



A New Computing Environment Using Hybrid Cloud

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Abstract

Cloud computing is commonly used for the delivery of software, infrastructure and storage services over the internet. The delivery of services can be done in the private cloud or public cloud. Private cloud resources will be within our data center and it is a secure environment where only specified client can operate. Public cloud resources are provided in a virtualized environment, which provides a pool of shared resources. Hybrid cloud is integration of private, public and in some cases community cloud to perform unique functions within the same organization. Small and medium scale organizations cannot effort to setup IT infrastructure so hybrid cloud is one prominent solution for them. This paper deals with the hybrid cloud computing and architecture of the hybrid cloud computing. The paper also depicts advantages, disadvantages, challenges and differences in hybrid cloud computing implementations.

Keywords: cloud computing; Hybrid cloud computing; Security; Architecture of hybrid cloud computing.

1.0 INTRODUCTION:

Cloud Computing refers to the applications delivered as services over the Internet and the hardware and system software in the data centers that provide those services (Software as a Service -SaaS). The cloud storage, is mainly used for the data which is not structured and it is growing fast and vast in content. In

cloud storage the structured data is less suitable, which lives on traditional enterprise data storage [1][2].

1.1 Building blocks of cloud computing:

1.1.1 Storage-as-a-service (SaaS): Storage as a Service is a business model. Third-party providers such as large companies to small and medium companies rent space on SaaS storage to end users so that providers lack the capital budget and maintain their own storage infrastructure on the cloud.

Physical storage exists remotely but logically it is used as a local storage resource to any application. It is cost effective model, whenever we require the amount of disk space, it can be expanded and pay as we use also we can reduce the disk space and thereby decrease the cost. Maintenance of hardware is not needed [2].

1.1.2 Database-as-a-service (DaaS): DaaS is the latest entry into the "Service" which typically provides required tools for defining logical data structures, data services like APIs and web service interfaces, customizable user interfaces, and data storage, backup, recovery and other export policies. Two real-world examples of DaaS are Salesforce.com and Force.com, which provides data services in its toolkit for building various applications [2].

1.1.3 Information as a service(IaaS): IaaS is defined to provide standards and secure methods to create, control and exchange useful information from all accessible data in the correct format at a correct time.

The various benefits of IaaS are reduction in time, cost and complexity of storing data in different locations.

1.1.4 Platform as a service (PaaS): Platform as a service is not a single technology. It is a collection of services where users can create and deploy software on the cloud. The technologies are growing rapidly. The PaaS offerings include features such as simple APIs, forms and databases. It gives benefits to application developers such as users don't have to invest in physical infrastructure, flexibility, security, resource metering, teams in various locations can work together[2].

1.1.5 Security as a service (SECaaS): Now-a-days the data in the cloud has more security and privacy issues. In Security as a Service provides maximum security to the enterprises who keep their confidential data in the cloud. Security as a service protocol gives the user a chance to define their data in secure, by dividing the user data into small portions called chunks [2][6].

1.1.6 Testing as a service (TaaS): Cloud computing give offers i.e., testing as a service for SaaS, clouds, and cloud-based applications. TaaS brings new business opportunities, challenges, and demands in innovative service models, testing techniques, QoS standards, and other requirements.

1.1.7 Infrastructure as a service (IaaS): Infrastructure-as-a-Service represents a new model for the use of IT resources. An IaaS provider offers customers bandwidth, storage and computer power on an elastic, on-demand basis, over the Internet. The benefits of IaaS are Instant deployment, Ability to rapidly scale, Lower TCO, Predictable uptime.

1.2 Deployment models:

There are four deployment models in cloud computing:

- 1) Public cloud
- 2) Private cloud
- 3) Community cloud
- 4) Hybrid cloud

1.2.1 Public cloud:

Public cloud provides services in a virtualized environment and is constructed in a shared pool of computing resources in a shared environment such as Internet. Anyone can access the resources of public cloud and can scale their use on demand and do not need to purchase hardware to use the services [1].

Advantages are:

- Continuous availability of data
- On-demand scalability
- Easy and inexpensive setup
- No wastage of resources

Disadvantages are:

- Data security
- Privacy

1.2.2 Private cloud:

Private cloud is a distinct and secure environment only the specified client can operate. It is accessed by only a single organization or third party and may exist on premise or off premise with greater control and privacy. It is hosted in the data center of a company and provides services only to users inside that company or its partners[4].

Advantages are:

- Security and privacy.

Disadvantage is

- High cost

1.2.3 Community cloud:

It is similar to private cloud. Private cloud provides resources to only one particular organization, but it provides resources, privacy and security of two or more organizations [5].

Advantages are:

- Set up cost is low because of the division of costs among all participants.
- Knowledge shared between organizations
- Community cloud management can be outsourced to a cloud provider

Disadvantages are:

- High cost
- Bandwidth and data storage should be fixed among all community members

1.2.4 Hybrid cloud:

Hybrid cloud is an integration of private and public clouds to perform distinct functions within the same organization. Public cloud services are more cost

efficient and scalable than the private cloud. In hybrid cloud, hosted private cloud can be used for mission-critical applications and public cloud is used for non-critical data and applications.

Hybrid cloud models can be implemented in number of ways, such as different cloud providers can team up and provide integration of public and private services. Individual cloud providers can offer a complete hybrid package; organizations who manage their own private clouds can take service from public cloud service which they then merge into their infrastructure [3][8][7].

Advantages are:

- Scalability
- Cost efficiency
- Security
- Flexibility
- Disadvantages are:
- security

Cloud computing replaces the organization's physical computing environment with flexible, scalable Internet and Virtualization technology. Organizations spend capital-intensive assets for the growth of storage and processing requirements, so they can save their assets by using cloud computing.

Organizations can access computing resources based on their requirements and pay what they use to the cloud. Public cloud deployments offer compelling scale and cost considerations, most investments are in private cloud environments that afford more control and visibility for security-conscious buyers. Hybrid cloud model combines the security and performance benefits of private environments with the cost and scale advantages of public cloud services.

2.0 HYBRID CLOUD ARCHITECTURE:

Hybrid cloud is a combination of public cloud and private cloud. In private cloud, networking, infrastructure and services are owned by the organization and provided internally within the organization. Private clouds are most beneficial and give more security but require higher initial investments. Private cloud may be organized by an organization or third party. The resources in the cloud are used by only single organization and the third party members who have permission to access the cloud. It gives ability to customize the compute, storage and networking components which are suitable for specific

IT organization something that cannot be achieved so easily in the public cloud environment.

Public clouds are opposite to private clouds. Public cloud networking infrastructure and services are owned by an external provider and are accessed over internet. Public cloud provides less security compared to private cloud. Public cloud provides IT resources as services to organizations or general people via public internet. Data and processing both are done in the public cloud and here there is no on-premise integration. In hybrid cloud, organizations or users cannot know where their data is being stored. Many organizations prefer public cloud as it provides resources on-demand. In Small and medium scale industries, there is no need to set up hybrid cloud infrastructure as it costs more than their budget so they can rent the resources from cloud and access services which are suitable for their organization and pay whatever they use. Organizations will have both secured data and unsecured data so using only one particular cloud either public or private is not sufficient. The only solution is to use hybrid cloud where you can store both secured and unsecured data. The hybrid cloud architecture is as shown in the fig 2.1:

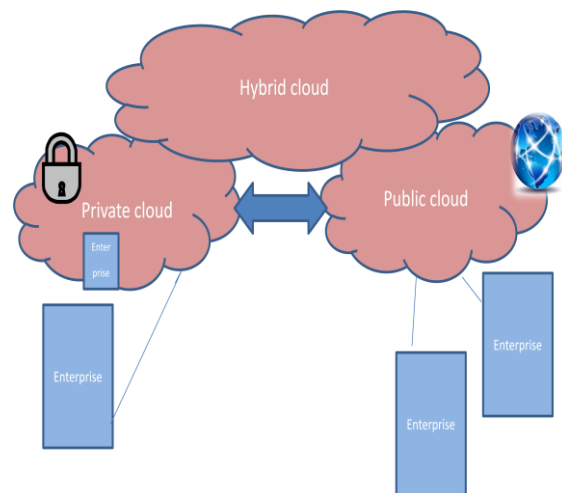


Fig: 2.1 Hybrid architecture

3.0 WHY HYBRID CLOUD

The adoption of the hybrid cloud is not only for cost reduction. It is very important to look at which cloud adoption creates a new way of business models and transactions.

In a hybrid cloud environment, some resources are managed and provisioned within an organization or

hosted in private cloud environments while others are delivered by public cloud services.

The benefit of using a hybrid cloud model is to have on-premises, private infrastructure that's directly accessible. Hybrid cloud reduces latency and access time in comparison to the public cloud services. The ability to have an on-premises computational infrastructure can support the average workload for the business.

In server design, the flexibility is enabled by building private end of a hybrid cloud. In low cost, the organization will get flexibility in using the resources available in cloud[8].

4.0 COMPARISION OF PUBLIC CLOUD, PRIVATE CLOUD, HYBRID CLOUD STORAGE

The comparison is depicted below in the table 4.1 based on the characteristics of public, private and hybrid cloud.

Characteristi c	Public cloud storage	Private cloud storage	Hybrid cloud storage
Scalability	Very high	Limited	Very high
Security	Good	Most secure	Very secure
Performance	Low to medium	Very good	Good.
Reliability	Medium, It depends on the service provider availability and connection to internet.	High, as many of the equipments are within the organization.	Medium to high, as replicated content is kept within enterprises
Cost	Pay-as-you-use	High cost	pay-as-you-use

Table 4.1 Comparison of public, private and hybrid cloud.

5.0 CHALLENGES IN HYBRID CLOUD COMPUTING:

5.1 Security:

Security is the primary challenge in hybrid cloud. Compliance, identity management, and data protection are the primary issues to plan out the hybrid cloud. Once you leave your local infrastructure, you can make sure data sovereignty policies are followed. It is better to have unique credentials and more permissions compare to your private cloud. These all considerations come under "Security" and may effect your vendor's choice and implementation plan [6].

5.2 Data and Application Integration:

It is one of the areas where organizations integrate between the public and private environments, but they face many challenges when they do. The challenges faced are the public cloud platform throttle inbound queries, which you can use the same patterns and tools to process the data without knowing where application resides in a hybrid cloud. It is best to choose the workloads and selecting host can be decided based on the nature of integration.

5.3 System Management:

In hybrid cloud, Lifecycle Management can be difficult if done incorrectly. It is difficult to do effective configuration management if the infrastructure resources are allocated across environments in a self-fashion. It is a difficult task for securing and covering all servers which are in different environments. There is a chance of changing nature of capacity and planning when it deals with elastic resource pools, but it is truly infinite. We should include the natural constraints when accessing planned usage. When we are monitoring, all environments aren't same. Only a subset of monitors is tracked in the public cloud environments that are used for capturing and many tools are required for monitoring the health of the system. It may be difficult to configure, monitor with the same tools and processes that you use for private cloud, if the network integration is not tight.

5.4 Compatibility:

The public and private clouds which are running on different infrastructure and software stacks have good scope. If we depend on a particular hypervisor we

may face difficulties when a public cloud deals with another hypervisor. The services and capabilities in a hybrid cloud vary greatly as public cloud is built inherently than any private cloud. We can check others expectations based on compatibility and face challenges.

5.5 Portability:

Portability is an important component of private cloud. The hybrid cloud can be used to move down workloads easily between hosts as business dictates. The virtual machines and applications can be moved easily between the clouds, but moving metadata and configurations between environments is a difficult task. It is based on similar platforms. But if there's any compatibility mismatch, it is difficult to handle.

5.6 Tooling and Skills:

There is a big demand for cloud and hybrid cloud skills. To find architectural skilled people it is very difficult, who deploy a successful hybrid cloud. An expert is required in a hybrid cloud for business process automation, network architecture, and application design and infrastructure configuration. The difficulty of the cultural transformation need takes advantage of private and hybrid clouds. Few of the technologies that deliver private cloud are not completely mature that many organizations find that rework is needed to meet the requirements, but it is difficult to transform the adaptations are required in utilizing the technology. Cloud services need working processes for speed and to modify the services provided. Finding new tools is another difficult task that offers same capabilities across clouds.

5.7 Setting Yourself Up for Success:

There are many difficulties faced in hybrid cloud but also we have tangible business benefits. Organizations adopt hybrid cloud as they require agility that cloud paradigm can provide. Hybrid cloud accepts discreet consideration and ongoing effort to maintain and function that delivers efficiently.

6.0 EXAMPLE OF HYBRID CLOUD COMPUTING:

In near future, you can see different platforms of the hybrid cloud.

For example:

To improve the flexibility of service offerings Biomni adopts VCHS (V Cloud Hybrid Service). Biomni is a company which provides the software and hardware to more than 1.4 million users. It also optimized to support a wide range of products which means that the infrastructure can run very efficiently. The company needed to respond to customer requests. It faced difficulties when taking order from the customer's. The company never had an environment to respond to all customers. So many people took other projects to set up the environment what they needed.

It was then the company was trying to find the best way, that it got the alert from VMware about the new hybrid cloud and immediately began to explore it. It was apparent that VCHS would allow Biomni to make use of software via the cloud but remaining within the VMware environment. The main goal of the company was to keep everything with the IT department. The VMware hybrid cloud allowed asserting control. "The hybrid cloud could solve many of the problems".

7.0 CONCLUSION:

Many organizations are moving towards hybrid cloud computing because it provides security to user data and also used for storing large amount of data. Hybrid cloud adoption is a plan for various businesses which focus on security. Hybrid cloud computing provides many services to the user based requests. If organizations want to do any changes to the system, they would modify in cloud so that existing system is not disturbed. This paper explains the integration of public and private clouds along with the challenges faced by hybrid cloud computing.

References:

- [1] Hassan, Qusay. Demystifying Cloud Computing. The Journal of Defense Software Engineering; 16–21; 11 December 2014.
- [2] Sumit Goyal. Perils of cloud-based enterprise resource planning, Advances in Asian Social Science, 3(4), 880-881, 2013.
- [3] D. Garber, J. Malik and A. Fazio. Windows Azure Hybrid Cloud, John Wiley & Sons, 2013.
- [4] Z. Zhou, H. Zhang, X. Du, P. Li and X. Yu. Prometheus: Privacy-aware data retrieval on hybrid cloud, In; Proceedings of IEEE INFOCOM, (pp. 2643-2651), April 2013

- [5] X. G. Condori. Community cloud computing, *Revista de Información Teconología Y Sociedad*, 70-72, 2013.
- [6] L. Cao, X. Liu, M. Liu and K. Han. Process-based Security Detection Approach for Virtual Machines on Private Cloud Platforms, *Journal of Networks*, 8(6), 1380-1386, 2013.
- [7] A. Tripathi and M.S. Jalil. Data access and integrity with authentication in hybrid cloud. *Oriental International Journal of Innovative Engineering Research*, 1(1), pp-030, 2013.
- [8] R.K. Grewal and P.K. Pateriya, —A rule-based approach for effective resource provisioning in hybrid cloud environment, In: *New Paradigms in Internet Computing* (pp. 41-57). Springer Berlin Heidelberg, 2013.



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