

A Review on Matching Public, Private, and Hybrid Cloud Computing Options

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I. INTRODUCTION

The Personal Cloud model is a mainstream service that meets the growing demand of millions of users for reliable off-site storage. However, despite their broad adoption, very little is known about the quality of service (QoS) of Personal Clouds. In this paper, we present a *measurement study* of three major Personal Clouds: DropBox, Box and SugarSync. Actively accessing to free accounts through their REST APIs, we analyzed important aspects to characterize their QoS, such as transfer speed, variability and failure rate. Our measurement, conducted during two months, is the first to deeply analyze many facets of these popular services and reveals new insights, such as important performance differences among providers, the existence of transfer speed daily patterns or sudden service breakdowns.

II. SECURITY ISSUES IN CLOUD COMPUTING

2.1 Cloud Deployments Models

In the cloud deployment model, networking, platform, storage, and software infrastructure are provided as services that scale up or down depending on the demand as depicted in figure. The Cloud Computing model has three main deployment models which are:

2.1.1 Private cloud

Private cloud is a new term that some vendors have recently used to describe offerings that emulate cloud computing on private networks. It is set up within an organization's internal enterprise datacenter. In the private cloud, scalable resources and virtual applications provided by the cloud vendor are pooled together and available for cloud users to share and use. It differs from the public cloud in that all the cloud resources and applications are managed by the organization itself, similar to Intranet functionality. Utilization on the private cloud can be much more secure than that of the public cloud because of its specified internal exposure. Only the organization and designated stakeholders may have access to operate on a specific Private cloud.[12]

2.1.2 Public cloud

Public cloud describes cloud computing in the traditional mainstream sense, whereby resources are dynamically provisioned on a fine-grained, self-service basis over the Internet, via web applications/web services, from an off-site third-party provider who shares resources and bills on a fine-grained utility computing basis. It is typically based on a pay-per-use model, similar to a prepaid electricity metering system which is flexible enough to cater for spikes in demand for cloud optimization.[13] Public clouds are less secure than the other cloud models because it places an additional burden of ensuring all applications and data accessed on the public cloud are not subjected to malicious attacks.

2.1.3 Hybrid cloud

Hybrid cloud is a private cloud linked to one or more external cloud services, centrally managed, provisioned as a single unit, and circumscribed by a secure network [14]. It provides virtual IT solutions through a mix of both public and private clouds. Hybrid Cloud provides more secure control of the data and applications and allows various parties to access information over the Internet. It also has an open architecture that allows interfaces with other management systems.

Hybrid cloud can describe configuration combining a local device, such as a Plug computer with cloud services. It can also describe configurations combining virtual and physical, collocated assets -for example, a mostly virtualized environment that requires physical servers, routers, or other hardware such as a network appliance acting as a firewall or spam filter.

III. DIFFERENCE BETWEEN PUBLIC, PRIVATE AND HYBRID CLOUD

Cloud computing offers many advantages for investment firms. This technology enables the sharing of resources in a way that dramatically simplifies infrastructure planning. Let's explore the major cloud computing infrastructures and the methods in which they are deployed.

With cloud computing technology, large pools of resources can be connected via private or public networks to provide dynamically scalable infrastructures for application, data and file storage. Additionally, the costs of computing, application hosting, content storage and delivery can be significantly reduced. Firms can choose to deploy applications on **Public**, **Private** or **Hybrid** clouds.

Public Clouds

Public clouds are owned and operated by third-party service providers. Customers benefit from economies of scale because infrastructure costs are spread across all users, thus allowing each individual client to operate on a low-cost, "pay-as-you-go" model. Another advantage of public cloud infrastructures is that they are typically larger in scale than an in-house enterprise cloud, which provides clients with seamless, on-demand scalability.

It is also important to note that all customers on public clouds share the same infrastructure pool with limited configurations, security protections and availability variances, as these factors are wholly managed and supported by the service provider.

A public cloud is one in which the services and infrastructure are provided off-site over the Internet. These clouds offer the greatest level of efficiency in shared resources; however, they are also more vulnerable than private clouds. A public cloud is the obvious choice when

- standardized workload for applications is used by lots of people, such as e-mail.
- Need to test and develop application code.
- Have SaaS (Software as a Service) applications from a vendor who has a well-implemented security strategy.
- Need incremental capacity (the ability to add computer capacity for peak times).
- Doing collaboration projects.
- Doing an ad-hoc software development project using a Platform as a Service (PaaS) offering cloud.

Private Cloud

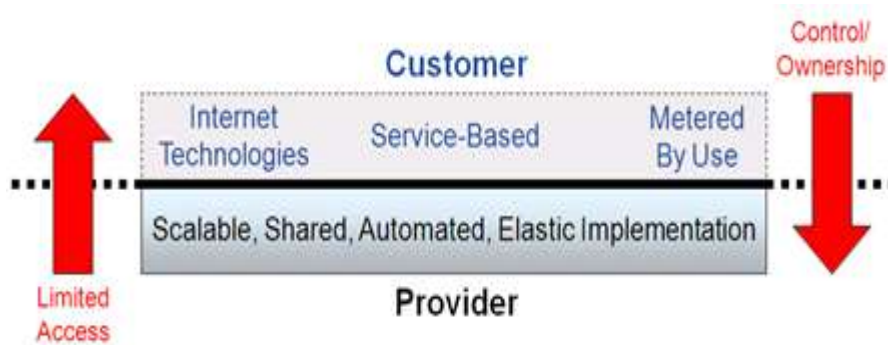
Private clouds are those that are built exclusively for an individual enterprise. They allow the firm to host applications in the cloud, while addressing concerns regarding data security and control, which is often lacking in a public cloud environment. There are two variations of private clouds:

- **On-Premise Private Cloud:** This format, also known as an "internal cloud," is hosted within an organization's own data center. It provides a more standardized process and protection, but is often limited in size and scalability. Also,

a firm's IT department would incur the capital and operational costs for the physical resources with this model. On-premise private clouds are best used for applications that require complete control and configurability of the infrastructure and security.

- **Externally-Hosted Private Cloud:** This private cloud model is hosted by an external cloud computing provider (such as Eze Castle Integration). The service provider facilitates an exclusive cloud environment with full guarantee of privacy. This format is recommended for organizations that prefer not to use a public cloud infrastructure due to the risks associated with the sharing of physical resources.

The following graphic shows the difference between customer private clouds and provider private clouds.



A private cloud is one in which the services and infrastructure are maintained on a private network. These clouds offer the greatest level of security and control, but they require the company to still purchase and maintain all the software and infrastructure, which reduces the cost savings. A private cloud is the obvious choice when

- Business is your data and your applications. Therefore, control and security are paramount.
- Business is part of an industry that must conform to strict security and data privacy issues.
- Company is large enough to run a next generation cloud data center efficiently and effectively on its own.

Hybrid Cloud

Hybrid clouds combine the advantages of both the public and private cloud models. In a hybrid cloud, a company can leverage third-party cloud providers in either a full or partial manner. This increases the flexibility of computing. The hybrid cloud environment is also capable of providing on-demand, externally-provisioned scalability. Augmenting a traditional private cloud with the resources of a public cloud can be used to manage any unexpected surges in workload.

A hybrid cloud includes a variety of public and private options with multiple providers. By spreading things out over a hybrid cloud, you keep each aspect at your business in the most efficient environment possible. The downside is that you have to keep track of multiple different security platforms and ensure that all aspects of your business can communicate with each other. Here are a couple of situations where a hybrid environment is best.

- Company wants to use a SaaS application but is concerned about security. Your SaaS vendor can create a private cloud just for your company inside their firewall. They provide you with a virtual private network (VPN) for additional security.
- Company offers services that are tailored for different vertical markets. You can use a public cloud to interact with the clients but keep their data secured within a private cloud.

IV. RESEARCH & CONCLUSION

In our work, we have reviewed cloud computing key concepts and attributes and provided a thorough background of pricing in businesses. We have presented inclusive assessments and comparisons between several recent pricing models in cloud computing. We have noted that many efficient pricing models were not implemented in real markets, although their simulation results were promising. We also noted that most pricing models in cloud computing are biased toward the

service provider. Most of them aimed to increase the service provider's revenues and decrease its costs. A better pricing approach would include attributes regarding the end user, such as user satisfaction level, QoS, end user utility, and so on. A customer satisfied with a provider's services will continue to use them in the future and recommend them to peers, which eventually results in higher revenues and popularity among customers. The customer can choose the service provider with the pricing approach that is most compatible with the customer's behavior. For example, a customer who needs to use the cloud extensively would be better off using the services of a cloud with a static pricing approach than a dynamic one because a static approach would charge less in this case. Customers with limited usage would fare better if they used the services of a cloud with a dynamic pricing approach.

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