

CDH Post-Upgrade 1.0.0

# Migrating Impala Workloads to CDW Private Cloud

Date published: 2021-2-22

Date modified: 2023-01-18

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<https://docs.cloudera.com/>

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## Migrating Impala workloads

Cloudera Data Warehouse (CDW) Private Cloud offers the latest, updated, and managed elastic Impala experience. Migrating the Impala workloads to CDW enables you to leverage auto-scaling, data sharing, data and result caching, and many other powerful capabilities of the Data Lakehouse architecture.

If you are on CDH or HDP platforms, then you must first upgrade your clusters to CDP Private Cloud Base before you can install CDP Private Cloud Data Services and migrate your Impala compute workloads to CDW. Compute workloads are SQL programs that get generated from either a shell script, a JDBC/ODBC client, thick SQL clients, or Hue.

Moving certain Impala workloads from CDP to CDW has the following advantages:

- Ability to scale out the Impala compute layer independently from the storage layer
- Provides better isolation between workloads to prevent interference and maintain SLAs
- Simplifies the management of Impala clusters, by not having you to focus on admission control and tuning configuration parameters
- Automatic installation, setup, start-up, scale-up, and scale-down of workloads running on a Kubernetes backend
- Ability to run different versions of Impala for different types of workloads (For example, operational reporting can remain locked on a given version, while data science users can always upgrade their Virtual Warehouses to the latest versions)

## Migrating Impala workloads from CDH/HDP to CDP Private Cloud Base

If you are running Impala workloads on CDH or HDP platforms, then you must first upgrade your cluster to CDP Private Cloud Base and then migrate your Impala workloads. If you are already running Impala workloads on CDP Private Cloud Base, then you can skip this step.

### Migration choices to migrate workloads to CDP Private Cloud Base

To migrate Impala workloads from CDH to CDP Private Cloud Base, you can perform a side-car migration. If your goal is to migrate the workloads to Cloudera Data Warehouse (CDW) Private Cloud, then perform an in-place upgrade of CDH nodes to CDP Private Cloud Base and then migrate the Impala workloads to CDW Private Cloud on new nodes.

Each mechanism has common aspects of work, risk mitigation, and successful outcomes expected across all paths from legacy distributions into CDP. Both paths include assessing the workloads, testing, validating, and minimizing workload unavailability during the move. Cloudera recommends the in-place upgrade and migration method to migrate Impala workloads from CDH to CDW on Private Cloud.

### Side-car migration

The side-car migration mechanism is best employed when you have tighter service-level agreements (SLAs) that preclude an extended, multi-hour downtime for your workloads. This process aims to minimize downtime on individual workloads while providing a straightforward roll-back mechanism on a per-workload basis.

For a side-car migration, you must install and configure a new greenfield CDP Private Cloud Base cluster on the second set of hardware, consisting of a few dense storage nodes and several compute nodes. The side-car migration breaks down into the following three major phases:

1. Building and configuring the new CDP Private Cloud Base cluster
2. Configuring a replication process to provide periodic and consistent snapshots of data, metadata, and accompanying governance policies

3. Deploying the workloads onto the new cluster, testing them, and flipping them into a production state after validation

After you move the workloads, disable them on the legacy cluster. You will temporarily have production workloads running across multiple clusters during the migration period.



**Note:** For better query performance and more efficient resource utilization by queries and to benefit from the new features, recompute the statistics after migrating your compute workload.

### In-place upgrade with new nodes for CDW Data Service

The age and hardware refresh cycle of legacy clusters is an important consideration when deciding on the in-place upgrade strategy. To add new hardware to the base cluster this mechanism is the best choice. Adding new hardware to the base cluster makes it simpler to set up the Cloudera Data Warehouse (CDW) Data Service, which reduces the time required and lowers risk.

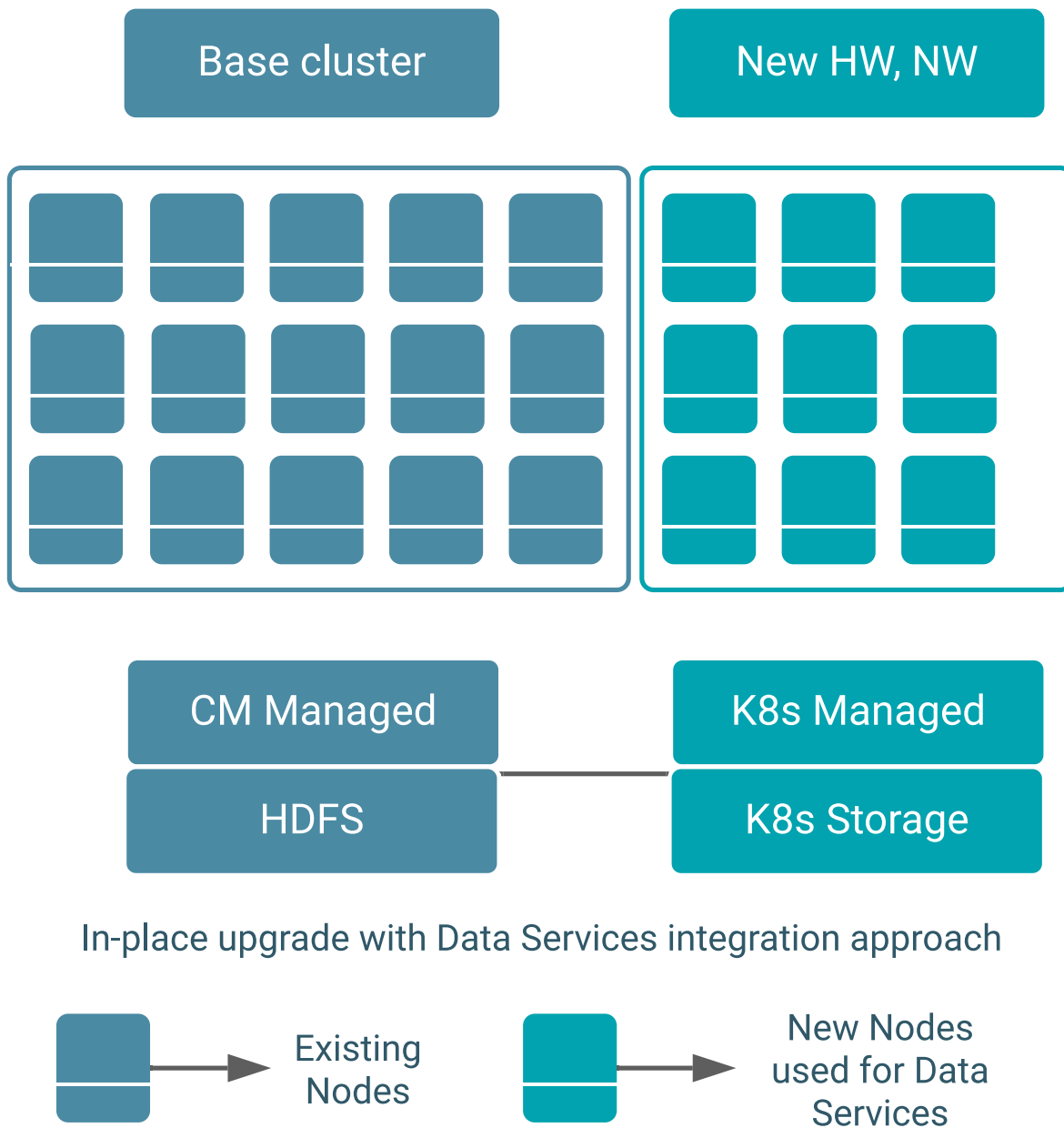


**Note:** Cloudera recommends this migration path to move from CDH to CDW Data Service on CDP Private Cloud.

In-place upgrade and migration is a two-step process. To get to CDW on Private Cloud, you must:

- Upgrade an existing CDH cluster to CDP Private Cloud base
- Install CDW Data Service on the new hardware alongside the base cluster and then move your compute workloads from CDP Private Cloud base to CDW Data Service

The following diagram shows running the CDW Data Service on Private Cloud on the new hardware alongside the base cluster after an in-place upgrade from CDH. HW stands for hardware and NW stands for new workloads:



To upgrade from CDH to CDP Private Cloud Base, see [Upgrading CDH 6 to CDP Private Cloud Base](#).

## Moving Impala compute workloads from CDP Private Cloud Base to CDW Data Service on Private Cloud

To migrate the Impala compute workloads to Cloudera Data Warehouse (CDW) Data Service, you must have completed an in-place upgrade from CDH to CDP Private Cloud Base. Review how to identify the workloads to migrate and configuration changes that are needed between CDP Private Cloud Base and CDW.

## Workload selection

Depending on the size (CPU, Memory, Cache) of your CDW environment, you must choose which workloads should be migrated from base Impala to CDW Impala.

### Business Intelligence workloads

If you have teams of data analysts using Business Intelligence (BI) tools and applications, then you can migrate to CDW Data Service on Private Cloud to benefit from data and result caching. If you have repeated BI workloads, see [Guidelines for moving repeated BI workloads](#).

### Pioneering user base

New features are developed and released in CDW first. If your user base needs to use newer technologies such as Iceberg, Unified Analytics, Data and Result Caching, and so on, then you can consider moving your workloads to CDW Data Service on Private Cloud.

### Performance-demanding workloads

If your teams are running complex and large queries that require high memory and run for a long time that cause other SLA-driven workloads to be impacted, then you can isolate them out from the Impala service on the base cluster and run them from dedicated Impala Virtual Warehouses to achieve compute isolation.

### Kudu workloads

If your workloads depend on streaming datasets that are inserted, updated, or deleted frequently, then you must configure Kudu on the base cluster and you can use Impala to query Kudu on base. CDW supports creating Impala tables in Kudu. For more information, see [Configuring Impala Virtual Warehouses to create Impala tables in Kudu in Cloudera Data Warehouse Private Cloud](#).

### Anti-pattern workloads

If your workloads scan extremely large datasets, then you need to consider data locality before moving the workloads from the Impala service on the base cluster to Impala in CDW Data Service. Scanning large data sets over the network can take time. If you plan to move such workloads to CDW, then ensure that the data can be cached for better performance. You can also increase the auto-suspend time for the Impala Virtual Warehouse to make sure that the cache is retained.

Other things that you must consider while assessing the workloads are tenant modeling and sizing followed by performance testing. This ensures that queries return correct results and that performance is acceptable.

## Steps for migrating Impala workloads to CDW Data Service on Private Cloud

After you upgrade from CDH to CDP Private Cloud Base you can retain your compute workload on CDP Private Cloud Base and continue to use Impala as your query engine. To get to the latest Impala version with the full feature set, the ideal choice available to you is to move your compute workload from CDP Private Cloud Base to CDW Private Cloud.

Before you begin, acquire basic information about the CDP platform and the interfaces.

### Activate the CDP environment in CDW

Before you can create a Database Catalog to use with a Virtual Warehouse, you must activate a CDP environment in Cloudera Data Warehouse (CDW). Activating an environment causes CDP to connect to the Kubernetes cluster, which provides the computing resources for the Database Catalog. In addition, activating an environment enables the

Cloudera Data Warehouse (CDW) service to use the existing data lake that was set up for the environment, including all data, metadata, and security.

To activate an environment, see [Activating OpenShift and Embedded Container Service environments](#). Also, review the [sizing information](#) to plan resources for your environment. See [How to use the CDP Private Cloud Data Services sizing spreadsheet](#).

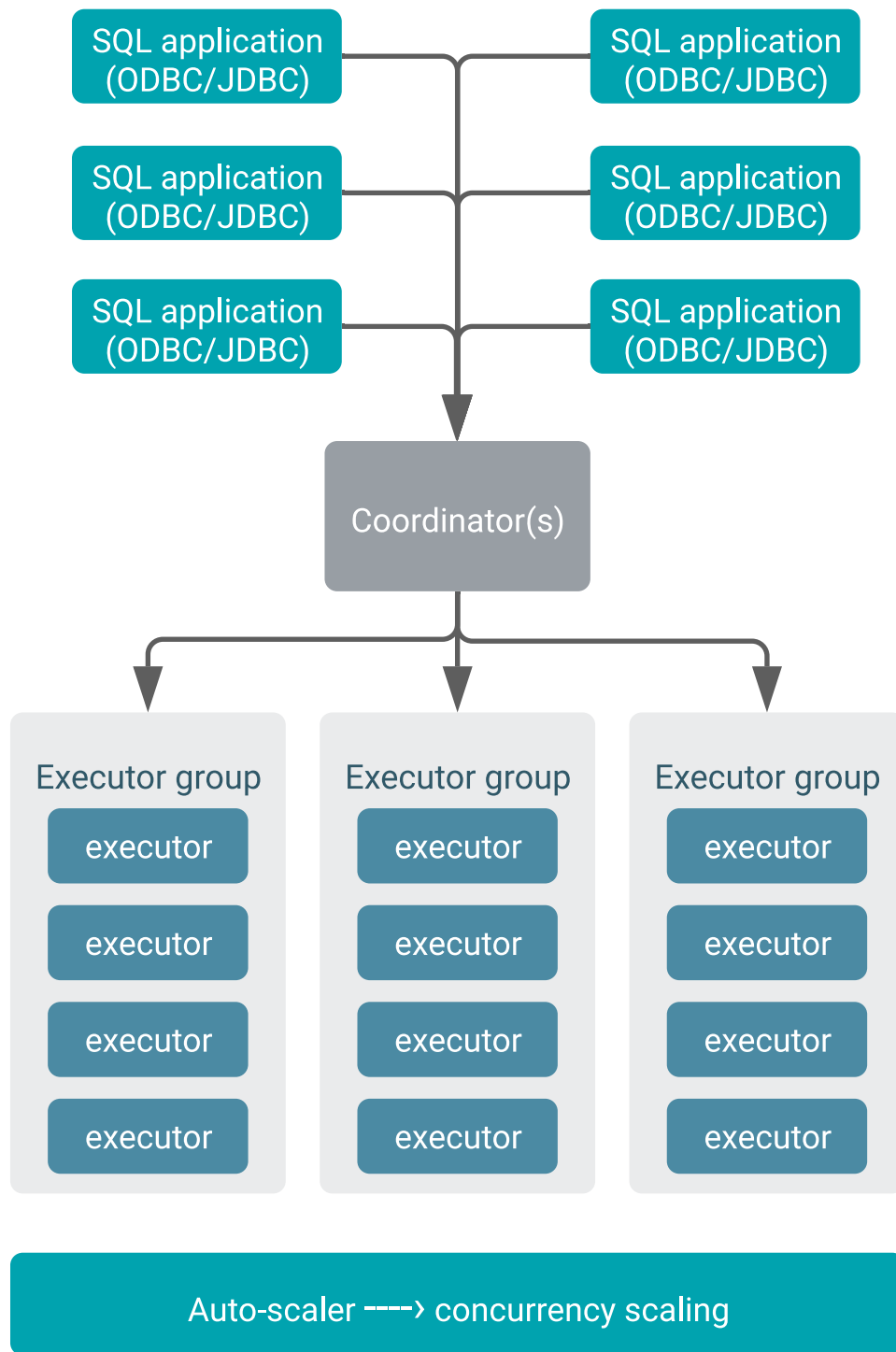
## Setup and size an Impala Virtual Warehouse

After activating the environment, you must create and configure an Impala Virtual Warehouse. Learn about the configurations and options that Cloudera Data Warehouse (CDW) provides to size the Virtual Warehouse.

### Size

The size of a Virtual Warehouse controls the “Executor group” size as shown in the following diagram. This controls the number of Impala executor pods that a single query runs on. Select a size that is appropriate for the amount of data to be scanned or aggregated and the amount of data cache that is needed overall. By default, each executor pod and coordinator pod caches 300 GB data and scratches 300 GB data.





You can select a standard size (2, 10, 20, or 40, set a custom size of, say, 15 nodes in an executor group) as shown in the following image:

Size \*

custom

Node Count : 15

10 20 30 40 50 60 70 80 90 100

15



**Tip:** If your query is running slow and scans take a lot of time, then increase the size of the executor group.

### Concurrency-based auto-scaling

Once you have selected the executor group size, concurrency-based autoscaling allows the Virtual Warehouse to scale up when concurrent queries are seen. This triggers scales up the Virtual Warehouse size to run the concurrent query. You can scale up the Virtual Warehouse in proportion to its size. For example, if you set the Virtual Warehouse size equal to 15 nodes, then the Virtual Warehouse scales up in multiples of 15 nodes, namely, 15, 30, 45, 60, and so on. You can control the scale up ratio by controlling the maximum number of executors as shown in the following image:

Concurrency Autoscaling ⓘ

Executors: Min:15, Max:45

20 30 40 50 60 70 80 90 100 110 120 130 140 150

### Auto-suspend a Virtual Warehouse

Virtual Warehouses automatically stop after a period of inactivity. You can disable it or set the amount of time before the Virtual Warehouse suspends itself as shown in the following image:

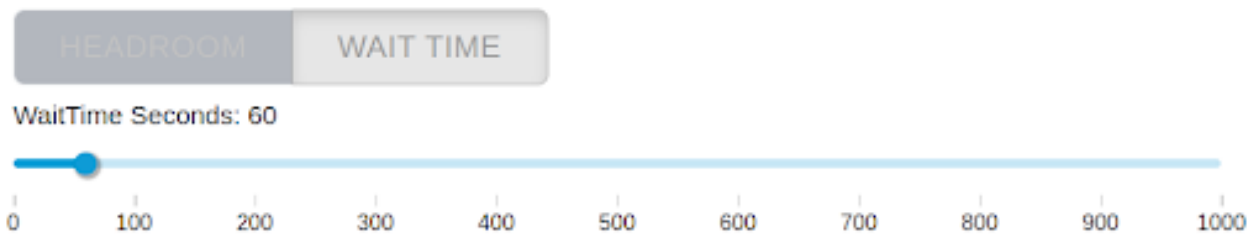
Disable AutoSuspend

AutoSuspend Timeout (in seconds): 300

0 1000 2000 3000 4000 5000 6000 7000

### Wait time

Wait time is used to set the amount of time a query stays in a queue before a new executor group is spawned, as shown in the following image:



## Import custom configurations


You must import custom configurations that you used for optimizing performance, mitigating the pressure on the network, avoiding resource usage spikes and out-of-memory conditions, to keep long-running queries or idle sessions from tying up cluster resources, and so on.

### About this task

Following is a list of configurations that are typically modified and should be copied to the Cloudera Data Warehouse (CDW) Data Service from the base cluster:

- default\_file\_format and default\_transactional\_type
- CONVERT\_LEGACY\_HIVE\_PARQUET\_UTC\_TIMESTAMPS and USE\_LOCAL\_TZ\_FOR\_UNIX\_TIMESTAMPS\_CONVERSIONS (especially for older datasets to avoid Hive vs Impala timestamp issues)
- Runtime filters for performance: RUNTIME\_BLOOM\_FILTER\_SIZE, RUNTIME\_FILTER\_MAX\_SIZE, RUNTIME\_FILTER\_MIN\_SIZE, RUNTIME\_FILTER\_MODE, and RUNTIME\_FILTER\_WAIT\_TIME\_MS
- PARQUET\_FALLBACK\_SCHEMA\_RESOLUTION (to handle any column order changes)
- TIMEZONE (because CDW uses the UTC timezoone)
- COMPRESSION\_CODEC (based on your need; LZ4 is recommended)
- SCHEDULE\_RANDOM\_REPLICA and REPLICA\_PREFERENCE (to avoid hotspotting)
- EXEC\_TIME\_LIMIT\_S, IDLE\_SESSION\_TIMEOUT, and QUERY\_TIMEOUT\_S
- DISABLE\_CODEGEN\_ROWS\_THRESHOLD, EXEC\_SINGLE\_NODE\_ROWS\_THRESHOLD, and BROADCAST\_BYTES\_LIMIT
- SCRATCH\_LIMIT if set to higher on CDP Private Cloud Base needs to be limited to a value between 300 and 600 GB
- Enable ALLOW\_ERASURE\_CODED\_FILES and disable DECIMAL\_V2 only if needed
- MEM\_LIMIT (automatically selected between a range of 2 G to 50 G)
  - You can set MEM\_LIMIT in the default query options, if needed
  - Administrators can tweak the Impala's admission control configurations to set a reasonable range for minimum and maximum query memory limit

### Procedure

1. Log in to the CDW service as a DWAdmin.
2. Select the Impala Virtual Warehouse that you want to modify and click  Edit CONFIGURATIONS Impala Coordinator and select flagfile from the drop-down list.

- Update the configurations in the `default_query_options` field as shown in the following image:

The screenshot shows the Cloudera Impala configuration interface for a Virtual Warehouse named 'field-impala'. The interface is divided into several sections:

- Header:** Displays the Virtual Warehouse Name 'field-impala', Version '7.2.9.0-117', Impala Nodes '2', CPU '41', and MEMORY '365.34 GB'. There are 'ACTIONS' and 'APPLY' buttons.
- Navigation:** Includes tabs for 'Hue', 'Impala autoscaler', 'Impala catalog', 'Impala coordinator' (selected), 'Impala executor', and 'Impala stationer'.
- Configuration Table:** A table with columns 'KEY' and 'VALUE'. The 'default\_query\_options' row is highlighted with the value 'hive.query.results.columns.disable\_codegen=true'. Other rows are empty.
- Sliders:** On the right, there are three sliders:
  - 'AutoSuspend Timeout (in seconds): 1800' with a scale from 0 to 7000.
  - 'Scale Up Delay (in seconds): 20' with a scale from 0 to 1000.
  - 'Scale Down Delay (in seconds): 20' with a scale from 0 to 1000.
- Metadata:** Includes 'Created: 2 months ago', 'User: pmohan', and 'User CRN: cmcaltus.iarnous-west-1:174b72bd-118f-43c1-8fc2-5718tz2f0818:user.Oa950259-939d-4fe0-b8ac-c0256032bdc1'. The 'Email' is 'pmohan@olympus.cloudera.com'.

Similarly, make the required changes for the Impala executor ( Impala executor flagfile `default_query_options` .

- Click APPLY.
- Restart the Virtual Warehouse.

### Related Information

[Admission Control Architecture for Cloudera Data Platform](#)  
[Managing Resources in Impala](#)

## Create Virtual Warehouses to implement admission control

There is only one queue in Cloudera Data Warehouse's (CDW) Virtual Warehouses that is used to run all queries in a first-in-first-out (FIFO) order. If you have multiple queues on the base cluster that you are migrating to CDW Impala, then you must create a Virtual Warehouse for each queue or a request pool, so that you can isolate the compute environments for each of those user groups.

### Related Information

[Adding a new Virtual Warehouse](#)

## Modify client connections (JDBC and ODBC)

Impala in Cloudera Data Warehouse (CDW) provides a JDBC/ODBC endpoint that can be used to configure all BI tools and applications for each Virtual Warehouse. In CDW, different user groups will likely get their own Virtual Warehouse, each of which has its own unique JDBC/ODBC URL. Make sure that you point your BI clients to the corresponding URL.


In the CDH environment, you had access to one monolithic Impala cluster and you used one JDBC/ODBC URL to connect your Impala clients to the cluster. All your client applications used that one URL. In CDW, you must direct your individual client applications to their own Virtual Warehouse JDBC/ODBC URLs. The URL for each Virtual Warehouse is unique. Therefore, you can recreate a Virtual Warehouse with the same name so that the URL remains the same.

Following is a list of changes for the clients between the base cluster and CDW Data Service on Private Cloud:

- Impala in CDW uses the port 443 and communicates over the http protocol, whereas, Impala on the base cluster uses the binary 21050 protocol.
- Impala in CDW uses LDAP authentication, whereas, Impala on the base cluster uses Kerberos and Knox. Therefore, you must specify a username and password.

Kerberos authentication will be available in CDW Data Service on Private Cloud in a future release.

- Impala in CDW uses the latest Simba drivers. Download the latest JDBC driver from the [Cloudera Downloads](#) page, or alternatively, on the Virtual Warehouses page. Simba drivers are backward-compatible.

- For granting access to the Impala-shell, click  Copy Impala shell command on the Virtual Warehouse tile to copy the command line for invoking the impala-shell. This command line contains all the required parameters, including the default user ID for the Virtual Warehouse (this is the Virtual Warehouse's admin user) as required for LDAP, and the network address of the Impala coordinator.

The Impala-shell command line in CDW contains the following parameters that are not present in the Impala-shell command line on the base cluster:

- --protocol='hs2-http': The HiveServer2 protocol that impala-shell uses to speak to the Impala daemon
- --ssl: Used to enable TLS/SSL for the Impala-shell. This parameter is always present in the command line.
- Uses the 443 port by changing the endpoint to the Virtual Warehouse's coordinator endpoint inside the Virtual Warehouse's coordinator pod. For example: coordinator-default-impala.dw-demo.ylcu-atmi.cloudera.site:443
- -l: Used to specify LDAP user name and password for LDAP-based authentication instead of Kerberos. LDAP authentication uses the LDAP server defined on the **Authentication** page of the Private Cloud Management Console.

Following is a sample Impala shell command:

```
impala-shell --protocol='hs2-http' --strict_hs2_protocol --ssl -i coordinator-default-impala.dw-demo.ylcu-atmi.cloudera.site:443' -u [***USERNAME***] -l
```

### Related Information

[Setting up ODBC connection from a BI tool](#)

## Reference information

Review guidelines and related information while migrating Impala workloads to Cloudera Data Warehouse Data Service on Private Cloud.

### Guidelines for moving repeated BI workloads

Review the guidelines for moving Repeated BI workloads.

- Avoid selecting workloads that download data.
- Ensure that the datasets are compressed Parquet tables and not in text or ORC format.
- Select workloads that are an output of BI queries submitted from any BI tools and repeated multiple times.

You can find the repeated queries under simple query profile analysis.

- A small to medium-sized VW is recommended for BI workloads.
- Redirect the BI tool to point to CDW for the workloads.
- Check that the performance of the queries in CDW is faster.
- Set proper values for run-time filters, EXEC\_TIME\_LIMIT\_S property, and so on as recommended for TPC-DS queries.

- Set query timeouts and session timeouts to avoid non-responsive queries.
- Look at the peak spilled metrics in the query profiles and depending on the value increase the data cache size and lower the scratch space (SCRATCH\_LIMIT) to cache more data for better performance.
- Increase the value of the EXEC\_SINGLE\_NODE\_ROWS\_THRESHOLD property to at least 5000 for small query optimization.
- Schedule weekly statistic data collection for better query performance.

## Configuration options available in CDW by default

Certain customization that you embraced in a CDH environment need not be imported to Cloudera Data Warehouse (CDW), due to its containerized and compute-isolated architecture and available default configurations.

The following list is a list of customization options that are set by default in CDW and need not be configured:

- Admission control in CDW is tuned by default because of tenant isolation using multiple Virtual Warehouses, and auto-scaling.
- Impala multithreading and remote data cache settings can be ignored because CDW provides them as default configurations.

## Supported authentication

In CDH, the list of supported authentication modes for Impala clients included Kerberos. However, Kerberos authentication is not supported for Impala clients in Cloudera Data Warehouse (CDW). To connect to Impala that is running in CDW you can use your workload userID and password.

### Security change - Apache Knox authentication not supported in CDW

Knox proxy that is generally used to extend the reach of Apache™ Hadoop® services to users outside of a Hadoop cluster is not supported within CDW. Open the ports for Private Cloud with Data Services as a gateway for communicating with AWS services.

### Switch to LDAP auth for Impala-shell and Impyla clients

You can use impala-shell and impyla to query Impala Virtual Warehouses in CDW; however, Kerberos is not supported with impala-shell and impyla in CDW. To query Impala Virtual Warehouse, you must switch to LDAP authentication. To switch to LDAP, upgrade impala-shell to the latest version by running the following command: pip2 install impala-shell. You can specify the following connection string when starting impala-shell to control how shell commands are executed. You can specify options on the command line or in the impala-shell configuration file:

```
Impala-shell --protocol='hs2-http' --ssl -i "<impalad=host-name>:443" -u <user-name> -l
```

where,

- hs2-http is the HiveServer2 protocol that impala-shell uses to speak to the Impala daemon
- -l enables LDAP authentication
- --ssl enables TLS/SSL for impala-shell

## Setting up ODBC connection from a BI tool

Describes how to connect to Impala Virtual Warehouses using ODBC with your BI tool, with Tableau as an example.

## Before you begin

Before you can use Tableau with Impala Virtual Warehouses, you must have created a Database Catalog that is populated with data. You have the option to populate your Database Catalog with sample data when you create it. You must also create an Impala Virtual Warehouse, which is configured to connect to the Database Catalog that is populated with data.

## Procedure

1. Download the latest version of the Impala ODBC driver from [Cloudera Downloads page](#) or alternatively, on the Virtual Warehouses page, click the options menu for the warehouse you want to connect to your BI tool, and select Download JDBC/ODBC Driver and install it.
2. Install the driver on the local host where you intend to use Tableau Desktop.
3. Log in to the CDP web interface and navigate to the Data Warehouse service.
4. In the Data Warehouse service, click Virtual Warehouse in the left navigation panel.
5. On the Virtual Warehouses page, click the more options menu for the Impala warehouse you want to connect to with Tableau, and select Copy JDBC URL:

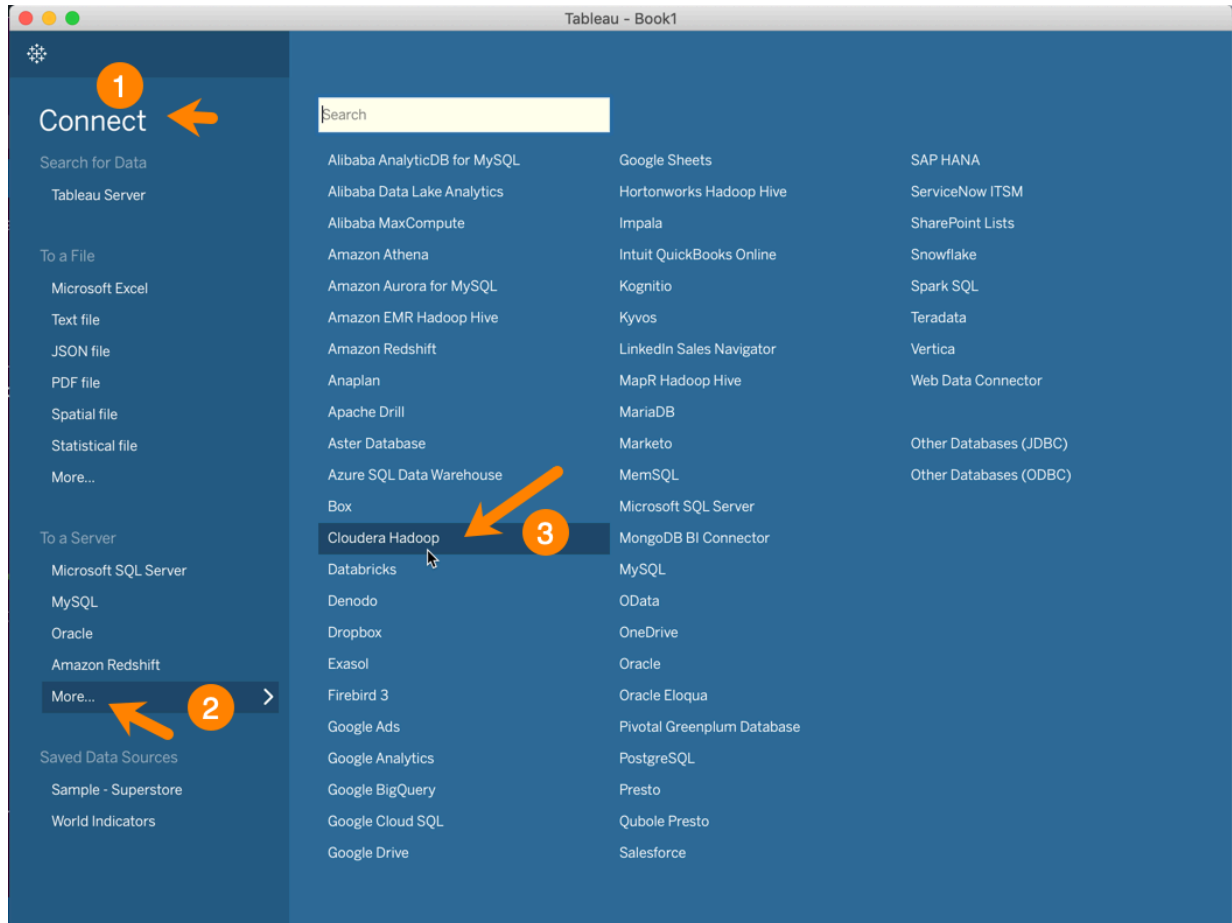
This copies the JDBC URL to your system clipboard.

6. Paste the copied JDBC URL into a text file. It should look similar to the following:

```
jdbc:hive2://<your-virtual-warehouse>.<your-environment>.<dwx.company.com>/default;transportMode=http;httpPath=cliservice;ssl=true;retries=3
```

7. From the text file where you just pasted the URL, copy the host name from the JDBC URL to your system clipboard. For example, in the URL shown in Step 6, the host name is:

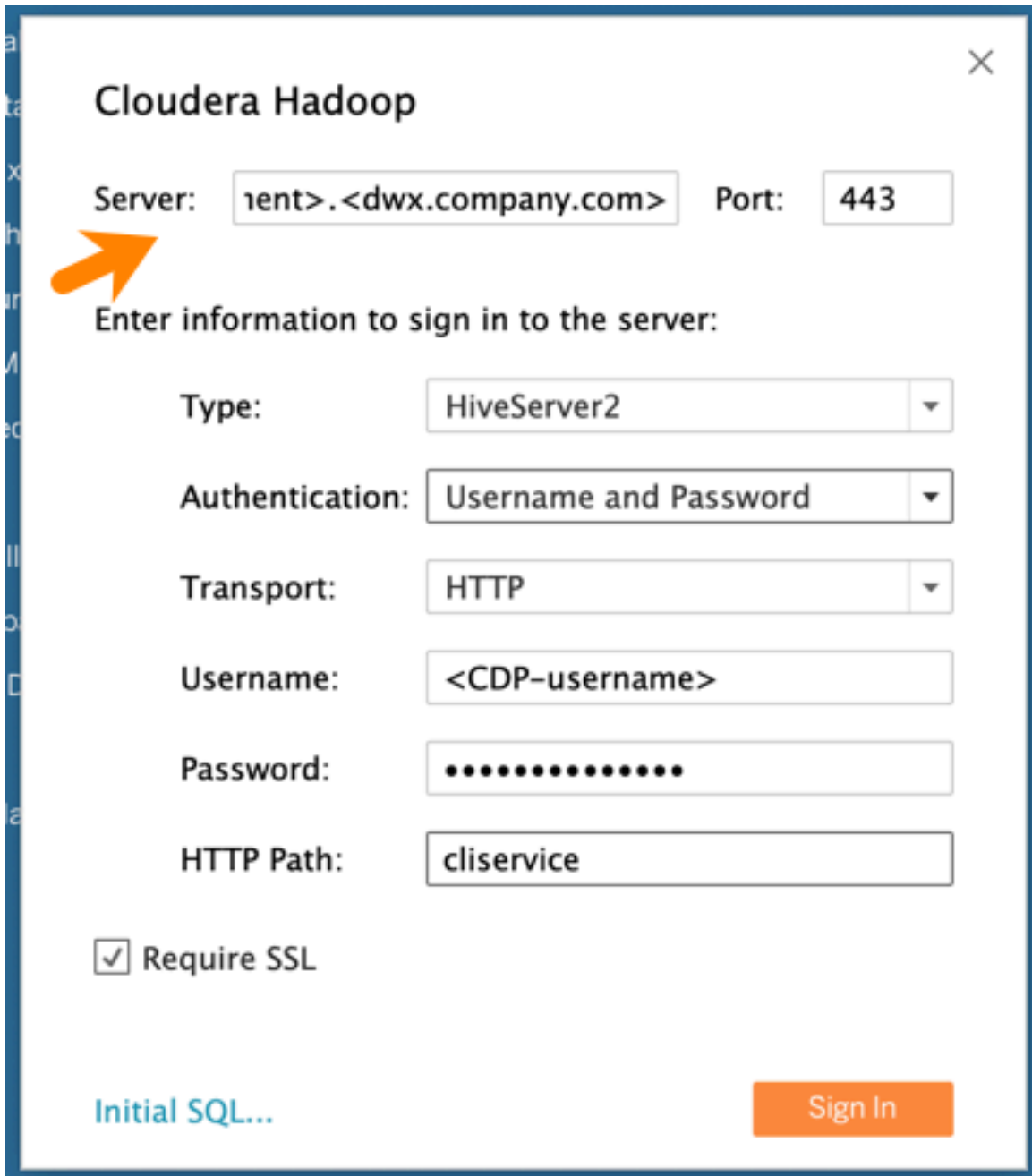
```
<your-virtual-warehouse>.<your-environment>.<dwx.company.com>
```

**8. Start Tableau and navigate to ConnectMore...Cloudera Hadoop :**

This launches the Cloudera Hadoop dialog box.



9. In the Tableau Cloudera Hadoop dialog box, paste the host name you copied to your clipboard in Step 7 into the Server field:



Cloudera Hadoop

Server:  Port:

Enter information to sign in to the server:

Type:

Authentication:

Transport:

Username:

Password:

HTTP Path:

Require SSL

[Initial SQL...](#)

10. Then in the Tableau Cloudera Hadoop dialog box, set the following options:

- Port: 443
- Type: HiveServer2
- Authentication: Username and Password
- Transport: HTTP
- Username: Username to connect to the CDP Data Warehouse service.
- Password: Password to connect to the CDP Data Warehouse service.
- HTTP Path: cliservice
- Require SSL: Make sure this is selected.

11. Click Sign In.