



A Survey Paper on the Evaluation Criteria of Open Source Cloud Computing Solutions

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Abstract

Cloud computing is the recent area of research where a cloud is used to access everything like data, files, software, etc. The cloud computing deploys its services to the organizations according to their requirement. Open source software is software code that is freely available and open for modification and improvement. If open source is used in collaboration with cloud computing, it adds to the productivity and applicability. There is a number of open source software available in the market. This paper provides a survey of the open source cloud solutions and also discusses the criteria for evaluating their stability, performance, and features. The primary focus of the evaluation criteria is on the components like storage, virtualization, and management.

Keywords: Cloud computing, open source software, open source cloud computing solutions, Evaluation Criteria.

1. Introduction

Cloud Computing is the emerging revolution in the field of the information technology (IT). It is internet based and provides various web-based services to the users. There are many definitions of the cloud computing, but the best suited is given by NIST [1]. According to the US National Institute of Standards and Technology (NIST) [1], “Cloud Computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction”. Figure 1 shows that a cloud is a metaphor for the internet [2].

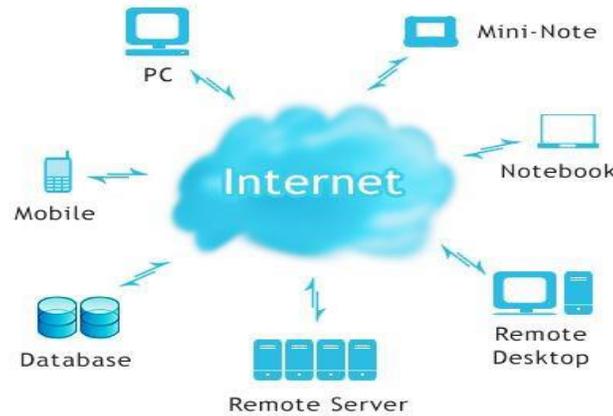


Figure 1: Internet Cloud

Thus, cloud computing provides shared resources, applications, software and resources over the internet according to demands of the user. It also helps in improving the availability of IT resources. By providing easy use of the IT resources, the Cloud computing has advantages over the other computing techniques.

1.1 Cloud Deployment Strategies

This section of the paper explains the basic cloud deployment strategies proposed by NIST [1]. A cloud can be deployed using any of the below-mentioned strategies:

Private cloud:

The private cloud infrastructure is available for exclusive use by a single organization that comprises of multiple consumers or business units. The organization owned, managed and operated it by itself, by a third party or by a combination of both. This infrastructure may exist on or off premises.

Community cloud:

The community cloud infrastructure is exclusively designed for a specific community of consumers who have shared concerns (e.g., mission, security requirements, policy, and compliance considerations). These clouds are owned, managed, and operated by the organizations in the community, a third party, or by combination of these. It exists on or off premises.

Public cloud:

This cloud infrastructure is provisioned for general public for its open use. The public clouds are owned, managed, and operated by a business, academic, or government organization, or some combination of them. But it exists only in the premises of the cloud provider.

Hybrid cloud:

The hybrid cloud infrastructure is composed of two or more distinct cloud infrastructures like private, community, or public. These clouds are bounded together standardized or proprietary technology and remain unique entities. It also enables data and application portability.



1.2 Cloud Delivery Models

This section of the paper describes the various cloud delivery models namely SaaS, PaaS, and IaaS provided by NIST [1] [9].

Software as a Service (SaaS):

The capability is provided to the consumer to use the applications running on a cloud infrastructure with little or no customizations. The applications are accessible through a thin client interface, such as a web browser, or a program interface by client's devices. In these, the consumer is not responsible for controlling or managing the cloud infrastructure, network, servers, operating systems, and storage or application capabilities. But there is an exception of limited user-specific application configuration settings.

Platform as a Service (PaaS):

The capability is provided to the consumer where they develop and deploy product onto the cloud infrastructure. These are consumer-created or acquired applications which are created using programming languages, libraries, services, and tools supported by the provider. The consumer is not responsible for managing or controlling the underlying cloud infrastructure including network, servers, operating systems, or storage. The client has control over the deployed applications and possibly configuration settings for the application-hosting environment.

Infrastructure as a Service (IaaS):

The capability is provided to the consumer to create customized application environments. There is the provision of processing, storage, networks, and other fundamental computing resources. In this, the consumer can deploy and run arbitrary software that includes operating systems and applications. The consumer has the control over operating systems, storage, and deployed applications. But limited control of select networking components like host firewalls.

2. Open Source Software

Open source software is a recent phenomenon that has revolutionized the software industry. It is developed with public collaboration and is freely available. According to Open Source Initiative (OSI) [6] Open source software is software that is freely used, changed, and shared (in modified or unmodified form) by anyone many people make open source software and distribute under license. The main elements in this definition are [4]:

1. The software must be redistributed without restriction.
2. The source code must be made available.
3. The license may require improved versions of the software to carry a different name or version from the original software.

Open Source Software (OSS) is leading in the market of some of the software categories. In the future, it is going to play a significant role in the desktop publications. It is used in many areas because it is an ethical, legal and safe use of technology [5].

Some of the advantages [5] of the open source software are:

- Lower Cost
- Freedom to use
- Interoperability
- Maximum Choice
- Openness
- Centralized Access
- Distributed Computing

Open source has provided cheap inputs and rich capabilities to the cloud service providers.



3. Open Source with Cloud Computing

There is strong synergy between Open Source Software (OSS) and cloud computing. Open source provides raw materials to build private and public clouds. There is a close relationship between OSS and Cloud Computing. Cloud computing and open-source software are bonded in a circle. Cloud computing directly benefits from the use of OSS, because it eliminates critical dependencies that can impact the service delivery model. The utilization of open source software results in mature and diverse clouds. Open source software enables cloud providers to share the code provided without an end user license agreement. Fig. 2 shows interaction of open source software with cloud computing [5].

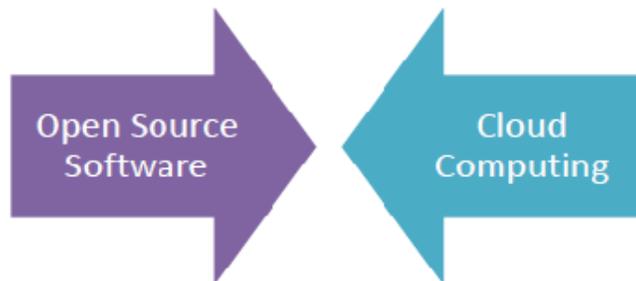


Figure 2: Open source Software with Cloud Computing

4. SOME EXAMPLES OF OPEN SOURCE CLOUD COMPUTING SOLUTIONS

There are many open source cloud computing solutions available due to the growth of cloud computing [3] [5] [4] [10] [11] [12] [13] [15]. Some popular tools are [17]:

Eucalyptus



Eucalyptus is an open source based cloud software that has the infrastructure as a service software for building private clouds that are AWS (Amazon Web Services) compatible. It is a system that provides the ability to run and control the entire virtual machine instances deployed across a variety physical resources [8] [16].

Abiquo



Abiquo is flexible open-source based cloud computing platform. It is for large organizations. It allows the customers to build rapidly and manage a fully automated and governed, public, private or hybrid cloud [19].

OpenNebula



OpenNebula is a boon for virtual machine management offerings. It is the most popular Virtual Infrastructure Manager [14] [20]. OpenNebula is an open-source toolkit used to build private, public and hybrid clouds



OpenStack



OpenStack is an IaaS offering complete open source development, and it helps companies in the development of their infrastructure solutions [7] [14] [18].

Globus Nimbus



Nimbus is an open source based cloud platform and infrastructure that delivers the power and versatility of clouds to the scientific users [21].

The open source cloud computing solutions are not limited to the contents of this section. It is the growing area of research.

However, as there are some of the cloud platforms, each having its characteristics and advantages, the question arises how to make a reasonable choice.

This paper provides a brief criterion to find a solution to this problem and for better decision making.

5. Evaluation Criteria

For evaluating the cloud platforms, there is a requirement of a standard set of criteria for comparison [22][23][24]. The criterion used is divided into six main categories: storage, virtualization, network, management, security and vendor support.

Storage criteria:

For virtual machine storage, the management and functionalities are critical to achieving flexible and scalable implementations. This criterion focuses on the technologies that implement cloud storage through direct-attached storage, storage area networks, and network-attached storage. It also involves backup features and techniques.

Virtualization Criteria:

Virtualization criteria focus on VM type and technology. It also focuses on monitoring and reconfiguration features. It is support for migration and provisioning. It provides resource prioritization, hot configuration.

Network Criteria:

Network connectivity is highly dependent on the actual implementation. It binds the cloud components together and connects it with its administrators and end-users. Its focus is on describing support for VLAN services, firewall support, Ethernet quality of service and integration capabilities.

Management Criteria:

Management is related to the way a virtual machine cloud is handled. The management criteria focus on the



integration of hardware and software, focus on host-guest OS integration, individual and mass management of hosts and guests, accounting, recovery, availability and features alert.

Security Criteria:

In the installation of the cloud, there is the significant risk of the security. It focuses on security-related capabilities such as data encryption, directory services integration, authorization levels and auditing events for specific resources for both the VM and storage servers. The security reports are available for cloud administrators, evaluation of third-party product and certifications of compliance with security standards. It also provides secure management access.

Community and Vendor Support Criteria:

The product support is divided between a user community and a vendor. Community criteria focus freely available support channels of the user or developer communities related to the product and its quality. Vendor-related criteria are concerned with direct vendor support channels. It is related to with the possibility of a SLA contract. It covers aspects of customer relations such as public issue tracking, proactive updates, and CRM-like approaches. It also includes the completeness of open-source, free product versions and related documentation. It is responsible for tracking record, future viability, and the possibility of third-party auditing.

6. Conclusion

Thus, the open source cloud computing is a flexible paradigm which has reached heights by facilitating a large number of users with unlimited services. But there is a need to evaluate the performance of the open source cloud computing solutions so that from a pool some of the best solutions can be selected for the particular purpose and according to the requirement. Thus, by using the given set of criteria the open source cloud computing solutions can be evaluated. For future, it is suggested to evaluate these solutions on the basis of the performance evaluation.

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