

## Data Warehouse Overview

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## Cloudera Data Warehouse Data Service overview

Cloudera Data Warehouse (CDW) Data Service is a containerized application that enables you to create highly-performant, independent, self-service data warehouses for teams of business analysts without the overhead of bare metal deployments. Learn more about the service architecture, and how CDW enables data practitioners and IT administrators to achieve their goals.

Cloudera Data Platform (CDP) enables you to implement powerful modern data architectures such as Data Mesh, Data Fabric, and Data Lakehouse. CDP supports a Data Lakehouse architecture by pre-integrating and unifying the capabilities of Data Warehouses and Data Lakes, to support data engineering, business intelligence, and machine learning – all on a single platform. Cloudera's support for an open data lakehouse, centered on CDW, brings high-performance, self-service reporting and analytics to your business – simplifying data management for both for data practitioners and administrators.

CDW provides tight integration with the other Cloudera Data Services providing data ingestion, data engineering, machine learning, and data visualization.

CDW leverages Apache Impala, Hive ACID, and Hive table format to provide broad coverage, enabling the best optimized set of capabilities to each workload.

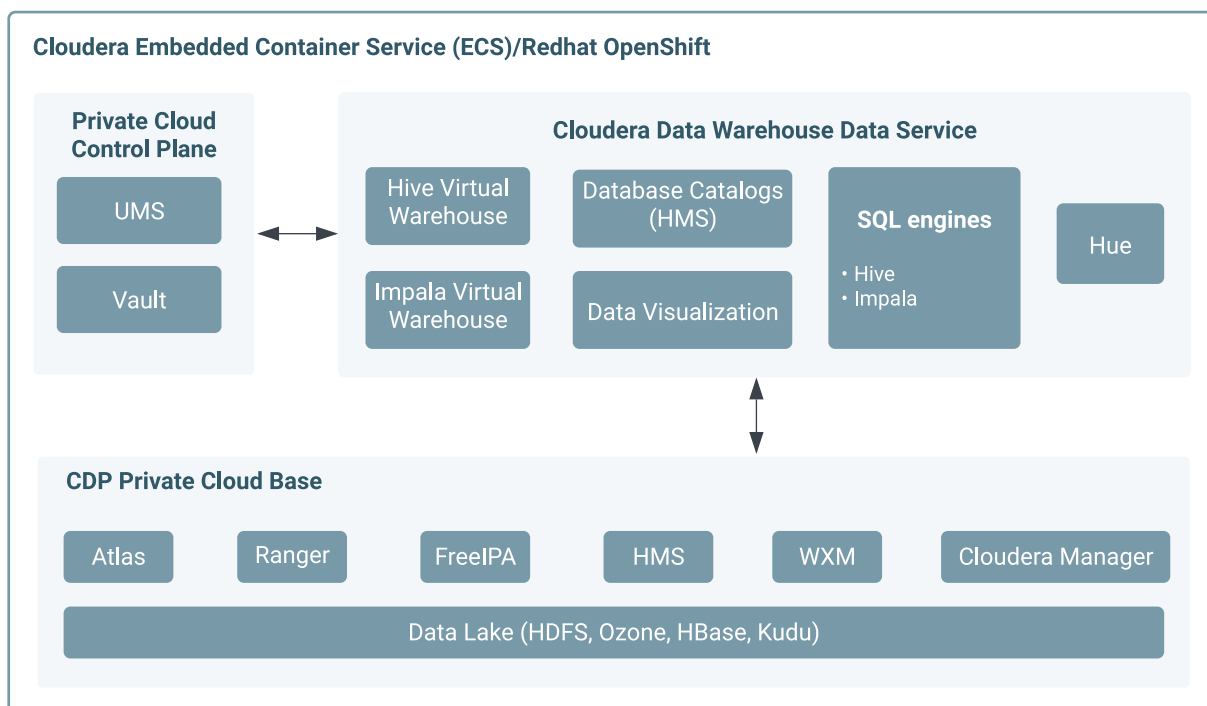
For data practitioners, CDW provides consistent quick response times with high concurrency, easy data exploration and business intelligence on any enterprise data across the Data Lake. CDW also supports streamlined application development with open standards, open file and table formats, and standard APIs. Through tenant isolation, CDW can process workloads that do not interfere with each other, so everyone meets report timelines while controlling costs.

For administrators, CDW simplifies administration by making multi-tenancy secure and manageable. Virtual Warehouses can be provisioned on-demand, using self-service, and de-provisioned when idle. Administrators also benefit from the ability to independently upgrade the Virtual Warehouses and Database Catalogs.

## Cloudera Data Warehouse service architecture

Administrators and IT teams can get a high-level view of the Cloudera Data Warehouse (CDW) service components and how they are integrated within the CDP stack.

The CDW service is composed of Database Catalogs (storage prepared for use with a Virtual Warehouse) and Virtual Warehouses (compute environments that can access a Database Catalog) and they are decoupled by design. Multiple Virtual Warehouses of differing sizes and types can be configured to operate on the same Database Catalog, providing workload diversity and isolation on the same data at the same time.



### Database Catalog

A Database Catalog is a logical collection of table and view metadata, security permissions, and other information. The data context is comprised of table and view definitions, transient user and workload contexts from the Virtual Warehouse, security permissions, and governance artifacts that support functions like auditing. Multiple Virtual Warehouses can query a Database Catalog. An environment can have multiple Database Catalogs.

When you activate an environment from the Data Warehouse, a default Database Catalog is created automatically and named after your environment. The default Database Catalog shares the HMS database with HMS on the base cluster. This enables you to access any of the objects or data sets created in the base clusters from CDW Virtual Warehouses and vice versa. Queries and query history saved in the Hue database are stored in the Database Catalog and not deleted when you delete a Virtual Warehouse.

You can load demo data to use in Hue when you add a non-default Database Catalog to your environment.

### Virtual Warehouses

A Virtual Warehouse is an instance of compute resources running in Kubernetes to execute the queries. From a Virtual Warehouse, you access tables and views of your data in a Database Catalog's Data Lake. Virtual Warehouses bind compute and storage by executing authorized queries on tables and views through the Database Catalog. Virtual Warehouses can scale automatically, and ensure performance even with high concurrency. All JDBC/ODBC compliant tools connect to the virtual warehouse to run queries. Virtual Warehouses also expose HS2-compatible endpoints for CLI tools such as Beeline, Impala-Shell, and Impyla.

### Data Visualization

In addition to Database Catalogs and Virtual Warehouses that you use to access your data, CDW integrates Data Visualization for building graphic representations of data, dashboards, and visual applications based on CDW data, or other data sources you connect to. You, and authorized users, can explore data across the entire CDP data lifecycle using graphics, such as pie charts and histograms. You can arrange visuals on a dashboard for collaborative analysis.

## Key features of Cloudera Data Warehouse Private Cloud

The Cloudera Data Warehouse (CDW) service provides data warehouses that can be automatically configured and isolated. CDW optimizes existing workloads when you move to your private cloud. You scale resources up and down to meet your business demands, and save costs by suspending and resuming resources automatically. Data warehouses comply with the security controls associated with your base cluster.

### Automatically configured and isolated

Each data warehouse can be automatically configured for you by the CDW service, but you can adjust certain settings to suit your needs. Individual warehouses are completely isolated, ensuring that the users have access to only their data and eliminating the problem of "noisy neighbors." *Noisy neighbors* are workloads that monopolize system resources and interfere with the queries from other tenants. With Cloudera Data Warehouse, you can easily offload noisy neighbor workloads to their own Virtual Warehouse instance so other tenants have access to enough compute resources for their workloads to complete and meet their SLAs.

This capability to isolate individual warehouses is equally useful for "VIP workloads." *VIP workloads* are crucial workloads that must have resources to complete immediately and as quickly as possible without waiting in a queue. You can run these VIP workloads in their own warehouse to ensure they get the resources they need to complete as soon as possible.

### Optimized for your workloads

Data warehouses are automatically optimized for your workloads. This includes pre-configuring the software and creating the different caching layers, which means that you need not engage in complex capacity planning or tuning. You create a Virtual Warehouse that specifies a SQL engine:

- Hive for data warehouses that support complex reports and enterprise dashboards.
- Impala for Data Marts that support interactive, ad-hoc analysis.

You choose the Virtual Warehouse instance size and adjust thresholds for auto-scaling.

### Auto-scaling

*Auto-scaling* enables both scaling up and scaling down of Virtual Warehouse instances so they can meet your varying workload demands and save costs on cloud resources when they are not needed.

Auto-scaling provides the following benefits:

- Service availability: Clusters are ready to accept queries "24 x 7".
- Auto-scaling based on query wait-time: Queries start executing within the number of seconds that you specify and cluster resources are added or shut down to meet demand.
- Auto-scaling based on number of concurrent queries running on the system: "Infinite scaling" means that the number of concurrent queries can go from 10 to 100 in minutes.
- Cost guarantee: You can configure auto-scaling upper limits, which determine how large a compute cluster can grow. Since compute costs increase as cluster size increases, having a way to configure upper limits gives administrators a method to stay within a budget.

### Auto-suspend and resume

You have the capability to set an AutoSuspend Timeout when creating a Virtual Warehouse. This sets the maximum time a Virtual Warehouse idles before shutting down. For example, if you set this to 60 seconds, then if the Virtual Warehouse is idle for 60 seconds, it suspends itself so you do not have to pay for unused compute resources. The first time a new query is run against an auto-suspend Virtual Warehouse, it restarts. This feature helps you maintain a tight control on your cloud spend while ensuring availability to run your workloads.

## Security compliance

Your Database Catalogs and Virtual Warehouses automatically inherit the same security restrictions that are applicable to your CDP environment. There is no need to specify the security setup again for each Database Catalog or Virtual Warehouse.

The following security controls are inherited from your CDP environment:

- **Authentication:** Ensures that all users have proven their identity before accessing the Cloudera Data Warehouse service or any created Database Catalogs or Virtual Warehouses.
- **Authorization:** Ensures that only users who have been granted adequate permissions are able to access the Cloudera Data Warehouse service and the data stored in the tables.
- **Dynamic column masking:** If rules are set up to mask certain columns when queries run, based on the user executing the query, then these rules also apply to queries executed in the Virtual Warehouses.
- **Row-level filtering:** If rules are set up to filter certain rows from being returned in the query results, based on the user executing the query, then these same rules also apply to queries executed in the Virtual Warehouses.

## Tenant isolation

The multitenant storage technique in CDW offers increased security over the storage method used in earlier releases. The earlier releases based all storage access in CDW on a single Kubernetes pod. Tenant isolation offers users independence on several levels:

- Isolation reduces contention
- Workloads do not interfere with each other
- Each tenant can choose a version of an independent deployment
- Independent upgrades limit the scope of changes

## Related Information

[Private cloud security](#)