An Introduction to Private Cloud

As the word "cloud computing" becomes more ubiquitous these days, several questions can be raised ranging from basic question like the definitions of a cloud and cloud computing to more tempting questions like architecture of cloud infrastructure and implementation of cloud computing to solve complex, data-intensive compute problems.

An existing cloud user may have been familiar with Amazon EC2, Amazon S3, Google App Engine, Apache Hadoop, Cloudera and other products from companies providing cloud infrastructure or cloud-based software and service. Some success stories of technology shift from legacy system to the cloud may have tempted institutions or companies to leverage cloud computing paradigm in their organization. However, decision over implementation of certain technology in companies should have passed due feasibility study. Concerns raised over the cloud computing are mainly related on how secure and reliable the cloud is to support enterprise-level requirements. The notion of offloading data and process to third party infrastructure or software providers in cloud computing may not be a sound idea in the enterprise realm.

The rest of this article will briefly summarize private cloud, a type of cloud environment which is designed to be run with stringent requirements that may fit the enterprise-level SLAs.

I. Private Cloud Defined

A compiled definition of private cloud or internal cloud based on [1][2][3][4][7][11] is an environment which is capable of running and implementing characteristics of cloud computing like virtualization and layered services over the network but at the same time also applies stricter policies and requirements like security, latencies, SLAs and also usage of existing datacenter resources.

A general comparison between private cloud and public cloud utilization can be seen in the following table [4].

Private Cloud	Public Cloud
Mission critical SLAs	Non-mission critical SLAs
High security and compliance requirements	More loose security and compliance requirements
Operated by corporate IT	Operated by public cloud provider
Built to maximize value of underutilize resources (compute not people)	Built to cope with limitation of scale, scope, and expertise of in-house IT

Enterprise requirements of private cloud [4]:

1. Heterogeneous support: OS, VM, storage, interconnects, etc

2. Integration with management tools: security provisioning, directory, reporting & billing, data management, management console, internal regulation, compliance, 3rd party and internal tools
3. Integration with apps and middleware: IaaS supporting SaaS
4. Support IT and business process: automate IT operations
5. Enterprise solution, not workgroup: scalability, global resources & access, dynamic evolution
6. Rapid delivery of new capabilities

However, private cloud is not always associated with enterprise cloud. Some private clouds can be formed by a smaller quantity of servers hinting smaller size of server virtualizations. Since most of cloud technologies are proprietary, building this kind of private cloud may require open source technology and interoperability with public cloud for scaling the cloud.

II. Current Solutions and Providers

Current private cloud solutions and providers can be categorized into two groups based on the availability of the solution:

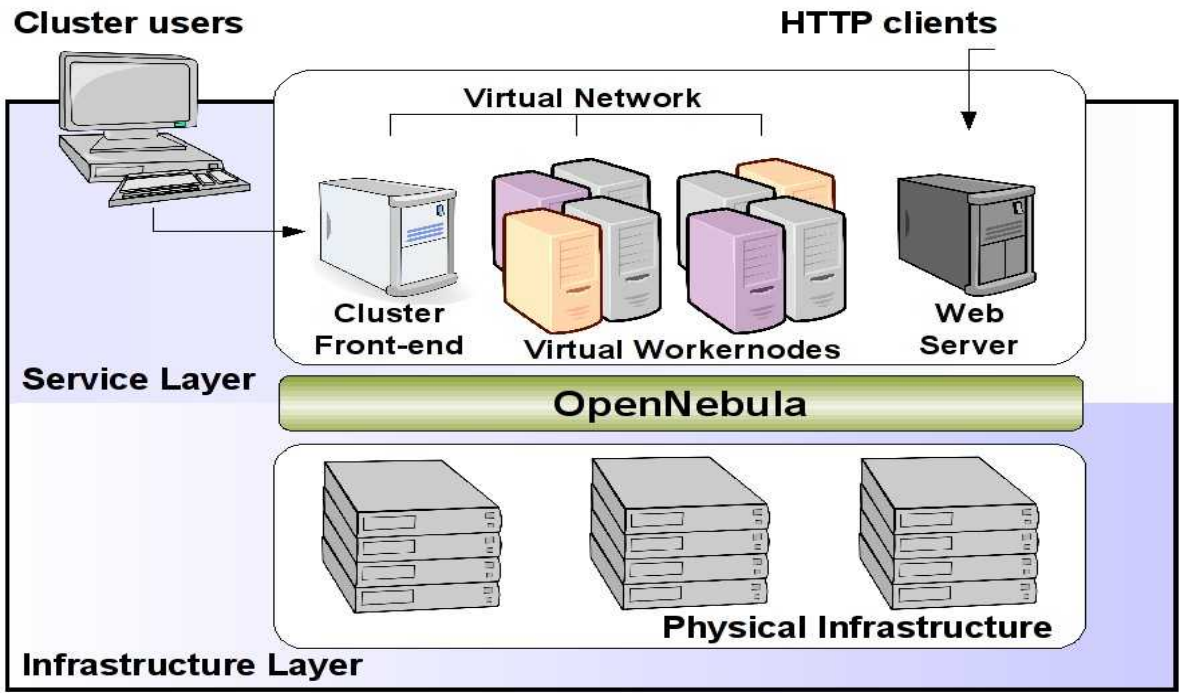
1. Open source solutions
   Sample solution: OpenNebula
2. Proprietary solutions
   Sample solutions: Amazon Virtual Private Cloud (VPC), VMWare private cloud, VMLogix LabManager

2.1 OpenNebula

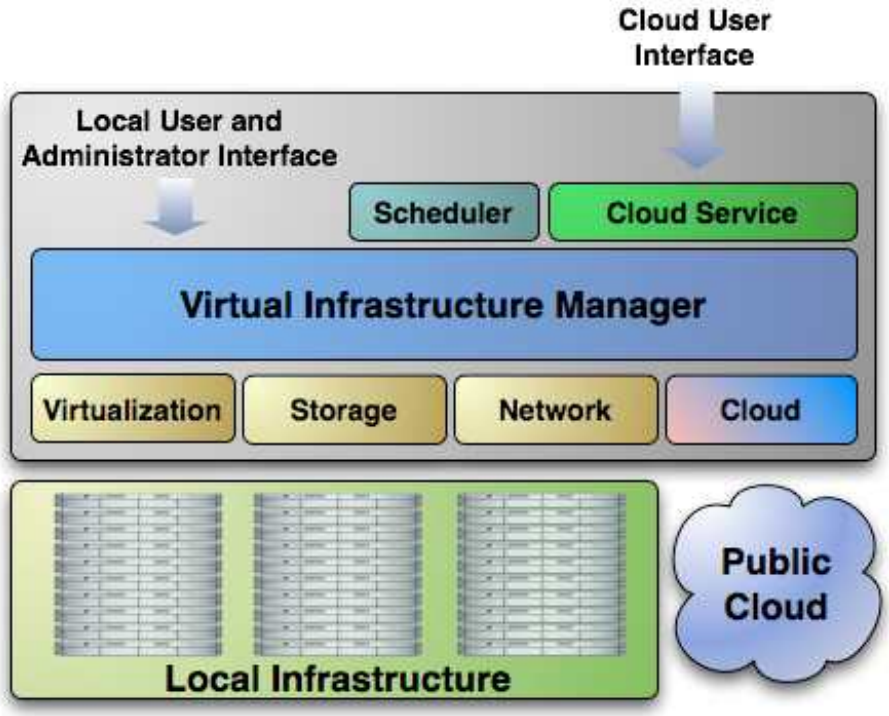
OpenNebula [6][7] is a distributed virtual machine manager which allows virtualization of the infrastructure. It also features an integral management of virtual services, including networking and image management. It has EC2 plugins which enable simultaneous deployment of virtual machines in local infrastructure and in Amazon EC2.

Open Nebula supports hybrid cloud which combines local infrastructure with public cloud-based infrastructure. It provides cloud interfaces to public clouds which expose its functionality for virtual machine, storage and network management.

Based on its functionality, OpenNebula is principally a middleware that is placed between the infrastructure layer and service layer. Its architecture can be seen in the following picture:



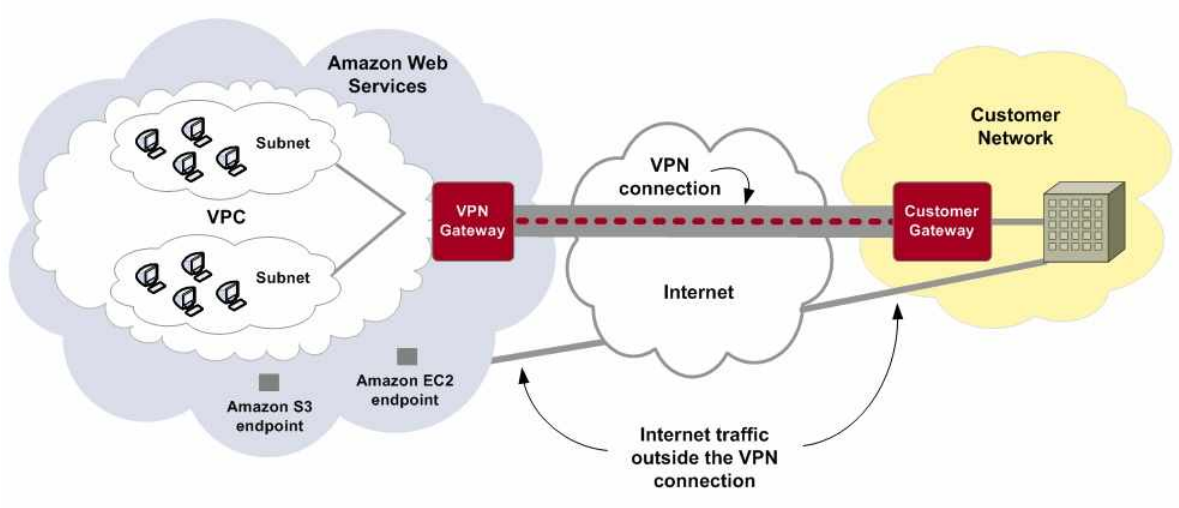
Inside OpenNebula:



2.2 Amazon Virtual Private Cloud (VPC)

Amazon Virtual Private Cloud [9][12] is a solution offered by Amazon which enables private cloud establishment in Amazon EC2 cloud environment. Through gateways on both ends, a secure connection is setup enabling

connection between two clouds. This can also be referred as public private cloud.

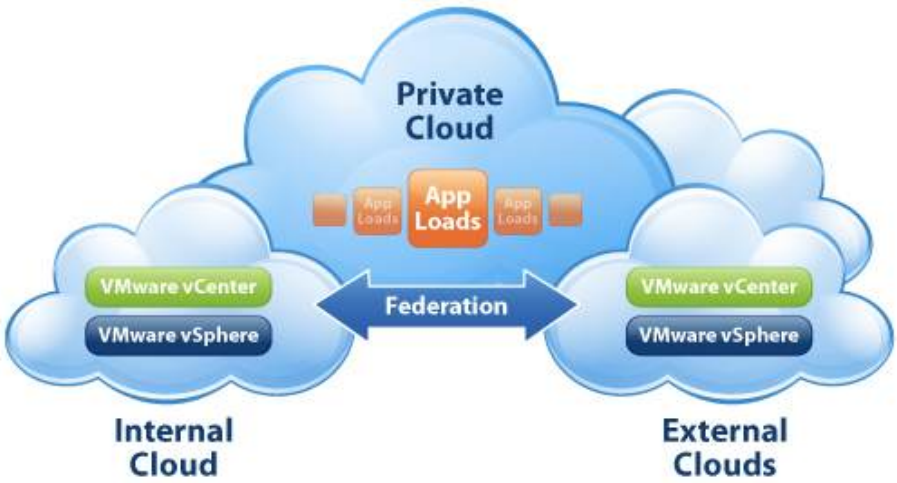


This solution opens new possibilities of cloud extension such as:

- Cloud burst: ability to add extra capacity to a private cloud without having to add more hardware.
- Lab cloud: using VPC for conducting tests
- Business continuity cloud: business continuity for failure mitigation at private cloud

2.3 VMWare Private Cloud Technologies

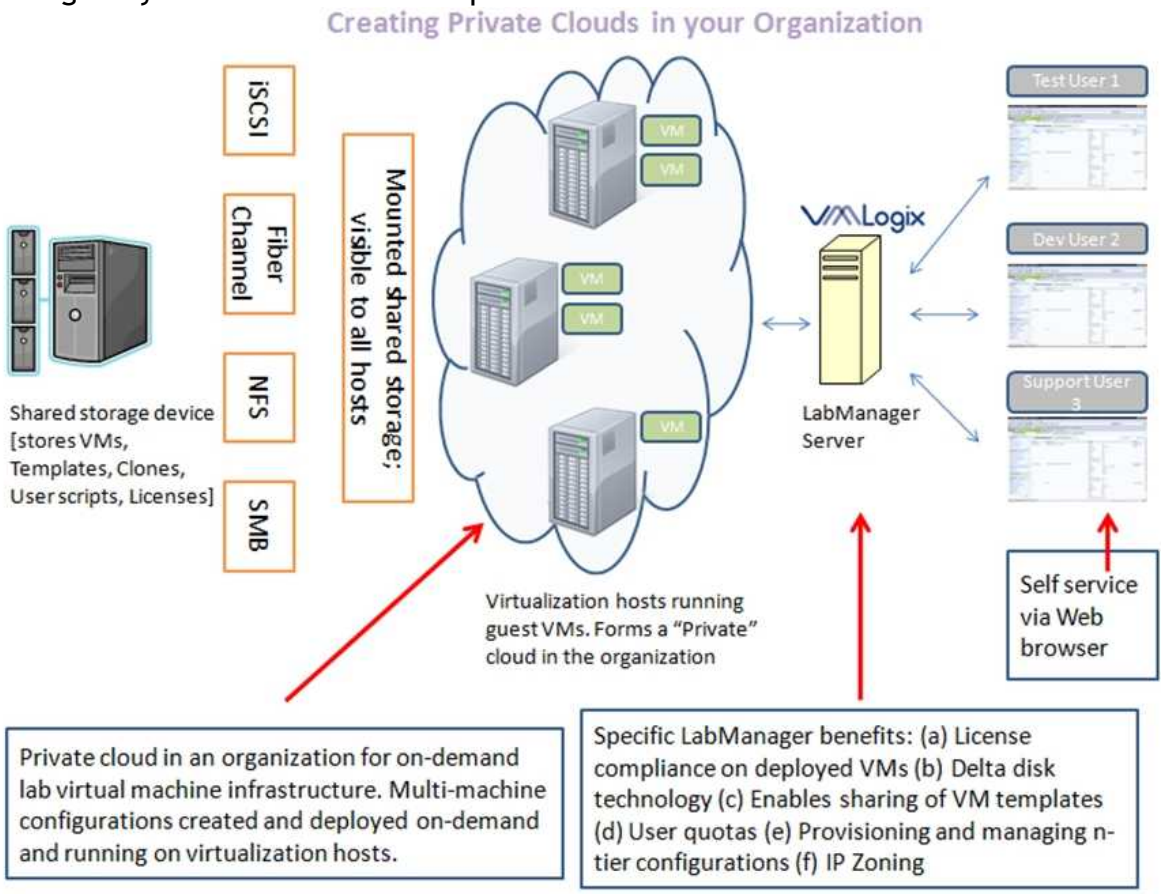
VMWare private cloud [8] consists of vCloud API technology which is applied on VMWare vCenter and VMWare vSphere. The vCloud API itself is an interface for providing a consuming virtual resources from the cloud. It enables deploying and managing virtualized workloads in internal and external clouds.



To make moving application workload among multiple clouds seamless and without downtime, VMWare and Cisco have been collaborating to ship a product named VMotion [13].

2.4 VMLogix LabManager

This solution is used to manage internal/private cloud in the enterprises. Typical deployment of VMLogix LabManager and the private cloud that is managed by it can be seen in the picture below.



In the figure, users connect to LabManager server which manages a set of virtualization hosts using a web browser. The virtualization hosts are

connected to shared storage which is used to retain VM templates, VMs, clones and other lab artifacts such as user scripts and licenses. Storage use in storage device is optimized through the used of delta-disk technology (linked clones).

Users can self-serve their infrastructure requirements through LabManager. On the other hand, LabManager administrators maintain overall policies and administration control over the deployment. This enables access and creation of virtual infrastructure without minimum or no administration intervention required.

III. Conclusion and Recommendation

Major concern in cloud computing implementation is the security and reliability of this paradigm in satisfying stringent requirements. Efforts have been made by several parties aiming at providing private cloud environment that can cope with such requirements while at the same time provides integration with public cloud so that mission critical compute tasks and process can still be conducted internally while keeping the possibility to scale computation of complex yet less mission critical processes and computation on-demand by using public cloud infrastructure.

However, the technology has yet to become mature. Enterprises and private institutions may start looking at this alternative but it is recommended to stay for a while with legacy system for handling company's sensitive data and mission critical tasks.

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