BA-BEAD Big Data Engineering for Analytics

BEAD Workshop Series

Lab Setup Instructions

NUS National University of Singapore | ISS INSTITUTE OF SYSTEMS SCIENCE

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Introduction

This Setup instruction document provides 'General Notes' for the further labs regarding use of a Virtual Machine running the CentOS Linux distribution. The distributed Virtual Machine (VM in short) has CDH (Cloudera's Distribution, including Apache Hadoop) is installed in Pseudo-Distributed mode. Pseudo-Distributed mode is a method of running Hadoop whereby all Hadoop daemons run on the same machine. It is, essentially, a cluster consisting of a single machine. It works just like a larger Hadoop cluster, the only difference (apart from speed, of course!) being that the block replication factor is set to 1, since there is only a single DataNode available.

Prerequisite

This course is designed for developers and engineers who have programming experience. Apache Spark examples and homework labs are presented in Scala or Python, therefore, the ability to program in one of those languages is required. Basic familiarity with the Linux command line is assumed. Basic knowledge of SQL is helpful; prior knowledge of Hadoop is not required.

Software Essentials

This courses will use a VMware Virtual Machine (VM), which is configured with everything required for the class. Each student should have a Windows or Macintosh computer on which to run the VM. Below are the additional computer requirements:

- Minimum RAM required: 8GB
- Minimum Free Disk Space: 25GB
- VMware Player or Virtual Box Player
- Student machines must support a 64-bit VMware guest image. Please check the relevant machine configuration requirements with your machine before proceeding with installation.
- Student machines must have VT-x virtualization support enabled in the BIOS.

VMware / VBox Player

To download VMware Player:

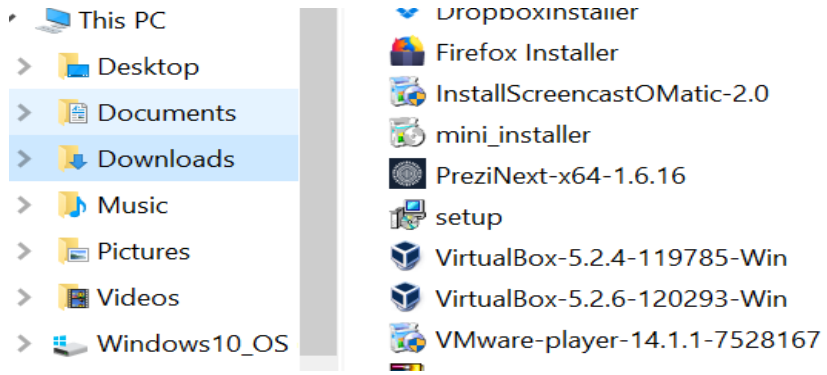
- Navigate to the VMware or Virtual Box Download Center.
- Locate the appropriate Player.
- Select the installer from the list according to your host operating system.
- Click Download.

Notes:

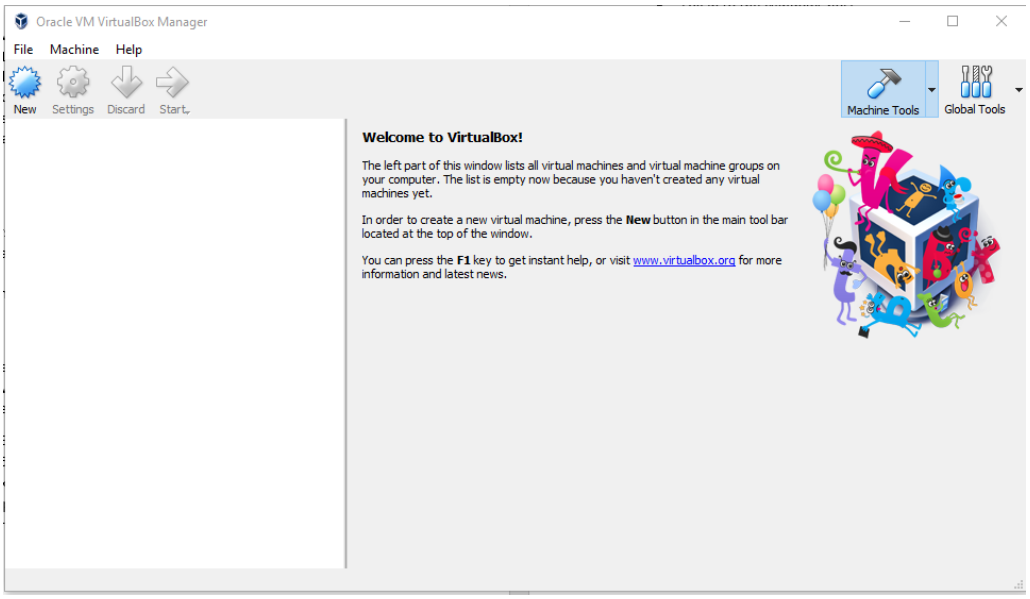
You can only have one version of Player installed at once. You must uninstall any previous version of Player before installing a new version.

Example to install VirtualBox Player on a Windows host:

Download site: https://www.virtualbox.org/wiki/Downloads



- Log in to the Windows host.
- Open the folder where the Vbox Player installer was downloaded. The default location is the Downloads folder for the user account on the Windows host.
- Right-click the installer executable file and click Run as Administrator.
- Follow the on-screen instructions to finish the installation.
- Restart the host machine.



You can refer to the additional support video at: https://youtu.be/hr6JZfusDLQ

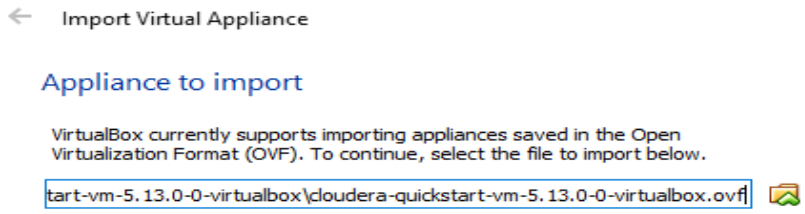
Note: If you use VirtualBox, you can use Docker Toolbox - it's continuously updated with the latest Docker Engine releases. Running Virtual box and Docker engine in parallel seems to create bridge problems in VirtualBox. Talk to instructor to understand the problem better.

Obtaining the Quick VM from Cloudera

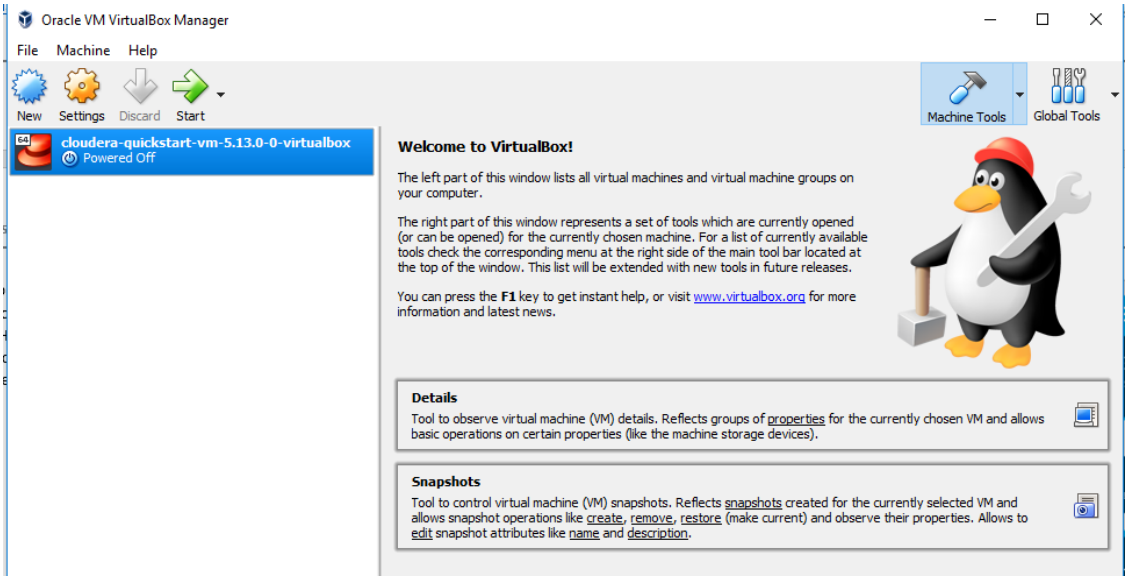
This is the link for download: https://www.cloudera.com/downloads/quickstart_vms/5-13.html

Cloudera QuickStart VMs (single-node cluster) make it easy to quickly get hands-on with CDH for testing, demo, and self-learning purposes, and include Cloudera Manager for managing your cluster. Cloudera QuickStart VM also includes a tutorial, sample data, and

scripts for getting started. The official documentation is available from: https://www.cloudera.com/documentation/enterprise/latest/topics/introduction.html



Cloudera provides a scalable, flexible, integrated platform that makes it easy to manage rapidly increasing volumes and varieties of data in your enterprise. Cloudera products and solutions enable you to deploy and manage Apache Hadoop and related projects, manipulate and analyze your data, and keep that data secure and protected. Use 7ZIP tool to unzip the VM contents and start the image using Virtual box as shown in the screen shot below.



Accounts

Once you launch the VM, you are automatically logged in as the `cloudera` user:

- username: `cloudera`
- password: `cloudera`

The `cloudera` account has `sudo` privileges in the VM. The `root` account password is `cloudera`.

The root MySQL password (and the password for other MySQL user accounts) is also `cloudera`.

Hue and Cloudera Manager use the same credentials.

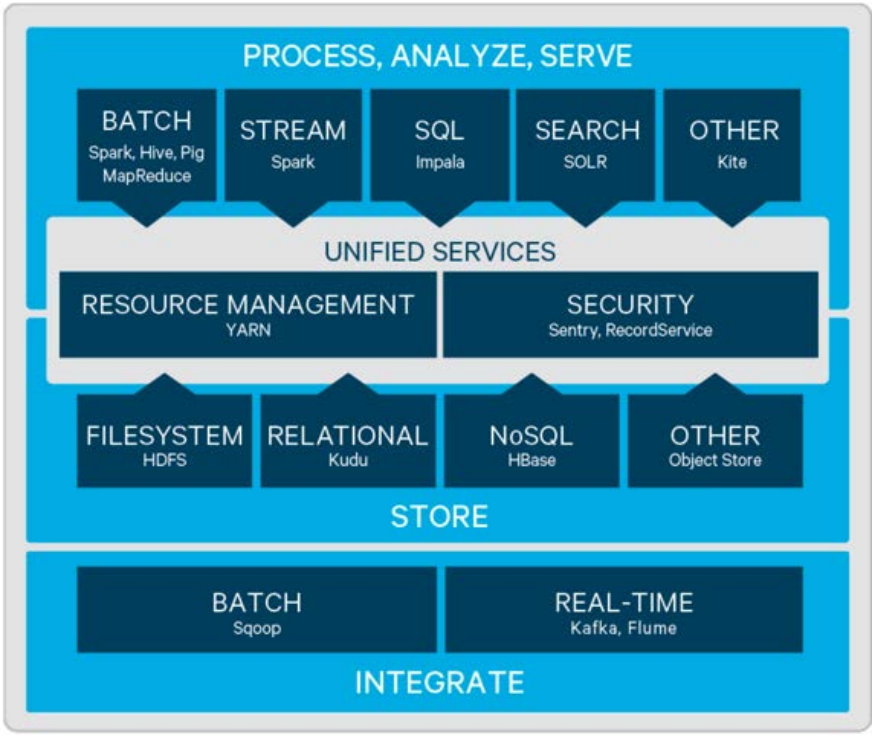
CDH

The Cloudera distribution of Apache Hadoop and other related open-source projects, including Apache Impala and Cloudera Search. CDH also provides security and integration with numerous hardware and software solutions.

CDH is the most complete, tested, and popular distribution of Apache Hadoop and related projects. CDH delivers the core elements of Hadoop – scalable storage and distributed computing – along with a Web-based user interface and vital enterprise capabilities. CDH is Apache-licensed open source and is the only Hadoop solution to offer unified batch processing, interactive SQL and interactive search, and role-based access controls.

CDH provides:

- Flexibility—Store any type of data and manipulate it with a variety of different computation frameworks including batch processing, interactive SQL, free text search, machine learning and statistical computation.
- Integration—Get up and running quickly on a complete Hadoop platform that works with a broad range of hardware and software solutions.
- Security—Process and control sensitive data.
- Scalability—Enable a broad range of applications and scale and extend them to suit your requirements.
- High availability—Perform mission-critical business tasks with confidence.
- Compatibility—Leverage your existing IT infrastructure and investment.



Apache Spark

Apache Spark is a general framework for distributed computing that offers high performance for both batch and interactive processing. It exposes APIs for Java, Python, and Scala and consists of Spark core and several related projects:

- Spark SQL - Module for working with structured data. Allows you to seamlessly mix SQL queries with Spark programs.
- Spark Streaming - API that allows you to build scalable fault-tolerant streaming applications.
- MLlib - API that implements common machine learning algorithms.
- GraphX - API for graphs and graph-parallel computation.

You can run Spark applications locally or distributed across a cluster, either by using an interactive shell or by submitting an application. Running Spark applications interactively is commonly performed during the data-exploration phase and for ad hoc analysis.

Apache Hive

Hive data warehouse software enables reading, writing, and managing large datasets in distributed storage. Using the Hive query language (HiveQL), which is very similar to SQL, queries are converted into a series of jobs that execute on a Hadoop cluster through MapReduce or Apache Spark.

Apache Sentry

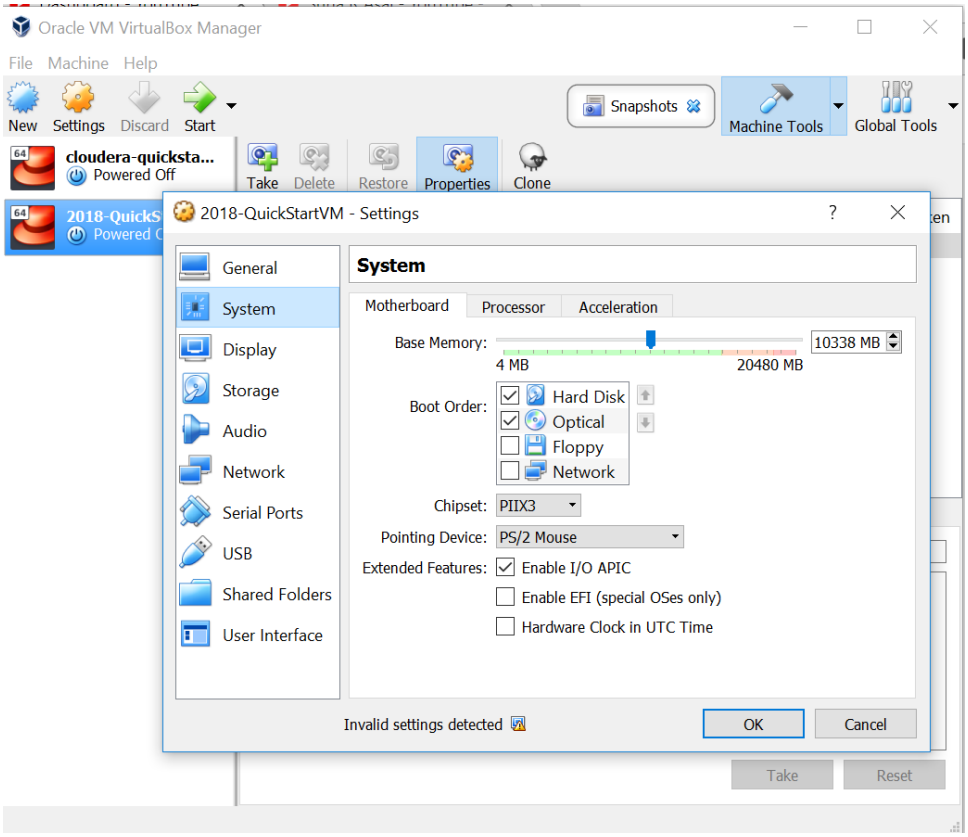
Apache Sentry is a granular, role-based authorization module for Hadoop. Sentry provides the ability to control and enforce precise levels of privileges on data for authenticated users and applications on a Hadoop cluster. Sentry currently works out of the box with Apache Hive, Hive Metastore/HCatalog, Apache Solr, Impala, and HDFS (limited to Hive table data).

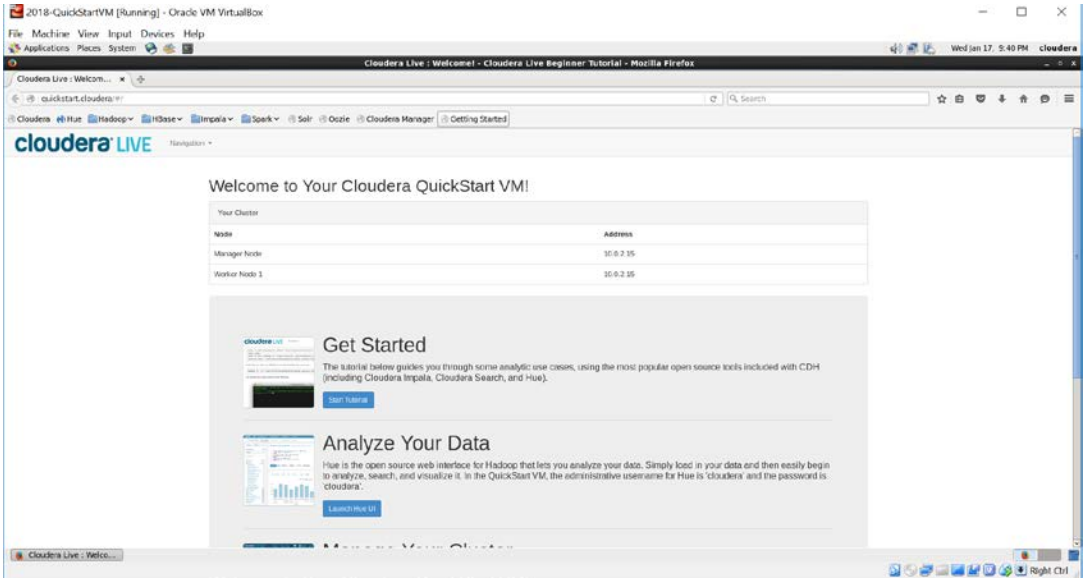
Cloudera Manager

A sophisticated application used to deploy, manage, monitor, and diagnose issues with your CDH deployments. Cloudera Manager provides the Admin Console, a web-based user interface that makes administration of your enterprise data simple and straightforward. It also includes the Cloudera Manager API, which you can use to obtain cluster health information and metrics, as well as configure Cloudera Manager.

Getting Started

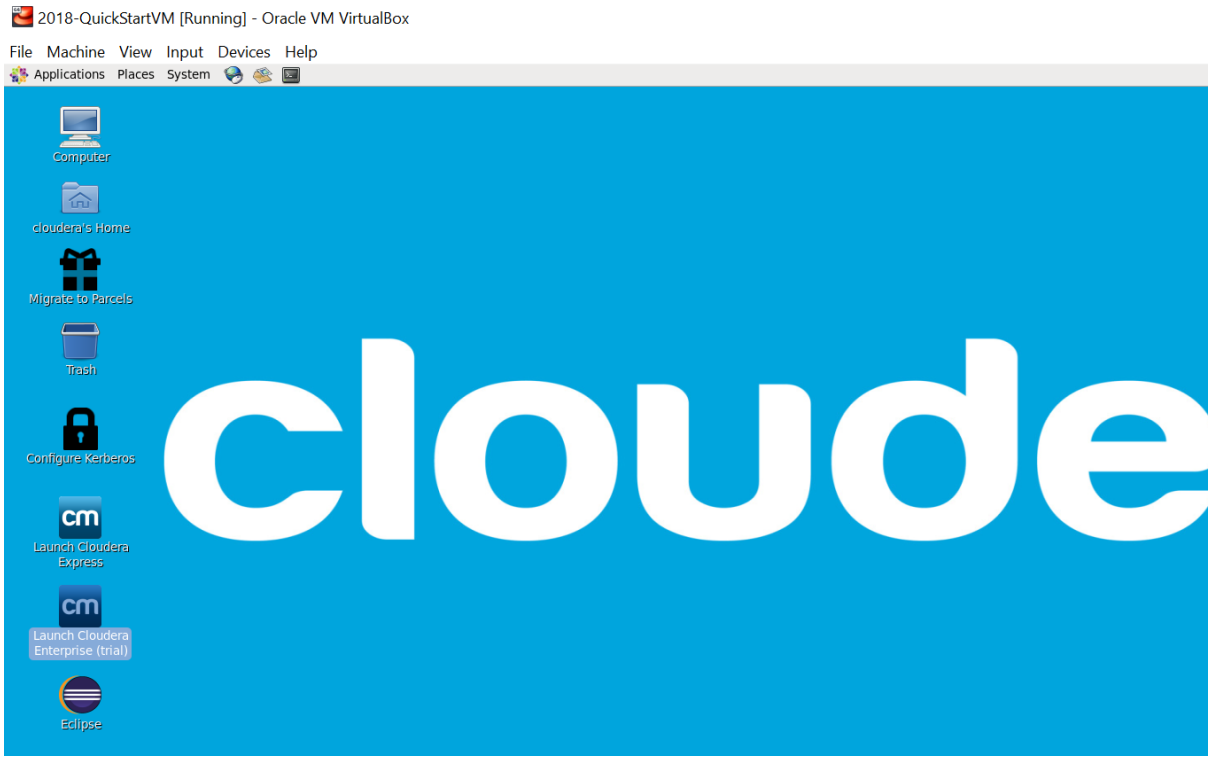
In most cases, the QuickStart VM requires no administration beyond managing the installed products and services.





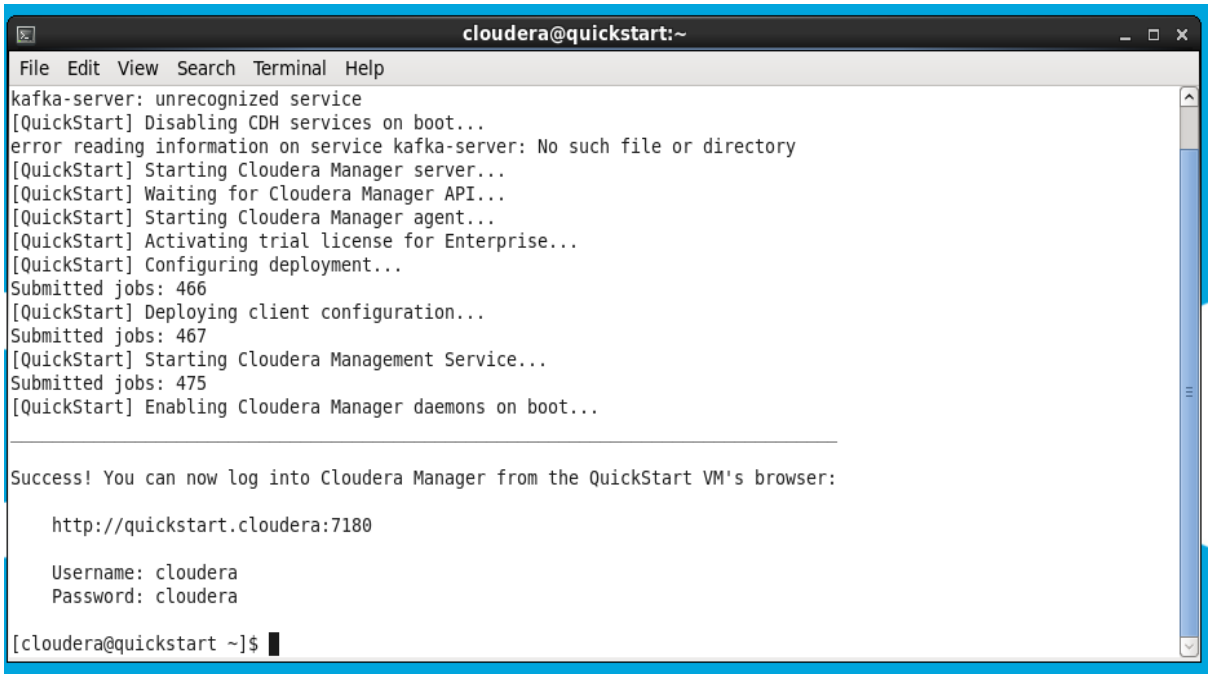
Start-up Services

Before starting the homework assignments, run the course express or enterprise trail edition script in the quick VM desktop window:



Alternatively open a terminal and type the following command in sudo mode.

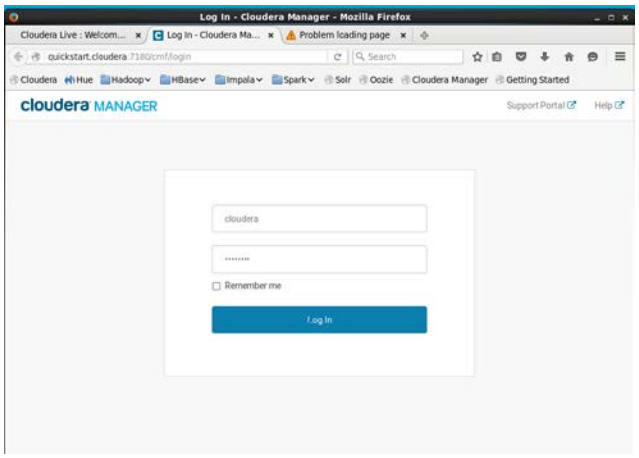
```
sudo /home/cloudera/cloudera-manager --force –enterprise
```



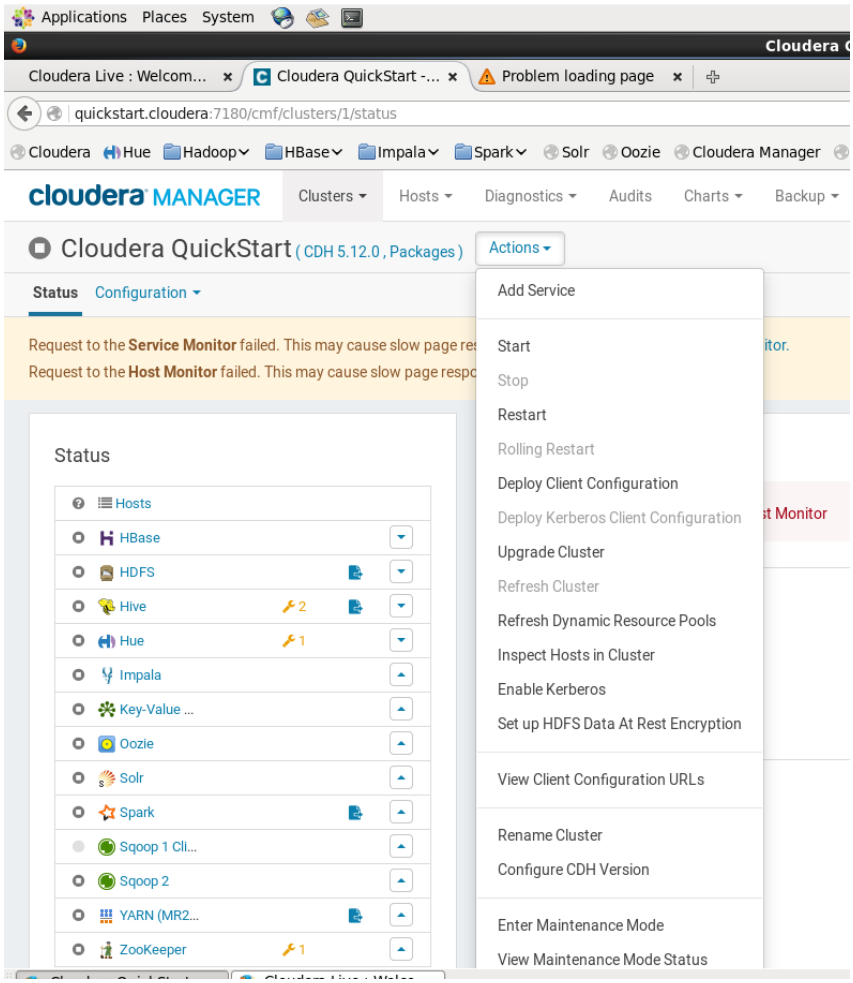
This script will enable services and set up any data required for the course.

Working with the Virtual Machine

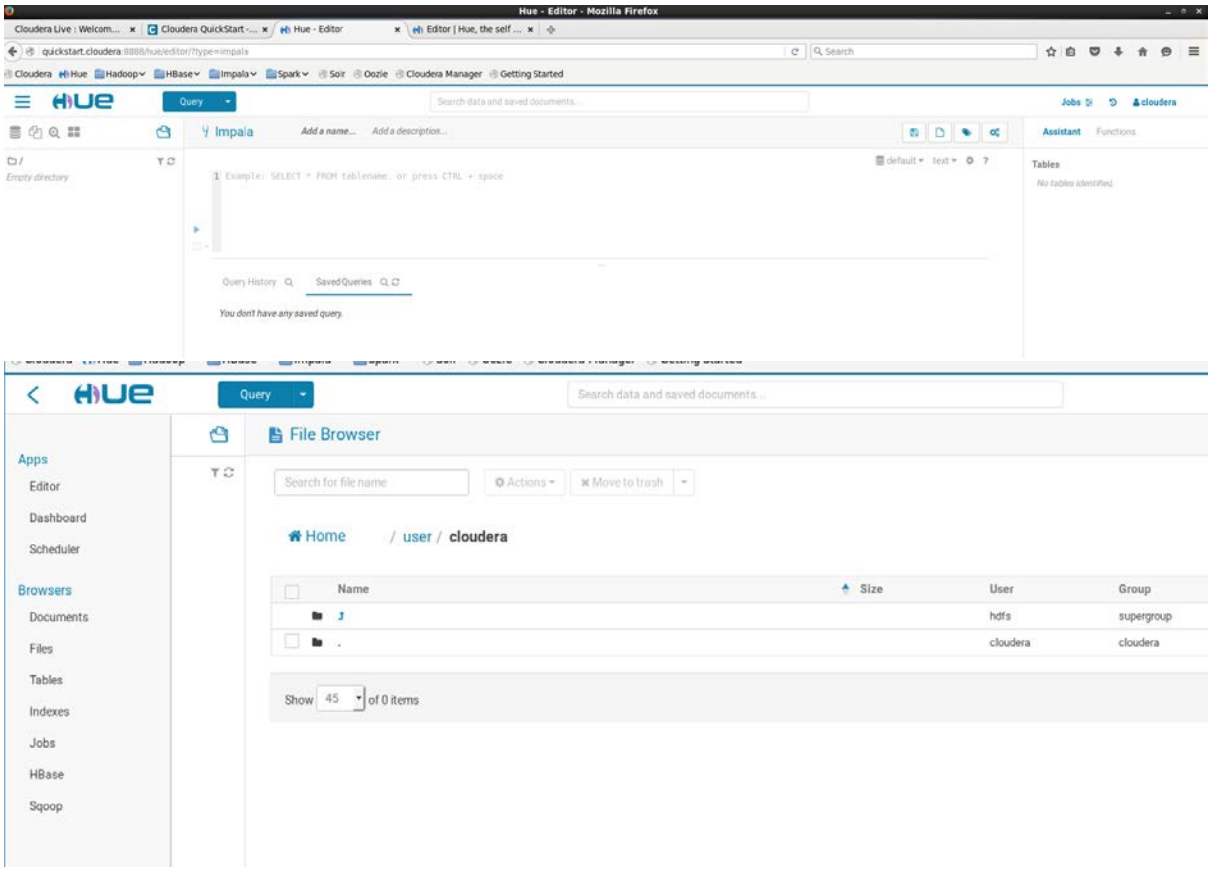
1. The VM is set to automatically log in as the user `cloudera`. Should you log out at any time, you can log back in as the user `cloudera` with the password training.
2. Once the enterprise trial scripts are activated, the cloudera cluster can be well managed using cloudera manager page, Cluster's Start Services - that looks similar to the screen shot below:



You can restart any of the services that has not started properly. Be patient and make sure that the server is stable before moving to further exercises.



3. Should you need it, the root password is `cloudera`. You may be prompted for this if, for example, you want to change the keyboard layout. In general, you should not need this password since the `cloudera` user has unlimited sudo privileges. (For example Hue Log In)



4. In some command-line steps in the `homework`, you will see lines like this:

```
$ hdfs dfs -put shakespeare \
/user/cloudera/shakespeare
```

The dollar sign (**$**) at the beginning of each line indicates the Linux shell prompt. The actual prompt will include additional information (e.g., `[cloudera@localhost workspace]$`) but this is omitted from these instructions for brevity.

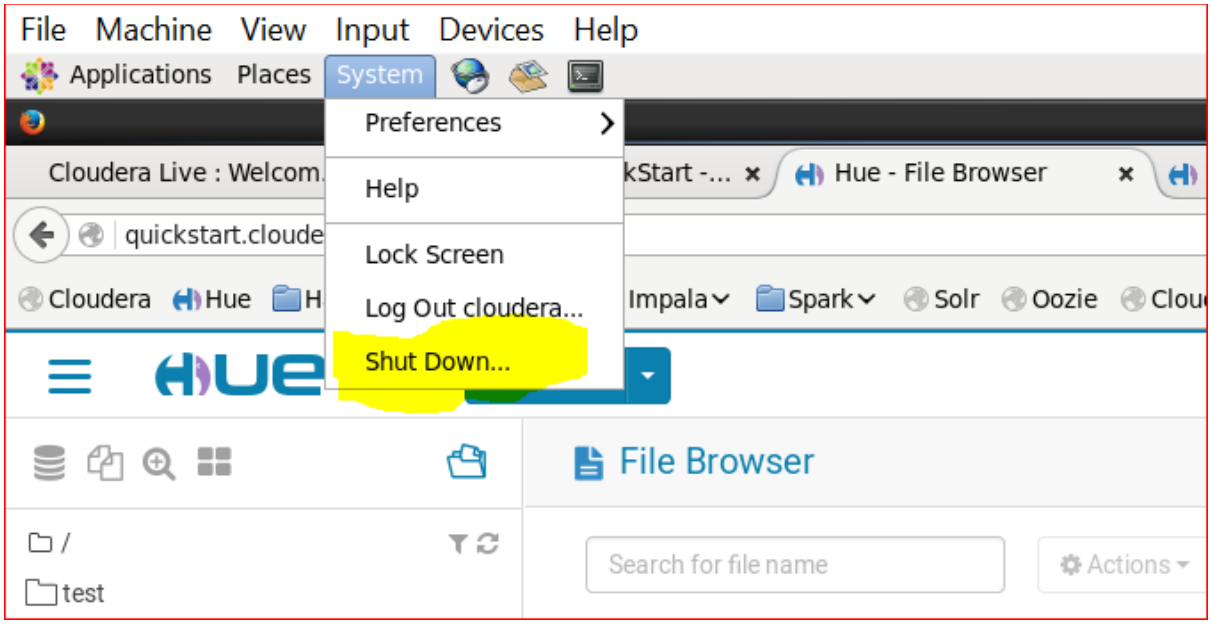
The backslash (\) at the end of the first line signifies that the command is not completed, and continues on the next line. You can enter the code exactly as shown (on two lines), or you can enter it on a single line. If you do the latter, you should *not* type in the backslash.

Points to note during the homework

As the exercises progress, and you gain more familiarity with Hadoop and Spark, we provide fewer step-by-step instructions; as in the real world, we merely give you a requirement and it's up to you to solve the problem!

Switching off the Virtual Image.

When you have finished working with the image you can properly close the machine by choosing the Shut Down option under the System Menu of the Cent OS Linux Virtual Image.



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