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Challenges in Implementing Private Cloud in an Organization

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***Abstract*— The design, execution, and advantages of creating a private cloud infrastructure using OpenStack within the context of educational institutions are thoroughly examined in this research study. IT solutions that are dependable, scalable, and economical are needed in today's educational environment to support a variety of academic and administrative purposes. The purpose of this study is to investigate how using OpenStack as a private cloud solution might meet these needs and improve the broader institutional IT ecosystem.**

***Index Terms*— Public Cloud, Private Cloud, OpenStack, Ubuntu, DevStack**

I. INTRODUCTION

The introduction sets the stage for a research article on constructing a private cloud infrastructure for educational institutions with OpenStack. It underscores the escalating reliance of educational entities on IT for administrative and learning support. The article aims to explore how OpenStack, an open-source cloud platform, can address the specific needs of educational institutions, emphasizing scalability, security, and cost-effectiveness. Key study objectives, including architectural considerations, deployment procedures, resource management, system integration, and user input, are outlined. The anticipated benefits, such as enhanced user experiences and financial savings, are emphasized, ultimately seeking to provide insights into how OpenStack may reshape IT architecture in academic settings.

A. Cloud computing

Cloud computing involves delivering internet-hosted services, utilizing virtualization to create a dynamic shared resource pool. The three primary deployment categories are public cloud, private cloud, and hybrid cloud. Public cloud, provided by external service providers, offers general accessibility. Private cloud provides businesses with personalized, efficient resource allocation and is suitable for sensitive data due to exclusive access and control over resources, aligning with organizational objectives.

B. Tools for implementing private cloud

The physical and virtual infrastructure of the private cloud are built and managed using infrastructure tools. Servers, storage, networking, and virtualization are some examples of this. Popular private cloud infrastructure tools include:

1. Open Stack :- OpenStack, a robust open-source cloud platform [1], is widely deployed in both public and private

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cloud environments, serving as infrastructure-as-a-service (IaaS) and effectively managing diverse hardware resources in data centers. CloudStack Apache [3] functions as a turnkey IaaS cloud computing platform, utilized by both public cloud vendors and organizations operating private clouds.

II. Literature Review

A. Types Of Cloud

There are four types of cloud computing: multi-cloud, hybrid, private, and public clouds. Research indicates that 89% of companies employ multiple clouds, and 80% use hybrid clouds that combine public and private cloud resources.

1. Public clouds, owned by service providers, offer accessible and cost-effective computing resources to external organizations and individuals, relieving users of infrastructure procurement responsibilities [2].
2. Private clouds, whether internally or externally hosted, are exclusively utilized by a single company, requiring significant dedication to virtualize the business environment and presenting security challenges [5].
3. Hybrid clouds, composed of distinct but interconnected private, community, or public clouds, enhance computing flexibility by allowing control over third-party cloud services, enabling dynamic adjustments based on demand [4].

B. OpenStack

OpenStack, an open-source cloud platform, centrally manages distributed computing, networking, and storage resources, enabling on-demand virtual resource supply through resource pools. Key modules like Nova, Swift, and Glance provide compute, object storage, and image management services. The compute service regulates users, networks, and instances, facilitating diverse applications such as data replication and video storage. The scalable object storage service supports applications like data access services, while the mirror service serves as an image storage and administration solution for virtual machines (VMs).

C. OpenStack Components

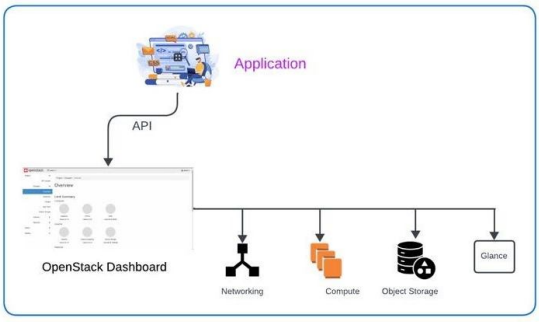

Figure 1. OpenStack Architecture

1) *Nova:* The compute service of OpenStack, known as Nova, is in charge of overseeing and setting up instances and virtual machines (VMs). It makes it possible for businesses to build and control virtualized computing resources.
2) *Swift*: For scalable and distributed storage of unstructured data, such as files and backups, Swift is the object storage service. It offers data durability and redundancy.
3) *Cinder:* Cinder provides block storage services that let users manage and attach block devices to their virtual machines (VMs), such as virtual hard drives. For VMs, it offers persistent storage.
4) *Neutron:* The networking service known as Neutron handles network resources and connects VMs to the internet. It facilitates the development of routers, security groups, and virtual networks.
5) *Glance:* The service for managing and storing virtual machine images is called Glance..
6) *Horizon:* The web-based OpenStack dashboard called Horizon provides a graphical user interface (GUI) for controlling and keeping track of cloud resources.
7) *Keystone:* Keystone is OpenStack's user and role management service for identity and authentication. Access to cloud resources is made secure.

OpenStack, with its easy customization and extension capabilities, finds application in diverse cloud computing use cases such as private business data center clouds and public cloud services.

III. Problem Statement

This user-friendly, cost-effective problem statement aims to seamlessly integrate goods and services with minimal labor, ensuring optimal functionality. The project promises enhanced security benefits by leveraging the limited physical equipment of private clouds, simplifying physical security maintenance.

IV. Proposed Methodology

OpenStack, an open-source software platform, plays a pivotal role in the suggested system's development by offering diverse services like networking, storage, and computation. Widely embraced for enterprise private clouds, its popularity among global developers stems from its open-source nature. Accessible through APIs, key services include Nova for computation, Swift for object storage, and Keystone, Horizon, and Glance for additional functionalities.

A. Installing Openstack on Ubuntu using Devstack

1. Installing Ubuntu Server: An operating system variant called Ubuntu Server was created and intended to serve as the internet's backbone.

Requirements for Ubuntu installation are:

- CPU: 1 GHz or better
- RAM : 1 GHz or better
- DISK: minimum of 2.5 GB

2. Downloading VMware Workstation Player

3. *Create Virtual Machine*: Set the environment, Make sure our system is updated by running the following command.

sudo apt - get update && sudo apt - get upgrade – y

4. Use this command to create a stack user with sudo privileges:

sudo useradd -s /bin/bash -d / opt/stack -m stack

5. Enable stack user to have root privileges:

Echo “stack ALL=(ALL) NOPASSWD: ALL” >> /etc/sudoers

6. Run command ifconfig :

Figure 2. Output of Ifconfig

7. Now that stack user has been created, execute the following command to log in to it:

sudo su – stack

8. *Downloading Devstack*: We considered you had already installed Git on your machine for this step. Enter this command now to download and clone DevStack to your PC from its repository.:

git clone https://opendev.org/opensack/devstack

The stack.sh script from the Devstack repository is what we'll use to install OpenStack. It also includes configuration file templates.

9. Creating a configuration(.conf) file: After downloading Devstack, we now need to set up its configuration files. First, we must execute in order to get to the devstack folder:

Cd devstack

Next, use this command to generate a local.conf file:

vim local.conf

And write the following context:

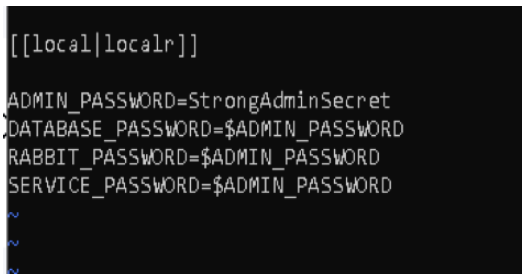

Figure 3. local.conf file

10. *Install OpenStack with DevStack*: Now that the configuration files are set up correctly, run the script with the following command to set up OpenStack on our system:

./stack.sh

The Devstack script swiftly installs key OpenStack components like Cinder, Horizon, Keystone, Nova, Glance, Neutron, and Placement. Ensuring a streamlined setup, it facilitates a user-friendly dashboard, identity services, compute resources, image management, networking, and optimized resource allocation in OpenStack deployment. Your terminal will appear as seen in the following image once the installation has completed successfully:

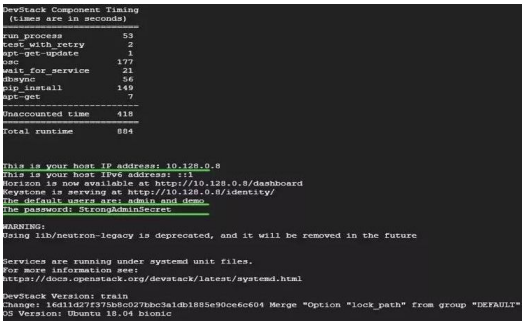

Figure 4. Output After Successful Installation

At the above URL, we can now observe that the Horizon Dashboard (Openstack Dashboard) varies depending on the system

11. Accessing Open stack using a web browser

Figure 5. Open stack Web Browser

12. Enter the credentials.

This is how your dashboard will appear after logging in.

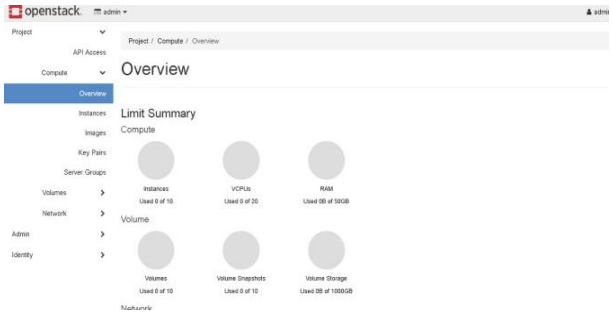

Figure 6. Open stack Dashboard

B. Error faced during Installation of Openstack

In this section, we examine common errors and problems that occur throughout the OpenStack installation procedure, shedding light on the obstacles that administrators and organizations must navigate to harness the full potential of this powerful cloud technology.

1. HttpException: 503, Unable to create the network. No tenant network is available for allocation. This error message indicates that there are no available networks for the tenant to allocate. This can occur when trying to create a new network for a project or tenant within the OpenStack cloud infrastructure. Here are some steps you can take to troubleshoot and resolve this issue:

- Check network quotas:
- Ensure that the tenant has not exceeded their network quota.

2. stack@stacknew-virtual-machine:~/devstack$ openstack network list Missing value auth-url required for auth plugin password It is clear from the error message "Missing value auth-url required for auth plugin password" that the OpenStack command-line client does not have the necessary authentication data to connect to the OpenStack API. The OpenStack API endpoint (auth url) and your login credentials (username, password, project, and domain) are included in this data.

To resolve this issue, you need to ensure that you have sourced the correct OpenStack RC file, which contains the necessary authentication environment variables.

Here are the steps to resolve the issue:

Locate the OpenStack RC File: Find the OpenStack RC file specific to your OpenStack environment. This file is usually provided to you or generated when you create or download your OpenStack credentials.

C. Error faced during creation of Instance on Openstack

1. Unable to allocate Floating IP. Details

Invalid input for dns_name. Reason: '172.24.4.123' not a valid PQDN or FQDN. Reason: TLD '123' must not be all numeric. Neutron server returns request_ids: ['req-d3fbf1c3-1f4e-4588-a5ef-edd3f32fe787'] The error message indicates that the DNS name 172.24.4.123 is not a valid Fully Qualified Domain Name (FQDN) or Partially Qualified Domain Name (PQDN).

To resolve this issue, you must provide a valid DNS name, such as my-server.example.com. The DNS name must have a valid TLD, which is typically alphabetic, such as .com, .org, or .net.

2. No valid host was found. There are not enough hosts available. Code 500 Nova OpenStack is unable to schedule instances because there are no available hosts. This error can occur for a variety of reasons, such as:

- There are not enough hosts in the cluster to meet the demand.
- Some hosts are in maintenance mode or otherwise unavailable.

To troubleshoot this error, you can check the following:

- Make sure that there are enough hosts in the cluster and that they are all available.
- Verify that the requested flavor requirements are valid and can be met by at least one of the available hosts.

3. Failed to restart nova-api.service: Unit nova api.service not found.

Failed to restart nova-conductor.service: Unit nova conductor.service not found.

Failed to restart nova-scheduler.service: Unit nova scheduler.service not found.

Here are some steps you can take to troubleshoot the issue:

- Check Nova installation: Make sure that Nova is installed on your system. In a typical OpenStack deployment, Nova is installed as part of the Nova project.

● Verify service names: Double-check the service names for Nova API, Nova Conductor, and Nova Scheduler. The service names can vary depending on the OpenStack distribution or deployment method.

V. Observation

The introduction of the research article focuses on implementing a private cloud infrastructure for educational institutions using OpenStack, emphasizing IT's significance in education and outlining study objectives, including architecture, deployment, and cost-saving benefits. It introduces other cloud tools, lists key OpenStack components like Nova and Swift, and concludes with guidance on installing OpenStack on Ubuntu using Devstack, though lacking comprehensive error resolution details.

VI. Conclusion

The document outlines the study's objectives, encompassing architectural considerations, deployment procedures, resource management, system integration, and user input, emphasizing the potential benefits of this strategy, including enhanced user experiences and financial savings. Moreover, the study aims to demonstrate how OpenStack could bring about transformative changes in IT architecture within academic institutions. The paper provides valuable insights and practical guidance for implementing OpenStack in educational environments, addressing the need for reliable and efficient IT solutions in modern educational settings.

References

[1] Nageswara Rao and S. Pratap Singh, "Setting Up A Private Cloud Using Free Open Source Software" in International Journal of Research in Advent Technology, Special Issue, NCRCEST 2019, E-ISSN: 2321- 9637, pp. 166, Available online at www.ijrat.org.

[2] S. Heuchert, B. P. Rimal, M. Reisslein, and Y. Wang, "Design of a Small-Scale and Failure-Resistant IaaS Cloud Using OpenStack," in Applied Computing and Informatics, ISSN: 2634-1964, Open Access, Article publication date: 30 September 2021.

[3] V. Raghavendran, G. Naga Satish, P. Suresh Varma, and G. Jose Moses, "A Study on Cloud Computing Services," in International Journal of Engineering Research & Technology (IJERT), ISSN: 2278- 0181, ICACC - 2016 Conference Proceedings.

[4] P. Bhide and M. Humane, "Study of Private Cloud," in International Journal of Engineering Research & Technology (IJERT), ISSN: 2278- 0181, ICIAC' 14 Conference Proceedings.

[5] Agarwal A. Venkatadri M. Pasricha A. (2018, December). Autonomic cloud resource management. In 2018 Fifth International Conference on Parallel, Distributed and Grid Computing (PDGC) (pp. 138-143). IEEE.

[6] Ma X. Yang L. T. Xiang Y. Zeng W. K. Zou D. Jin H. (2015). Fully reversible privacy region protection for cloud video surveillance. IEEE. Transactions on Cloud Computing, 5(3), 510– 522.10.1109/TCC.2015.2469651

[7] Lei Wang and Dandan Zhang, “Research on OpenStack of open source cloud computing in colleges and universities' computer room”, 3rd International Conference on Advances in Energy 2017

[8] Ramachandra, Gururaj & Iftikhar, Mohsin & Khan, Farrukh. (2017). A Comprehensive Survey on Security in Cloud Computing. Procedia Computer Science. 110. 465-472. 10.1016/j.procs.2017.06.124.

[9] Saghir, Arsalan & Masood, Tahir. (2019). Performance Evaluation of OpenStack Networking Technologies. 1-6. 10.1109/CEET1.2019.8711829.

[10] Omayma, Belkadi & Laaziz, Yassin & Vulpe, Alexandru & Halunga, Simona. (2019). An Integration of OpenDaylight and OpenNebula for Cloud Management Improvement using SDN. 10.1109/TELFOR48224.2019.8971123.

[11] https://www.globo.tech/pdf/Openstack-Whitepaper.pdf

[12] https://www.openstack.org/

[13] https://ubuntu.com/tutorials/install-openstack-on-your-workstation-and launch-your-first-instance#1-overview