About the Tutorial

Impala is the open source, native analytic database for Apache Hadoop. It is shipped by vendors such as Cloudera, MapR, Oracle, and Amazon. The examples provided in this tutorial have been developing using Cloudera Impala.

Audience

This tutorial is intended for those who want to learn Impala. Impala is used to process huge volumes of data at lightning-fast speed using traditional SQL knowledge.

Prerequisites

To make the most of this tutorial, you should have a good understanding of the basics of Hadoop and HDFS commands. It is also recommended to have a basic knowledge of SQL before going through this tutorial.

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Impala – Introduction
**What is Impala?**

Impala is a MPP (Massive Parallel Processing) SQL query engine for processing huge volumes of data that is stored in Hadoop cluster. It is an open source software which is written in C++ and Java. It provides high performance and low latency compared to other SQL engines for Hadoop.

In other words, Impala is the highest performing SQL engine (giving RDBMS-like experience) which provides the fastest way to access data that is stored in Hadoop Distributed File System.

**Why Impala?**

Impala combines the SQL support and multi-user performance of a traditional analytic database with the scalability and flexibility of Apache Hadoop, by utilizing standard components such as HDFS, HBase, Metastore, YARN, and Sentry.

- With Impala, users can communicate with HDFS or HBase using SQL queries in a faster way compared to other SQL engines like Hive.

- Impala can read almost all the file formats such as Parquet, Avro, RCFile used by Hadoop.

Impala uses the same metadata, SQL syntax (Hive SQL), ODBC driver, and user interface (Hue Beeswax) as Apache Hive, providing a familiar and unified platform for batch-oriented or real-time queries.

Unlike Apache Hive, **Impala is not based on MapReduce algorithms**. It implements a distributed architecture based on daemon processes that are responsible for all the aspects of query execution that run on the same machines.

Thus, it reduces the latency of utilizing MapReduce and this makes Impala faster than Apache Hive.

**Advantages of Impala**

Here is a list of some noted advantages of Cloudera Impala.

- Using impala, you can process data that is stored in HDFS at lightning-fast speed with traditional SQL knowledge.

- Since the data processing is carried where the data resides (on Hadoop cluster), data transformation and data movement is not required for data stored on Hadoop, while working with Impala.
• Using Impala, you can access the data that is stored in HDFS, HBase, and Amazon s3 without the knowledge of Java (MapReduce jobs). You can access them with a basic idea of SQL queries.

• To write queries in business tools, the data has to be gone through a complicated extract-transform-load (ETL) cycle. But, with Impala, this procedure is shortened. The time-consuming stages of loading & reorganizing is overcome with the new techniques such as exploratory data analysis & data discovery making the process faster.

• Impala is pioneering the use of the Parquet file format, a columnar storage layout that is optimized for large-scale queries typical in data warehouse scenarios.

Features of Impala

Given below are the features of cloudera Impala:

• Impala is available freely as open source under the Apache license.

• Impala supports in-memory data processing, i.e., it accesses/analyzes data that is stored on Hadoop data nodes without data movement.

• You can access data using Impala using SQL-like queries.

• Impala provides faster access for the data in HDFS when compared to other SQL engines.

• Using Impala, you can store data in storage systems like HDFS, Apache HBase, and Amazon s3.

• You can integrate Impala with business intelligence tools like Tableau, Pentaho, Micro strategy, and Zoom data.

• Impala supports various file formats such as, LZO, Sequence File, Avro, RCFile, and Parquet.

• Impala uses metadata, ODBC driver, and SQL syntax from Apache Hive.

Relational Databases and Impala

Impala uses a Query language that is similar to SQL and HiveQL. The following table describes some of the key differences between SQL and Impala Query language.

<table>
<thead>
<tr>
<th>Impala</th>
<th>Relational databases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Relational databases use SQL language.</td>
</tr>
</tbody>
</table>
Impala uses an SQL like query language that is similar to HiveQL.

In Impala, you cannot update or delete individual records. In relational databases, it is possible to update or delete individual records.

Impala does not support transactions. Relational databases support transactions.

Impala does not support indexing. Relational databases support indexing.

Impala stores and manages large amounts of data (petabytes). Relational databases handle smaller amounts of data (terabytes) when compared to Impala.

### Hive, Hbase, and Impala

Though Cloudera Impala uses the same query language, metastore, and the user interface as Hive, it differs with Hive and HBase in certain aspects. The following table presents a comparative analysis among HBase, Hive, and Impala.

<table>
<thead>
<tr>
<th>HBase</th>
<th>Hive</th>
<th>Impala</th>
</tr>
</thead>
<tbody>
<tr>
<td>HBase is wide-column store database based on Apache Hadoop. It uses the concepts of BigTable.</td>
<td>Hive is a data warehouse software. Using this, we can access and manage large distributed datasets, built on Hadoop.</td>
<td>Impala is a tool to manage, analyze data that is stored on Hadoop.</td>
</tr>
<tr>
<td>The data model of HBase is wide column store.</td>
<td>Hive follows Relational model.</td>
<td>Impala follows Relational model.</td>
</tr>
<tr>
<td>HBase is developed using Java language.</td>
<td>Hive is developed using Java language.</td>
<td>Impala is developed using C++.</td>
</tr>
<tr>
<td>The data model of HBase is schema-free.</td>
<td>The data model of Hive is Schema-based.</td>
<td>The data model of Impala is Schema-based.</td>
</tr>
<tr>
<td>HBase provides Java, RESTful and, Thrift API’s.</td>
<td>Hive provides JDBC, ODBC, Thrift API’s.</td>
<td>Impala provides JDBC and ODBC API’s.</td>
</tr>
</tbody>
</table>
Impala

<table>
<thead>
<tr>
<th>Supports programming languages like C, C#, C++, Groovy, Java, PHP, Python, and Scala.</th>
<th>Supports programming languages like C++, Java, PHP, and Python.</th>
<th>Impala supports all languages supporting JDBC/ODBC.</th>
</tr>
</thead>
<tbody>
<tr>
<td>HBase provides support for triggers.</td>
<td>Hive does not provide any support for triggers.</td>
<td>Impala does not provide any support for triggers.</td>
</tr>
</tbody>
</table>

All these three databases –

- Are NOSQL databases.
- Available as open source.
- Support server-side scripting.
- Follow ACID properties like Durability and Concurrency.
- Use sharding for partitioning.

**Drawbacks of Impala**

Some of the drawbacks of using Impala are as follows:

- Impala does not provide any support for Serialization and Deserialization.
- Impala can only read text files, not custom binary files.
- Whenever new records / files are added to the data directory in HDFS, the table needs to be refreshed.
This chapter explains the prerequisites for installing Impala, how to download, install and set up Impala in your system.

Similar to Hadoop and its ecosystem software, we need to install Impala on Linux operating system. Since cloudera shipped Impala, it is available with Cloudera Quick Start VM.

This chapter describes how to download Cloudera Quick Start VM and start Impala.

**Downloading Cloudera Quick Start VM**

Follow the steps given below to download the latest version of Cloudera QuickStartVM.

**Step 1**

Open the homepage of cloudera website [http://www.cloudera.com/](http://www.cloudera.com/). You will get the page as shown below.
Step 2
Click the **Sign in** link on the cloudera homepage, which will redirect you to the Sign in page as shown below.

If you haven’t registered yet, click the **Register Now** link which will give you **Account Registration** form. Register there and sign in to cloudera account.

Step 3
After signing in, open the download page of cloudera website by clicking on the **Downloads** link highlighted in the following snapshot.
Step 4: Download QuickStartVM

Download the cloudera QuickStartVM by clicking on the Download Now button, as highlighted in the following snapshot.
This will redirect you to the download page of QuickStart VM.
Click the Get ONE NOW button, accept the license agreement, and click the submit button as shown below.

Cloudera provides its VM compatible VMware, KVM and VIRTUALBOX. Select the required version. Here in our tutorial, we are demonstrating the Cloudera QuickStartVM setup using
virtual box, therefore click the VIRTUALBOX DOWNLOAD button, as shown in the snapshot given below.

This will start downloading a file named cloudera-quickstart-vm-5.5.0-0-virtualbox.ovf which is a virtual box image file.

**Importing the Cloudera QuickStartVM**

After downloading the cloudera-quickstart-vm-5.5.0-0-virtualbox.ovf file, we need to import it using virtual box. For that, first of all, you need to install virtual box in your system. Follow the steps given below to import the downloaded image file.

**Step 1**
Download virtual box from the following link and install it https://www.virtualbox.org/

**Step 2**
Open the virtual box software. Click File and choose Import Appliance, as shown below.
Step 3

On clicking **Import Appliance**, you will get the Import Virtual Appliance window. Select the location of the downloaded image file as shown below.
After importing **Cloudera QuickStartVM** image, start the virtual machine. This virtual machine has Hadoop, cloudera Impala, and all the required software installed. The snapshot of the VM is shown below.

![Virtual Machine Snapshot](image)

**Starting Impala Shell**

To start Impala, open the terminal and execute the following command.

```
[cloudera@quickstart ~] $ impala-shell
```

This will start the Impala Shell, displaying the following message.

```
Starting Impala Shell without Kerberos authentication
Connected to quickstart.cloudera:21000
Server version: impalad version 2.3.0-cdh5.5.0 RELEASE (build 0c891d79aa38f297d244855a32f1e17280e2129b)
**************************************************************************
Welcome to the Impala shell. Copyright (c) 2015 Cloudera, Inc. All rights reserved.
(Impala Shell v2.3.0-cdh5.5.0 (0c891d7) built on Mon Nov  9 12:18:12 PST 2015)
Press TAB twice to see a list of available commands.
**************************************************************************
[quickstart.cloudera:21000] >
```
**Note:** We will discuss all the impala-shell commands in later chapters.

**Impala Query editor**

In addition to Impala shell, you can communicate with Impala using the Hue browser. After installing CDH5 and starting Impala, if you open your browser, you will get the cloudera homepage as shown below.

Now, click the bookmark Hue to open the Hue browser. On clicking, you can see the login page of the Hue Browser, logging with the credentials cloudera and cloudera.
As soon as you log on to the Hue browser, you can see the Quick Start Wizard of Hue browser as shown below.
On clicking the **Query Editors** drop-down menu, you will get the list of editors Impala supports as shown in the following screenshot.

![Impala Query Editors](image)

On clicking **Impala** in the drop-down menu, you will get the Impala query editor as shown below.
Impala
Impala is an MPP (Massive Parallel Processing) query execution engine that runs on a number of systems in the Hadoop cluster. Unlike traditional storage systems, Impala is decoupled from its storage engine. It has three main components namely, Impala daemon (Impalad), Impala Statestore, and Impala metadata or metastore.

Impala daemon (Impalad)

Impala daemon (also known as impalad) runs on each node where Impala is installed. It accepts the queries from various interfaces like impala shell, hue browser, etc. and processes them.
Whenever a query is submitted to an impalad on a particular node, that node serves as a "coordinator node" for that query. Multiple queries are served by Impalad running on other nodes as well. After accepting the query, Impalad reads and writes to data files and parallelizes the queries by distributing the work to the other Impala nodes in the Impala.
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