

## Operational Database Overview

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# Introduction to Operational Database

Cloudera Operational Database delivers a real-time, always available, scalable operational database that serves traditional structured data alongside unstructured data within a unified operational and warehousing platform.

Cloudera Operational Database is a CDP Public Cloud service for self-service creation of an operational database. Cloudera Operational Database is designed to be used by developers. You do not need a dedicated team of system administrators to run an on-premise cluster of physical servers. You can go directly to CDP and provision a new database, therefore letting you rapidly prototype and deploy new applications onto the public cloud.

## **Apache HBase**

Apache HBase is a column-oriented database management system that runs on top of the Hadoop Distributed File System (HDFS), a main component of Apache Hadoop. It enables random, strictly consistent, and real-time access to petabytes of data.

## **Apache Phoenix**

Apache Phoenix is a SQL layer for Apache HBase that provides a programmatic ANSI SQL interface. Apache Phoenix implements best-practice optimizations to enable software engineers to develop HBase based next-generation applications that operationalize big data.

## **Apache Kafka**

Apache Kafka is a distributed streaming platform that is used to build real-time applications.

## **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.

## **Apache Nifi**

Apache Nifi is used to develop, manage, and monitor data flows.

## **Apache Hive**

Apache Hive is a data warehouse software that facilitates reading, writing, and managing large datasets residing in distributed storage using SQL.

## **Apache Hue**

Apache Hue is a SQL assistant for databases and data warehouses.

## **Apache Impala**

Apache Impala is a modern, open source, distributed SQL query engine for Apache Hadoop.

## **Apache Knox**

Apache Know Gateway provides access to Apache Hadoop through proxying of HTTP resources. It provides proxying services, authentication services, and client DSL or SDK services.

Cloudera Operational Database is powered by Apache HBase and Apache Phoenix. In Cloudera Operational Database, you use object store such as Amazon S3 and Microsoft ADLS Gen2 to store the Apache HBase files. You have the choice to either develop applications using one of the native Apache HBase API, or you can use Apache Phoenix for data access. Apache Phoenix is a SQL layer that provides a programmatic ANSI SQL interface. It works on top of Apache HBase, and it makes it possible to handle data using standard SQL queries and Apache Phoenix commands. You can use Cloudera Operational Database in the public cloud or on-premises.

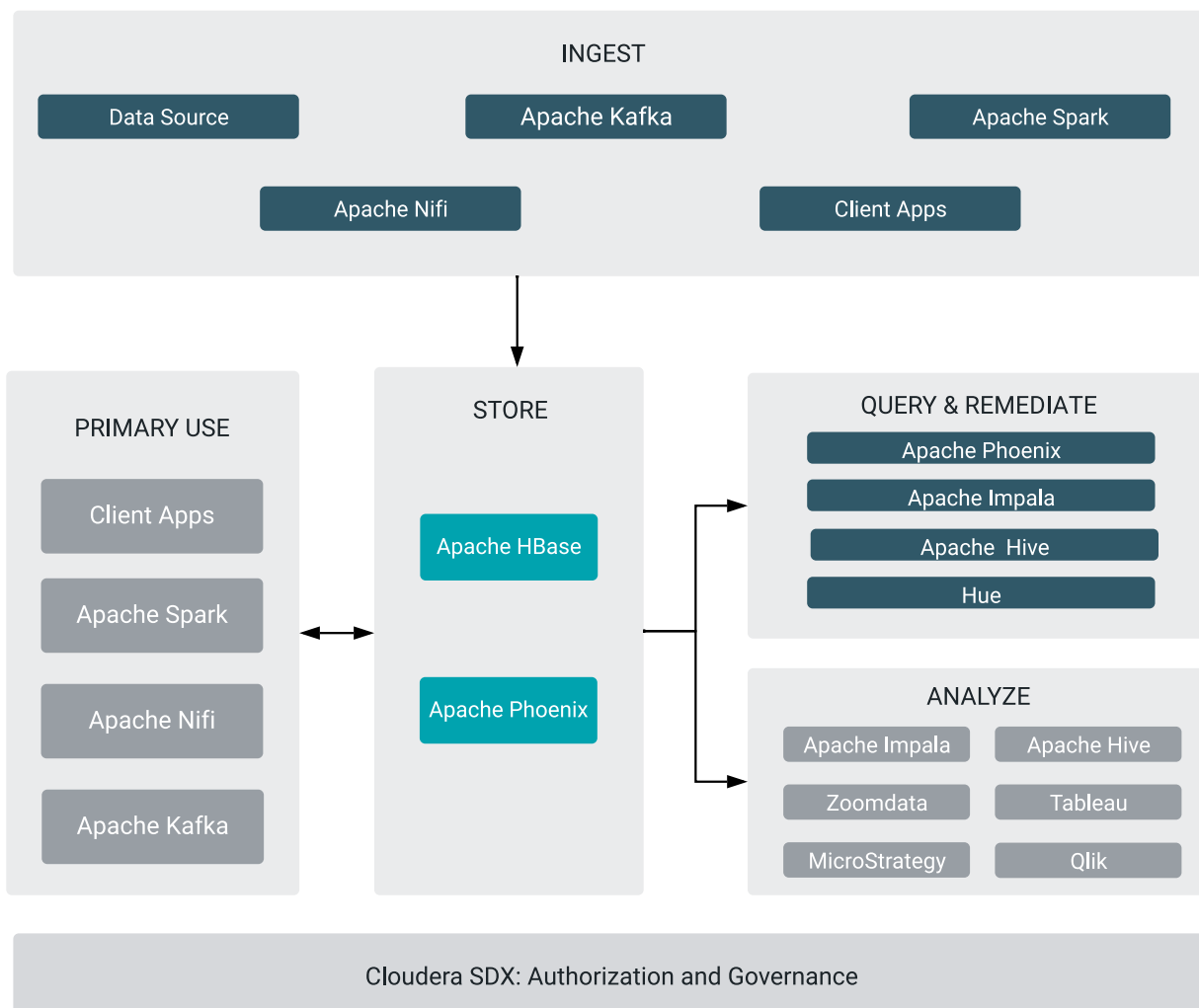
## **Public cloud**

Cloudera Operational Database (COD) that is a managed database platform as a service (dbPaaS).

## On-premises

- CDP Private Cloud Base

Cloudera Operational Database plays the crucial role of a data store in the enterprise data lifecycle. The following graphic shows some of the key elements in a typical operational database deployment.



The operational database has the following components:

- *Apache Phoenix* provides a SQL interface that runs on top of *Apache HBase*.
- *Apache HBase* provides the key-value stores with massive scalability, so you can store unlimited amounts of data in a single platform and handle growing demands for serving data.
- *Apache ZooKeeper* provides a distributed configuration service, a synchronization service, and a naming registry.
- *Apache Knox Gateway* provides perimeter security so that the enterprise can confidently extend access to new users.
- *Apache HDFS* is used to write the *Apache HBase* WALs.
- *Hue* provides a web-based editor to create and browse *Apache HBase* tables.
- Object store such as Amazon S3 and Microsoft ADLS Gen2 is used to store the *Apache HBase* HFiles.
- *Cloudera Shared Data Experience (SDX)* is used for security and governance capabilities. Security and governance policies are set once and applied across all data and workloads.
- *IDBroker* provides an authentication mechanism that is built as part of the *Apache Knox* authentication service. It allows an authenticated and authorized user to exchange a set of credentials or a token for cloud vendor access tokens.

## Introduction to Apache HBase

Apache HBase is a scalable, distributed, column-oriented datastore. Apache HBase provides real-time read/write random access to very large datasets hosted on HDFS.

HBase is sparse, distributed, persistent, multidimensional sorted map, which is indexed by rowkey, column key, and timestamp. Fundamentally, it is a platform for storing and retrieving data with random access. HBase is designed to run on a cluster of computers, built using commodity hardware. HBase is also horizontally scalable, which means you can add any number of columns anytime.

## Introduction to Apache Phoenix

Apache Phoenix is a SQL layer for Apache HBase that provides a programmatic ANSI SQL interface.

Apache Phoenix implements best-practice optimizations to enable software engineers to develop HBase based next-generation applications that operationalize big data. Using Phoenix, you can create and interact with tables in the form of typical DDL/DML statements using the Phoenix standard JDBC API.

Apache HBase timestamps are the core part of the Apache Phoenix functionality. It is used as part of the *Travel in time* functionality and by the Transactional engines. Due to this, we expect that the data must have valid timestamps that signifies the time when the record is created. Invalid timestamps cause incorrect behavior for most Apache Phoenix functionalities, such as secondary indexes or CRUD operations. If your data is relying on the special behavior of the record's timestamps or future timestamps, you must not use such data with Apache Phoenix.

## Apache Phoenix and SQL

You can use the Apache Phoenix SQL commands to create, drop, or modify an Apache HBase table. You can also create Apache Phoenix views that are virtual tables that share the same Apache HBase table.

The Apache Phoenix commands enable you to use standard SQL data definition language (DDL) and data manipulation language (DML) commands to interact with Apache HBase tables. You can create a new Apache HBase table using the standard `CREATE TABLE` SQL command or create a view on an existing Apache HBase table using the `VIEW` command. View enables you to have multiple virtual tables that share the same physical Apache HBase table.

Apache HBase tables and Apache Phoenix tables have a one-to-one relationship. This means each Apache HBase table is associated with a corresponding Apache Phoenix table.



**Warning:** Although you can modify Apache Phoenix tables using the Apache HBase native APIs, this is not supported and results in errors, inconsistent indexes, incorrect query results, and sometimes corrupt data.

Using Apache Phoenix commands you can do the following tasks:

- Create or alter Apache HBase tables using DDL commands like `CREATE TABLE`
- Modify contents in an Apache HBase table using DML commands like `UPSERT VALUES`