Certified OpenStack Administrator Study Guide

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Printed on acid-free paper

To my wife, Elena, for her love and support.

Contents at a Glance

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About the Author

Andrey Markelov is an experienced Linux and cloud architect who currently works as a Senior Solution Architect at Ericsson in Sweden. Before Ericsson, Andrey worked as the first ever Red Hat Solution Architect in Russia and with various large system integrators. He has written more than 50 articles about Linux and Unix systems services, virtual systems, and OpenSource, published in the Russian IT Press (*Linux Format RE*, *Computerra*, *PCWeek/RE*, and others). Andrey is the author of the only Russian OpenStack book at the moment. He also has experience in teaching Microsoft and Red Hat authorized courses over the past ten years. Andrey has been a Red Hat Certified Architect since 2009. He has the following certifications: Microsoft Certified System Engineer, Sun Certified System Administrator, Novell Certified Linux Professional, Mirantis Certified OpenStack Administrator, and Certified OpenStack Administrator by The OpenStack Foundation. His LinkedIn profile can be found at `http://ru.linkedin.com/in/amarkelov`.

About the Technical Reviewer

Anton Arapov leads the team responsible for infrastructure projects in Xura, which help customers unlock and protect the full potential of their mobile communication channels, while supporting the evolution to LTE 4G services and accelerating return on investment. Nowadays, virtualization is crucial for achieving the goals. Prior to Xura, Anton held a role of Engineering Manager at Red Hat, responsible for development of virtualization technologies in Linux Kernel.

Introduction

The Certified OpenStack Administrator (COA) is the first professional certification offered by the OpenStack Foundation. As OpenStack's web site states, it's designed to help companies identify top talent in the industry, and help job seekers demonstrate their skills.

The COA certification is available to anyone who passes the exam. No mandatory learning is required. However, the Certified OpenStack Administrator is a professional, typically with at least six months' OpenStack experience. It is very important to gain practical skills of work with OpenStack before taking the exam. If you read this or any other books or if you watch any video courses with no practice, you will likely fail your exam. Practice, practice, practice is the only way to successfully reach the exam goals.

Quick facts about the exam:

- The duration is 2.5 hours.
- The price (at the time of writing) to take the exam is $300. One free retake per exam purchase will be granted in the event that a passing score is not achieved.
- The exam is performance-based. You may use a graphical interface or the command line.
- The exam is available anywhere in the world through the Internet.
- Candidates are monitored virtually by a proctor during the exam session via streaming audio, video, and screensharing.

This book is organized to cover all COA exam requirements, publicly available at `www.openstack.org/coa/requirements`. They are also shown at Figure I-1 in short form. Exam objectives are subject to change. Please visit the COA exam web site for the most current listing of exam objectives. Even if you don't plan to take the COA exam, this book can be a useful tutorial for OpenStack operators.

COA Exam Topic	Weight	Chapter number
Getting to know OpenStack	3 %	Chapter 1
Identity management	12 %	Chapter 3
Image management	10 %	Chapter 4
Networking	16 %	Chapter 5
Compute	15 %	Chapter 6
Dashboard	3 %	Chapter 7
Object Storage	10 %	Chapter 8
Block Storage	10 %	Chapter 9
Heat/Orchestration	8 %	Chapter 10
Troubleshooting	13 %	Chapter 11

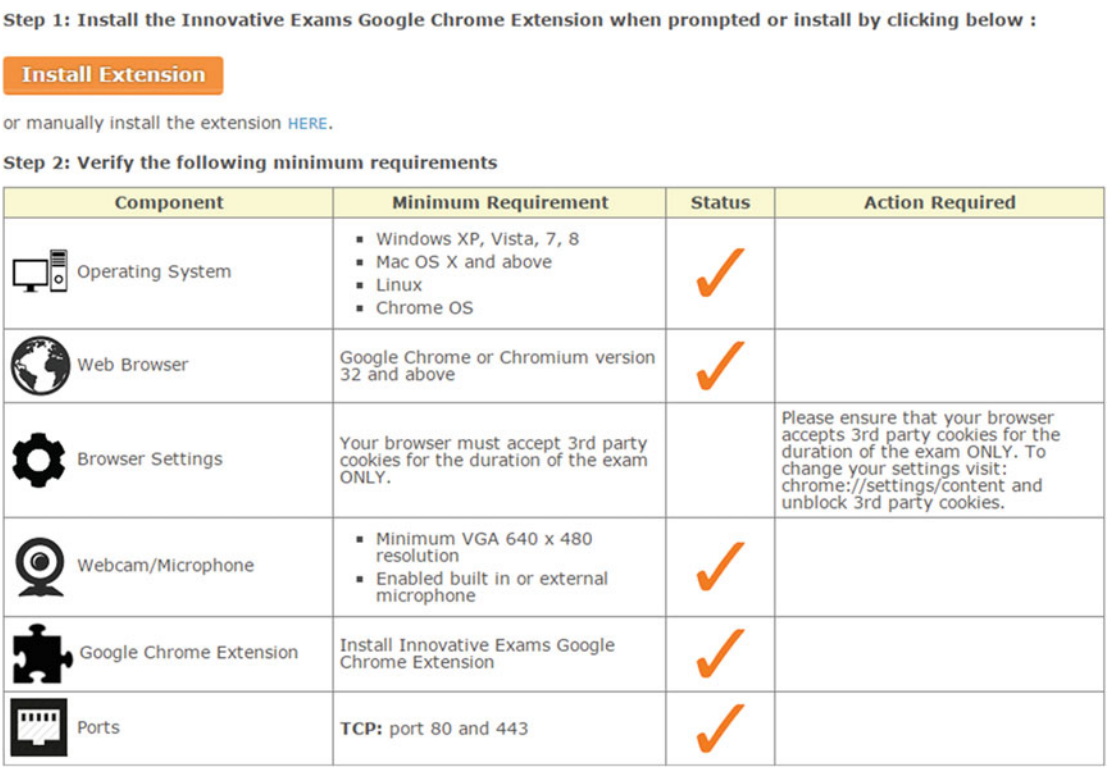
Figure I-1. *OpenStack COA exam requirements*

Tips for COA Exam Preparation

If you successfully run through all of the book's contents and think you are ready for exam, you should start by reading the OpenStack Foundation Certification Candidate Handbook for OpenStack Foundation Certified OpenStack Administrator (COA). This guide is available from the COA web site at `www.openstack.org/coa/`. It contains all the instructions and conditions you need to know before taking the exam.

A day before the exam, it is better to rest and not to study until into the late evening. Try to schedule the exam for the first part of the day when your brain is fresh.

It's very important to test your PC to make sure it meets the minimal requirements with the exam provider's web site. Figure I-2 shows the requirements (at the time of this writing). Pay attention to the screen resolution. At the time of writing, the minimum was set to 1280x800. It is really a minimum value and it will probably be uncomfortable to work with exam consoles with this resolution. I would recommend you use a monitor as big as possible.



Step 1: Install the Innovative Exams Google Chrome Extension when prompted or install by clicking below :

Install Extension

or manually install the extension HERE.

Step 2: Verify the following minimum requirements

Component	Minimum Requirement	Status	Action Required
Operating System	▪ Windows XP, Vista, 7, 8 ▪ Mac OS X and above ▪ Linux ▪ Chrome OS	✓	
Web Browser	Google Chrome or Chromium version 32 and above	✓	
Browser Settings	Your browser must accept 3rd party cookies for the duration of the exam ONLY.		Please ensure that your browser accepts 3rd party cookies for the duration of the exam ONLY. To change your settings visit: chrome://settings/content and unblock 3rd party cookies.
Webcam/Microphone	▪ Minimum VGA 640 x 480 resolution ▪ Enabled built in or external microphone	✓	
Google Chrome Extension	Install Innovative Exams Google Chrome Extension	✓	
Ports	**TCP:** port 80 and 443	✓	

Figure I-2. *Screenshot of compatibility checklist at exam provider web site*

The handbook tells you to launch `http://docs.openstack.org/` to access the technical documentation. Take some time to investigate the information. You do not need to memorize everything, but it is good to know what the documentation web site contains.

It is probably better not to type long names of projects, volumes, directories, and so forth but rather to copy them from the exam task list to the command line during the exam. You can avoid mistypes and errors if you do so. Use Ctrl+Insert to copy and Shift+Insert to paste in Microsoft Windows operating systems. Shortcuts Ctrl+C and Ctrl+V are not currently supported in the exam terminal.

It is highly recommended to use one of the terminal multiplexers because the exam terminal has a single console. You can use the `screen` command or the more advanced `tmux`. Take your time to practice with one of them. If you choose to use `tmux` you can start a new session with the command:

```
# tmux new
```

If the connection is lost, you can rejoin a session with the command:

```
# tmux attach
```

In Figure I-3 you can see what the `tmux` display looks like. Table I-1 lists the most common shortcuts for `tmux` commands.

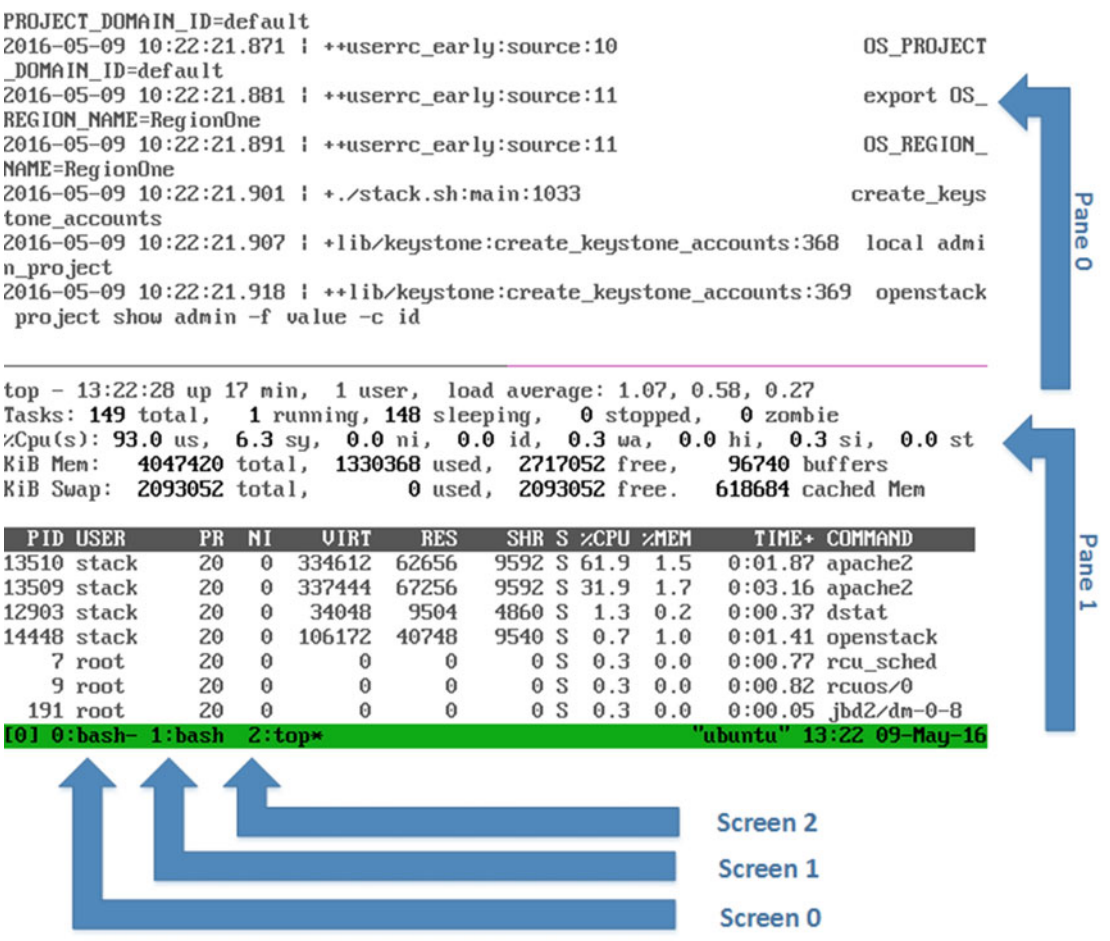


Figure I-3. *The* `tmux` *screen multiplexer*

Table I-1. *Some of* `tmux` *Command Key Bindings*

Command Key Bindings	Action
Ctrl-B ?	Show screen with help.
Ctrl-B d	Detach from session.
Ctrl-B s	List sessions.
Ctrl-B c	Create a new window.
Ctrl-B n	Change to the next window.
Ctrl-B p	Change to the previous window.
Ctrl-B 0…9	Select windows 0 through 9.
Ctrl-B %	Create a horizontal pane.
Ctrl-B "	Create a vertical pane.
Ctrl-B ↑↓→←	Move to pane.

Other OpenStack Certifications

Although I have the other two OpenStack certificates, there will not be any discussion of other vendors' OpenStack exams in this book. This book may help for their preparation, but it does not contain any specific information other than for the COA exam. Exam objectives can be different. The comparison in Table I-2 is purely for information purposes only. It is accurate at the time of writing but is always subject to change.

Table I-2. *Comparison of OpenStack Certifications*

Vendor	COA	Mirantis	Red Hat
Certification name	Certified OpenStack Administrator	Mirantis Certified Administrator for OpenStack	Red Hat Certified System Administrator in Red Hat OpenStack
Exam availability	Worldwide (through Internet connection)	Restricted (vendor and partners facility)	Restricted (vendor and partners facility)
Performance-based	Yes	Yes (MCA200)	Yes
Vendor neutral	Yes	Yes	No
Free retake per purchase	One	No	No
Certification validity	3 years	--	3 years
Passing score	78%	--	210 out of 300
Exam price	$300	$600	$600
Source of information	https://www.openstack.org/coa/	https://training.mirantis.com/certification	https://www.redhat.com/en/services/certification

CHAPTER 1

Getting to Know OpenStack

Before we delve into a discussion of OpenStack, let's determine what we mean when we refer to cloud computing. The National Institute of Standards and Technology's (NIST) definition is considered the established definition in the industry:

> *Cloud computing is a model of providing widely accessible and convenient access via the network to the common set of adjustable computational resources on demand (such as networks, servers, data storages, applications and services). These resourses can be promptly allocated and released with minimum customer efforts spent for management and interactions with service provider.*

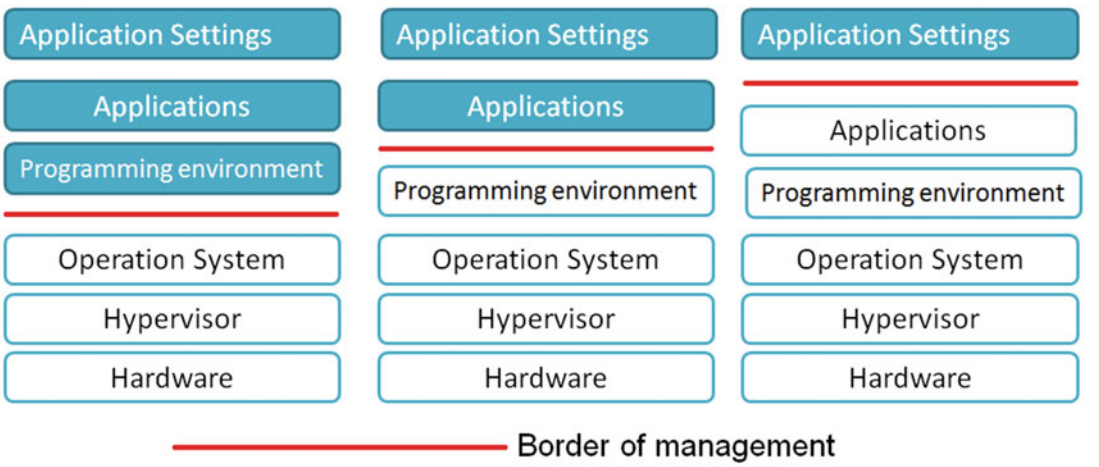


Figure 1-1. *Cloud service models*

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The service models shown in Figure 1-1 are defined by five essential characteristics, three service models, and four deployment models. It includes self-service, general access to the network, a common set of resources, flexibility, and calculation of use. Service models differ by the level of customer control of the provided infrastructure and include:

- **Infrastructure as a service (IaaS)**: In this case, the user gets control over all levels of the software stack above the cloud platform—virtual machines, networks, space volume at data storage system—given to the user. The user is an administrator of the operation system and all the work above it to the applications. OpenStack is an example of IaaS.
- **Platform as a service (PaaS**): The cloud of this model can exist "inside" the cloud of the IaaS model. In this case, the user gets control on the level of the platform applications built, for example, applications server, libraries, programming environment, and database. The user does not control and does not administer virtual machines and operational systems deployed on them, data storage systems, and networks. Ericsson Apcea and Red Hat OpenShift would be examples of PaaS.
- **Software as a service (SaaS)**: In this case, the user level of control is for only the application itself. The user would be unaware of what the virtual machine or the operational system is and would only work with the application. Examples of such products are Google Docs or Microsoft Office 365.

Four deployment models of the cloud platform implementations include:

- **Private cloud**: All the infrastructure is deployed in the data center and defined as a division of one company or a group of companies.
- **Public cloud**: Any company or even a person can be a customer of cloud services. This is the integration model the cloud service providers use.
- **Community cloud**: This is the model used when a community of companies with common tasks is the customer (common tasks can be missions, safety requirements, policies, or compliance with different requirements).
- **Hybrid cloud**: This is the combination of two or three of the clouds listed above, where various loads can be located at a private, public, or community cloud.

OpenStack can be a foundation for Clouds of all four deployment models.

Understanding the Components That Make Up the Cloud

OpenStack project, which is also called a cloud operational system, consists of a number of different projects developing separate subsystems (see Figure 1-2). Any OpenStack installation can include only a part of them. Some subsystems can even be used separately or as part of any other OpenSource project. Their number is increasing from version to version of OpenStack project, both through the appearance of new ones and the functionality split of the existing ones. For example, nova-volume service was extracted as a separate Cinder project.

Each project has its own documented set of Representational State Transfer Application Program Interfaces (REST APIs), command raw utilities, and "native" Python interfaces, providing a set of functions that are similar to the command raw utilities.