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B. Tech (CsBs) TY

Aim

To study and implement OpenStack Cloud Platform

Case Study

Introduction

OpenStack is a cloud operating system that controls large pools of compute, storage, and networking resources throughout a datacentre, all managed and provisioned through APIs with common authentication mechanisms.

Services Provided by OpenStack

OpenStack embraces a modular architecture to provide a set of core services that facilitates scalability and elasticity as core design tenets. This chapter briefly reviews OpenStack components, their use cases and security considerations.
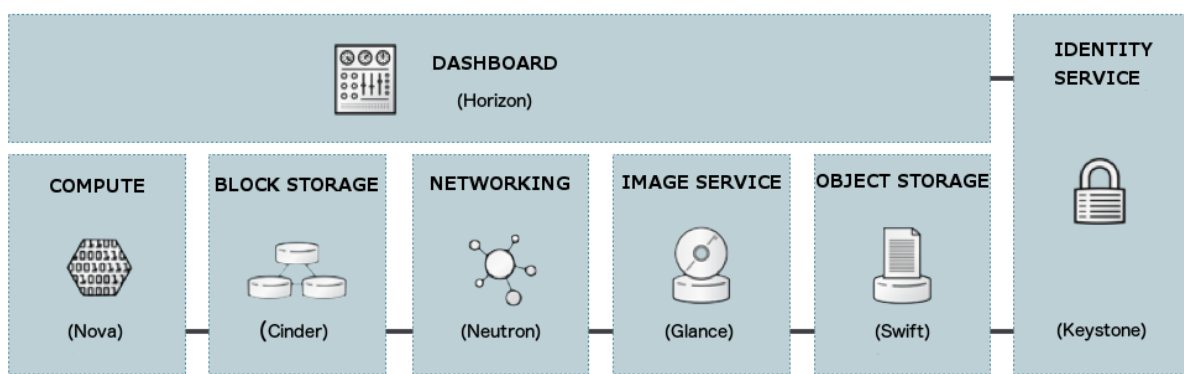
Compute

OpenStack Compute service (nova) provides services to support the management of virtual machine instances at scale, instances that host multi-tiered applications, dev, or test environments, "Big Data" crunching Hadoop clusters, or high-performance computing.

The Compute service facilitates this management through an abstraction layer that interfaces with supported hypervisors.

Compute security is critical for an OpenStack deployment. Hardening techniques should include support for strong instance isolation, secure communication between Compute sub-components, and resiliency of public-facing API endpoints.

Object Storage

The OpenStack Object Storage service (swift) provides support for storing and retrieving arbitrary data in the cloud. The Object Storage service provides both a native API and an Amazon Web Services S3-compatible API. The service provides a high degree of resiliency through data replication and can handle petabytes of data.

It is important to understand that object storage differs from traditional file system storage. Object storage is best used for static data such as media files (MP3s, images, or videos), virtual machine images, and backup files.

Object security should focus on access control and encryption of data in transit and at rest. Other concerns might relate to system abuse, illegal or malicious content storage, and cross-authentication attack vectors.

Block Storage

The OpenStack Block Storage service (cinder) provides persistent block storage for compute instances. The Block Storage service is responsible for managing the life cycle of block devices, from the creation and attachment of volumes to instances, to their release.

Security considerations for block storage are like that of object storage.

Shared File Systems

The Shared File Systems service (manila) provides a set of services for managing shared file systems in a multi-tenant cloud environment, similar to how OpenStack provides for block-based storage management through the OpenStack Block Storage service project. With the Shared File Systems service, you can create a remote file system, mount the file system on your instances, and then read and write data from your instances to and from your file system.

Networking

The OpenStack Networking service (neutron, previously called quantum) provides various networking services to cloud users (tenants) such as IP address management, DNS, DHCP, load balancing, and security groups (network access rules, like firewall policies). This service provides a framework for software defined networking (SDN) that allows for pluggable integration with various networking solutions.

OpenStack Networking allows cloud tenants to manage their guest network configurations. Security concerns with the networking service include network traffic isolation, availability, integrity, and confidentiality.

Dashboard

The OpenStack Dashboard (horizon) provides a web-based interface for both cloud administrators and cloud tenants. Using this interface, administrators and tenants can provision, manage, and monitor cloud resources. The dashboard is commonly deployed in a public-facing manner with all the usual security concerns of public web portals.

Identity service

The OpenStack Identity service (keystone) is a shared service that provides authentication and authorization services throughout the entire cloud infrastructure. The Identity service has pluggable support for multiple forms of authentication.

Security concerns with the Identity service include trust in authentication, the management of authorization tokens, and secure communication.

Image service

The OpenStack Image service (glance) provides disk-image management services, including image discovery, registration, and delivery services to the Compute service, as needed.

Trusted processes for managing the life cycle of disk images are required, as are all the previously mentioned issues with respect to data security.

The Data Processing service (Sahara) provides a platform for the provisioning, management, and usage of clusters running popular processing frameworks.

Security considerations for data processing should focus on data privacy and secure communications to provisioned clusters.

Other supporting technology

Messaging is used for internal communication between several OpenStack services. By default, OpenStack uses message queues based on the AMQP. Like most OpenStack services, AMQP supports pluggable components. Today the implementation back end could be RabbitMQ, Qpid, or ZeroMQ.

Because most management commands flow through the message queuing system, message-queue security is a primary security concern for any OpenStack deployment and is discussed in detail later in this guide.

Several of the components use databases though it is not explicitly called out. Securing database access is yet another security concern, and consequently discussed in more detail later in this guide.

Advantages of OpenStack

- Few prerequisites are needed to use it: Cloud services can be used on any device with internet access
- High data security and reliability
- Scalable storage volume and performance
- Cloud services enable collaboration
- Access is not limited by location
- High distribution and acceptance
- Uniform standards

Dis-Advantages of OpenStack

- Highly dynamic range of functions: OpenStack is an open and very dynamic cloud-computing solution. New functions are added regularly, but some other functions can also be removed.
- OpenStack does not offer any sort of organized support. A lot of documentation and helpful articles can be found online, but it can take quite a bit of time and effort to find the right ones. Unlike commercial solutions, there is no dedicated customer support.
- KVM and XEN are primarily supported as hypervisors, which can lead to problems when integrating other virtualization solutions such as VMWare. For example, users report network problems when using VMWare along with OpenStack.

Applications of OpenStack

Due to the absence of a license, using OpenStack is extremely inexpensive. Once the system has been set up, it can be easily managed. The use of virtual servers that include hosting services is already possible through a small cloud solution that costs $10 to $20 per month. That means OpenStack can be used as a platform for private cloud applications, for example, a bit like a Wiki. It can even be used to implement side-line projects or even start-up ideas, such as online shops.

OpenStack for SMBs and large companies

OpenStack is an ideal option for SMBs to get started in the cloud-computing world, as well as for the transfer of data and applications. For example, it also offers the possibility of creating a public cloud.

Rights management within the OpenStack cloud offers a wide range of possibilities for optimally managing the collaboration of various user profiles.

Large companies can transfer parts of their network infrastructure, such as particularly sensitive data or programs, and also use OpenStack within the framework of a multi-cloud approach or use it as a component of a hybrid Cloud. The failure of application servers is lower as a result since servers can be replicated as often as desired. Data is made redundant in any case in the system, so that the loss of data through hardware damage is virtually impossible.

Alternatives to OpenStack

Anyone who would prefer not to use OpenStack can replicate the required services using virtual servers or online storage, for example. Using solutions such as Owncloud or Nextcloud is also possible.

Other similar solutions are:

- **Open Nebula (free)**
- **VMWare (fee-based)**
- **Microsoft Azure Stack (fee-based)**
- **Google Anthos (fee-based)**

In addition, more and more companies are using the convenient option of using a service provider to set up and manage a cloud (managed cloud).

Conclusion

Hence, we were able to study OpenStack Cloud Platform