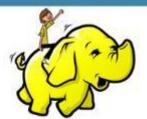
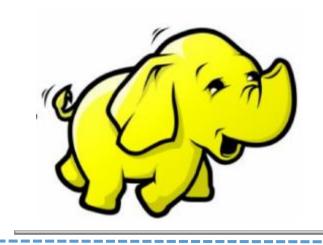
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Hadoop Administration **



Hadoop Administration



Module 2: Hadoop Architecture and Cluster setup

Course Topics

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✓ Module 1

- ✓ Understanding Big Data
- ✓ Hadoop Components

√ Module 2

- ✓ Different Hadoop Server Roles
- √ Hadoop Cluster Configuration

✓ Module 3

- ✓ Hadoop Cluster Planning
- ✓ Job Scheduling

✓ Module 4

- ✓ Securing your Hadoop Cluster
- ✓ Backup and Recovery

✓ Module 5

- ✓ Hadoop 2.0 New Features
- ✓ HDFS High Availability

✓ Module 6

- ✓ Quorum Journal Manager (QJM)
- ✓ Hadoop 2.0 YARN

✓ Module 7

- ✓ Oozie Workflow Scheduler
- ✓ Hive and Hbase Administration

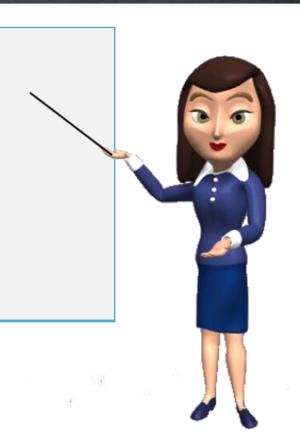
✓ Module 8

- √ Hadoop Cluster Case Study
- ✓ Hadoop Implementation

Topics of the day

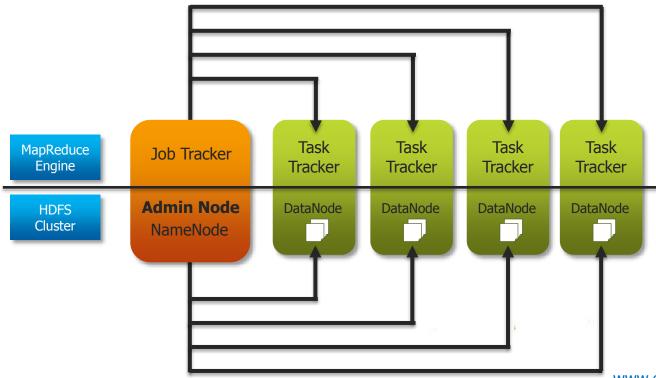


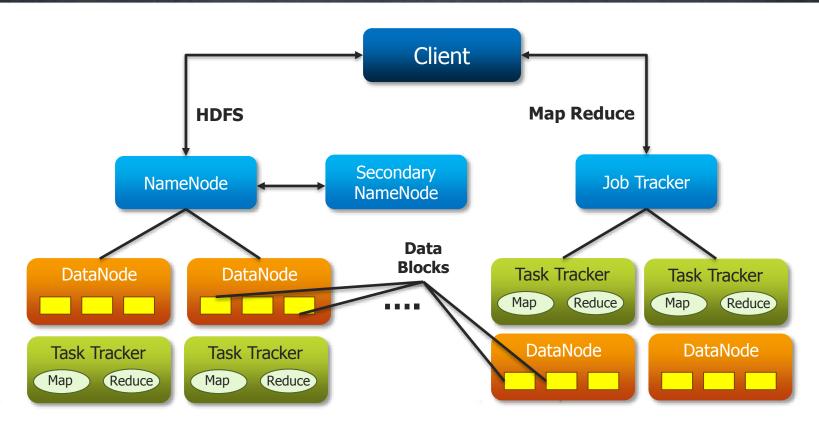
- Hadoop Server Roles
- HDFS Architecture
- **■** Map Reduce Job execution
- Anatomy of a File Write and Read
- Rack Awareness
- Hadoop Installation
- Hadoop Configuration Files
- Hadoop Cluster Modes
- Hadoop Cluster Architecture
- Hadoop Multi-Node Cluster Installation
- Hadoop Clients



Let's Revise

- ✓ Hadoop Core Component
- ✓ Hadoop Vs. Traditional systems





Hadoop 1.0 Core Components (Contd.)

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Hadoop is a system for large scale data processing.

It has two main components:

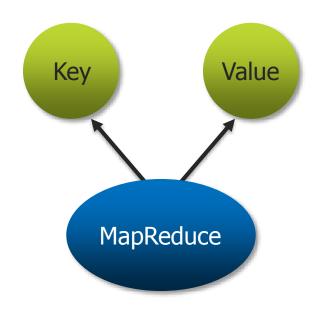
- √ HDFS Hadoop Distributed File System (Storage)
 - ✓ Distributed across "nodes"
 - ✓ Natively redundant
 - ✓ NameNode tracks locations.
- ✓ MapReduce (Processing)
 - ✓ Splits a task across processors
 - ✓ "near" the data & assembles results
 - ✓ Self-Healing, High Bandwidth
 - ✓ Clustered storage
 - ✓ Job Tracker manages the Task Trackers

Additional Administration Tools:

- ✓ File system utilities
- ✓ Job scheduling and monitoring
- ✓ Web UI

What is Map - Reduce?

- √ Map Reduce is a programming model
 - ✓ It is neither platform- nor language-specific
 - ✓ Record-oriented data processing (key and value)
 - √ Task distributed across multiple nodes
- ✓ Where possible, each node processes data stored on that node
- ✓ Consists of two phases
 - ✓ Map
 - ✓ Reduce



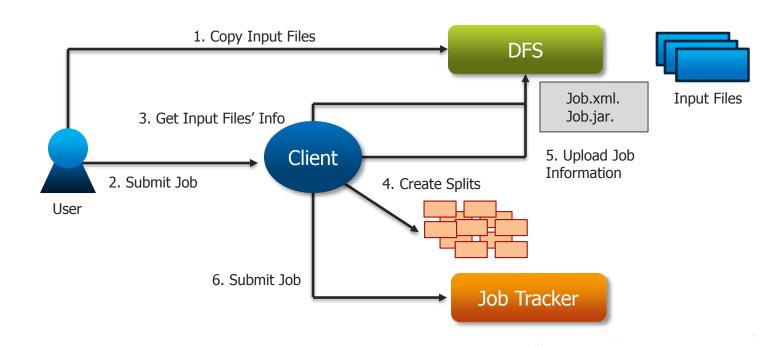
What is Map - Reduce? (Contd.)

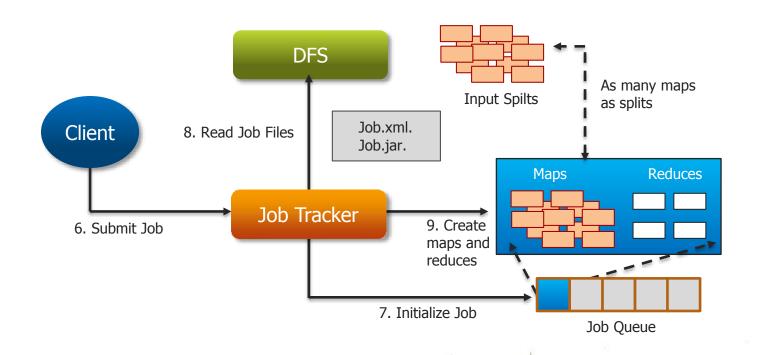


Process can be considered as being similar to a Unix pipeline

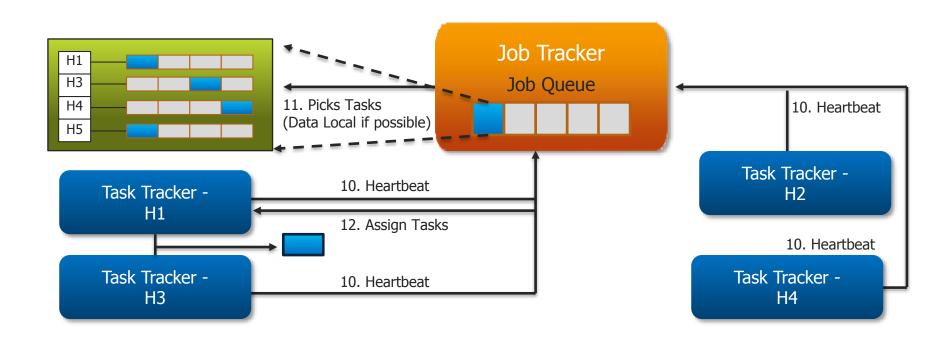
cat /my/log | grep '\.html' | sort | uniq -c > /my/outfile







Job Tracker (Contd.)



Hadoop framework picks which of the following daemon for scheduling a task?

- a) namenode
- b) datanode
- c) task tracker
- d) job tracker



Job Tracker takes care of all the job scheduling and assigns tasks to Task Trackers.



Hadoop Cluster Modes

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Hadoop can run in any of the following three modes:

Standalone (or Local) Mode

- ✓ No daemons, everything runs in a single JVM.
- ✓ Suitable for running MapReduce programs during development.
- ✓ Has no DFS.

Pseudo-Distributed Mode

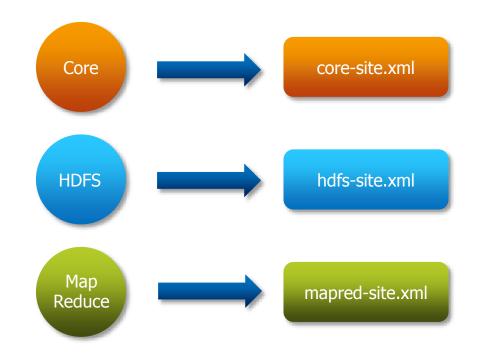
✓ Hadoop daemons run on the local machine.

Fully-Distributed Mode

✓ Hadoop daemons run on a cluster of machines.

Configuration Filenames	Description of Log Files
hadoop-env.sh	Environment variables that are used in the scripts to run Hadoop.
core-site.xml	Configuration settings for Hadoop Core such as I/O settings that are common to HDFS and MapReduce.
hdfs-site.xml	Configuration settings for HDFS daemons, the namenode, the secondary namenode and the data nodes.
mapred-site.xml	Configuration settings for MapReduce daemons: the job-tracker and the task-trackers.
masters	A list of machines (one per line) that each run a secondary namenode.
slaves	A list of machines (one per line) that each run a datanode and a task-tracker.

Hadoop 1.0: Core Configuration Files





hdfs-site.xml	core-site.xml		
xml version - "1.0"?	xml version ="1.0"?		
hdfs-site.xml	core-site.xml		
<configuration></configuration>	<configuration></configuration>		
<pre><pre><pre><pre><pre><pre><pre><pre></pre></pre></pre></pre></pre></pre></pre></pre>	<pre><pre><pre><pre><pre><pre><pre><pre></pre></pre></pre></pre></pre></pre></pre></pre>		
<name>dfs.replication</name>	<name>fs.default.name</name>		
<value>1</value>	<pre><value>hdfs://localhost:8020/</value></pre>		



Property		Value	Description
dfs.data.dir	<value></value>	/disk1/hdfs/data, /disk2/hdfs/data	A list of directories where the datanode stores blocks. Each block is stored in only one of these directories. \${hadoop.tmp.dir}/dfs/data
fs.checkpoint.dir	<value></value>	/disk1/hdfs/namesecondary, /disk2/hdfs/namesecondary	A list of directories where the secondary namenode stores checkpoints. It stores a copy of the checkpoint in each directory in the list \${hadoop.tmp.dir}/dfs/namesecondary



mapred-site.xml		
xml version="1.0"?		
<configuration></configuration>		
<pre><pre><pre><pre>property></pre></pre></pre></pre>		
<name>mapred.job.tracker</name>		
<value>localhost:8021</value>		
<pre><pre><pre><pre><pre><pre><pre><pre></pre></pre></pre></pre></pre></pre></pre></pre>		

Defining mapred-site.xml



Property	Value	Description
mapred.job.tracker	<value> localhost:8021 </value>	The hostname and the port that the job tracker RPC server runs on. If set to the default value of local, then the job tracker runs inprocess on demand when you run a MapReduce job.
mapred.local.dir	\${hadoop.tmp.dir}/mapred/local	A list of directories where MapReduce stores intermediate data for jobs. The data is cleared out when the job ends.
mapred.system.dir	\${hadoop.tmp.dir}/mapred/system	The directory relative to fs.default.name where shared files are stored, during a job run.

Defining mapred-site.xml



Property	Value	Description
mapred.tasktracker.map.tasks.maximum	2	The number of map tasks that may be run on a task tracker at any one time
mapred.tasktracker.reduce.tasks.maximum	2	The number of reduce tasks tat may be run on a task tracker at any one time.

More Details on Configuration Files





http://hadoop.apache.org/docs/r1.1.2/core-default.html

http://hadoop.apache.org/docs/r1.1.2/mapred-default.html

http://hadoop.apache.org/docs/r1.1.2/hdfs-default.html

Slaves and Masters



Two files are used by the startup and shutdown commands:

Slaves

✓ Contains a list of hosts, one per line, that are to host **DataNode** and **Task Tracker** servers.

Masters

✓ Contains a list of hosts, one per line, that are to host **Secondary** NameNode servers.



- ✓ This file also offers a way to provide custom parameters for each of the servers.
- ✓ Hadoop-env.sh is sourced by all of the Hadoop Core scripts provided in the conf/ directory of the installation.

✓ Examples of environment variables that you can specify:

```
export HADOOP_DATANODE_HEAPSIZE="128"
```

export HADOOP_TASKTRACKER_HEAPSIZE="512"

hadoop-metrics.properties



- ✓ This file controls the reporting
- ✓ The default is not to report

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fs.default.name

hadoop.tmp.dir

mapred.job.tracker

Web UI URLs

- ✓ NameNode status: http://localhost:50070/dfshealth.jsp
- ✓ JobTracker status: http://localhost:50030/jobtracker.jsp
- ✓ TaskTracker status: http://localhost:50060/tasktracker.jsp
- ✓ DataBlock Scanner Report: http://localhost:50075/blockScannerReport

Hadoop Cluster – Pseudo Cluster mode

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Demo

- ✓ Hadoop Configuration Files
- ✓ Hadoop Single Node Cluster
- ✓ Important Parameters
- ✓ Execution Stages of an Example MapReduce Job

Which of the following file is used to specify the NameNode's heap size?

- a) bashrc
- b) hadoop-env.sh
- c) hdfs-site.sh
- d) core-site.xml



hadoop-env.sh. This file specifies environment variables that affect the JDK used by Hadoop Daemon (bin/hadoop).



It is necessary to define all the properties in core-site.xml, hdfs-site.xml & mapred-site.xml.

- a) TRUE
- b) FALSE



False. Detailed answer will be give after the next question.



Stand alone Mode uses default configuration?

- a) TRUE
- b) FALSE



True. In Stand alone mode Hadoop runs with default configuration (Empty configuration files i.e. no configuration settings in core-site.xml, hdfs-site.xml, and mapred-site.xml). If properties are not defined in the configuration files, hadoop runs with default values for the corresponding properties.







Facebook

- We use Hadoop to store copies of internal log and dimension data sources and use it as a source for reporting/analytics and machine learning.
- Currently we have 2 major clusters:
 - A 1100-machine cluster with 8800 cores and about 12 PB raw storage.
 - A 300-machine cluster with 2400 cores and about 3 PB raw storage.
 - Each (commodity) node has 8 cores and 12 TB of storage.
 - We are heavy users of both streaming as well as the Java APIs. We have built a higher level data warehousing framework using these features called Hive (see the http://hadoop.apache.org/hive/). We have also developed a FUSE implementation over HDFS.

http://wiki.apache.org/hadoop/PoweredBy

Hadoop 1.0: Cluster Architecture

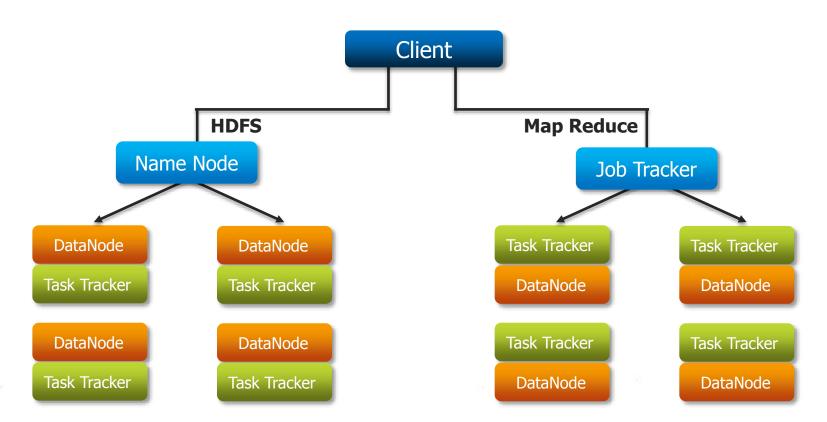
Master

NameNode http://master:50070/

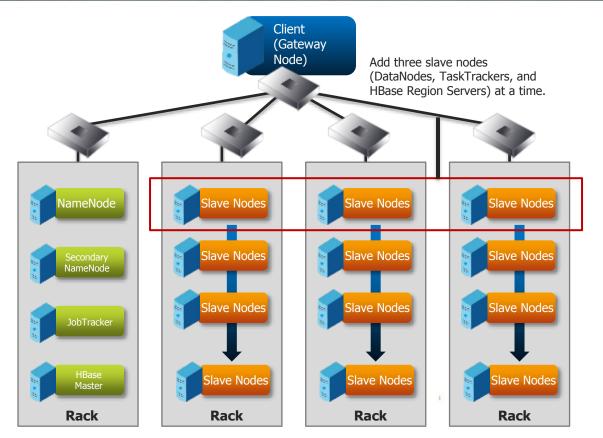
JobTracker http://master:50030/ Slave01 Slave02 Slave03 Slave04 Slave05 DataNode Task Tracker

Hadoop 1.0: Cluster Architecture (Contd.)



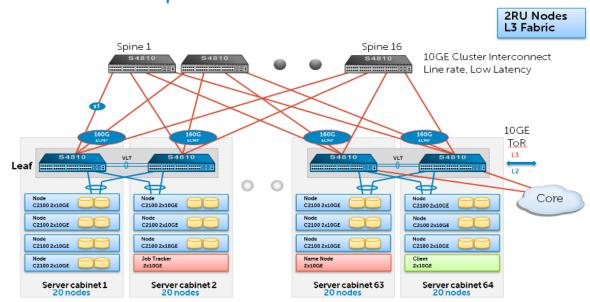








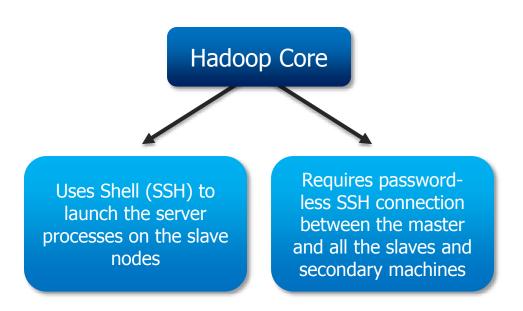
10GE Hadoop Cluster – Scaled to 1280 nodes



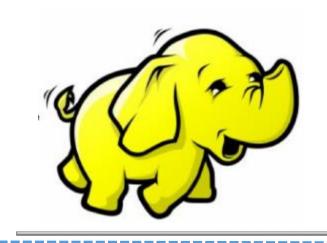
- 2RU Nodes 2 x 10GE (C2100)
- 20 Nodes per rack
- 64 racks, 1280 nodes
- 2.5:1 oversubscription @ ToR

- Expand as needed by adding Spine switches
- Leaf QSFP+ optics, Spine SFP+ optics
- Leaf QSFP optical breakout cables
- 150m Leaf to Spine





Demo



Hadoop Cluster: Password-Less SSH

If Password-less SSH Login is not set-up among nodes,

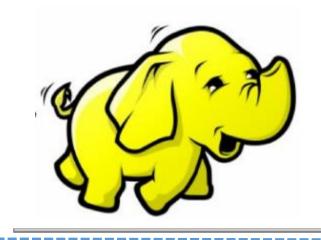
- a) Hadoop deamons won't start
- b) Only NameNode will start in Master
- c) User's password has to be entered to start every daemon
- d) None of these



Answer is **(C)**, User password is required to start the daemons.



Demo



Hadoop Multi-Node Cluster

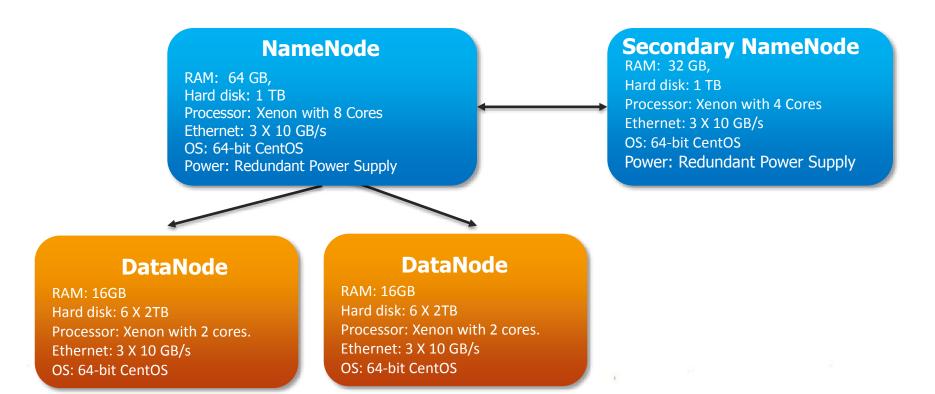
Further Reading

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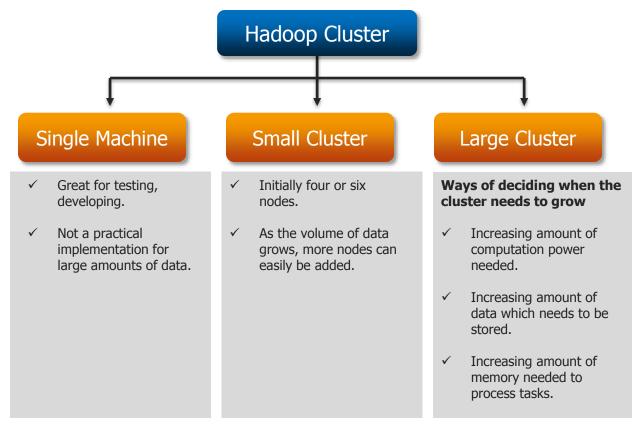


- ✓ Hadoop Cluster Setup

 http://hadoop.apache.org/docs/r0.19.1/cluster_setup.html
- ✓ Hadoop on Amazon AWS EC2
 http://www.edureka.in/blog/install-apache-hadoop-cluster/
- ✓ Hadoop Cluster Configuration
 http://www.edureka.in/blog/hadoop-cluster-configuration-files/







Tasks for you

- Attempt the following Assignments using the documents present in the LMS:
 - Install multi-node Apache Hadoop 1.0 using a Virtual Machine in VM Player or Virtual Box or AWS EC2 free tier.
 - Review the Interview Questions for setting up Hadoop Cluster http://www.edureka.in/blog/hadoop-interview-questions-hadoop-cluster/





Review Hadoop Blogs at

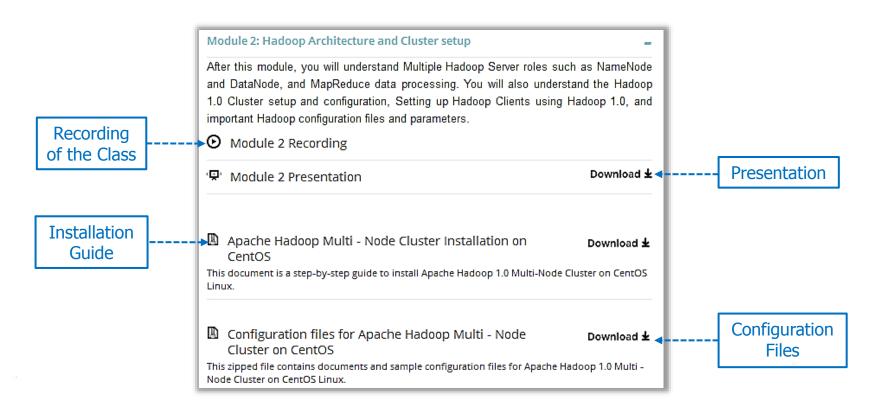
http://www.edureka.in/blog/?s=hadoop

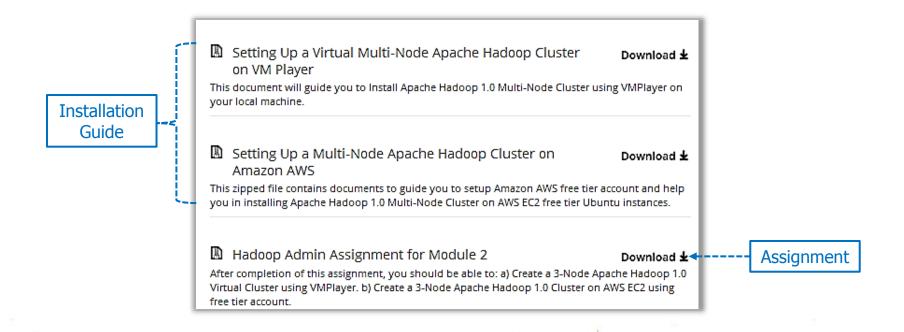
Specially,

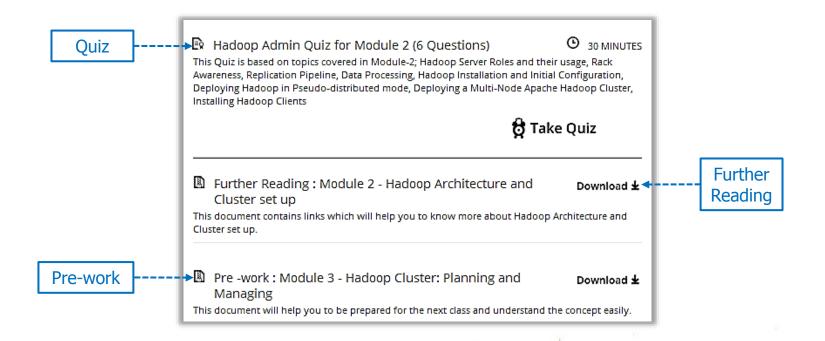
- http://www.edureka.in/blog/installapache-hadoop-cluster/
- http://www.edureka.in/blog/hadoopinterview-questions-hadoop-cluster/











Thank You

See You in Class Next Week