

## OpenStack Private Cloud Administration and Deployment

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### Course Summary

#### Description

This course covers the general administration and step-by-step installation of the OpenStack open source IAAS (Infrastructure As A Service) cloud solution, widely used for creating private clouds. After a short cloud and OpenStack primer, this course presents the architecture of OpenStack and introduces its base components and administration in detail. Components covered are the Horizon GUI dashboard, OpenStack CLI, the Keystone identity system, the Nova compute service, the Neutron network service, software-defined networking, the Glance image service, the Cinder block storage service, the Ceilometer metering solution, the Heat orchestration services, and the Swift object store. The last chapter presents typical OpenStack installation methods and explains the manual OpenStack installation in detail. Besides in-depth theoretical coverage, students also will practice hands-on exercises with all studied OpenStack components and with the installation in their own OpenStack lab system.

#### Topics

- Introduction
- Controller Node
- Cinder
- Compute Node
- Network Node
- Ceilometer
- Orchestration Service - Heat
- Object Storage Service - Swift
- Deployment

#### Audience

This course is designed for Developers, SysAdmins, and DevOps wanting to obtain working knowledge about the OpenStack open source cloud system.

#### Prerequisite

The prerequisite for this class is Basic Linux systems administration (GL250), networking, and virtualization.

#### Duration

Four Days

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### Course Outline

#### I. Introduction

- A. Cloud Computing
- B. Cloud Types
- C. Clouds – The Flip Side
- D. Overview - Life Without OpenStack
- E. Overview - What OpenStack Does?
- F. OpenStack Features
- G. OpenStack Foundation
- H. Contributing to Openstack
- I. Certified OpenStack Administrator (COA)
- J. Core Projects
- K. OpenStack Releases
- L. Distribution of Services
- Lab Exercises
  - Understanding the classroom environment
  - Perform initial health check
  - Test instance creation

#### II. Controller Node

- A. Overview Horizon and OpenStack
- B. Keystone Architecture
- C. Keystone workflow (simplified)
- D. Keystone Services
- E. Keystone backends
- F. Keystone v3 – domains/groups
- G. Keystone - User/tenant maintenance
- H. Keystone – service catalog
- I. Service APIs + keystone
- J. Troubleshooting Keystone - Cases
- K. Openstack messaging - AMQP
- L. OpenStack Messaging and Queues
- M. Messaging example with Oslo-RPC
- N. Message Queue Configuration
- O. Troubleshooting RabbitMQ - Service
- P. Message Queue Configuration
- Q. Image Management
- R. Glance overview
- S. Glance CLI overview

- T. Troubleshooting Glance - Cases
- Lab Exercises
  - Keystone
  - Glance

#### III. Cinder

- A. Block Storage
- B. Volume creation flow
- C. Volume operations
- D. Cinder CLI - create
- E. Cinder CLI – extend
- F. Cinder CLI - snapshot
- G. Cinder CLI – backup/restore
- H. Cinder – encrypted volumes
- I. Encrypted volumes - CLI
- J. Cinder quotas
- K. Troubleshooting Cinder - Cases
- L. Considerations for block storage
- Lab Exercises
  - Create volume
  - Attach volume to an instance
  - Extend a volume
  - Using snapshot
  - GlusterFS as backend for Cinder (optional)

#### IV. Compute Node

- A. Compute Terms
- B. Nova - Flavors
- C. Nova Services
- D. VM provisioning in-depth
- E. Hypervisors
- F. VM Placement
- G. VM Placement with nova-scheduler
- H. VM Placement - nova.conf
- I. Filtering Example - nova-scheduler.log
- J. Boot a VM Instance
- K. Managing VM Consoles
- L. Terminate Instance
- M. Working with host-aggregates
- N. Working with Availability Zone
- O. Examples for Scheduler Hints
- P. Post Configuration
- Q. Post-config - config-drive
- R. Post-config - cloud-init + metadata

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### Course Outline (cont.)

- S. Create/customize an Image
- T. Troubleshooting Nova-Cases
  - Lab Exercises
    - Setup
    - VM Placement
    - Instance Post Configuration
    - Image Customization
    - Migration
- V. Network Node**
  - A. Linux Networking – Linux Bridge
  - B. Linux Networking - OpenVSwitch
  - C. OpenVSwitch Architecture
  - D. Linux Networking - IP namespaces
  - E. Linux Networking - veth pairs
  - F. Linux Networking - Tunneling
  - G. OpenStack Networking Concepts
  - H. Nova-network Types (pre-grizzly)
  - I. Why Neutron? (quantum)
  - J. Networking with Neutron
  - K. The ML2plugin
  - L. Nova-network vs. Neutron
  - M. Neutron CLI Overview
  - N. OVS Neutron Plugin – Example topology
  - O. OVS Neutron Plugin – Physical layout
  - P. OVS Layout - Compute Node
  - Q. OVS Layout - Network Node
  - R. Floating IPs with OVS Neutron
  - S. Security Groups with Neutron
  - T. Troubleshooting Neutron - Cases
    - Lab Exercises
      - Neutron CLI
      - Working with Security Groups
      - Debugging Data Flows
      - Manage Network as a Tenant
      - Neutron load-balancer
- VI. Ceilometer**
  - A. Ceilometer
  - B. Ceilometer Agents
    - C. Ceilometer Data Flow
    - D. Ceilometer Meters and Pipelines
    - E. Ceilometer CLI - Samples, Meters
    - F. OpenStack Alarm CLI
    - G. Troubleshooting Ceilometer - Cases
    - H. Ceilometer Deployment Considerations
      - Lab Exercises
        - Ceilometer Health Check
        - Start Instance
        - Check VM with Ceilometer
        - Alarm Setup
- VII. Orchestration Service - Heat**
  - A. OpenStack Heat
  - B. Heat Overview
  - C. Heat Orchestration Template (HOT) Format
  - D. HOT - Basic Example
  - E. HOT – Parameters - Constraints
  - F. HOT - Parameters - Environment
  - G. Examples – Resource References
  - H. Examples – Multiple File Templates
  - I. Auto Scaling - Overview
  - J. Auto Scaling – Keystone Extension
  - K. CLI Overview
  - L. Troubleshooting Heat - Cases
    - Lab Exercises
      - Basic Static template
      - Template Using Input Parameters and Environment
      - Nested Templates
      - Template with Auto-Scaling
- VIII. Object Storage Service - Swift**
  - A. Swift – Object Storage Service
  - B. Swift Terminology
  - C. Swift Architecture
  - D. Swift Background Services
  - E. swift-ring-builder
  - F. Create/manage Objects

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### Course Outline (cont.)

- G. Storage Policies
  - H. Object ACLs
  - I. Object Expiration
  - J. Large Objects
  - K. Use Swift as Backend
  - L. Troubleshooting Swift - Cases
    - Lab Exercises
      - Start Storage Nodes and Configure Swift
      - Upload Files
      - Practice ACL and Expiration Usage
      - Swift Backend for Glance
- Install and Configure Neutron
  - Install and Configure Nova
  - Install and Configure Horizon
  - Install and Configure Cinder
  - Install and Configure Heat

### IX. Deployment

- A. Automated Installation
- B. Packstack
- C. Manual Installation
- D. Preparation
- E. Fundamental Services Setup
- F. OpenStack Service Setup
- G. Glance Service
- H. Glance Service – Controller Node
- I. Neutron Service
- J. Neutron Service – Controller Node
- K. Neutron Service – Network Node
- L. Neutron Service – Compute Node
- M. Nova Service
- N. Nova Service – Controller Node
- O. Nova Service – Compute Node
- P. Horizon Service
- Q. Cinder Service
- R. Cinder Service – Controller Node
- S. Cinder Service – Compute Node
- T. Heat Service
- U. Heat service – Controller node
- Lab Exercises
  - Prepare for Installation
  - Install Database and AMQ Server
  - Install and Configure KeyStone
  - Install and Configure Glance