish an efficient data migration process. Data extraction, where data is read from the old system, and data loading, where data is loaded onto the new system, are the two bare minimum phases of the data migration process. [13]

4. **Cloud Burst Techniques**: A hybrid cloud approach combines both private and public clouds, enhancing the effectiveness and benefits of cloud computing. This pairing is useful since we are investigating both the scalability and cost-effectiveness of public clouds as well as the security of private clouds. In order to ensure continuous service provisioning, data would initially be transmitted to a private cloud and then forwarded to a public cloud as soon as a threshold was reached.[13][14]

III. DESIGNING OF HYBRID CLOUD MODELLING:

This research effort suggests hybrid cloud as a potent remedy to the interoperability issues between public and private clouds. Hybrid clouds combine the strengths of public and private clouds to effectively address all problems and reap the benefits of both clouds' advantages. [10] As working with clouds in the

actual world is impractical due to the high costs involved as well as other factors, cloud simulators like Cloudsim, Cloud Analyst are used to study cloud modelling and interoperability.[15]

Proposed Hybrid Cloud Methodology

Modelling Hybrid cloud methodology involves following steps:

1. Model a Hybrid cloud with a combination of private and public cloud data centres.
2. The modelling mainly depends on the idea that the private clouds are smaller, limited accessible and of higher configuration whereas the public clouds are bigger in size and of lower configuration.
3. The size of the public or private cloud would be decided by number of virtual machines in the clouds and the configuration would be decided by the number of hosts in that cloud.
4. Private cloud would have more number of hosts and public cloud would have less number of hosts.
5. Private cloud would be accessible to the users of that specific region only whereas public cloud would be accessible to the users of any region.
6. The request sent by the user or customer is first by default sent to the private cloud and then on reaching a threshold is dynamically sent to public cloud if need be.
7. The basic hybrid cloud framework involves initially a private cloud with higher number of hosts and lower number of virtual machine and two public clouds with more number of virtual machines and lower number of hosts per region.
8. The most important part of hybrid cloud is the service broker policy which is the key role player that enables interoperability.
9. The last component of hybrid interoperability framework is the VM load balancing algorithm which selects the ideal virtual machine for allocation of job according to the need of the user.
10. The hybrid interoperability framework is mainly modelled region wise that is

across the world and hence the region wise time slot is varying.

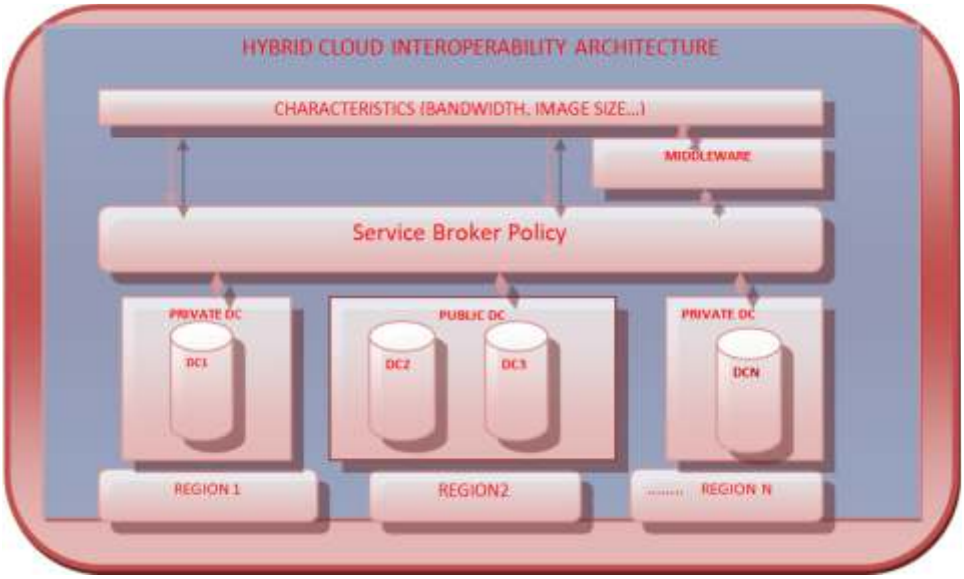

Figure : Hybrid Cloud Model

I. WORKING PRINCIPLES OF HYBRID CLOUD MODEL

The principle behind the framework is that the modelling of hybrid cloud would fully focus on the interoperability issues and hence the operating of framework would start with data first moving to private cloud which is small but powerful cloud and then according to the need of the user the requests are dynamically routed to public clouds which are big, easily accessible but less efficient.

Interoperability is very well supported by hybrid cloud where data centre brokers are the key interoperability enablers. Any request from the user is first processed by the data centre brokers who apply efficient service broker policies and redirect the request to appropriate data centre for resource provisioning. Each data centre consists of number of hosts and a pool of virtual machines which are allocated with the user request. The implementation of hybrid cloud enhances interoperability by solving the interoperability issues like data migration, work load management and load balancing.

The proposed framework while providing interoperability affects the following parameters:

1. Resource Utilization
2. Power Consumption
3. Throughput(Lower Response time suggest more throughput)
4. Data centre Processing Time
5. Grand Total Cost
6. Debt Value.

Figure 3: Snapshot Of Hybrid Cloud Model In Cloud Analyst

CONCLUSION

Hybrid cloud architecture offers several advantages over traditional cloud architectures. The hybrid cloud offers better flexibility with the help of cloud burst technique, scalability in terms of shifting from public to private cloud and optimised cost due to the combination of public and private clouds. The study also shows that hybrid cloud is an effective solution for better quality of service. By using hybrid cloud models such as cloud bursting, edge computing, and multi-cloud, organizations can overcome the challenges and achieve better cloud interoperability.

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