Cloud Management with OpenStack

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Abstract

OpenStack, an open source cloud software project released in October 2010, enables Fortune 500 companies and government agencies to build scalable cloud computing architectures. In our research we implement and evaluate OpenStack as a cloud-computing platform targeting both high performance computing and information technology workloads. We collected data by qualitatively evaluating OpenStack's utility as well as quantitatively measuring performance gains or losses using standard benchmarking tools.

Openstack Cloud

OpenStack is a free open-source cloud computing software project. It has a modular architecture with various components. In this project we incorporated compute, dashboard, identity, image, network, and storage services. OpenStack is commonplace in service providers offering an Infrastructure as a Service (IaaS) platform. IT departments implement OpenStack as a way to offer business units and project teams cloud services. OpenStack also offers an environment that makes it useful in processing High Performance Computing (HPC) workloads. With many popular use cases, OpenStack can be configured to meet the demands of diverse and intensive workloads. This cloud offers features such as the ability to manage virtualized commodity server resources, projects and quotas, role based access control, virtual networks, cloud proxy servers, image caching for faster VM provisioning. For this project we investigated the functionality of these features.

Test Environment

An 8 node cluster comprised of:

- 6 HP compute nodes
- 1 Supermicro storage node
- 1 Supermicro Head node (head node)

All hosts running:

- 16 GB RAM
- Intel Xeon Processors
- Gigabit Ethernet
- 10 Gigabit Ethernet
- CentOS 6.4

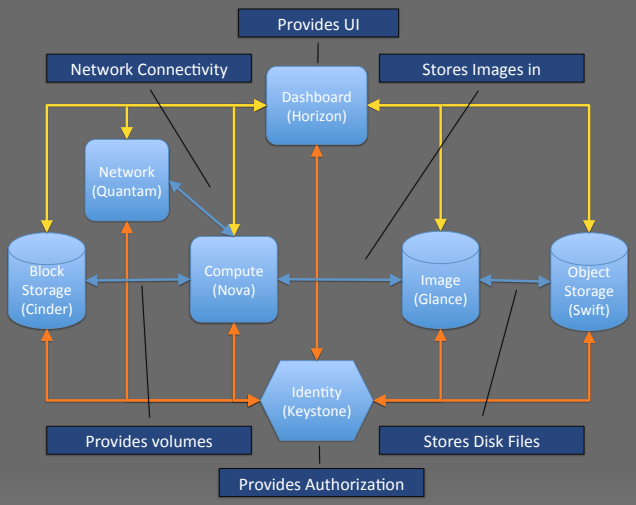

Figure 1: The figure above represents the OpenStack structure in terms of OpenStack's internal services and their interactions.

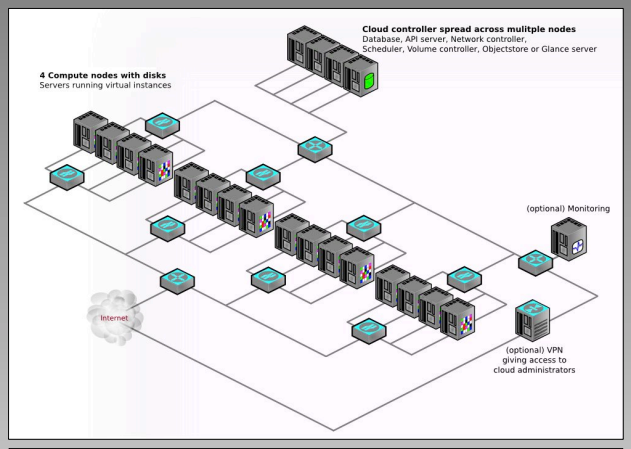

Figure 2: This figure represents a common OpenStack hardware configuration.

Results

While implementing OpenStack, we discovered that it is non-trivial to install. Our discoveries lead us to uncover problems with OpenStack failing to work properly. OpenStack requires near exclusive control of MySQL. This created conflicts with Warewulf which requires access to MySQL. This posed a threat to Warewulf and in several cases prevented Warewulf from being able to operate normally. Some services exhibited converse problems with installation. We found that manual configuration of Swift, before or after an automated installation, was difficult. However, swift functions correctly after an automated installation. Cinder's automated installation had no options to pre-configure the installation for production functionality. Cinder, however, was trivial to configure once the automated installation was complete.

Conclusions

After reviewing OpenStack's services and their documented utilities we noted that OpenStack has potential as a powerful cloud computing platform. The services, however, are complex and are not trivial to configure. OpenStack's internal services are tightly coupled with each other. This created a fragile cloud environment in which it was difficult for other applications and services to coexist.

Future Work

OpenStack, while a promising tool, requires additional testing. More time and manpower is recommended to properly configure and test the software's capabilities. We suggest that future researchers test OpenStack against traditional high performance computing clusters by performing standard benchmark tests on a virtualized cluster. One should consider testing OpenStack's failure tolerance, high availability, and live migration capabilities among other features.

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