



Cloudera Governance

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Release Information

Version: Cloudera Navigator Navigator 2.1.x
Date: May 15, 2019

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About Cloudera Governance

This guide describes how to perform governance using Cloudera Navigator. Governance activities include auditing access to data residing in HDFS and Hive metastores, reviewing and updating metadata, and discovering the lineage of data objects.



Important: This feature is available only with a Cloudera Enterprise license.

For other licenses, the following applies:

- Cloudera Express- The feature is not available.
- Cloudera Enterprise Data Hub Edition Trial - The feature is available until you end the trial or the trial license expires.

To obtain a license for Cloudera Enterprise, fill in this [form](#) or call 866-843-7207. After you install a Cloudera Enterprise license, the feature will be available.

Cloudera governance features are provided by Cloudera Navigator. Cloudera Navigator is a fully integrated data management tool for the Hadoop platform. Data management capabilities are critical for enterprise customers that are in highly regulated industries and have stringent compliance requirements.

Cloudera Navigator provides two categories of functionality:

- Auditing data access and verifying access privileges - The goal of auditing is to capture a complete and immutable record of all activity within a system. While Hadoop has historically lacked centralized cross-component audit capabilities, products such as Cloudera Navigator add secured, real-time audit components to key data and access frameworks. Cloudera Navigator allows administrators to configure, collect, and view audit events, to understand who accessed what data and how. Cloudera Navigator also allows administrators to generate reports that list the HDFS access permissions granted to groups.

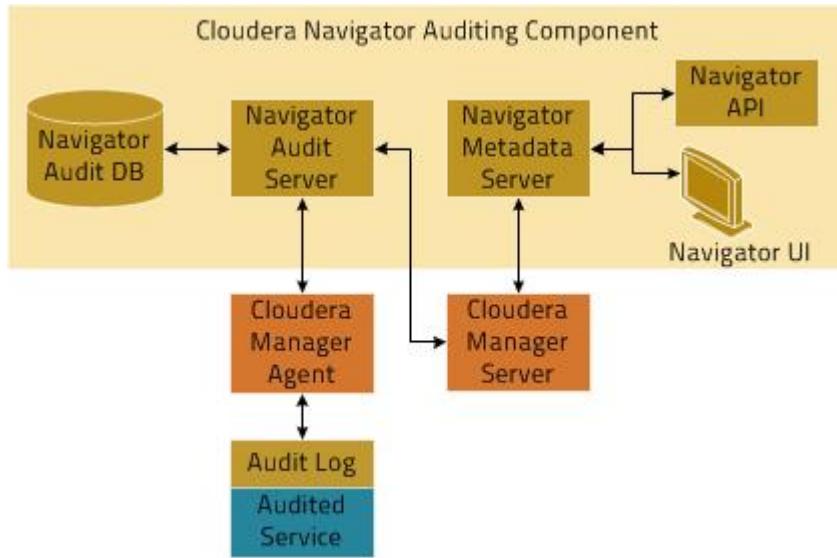
Cloudera Navigator tracks access permissions and actual accesses to all entities in HDFS, Hive, HBase, Impala, and Sentry to help answer questions such as - who has access to which entities, which entities were accessed by a user, when was an entity accessed and by whom, what entities were accessed using a service, which device was used to access, and so on. Cloudera Navigator auditing supports tracking access to:

- HDFS data accessed through HDFS, Hive, HBase, Cloudera Impala services
 - HBase and Impala operations
 - Hive metadata
 - Sentry access
- Searching metadata and visualizing lineage - Cloudera Navigator metadata management features allow DBAs, data modelers, business analysts, and data scientists to search for, amend the properties of, and tag data entities.

In addition, to satisfy risk and compliance audits and data retention policies, it supports the ability to answer questions such as: where did the data come from, where is it used, and what are the consequences of purging or modifying a set of data entities. Cloudera Navigator supports tracking the lineage of HDFS files and directories, Hive tables and columns, MapReduce and YARN jobs, Hive queries, Pig scripts, Sqoop jobs, and Oozie workflows.

Cloudera Navigator Auditing Architecture

The Cloudera Navigator auditing component provides data auditing and access features. The architecture of the Cloudera Navigator auditing component is illustrated below.



When the Cloudera Navigator auditing component is configured, plug-ins that enable collection of audit events are added to the HDFS, HBase, and Hive (that is, the HiveServer2 and Beeswax servers) services. The plug-ins write the audit events to an audit log on the local filesystem. Cloudera Impala and Sentry record audit events directly in an audit log file.

The Cloudera Manager Agent monitors the audit log files and sends these events to the Navigator Audit Server. The Cloudera Manager Agent retries any event that it fails to transmit. As there is no in-memory transient buffer involved, once the audit events are written to the audit log file, they are guaranteed to be delivered (as long as filesystem is available). The Cloudera Manager Agent keeps track of current audit event offset in the audit log that it has successfully transmitted, so on any crash/restart it picks up the audit event from the last successfully sent position and resumes. Audit logs are rotated and the Cloudera Manager Agent follows the rotation of the log. The Agent also takes care of purging old audit logs once they have been successfully transmitted to the Navigator Audit Server. If a plug-in fails to write audit event to audit log file, it can either drop the event or shut down the process in which they are running (depending on the configured queue policy).

The Navigator Audit DB stores audit events.

Audit Log Properties

Describes auditing log properties and how to configure the log properties.

The following properties apply to the audit log file:

- **Audit Log Directory** - The directory in which audit event log files are written. By default, this property is not set if Cloudera Navigator is not installed.



Note: If the value of this property is changed, and service is restarted, then the Cloudera Manager Agent will start monitoring the new log directory for audit events. In this case it is possible that not all events are published from the old audit log directory. To avoid loss of audit events, when this property is changed, perform the following steps:

1. Stop the service.
2. Copy audit log files and (for Impala only) the `impalad_audit_wal` file from the old audit log directory to the new audit log directory. This need to be done on all the nodes where Impala daemons are running.
3. Start the service.

- **Maximum Audit Log File Size** - The maximum size of the audit event log file before a new file is created. The unit of the file size is service dependent:
 - HDFS, HBase, Hive - MiB
 - Impala - lines (queries)
- **Number of Audit Logs to Retain** - Maximum number of rolled over audit logs to retain. The logs will not be deleted if they contain audit events that have not yet been propagated to Audit Server.

Configuring Audit Logs

1. Click a supported service.
2. Click the **Configuration** tab.
3. Configure the log properties in the following categories:
 - **Impala - Impala Daemon Default Group > Logs**
 - **HBase, HDFS, Hive, Sentry - Service-Wide > Logs**
4. Edit the audit log properties.
5. Click **Save Changes**.
6. Restart the service.

Service Auditing Properties

Describes service auditing properties and how to configure the properties.

Each service (with exceptions noted) that supports auditing configuration has the following properties:

- **Enable Collection** - Controls whether the Cloudera Manager Agent tracks a service's [audit log file](#). A validation check is performed for all life cycle actions (stop/start/restart). If the Enable Collection flag is selected and the Audit Log Directory property is *not set*, the validator displays a message that says that the Audit Log Directory property must be set to enable auditing.
- **Event Filter** - A set of rules that capture properties of auditable events and actions to be performed when an event matches those properties. This property is not supported for Sentry.
- **Event Tracker** - A set of rules for tracking and coalescing events. This feature is used to define equivalency between different audit events. When events match, according to a set of configurable parameters, only one entry in the audit list is generated for all the matching events.
- **Queue Policy** - The action to take when the audit event queue is full. The options are Drop or Shutdown. When a queue is full and the queue policy of the service is Shutdown, before shutting down the service, N audits will be discarded, where N is the size of the Cloudera Navigator Audit Server queue.



Note: If the queue policy is Shutdown, the Impala service is shut down only if Impala is unable to write to the audit log file. It is possible that an event may not appear in the audit event log due to an error in transfer to the Cloudera Manager Agent or database. In such cases Impala will not shut down and will keep writing to the log file. When the transfer problem is fixed the events will be transferred to the database.

The Event Filter and Event Tracker rules for filtering and coalescing events are expressed as JSON objects. For information on the structure of the objects, see the description on the configuration page within the Cloudera Manager Admin Console.

The default event filter discards events generated by the internal Cloudera and Hadoop users (`cloudera-scm`, `hdfs`, `hbase`, `hive`, `mapred`, `solr`, and `dr.who`) and that affect files in the `/tmp` directory.

Configuring Service Auditing Properties

Minimum Required Role: [Navigator Administrator](#) (also provided by **Full Administrator**)

1. Click a service that supports auditing.
2. Click the **Configuration** tab.
3. Click the **Cloudera Navigator** category. The Service-Wide category displays.
4. Edit the properties.
5. Click **Save Changes**.
6. Restart the service.

Configuring Impala Daemon Logging

Minimum Required Role: [Configurator](#) (also provided by **Cluster Administrator**, **Full Administrator**)

To control whether the Impala daemon logs to the audit log:

1. Click the Impala service.
2. Click the **Configuration** tab.
3. Expand the **Impala Daemon Default Group > Logs** category.
4. Edit the **Enable Impala Audit Event Generation** checkbox setting.
5. Click **Save Changes**.
6. Restart the service.

Audit Logging to Syslog

Minimum Required Role: [Navigator Administrator](#) (also provided by **Full Administrator**)

The Audit Server logs all audit records into a [Log4j](#) logger called `auditStream`. The log messages are logged at the TRACE level, with the attributes of the audit records. By default, the `auditStream` logger is inactive because the logger level is set to FATAL. It is also connected to a [NullAppender](#), and does not forward to other appenders (additivity set to false).

To record the audit stream, configure the `auditStream` logger with the desired appender. For example, the standard [SyslogAppender](#) allows you to send the audit records to a remote syslog.

The Log4j SyslogAppender supports only UDP. An example syslog configuration would be:

```
$ModLoad imudp
$UDPServerRun 514
# Accept everything (even DEBUG messages) local2.* /my/audit/trail.log
```

It is also possible to attach [other appenders](#) to the `auditStream` to provide other integration behaviors.

You can audit events to syslog in two formats: JSON and RSA EnVision. To configure audit logging to syslog, do the following:

Cloudera Navigator Auditing Architecture

1. Do one of the following:
 - Select **Clusters > Cloudera Management Service > Cloudera Management Service**.
 - On the Status tab of the Home page, in **Cloudera Management Service** table, click the **Cloudera Management Service** link.
2. Click the **Configuration** tab.
3. Search for **Navigator Audit Server Logging Advanced Configuration Snippet**.
4. Click the Value field and depending on the format type, enter:

```
log4j.logger.auditStream = TRACE,SYSLOG
log4j.appenders.SYSLOG = org.apache.log4j.net.SyslogAppender
log4j.appenders.SYSLOG.SyslogHost = hostname
log4j.appenders.SYSLOG.Facility = Local2
log4j.appenders.SYSLOG.FacilityPrinting = true
```

To configure the specific stream type, enter:

Format	Properties
JSON	log4j.additivity.auditStream = false
RSA EnVision	log4j.additivity.auditStreamEnVision = false

5. Click **Save Changes** to commit the changes.

Example Log Messages

Format	Log Message Example
JSON	Jul 23 11:05:15 hostname local2: {"type": "HDFS", "allowed": "true", "time": "1374602714758", "service": "HDFS-1", "user": "root", "ip": "10.20.93.93", "op": "mkdirs", "src": "/audit/root", "perms": "rwxr-xr-x"}
RSA EnVision	Cloudera Navigator 1 type="Hive",allowed="false",time="1382551146763",service="HIVE-1",user="systest",impersonator="",ip="/10.20.190.185",op="QUERY",opText="select count(*) from sample_07",db="default",table="sample_07",path="/user/hive/warehouse/sample_07",objType="TABLE"

If a particular field is not applicable for that audit event, it is omitted from the message.

Auditing Impala Operations

To monitor how Impala data is being used within your organization, ensure that your Impala authorization and authentication policies are effective, and detect attempts at intrusion or unauthorized access to Impala data, you can use the auditing feature in Impala 1.2.1 and higher:

- On a system managed by Cloudera Manager, enable auditing by [configuring Impala Daemon logging](#). On a system not managed by Cloudera Manager, include the option `-audit_event_log_dir=directory_path` in your `impalad` startup options. The log directory must be a local directory on the server, not an HDFS directory.
- Decide how many queries will be represented in each log files. By default, Impala starts a new log file every 5000 queries. To specify a different number, [configure Impala Daemon logging in Cloudera Manager](#), or include the option `-max_audit_event_log_file_size=number_of_queries` in the `impalad` startup options for systems not managed by Cloudera Manager.
- Configure the Cloudera Navigator product to collect and consolidate the audit logs from all the nodes in the cluster.
- Use Cloudera Navigator or Cloudera Manager to filter, visualize, and produce reports based on the audit data. (The Impala auditing feature works with Cloudera Manager 4.7 to 5.1 and Cloudera Navigator 2.1 and higher.) Check the audit data to ensure that all activity is authorized and/or detect attempts at unauthorized access.

Durability and Performance Considerations for Impala Auditing

The auditing feature only imposes performance overhead while auditing is enabled.

Because any Impala host can process a query, enable auditing on all hosts where the Impala Daemon role runs. Each host stores its own log files, in a directory in the local filesystem. The log data is periodically flushed to disk (through an `fsync()` system call) to avoid loss of audit data in case of a crash.

The runtime overhead of auditing applies to whichever node serves as the coordinator for the query, that is, the node you connect to when you issue the query. This might be the same node for all queries, or different applications or users might connect to and issue queries through different nodes.

To avoid excessive I/O overhead on busy coordinator nodes, Impala syncs the audit log data (using the `fsync()` system call) periodically rather than after every query. Currently, the `fsync()` calls are issued at a fixed interval, every 5 seconds.

By default, Impala avoids losing any audit log data in the case of an error during a logging operation (such as a disk full error), by immediately shutting down the Impala Daemon role on the host where the auditing problem occurred.

Format of the Audit Log Files

The audit log files represent the query information in JSON format, one query per line. Typically, rather than looking at the log files themselves, you use the Cloudera Navigator product to consolidate the log data from all Impala nodes and filter and visualize the results in useful ways. (If you do examine the raw log data, you might run the files through a JSON pretty-printer first.)

All the information about schema objects accessed by the query is encoded in a single nested record on the same line. For example, the audit log for an `INSERT ... SELECT` statement records that a select operation occurs on the source table and an insert operation occurs on the destination table. The audit log for a query against a view records the base table accessed by the view, or multiple base tables in the case of a view that includes a join query. Every Impala operation that corresponds to a SQL statement is recorded in the audit logs, whether the operation succeeds or fails. Impala records more information for a successful operation than for a failed one, because an unauthorized query is stopped immediately, before all the query planning is completed.

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The information logged for each query includes:

- Client session state:
 - Session ID
 - User name
 - Network address of the client connection
- SQL statement details:
 - Query ID
 - Statement Type - DML, DDL, and so on
 - SQL statement text
 - Execution start time, in local time
 - Execution Status - Details on any errors that were encountered
 - Target Catalog Objects:
 - Object Type - Table, View, or Database
 - Fully qualified object name
 - Privilege - How the object is being used (`SELECT`, `INSERT`, `CREATE`, and so on)

Which Operations Are Audited

The kinds of SQL queries represented in the audit log are:

- Queries that are prevented due to lack of authorization.
- Queries that Impala can analyze and parse to determine that they are authorized. The audit data is recorded immediately after Impala finishes its analysis, before the query is actually executed.

Cloudera Navigator Auditing Architecture

The audit log does not contain entries for queries that could not be parsed and analyzed. For example, a query that fails due to a syntax error is not recorded in the audit log. The audit log also does not contain queries that fail due to a reference to a table that does not exist, if you would be authorized to access the table if it did exist.

Certain statements in the `impala-shell` interpreter, such as `CONNECT`, `SUMMARY`, `PROFILE`, `SET`, and `QUIT`, do not correspond to actual SQL queries, and these statements are not reflected in the audit log.

Reviewing the Audit Logs

You typically do not review the audit logs in raw form. The Cloudera Manager Agent periodically transfers the log information into a back-end database where it can be examined in consolidated form. For CDH 5, see [Audit Events and Audit Reports](#). For CDH 4, see the [Cloudera Navigator documentation](#).

Audit Events and Audit Reports

Required Role:

Auditing Viewer

Full Administrator

An **audit event** is an event that describes an action of accessing a service. An **audit report**, is a collection of audit events that satisfy a set of filters.

Audit events are recorded by the [Cloudera Navigator Audit Server](#). Audit report metadata is recorded by the [Cloudera Navigator Metadata Server](#).

The following properties can appear in an audit event entry:

- **Timestamp** - Date and time the action was performed. The server stores the timestamp in the timezone of the server and the UI displays the timestamp converted to the local timezone.
- **Operation** - The action performed.
 - **HBase** - `createTable`, `deleteTable`, `modifyTable`, `addColumn`, `modifyColumn`, `deleteColumn`, `enableTable`, `disableTable`, `move`, `assign`, `unassign`, `balance`, `balanceSwitch`, `shutdown`, `stopMaster`, `flush`, `split`, `compact`, `compactSelection`, `getClosestRowBefore`, `get`, `exists`, `put`, `delete`, `checkAndPut`, `checkAndDelete`, `incrementColumnValue`, `append`, `increment`, `scannerOpen`, `grant`, `revoke`
 - **HDFS** - `setPermission`, `setOwner`, `open`, `concat`, `setTimes`, `createSymlink`, `setReplication`, `create`, `append`, `rename`, `delete`, `getFileInfo`, `mkdirs`, `listStatus`, `fsck`
 - **Hive** - `EXPLAIN`, `LOAD`, `EXPORT`, `IMPORT`, `CREATEDATABASE`, `DROPPEDATABASE`, `SWITCHDATABASE`, `DROPTABLE`, `DESCTABLE`, `DESCFUNCTION`, `MSCK`, `ALTERTABLE_ADDCOLS`, `ALTERTABLE_REPLACECOLS`, `ALTERTABLE_RENAMECOL`, `ALTERTABLE_RENAMEPART`, `ALTERTABLE_RENAME`, `ALTERTABLE_DROPPARTS`, `ALTERTABLE_ADDPARTS`, `ALTERTABLE_TOUCH`, `ALTERTABLE_ARCHIVE`, `ALTERTABLE_UNARCHIVE`, `ALTERTABLE_PROPERTIES`, `ALTERTABLE_SERIALIZER`, `ALTERPARTITION_SERIALIZER`, `ALTERTABLE_SERDEPROPERTIES`, `ALTERPARTITION_SERDEPROPERTIES`, `ALTERTABLE_CLUSTER_SORT`, `SHOWDATABASES`, `SHOWTABLES`, `SHOW_TABLESTATUS`, `SHOW_TBLPROPERTIES`, `SHOWFUNCTIONS`, `SHOWINDEXES`, `SHOWPARTITIONS`, `SHOWLOCKS`, `CREATEFUNCTION`, `DROPFUNCTION`, `CREATEVIEW`, `DROPVIEW`, `CREATEINDEX`, `DROPINDEX`, `ALTERINDEX_REBUILD`, `ALTERVIEW_PROPERTIES`, `LOCKTABLE`, `UNLOCKTABLE`, `ALTERTABLE_PROTECTMODE`, `ALTERPARTITION_PROTECTMODE`, `ALTERTABLE_FILEFORMAT`, `ALTERPARTITION_FILEFORMAT`, `ALTERTABLE_LOCATION`, `ALTERPARTITION_LOCATION`, `CREATETABLE`, `CREATETABLE_AS_SELECT`, `QUERY`, `ALTERINDEX_PROPS`, `ALTERDATABASE`, `DESCDATABASE`, `ALTER_TABLE_MERGE`, `ALTER_PARTITION_MERGE`, `GRANT_PRIVILEGE`, `REVOKE_PRIVILEGE`, `SHOW_GRANT`, `GRANT_ROLE`, `REVOKE_ROLE`, `SHOW_ROLE_GRANT`, `CREATEROLE`, `DROPROLE`
 - **Impala** - `Query`, `Insert`, `Update`, `Delete`, `GRANT_PRIVILEGE`, `REVOKE_PRIVILEGE`, `SHOW_GRANT`, `GRANT_ROLE`, `REVOKE_ROLE`, `SHOW_ROLE_GRANT`, `CREATEROLE`, `DROPROLE`
 - **Sentry** - `GRANT_PRIVILEGE`, `REVOKE_PRIVILEGE`, `ADD_ROLE_TO_GROUP`, `DELETE_ROLE_FROM_GROUP`, `CREATE_ROLE`, `DROP_ROLE`
- **Username** - The name of the user that performed the action.

- **Impersonator** - If the action was requested by another service, the name of the user that invoked the service action on behalf of the user.
 - When Sentry is not enabled, the Impersonator field always shows.
 - When Sentry is enabled, the Impersonator field shows for services other than Hive.
- **IP Address** - The IP address of the host where the service action occurred.
- **Service Name** - The name of the service that performed the service action.

Viewing Audit Events

1. [Start and log into the Navigator UI](#).
2. Click the **Audits** tab. The Audit Events report displays all audit events that occurred during the last hour.

Filtering Audit Events

Specifying a Time Range

1. Click the date-time range at the top right of the audits page.
2. Do one of the following:
 - Click a **Last n hours** link.
 - Specify a custom range:
 1. Click **Custom range**.
 2. In the Selected Range endpoints, click each endpoint and specify a date and time in the date control fields.
 - **Date** - Click the down arrow to display a calendar and select a date, or click a subfield and click the spinner arrows or up and down arrow keys.
 - **Time** - Click the hour, minute, and AM or PM fields and click the spinner arrows or up and down arrow keys to specify the value.
 - Move between fields using the right and left arrow keys.
 - 3. Click **Apply**.

Adding a Filter

- Click the icon that displays next to a property when you hover in one of the event entries. A filter containing the property, operator, and its value is added to the list of filters at the top and Cloudera Navigator redisplays all events that match the filter.
- Click the **Filters** link. The filters pane displays and a filter control with property, operation, and value fields is added to the list of filters.
 1. Choose a property in the drop-down list. You can search by properties such as Username, Service Name, or Operation. The properties vary depending on the service or role.
 2. Choose an operator in the operator drop-down list.
 3. Type a property value in the value text field. To match a substring, use the `like` operator and specify `%` around the string. For example, to see all the audit events for files created in the folder `/user/joe/out` specify `Source like %/user/joe/out%`.
 4. Click **Apply**. The property, operation, and value display above the list of audit events and the list of events displays all events that match the filter criteria.
 5. Click **Add New Filter** to add more filters and repeat steps [1](#) through [4](#).

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Removing a Filter

1. Do one of the following:
 - Click the **x** next to the filter above the list of events.
 - Remove from the Filters pane:
 1. Click the **Filters** link. The filters pane displays.
 2. Click the **-** at the right of the filter.
 3. Click **Apply**. The filter is removed from above the list of audit event and the list of events displays all events that match the filter criteria.

Creating Audit Reports

1. [Start and log into the Navigator UI](#).
2. Click the **Audits** tab. The Audit Events report displays all audit events that occurred during the last hour.
3. Do one of the following:
 - Save a filtered version of the Audit Events report:
 1. Optionally specify [filters](#).
 2. Click **Save As Report**.
 - Create a new report:
 1. Click **Create New Report**.
4. Enter a report name.
5. In the **Default time range** field, specify a relative time range. If you had specified a custom absolute time range before selecting **Save As Report**, the *custom absolute time range is discarded*.
6. Optionally add [filters](#).
7. Click **Save**.

Editing Audit Reports

1. [Start and log into the Navigator UI](#).
2. Click the **Audits** tab. The Audit Events report displays all audit events that occurred during the last hour.
3. In the left pane, click a report name.
4. Click **Edit Report**.
5. In the **Default time range** field, specify a relative time range. If you had specified a custom absolute time range before selecting **Save As Report**, the *custom absolute time range is discarded*.
6. Optionally add [filters](#).
7. Click **Save**.

Downloading Audit Events

You can download audit events in the Audit UI or using the Audit API. An audit event contains the following fields: timestamp, service, username, ipAddress, command, resource, allowed, [operationText], serviceValues. The structure of the resource and serviceValues fields depends on the type of the service. Hive, Hue, Impala, and Sentry events have the operationText field, which contains the operation string.

Downloading Audit Events Using the Audit UI

1. [Start and log into the Navigator UI](#).
2. Click the **Audits** tab. The Audit Events report displays all audit events that occurred during the last hour.
3. In the left pane, click a report name.
4. Select **Export > format**, where format is CSV or JSON.

HDFS Audit Log Example

```
{
  "items" : [ {
    "timestamp" : "2014-10-10T16:39:25.656Z",
    "service" : "HDFS-1",
    "username" : "admin",
    "ipAddress" : "10.20.190.241",
    "command" : "setPermission",
    "resource" : "/user/hive/warehouse/sample_09/000000_0",
    "allowed" : true,
    "serviceValues" : {
      "dest" : null,
      "delegation_token_id" : null,
      "permissions" : "rwxrwxrwt",
      "src" : "/user/hive/warehouse/sample_09/000000_0"
    }
  }, {
    "timestamp" : "2014-10-10T16:39:25.632Z",
    "service" : "HDFS-1",
    "username" : "admin",
    "ipAddress" : "10.20.190.241",
    "command" : "setPermission",
    "resource" : "/user/hive/warehouse/sample_09",
    "allowed" : true,
    "serviceValues" : {
      "dest" : null,
      "delegation_token_id" : null,
      "permissions" : "rwxrwxrwt",
      "src" : "/user/hive/warehouse/sample_09"
    }
  }, {
    "timestamp" : "2014-10-10T16:39:25.606Z",
    "service" : "HDFS-1",
    "username" : "admin",
    "ipAddress" : "10.20.190.241",
    "command" : "setOwner",
    "resource" : "/user/hive/warehouse/sample_09",
    "allowed" : false,
    "serviceValues" : {
      "dest" : null,
      "delegation_token_id" : null,
      "permissions" : null,
      "src" : "/user/hive/warehouse/sample_09"
    }
  }, {
    "timestamp" : "2014-10-10T16:39:25.590Z",
    "service" : "HDFS-1",
    "username" : "admin",
    "ipAddress" : "10.20.190.241",
    "command" : "delete",
    "resource" : "/user/hive/warehouse/sample_09",
    "allowed" : true,
    "serviceValues" : {
      "dest" : null,
      "delegation_token_id" : null,
      "permissions" : null,
      "src" : "/user/hive/warehouse/sample_09"
    }
  }, {
    "timestamp" : "2014-10-10T16:39:25.581Z",
    "service" : "HDFS-1",
    "username" : "admin",
    "ipAddress" : "10.20.190.241",
    "command" : "getfileinfo",
    "resource" : "/user/hive/warehouse",
    "allowed" : true,
    "serviceValues" : {
      "dest" : null,
      "delegation_token_id" : null,
      "permissions" : null,
      "src" : "/user/hive/warehouse"
    }
  }, {
}
```

Cloudera Navigator Auditing Architecture

```
[{"timestamp" : "2014-10-10T16:39:25.575Z",
 "service" : "HDFS-1",
 "username" : "admin",
 "ipAddress" : "10.20.190.241",
 "command" : "getfileinfo",
 "resource" : "/user/hive/warehouse/sample_09",
 "allowed" : true,
 "serviceValues" : [
   {"dest" : null,
    "delegation_token_id" : null,
    "permissions" : null,
    "src" : "/user/hive/warehouse/sample_09"
   }
 ]
}
```

In this example, the first event access was denied, and therefore the `allowed` field has the value `false`.

Hive Example - via downloaded JSON file

The following records list Hive operations to create and load a table:

```
[ {
  "timestamp" : "2014-10-10T16:39:26.184Z",
  "service" : "HIVE-1",
  "username" : "admin",
  "ipAddress" : "10.20.190.241",
  "command" : "QUERY",
  "resource" : "default:sample_09",
  "operationText" : "INSERT OVERWRITE \n TABLE sample_09 \nSELECT \n sample_07.code,sample_08.description \n FROM sample_07 \n JOIN sample_08 \n WHERE sample_08.code = sample_07.code",
  "allowed" : true,
  "serviceValues" : [
    {"object_type" : "TABLE",
     "database_name" : "default",
     "operation_text" : "INSERT OVERWRITE \n TABLE sample_09 \nSELECT \n sample_07.code,sample_08.description \n FROM sample_07 \n JOIN sample_08 \n WHERE sample_08.code = sample_07.code",
     "resource_path" : "/user/hive/warehouse/sample_09",
     "table_name" : "sample_09"
    }
  ],
  {
    "timestamp" : "2014-10-10T16:39:26.183Z",
    "service" : "HIVE-1",
    "username" : "admin",
    "ipAddress" : "10.20.190.241",
    "command" : "QUERY",
    "resource" : "default:sample_07",
    "operationText" : "INSERT OVERWRITE \n TABLE sample_09 \nSELECT \n sample_07.code,sample_08.description \n FROM sample_07 \n JOIN sample_08 \n WHERE sample_08.code = sample_07.code",
    "allowed" : true,
    "serviceValues" : [
      {"object_type" : "TABLE",
       "database_name" : "default",
       "operation_text" : "INSERT OVERWRITE \n TABLE sample_09 \nSELECT \n sample_07.code,sample_08.description \n FROM sample_07 \n JOIN sample_08 \n WHERE sample_08.code = sample_07.code",
       "resource_path" : "/user/hive/warehouse/sample_07",
       "table_name" : "sample_07"
      }
    ],
    {
      "timestamp" : "2014-10-10T16:39:26.182Z",
      "service" : "HIVE-1",
      "username" : "admin",
      "ipAddress" : "10.20.190.241",
      "command" : "QUERY",
      "resource" : "default:sample_08",
      "operationText" : "INSERT OVERWRITE \n TABLE sample_09 \nSELECT \n sample_07.code,sample_08.description \n FROM sample_07 \n JOIN sample_08 \n WHERE sample_08.code = sample_07.code",
      "allowed" : true
    }
  ]
}
```

```

"allowed" : true,
"serviceValues" : {
    "object_type" : "TABLE",
    "database_name" : "default",
    "operation_text" : "INSERT OVERWRITE \n TABLE sample_09 \nSELECT \n sample_07.code,sample_08.description \n FROM sample_07 \n JOIN sample_08 \n WHERE sample_08.code = sample_07.code",
    "resource_path" : "/user/hive/warehouse/sample_08",
    "table_name" : "sample_08"
},
{
    "timestamp" : "2014-10-10T16:38:18.604Z",
    "service" : "HIVE-1",
    "username" : "admin",
    "ipAddress" : "10.20.190.241",
    "command" : "CREATETABLE",
    "resource" : "default:sample_09",
    "operationText" : "CREATE TABLE sample_09 (code string,description string) ROW FORMAT DELIMITED FIELDS TERMINATED BY '\\t' STORED AS TextFile",
    "allowed" : true,
    "serviceValues" : {
        "object_type" : "TABLE",
        "database_name" : "default",
        "operation_text" : "CREATE TABLE sample_09 (code string,description string) ROW FORMAT DELIMITED FIELDS TERMINATED BY '\\t' STORED AS TextFile",
        "resource_path" : "",
        "table_name" : "sample_09"
    }
},
{
    "timestamp" : "2014-10-10T16:38:18.602Z",
    "service" : "HIVE-1",
    "username" : "admin",
    "ipAddress" : "10.20.190.241",
    "command" : "CREATETABLE",
    "resource" : "default:",
    "operationText" : "CREATE TABLE sample_09 (code string,description string) ROW FORMAT DELIMITED FIELDS TERMINATED BY '\\t' STORED AS TextFile",
    "allowed" : true,
    "serviceValues" : {
        "object_type" : "DATABASE",
        "database_name" : "default",
        "operation_text" : "CREATE TABLE sample_09 (code string,description string) ROW FORMAT DELIMITED FIELDS TERMINATED BY '\\t' STORED AS TextFile",
        "resource_path" : "/user/hive/warehouse",
        "table_name" : ""
    }
},
{
    "timestamp" : "2014-10-10T16:37:06.836Z",
    "service" : "HIVE-1",
    "username" : "admin",
    "ipAddress" : "10.20.190.241",
    "command" : "LOAD",
    "resource" : "::",
    "operationText" : "LOAD DATA INPATH\n '/user/admin/sample_08' OVERWRITE INTO TABLE sample_08",
    "allowed" : true,
    "serviceValues" : {
        "object_type" : "DFS_DIR",
        "database_name" : "",
        "operation_text" : "LOAD DATA INPATH\n '/user/admin/sample_08' OVERWRITE INTO TABLE sample_08",
        "resource_path" : "/user/admin/sample_08",
        "table_name" : ""
    }
},
{
    "timestamp" : "2014-10-10T16:37:06.836Z",
    "service" : "HIVE-1",
    "username" : "admin",
    "ipAddress" : "10.20.190.241",
    "command" : "LOAD",
    "resource" : "default:sample_08",
    "operationText" : "LOAD DATA INPATH\n '/user/admin/sample_08' OVERWRITE INTO TABLE sample_08",
    "allowed" : true,
    "serviceValues" : {
        "object_type" : "DFS_DIR",
        "database_name" : "",
        "operation_text" : "LOAD DATA INPATH\n '/user/admin/sample_08' OVERWRITE INTO TABLE sample_08",
        "resource_path" : "/user/admin/sample_08",
        "table_name" : ""
    }
}

```

Cloudera Navigator Auditing Architecture

```
"allowed" : true,
"serviceValues" : {
  "object_type" : "TABLE",
  "database_name" : "default",
  "operation_text" : "LOAD DATA INPATH\n      '/user/admin/sample_08' OVERWRITE INTO
TABLE sample_08",
  "resource_path" : "/user/hive/warehouse/sample_08",
  "table_name" : "sample_08"
},
{
  "timestamp" : "2014-10-10T16:37:05.752Z",
  "service" : "HIVE-1",
  "username" : "admin",
  "ipAddress" : "10.20.190.241",
  "command" : "DESCTABLE",
  "resource" : "default:sample_08",
  "operationText" : "DESCRIBE EXTENDED sample_08",
  "allowed" : true,
  "serviceValues" : {
    "object_type" : "TABLE",
    "database_name" : "default",
    "operation_text" : "DESCRIBE EXTENDED sample_08",
    "resource_path" : "/user/hive/warehouse/sample_08",
    "table_name" : "sample_08"
  }
},
{
  "timestamp" : "2014-10-10T16:37:05.379Z",
  "service" : "HIVE-1",
  "username" : "admin",
  "ipAddress" : "10.20.190.241",
  "command" : "LOAD",
  "resource" : "default:sample_07",
  "operationText" : "LOAD DATA INPATH\n      '/user/admin/sample_07' OVERWRITE INTO
TABLE sample_07",
  "allowed" : true,
  "serviceValues" : {
    "object_type" : "TABLE",
    "database_name" : "default",
    "operation_text" : "LOAD DATA INPATH\n      '/user/admin/sample_07' OVERWRITE INTO
TABLE sample_07",
    "resource_path" : "/user/hive/warehouse/sample_07",
    "table_name" : "sample_07"
  }
},
{
  "timestamp" : "2014-10-10T16:37:05.377Z",
  "service" : "HIVE-1",
  "username" : "admin",
  "ipAddress" : "10.20.190.241",
  "command" : "LOAD",
  "resource" : ":",
  "operationText" : "LOAD DATA INPATH\n      '/user/admin/sample_07' OVERWRITE INTO
TABLE sample_07",
  "allowed" : true,
  "serviceValues" : {
    "object_type" : "DFS_DIR",
    "database_name" : "",
    "operation_text" : "LOAD DATA INPATH\n      '/user/admin/sample_07' OVERWRITE INTO
TABLE sample_07",
    "resource_path" : "/user/admin/sample_07",
    "table_name" : ""
  }
},
{
  "timestamp" : "2014-10-10T16:37:00.002Z",
  "service" : "HIVE-1",
  "username" : "admin",
  "ipAddress" : "10.20.190.241",
  "command" : "DESCTABLE",
  "resource" : "default:sample_07",
  "operationText" : "DESCRIBE EXTENDED sample_07",
  "allowed" : true,
  "serviceValues" : {
    "object_type" : "TABLE",
    "database_name" : "default",
```

```

        "operation_text" : "DESCRIBE EXTENDED sample_07",
        "resource_path" : "/user/hive/warehouse/sample_07",
        "table_name" : "sample_07"
    }
}

```

Downloading Audit Events Using the Audit API

You can filter and download audit events using the [Cloudera Navigator API](#).

Hive Example - via audit API

To download the audits events using the API, issue the request

`http://host-1.ent.cloudera.com:7187/api/v3/audits?query=service==*HIVE*`, which could return the following JSON items:

```

{
  "items" : [ {
    "timestamp" : "2014-10-07T21:09:05.804Z",
    "service" : "HIVE-1",
    "username" : "test",
    "impersonator" : "",
    "ipAddress" : "20.10.191.128",
    "command" : "CREATEROLE",
    "resource" : ":",
    "operationText" : "CREATE ROLE bad_role",
    "allowed" : false,
    "serviceValues" : {
      "object_type" : "UNKNOWN",
      "database_name" : "",
      "operation_text" : "CREATE ROLE bad_role",
      "resource_path" : "",
      "table_name" : ""
    }
  },
  {
    "timestamp" : "2014-10-07T21:08:52.036Z",
    "service" : "HIVE-1",
    "username" : "test",
    "ipAddress" : "20.10.191.128",
    "command" : "DROPTABLE",
    "resource" : "default:ratings_sum",
    "operationText" : "DROP TABLE ratings_sum",
    "allowed" : true,
    "serviceValues" : {
      "object_type" : "TABLE",
      "database_name" : "default",
      "operation_text" : "DROP TABLE ratings_sum",
      "resource_path" : "/user/hive/warehouse/ratings_sum",
      "table_name" : "ratings_sum"
    }
  }
]
}

```

Downloading HDFS Directory Access Permission Reports

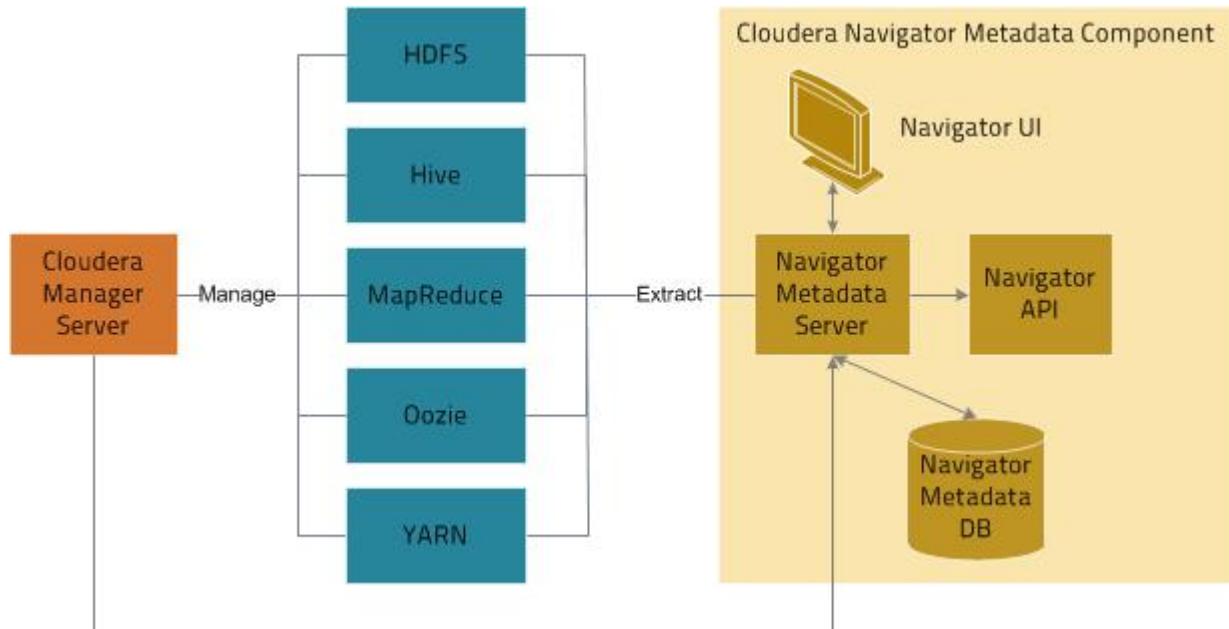
Minimum Required Role: [Cluster Administrator](#) (also provided by **Full Administrator**)

For each HDFS service you can download a report that details the HDFS directories a group has permission to access.

1. In the Cloudera Manager Admin Console, click **Clusters > ClusterName > General > Reports**.
2. In the Directory Access by Group row, click **CSV** or **XLS**. The Download User Access Report pop-up displays.
 - a. In the pop-up, type a group and directory.
 - b. Click **Download**. A report of the selected type will be generated containing the following information – path, owner, permissions, and size – for each directory contained in the specified directory that the specified group has access to.

Cloudera Navigator Metadata Component

The Cloudera Navigator metadata component provides data discovery and data lineage management functions. The architecture of the Cloudera Navigator metadata component is illustrated below.



The Navigator Metadata Server performs the following functions:

- Obtains connection information about the services whose data it manages from the Cloudera Manager Server
- Extracts entity metadata from the services at periodic intervals
- Manages and applies metadata extraction policies
- Indexes and stores entity metadata
- Manages user authorization data
- Manages audit report metadata
- Implements the Navigator UI and REST API

The Navigator Metadata database stores entity metadata, policies, and user authorization and audit report metadata.

Metadata

The Cloudera Navigator Metadata component manages metadata about the entities in a CDH cluster and relationships between the entities.

The Navigator metadata schema defines the types of metadata that are available for each entity type it supports. The types of metadata defined by the Navigator Metadata component include: the name of an entity, the service that manages or uses the entity, type, path to the entity, date and time of creation, access, and modification, size, owner, purpose, and relationships—parent-child, data flow, and instance of—between entities.

For example, the following shows the property sheet of a file entity:

sample_07.csv

tags:

source type: HDFS

category: FILE

path: /user/hdfs/sample_07.csv

owner: hdfs

group: supergroup

size: 44.98KiB

last accessed: Oct 8 2013 1:33 PM

last modified: Oct 8 2013 1:33 PM

There are two classes of metadata:

- **technical metadata** - metadata defined *when* entities are extracted. You cannot modify technical metadata.
- **custom metadata** - metadata [added](#) to extracted entities. You can add and modify custom metadata before or after entities are extracted.

Metadata Extraction

The [Navigator Metadata Server](#) extracts metadata for the following resource types from the listed servers:

- **HDFS** - Extracts HDFS metadata at the next scheduled extraction run after an HDFS checkpoint. However, if you have high availability enabled, metadata is extracted as soon as it is written to the JournalNodes.
- **Hive** - Extracts database and table metadata from the Hive Metastore Server.
- **MapReduce** - Extracts job metadata from the JobTracker. The default setting in Cloudera Manager retains a maximum of five jobs, which means if you run more than five jobs between Navigator extractions, the Navigator Metadata Server would extract the five most recent jobs.
- **Oozie** - Extracts Oozie workflows from the Oozie Server.
- **Pig** - Extracts Pig script runs from the JobTracker or Job History Server.
- **Sqoop 1** - Extracts database and table metadata from the Hive Metastore Server.
- **YARN** - Extracts job metadata from the Job History Server.

If an entity is created at time t0 in the system, that entity will be extracted and linked in Navigator after the extraction poll period (default 10 minutes) plus a service-specific interval as follows:

- **HDFS**: t0 + extraction poll period + HDFS checkpoint interval (default 1 hour)
- **HDFS + HA**: t0 + extraction poll period
- **Hive**: t0 + extraction poll period + Hive maximum wait time (default 60 minutes)

Metadata Indexing

After metadata is extracted it is indexed and made available for [searching](#) by an embedded [Solr](#) engine. The Solr schema indexes two types of metadata: entity properties and relationship between entities.

You can search entity metadata using the Navigator UI. Relationship metadata is implicitly visible in [lineage diagrams](#) and explicitly available in a [lineage file](#).

About Metadata Search

Search in the Navigator Metadata component is implemented by an embedded Solr engine that supports the syntax described in [LuceneQParserPlugin](#).

Search Syntax

You construct search strings by specifying the value of a [default property](#), property name-value pairs, or user-defined name-value pairs using the syntax:

- **Property name-value pairs** - `propertyName:value`, where
 - `propertyName` is one of the properties listed in [Search Properties](#) on page 20.
 - `value` is a single value or range of values specified as `[value1 TO value2]`. In a value, `*` is a wildcard. In property name-value pairs you must escape special characters `:`, `/`, and `*` with the backslash character `\`.
For example, `fileSystemPath:\user\admin`.
- **User-defined name-value pairs** - `up(propertyName:value)`.

To construct complex strings, join multiple property-value pairs using the `or` and `and` operators.

Example Search Strings

- Filesystem path `/user/admin - fileSystemPath:\user\admin`
- Descriptions that start with the string "Banking" - `description:Banking*`
- Sources of type MapReduce or Hive - `sourceType:MAPREDUCE or sourceType:HIVE`
- Directories owned by hdfs in the path `/user/hdfs/input - owner:HDFS` and `type:directory` and `fileSystemPath:\user\hdfs\input`
- Job started between 20:00 to 21:00 UTC - `started:[2013-10-21T20:00:00.000Z TO 2013-10-21T21:00:00.000Z]`
- User-defined key-value `project-customer1 - up_project:customer1`



Note: When viewing MapReduce jobs in the Cloudera Manager Activities page, the string that appear in a job's Name column equates to the `originalName` property. Therefore, to specify a MapReduce job's name in a search, use the following string: `(resType:mapreduce) and (originalName:jobName)`, where `jobName` is the value in the job's Name column.

Search Properties

A reference for the search schema properties.

Default Properties

The following properties can be searched by simply specifying a property value: `type`, `fileSystemPath`, `inputs`, `jobId`, `mapper`, `mimeType`, `name`, `originalName`, `outputs`, `owner`, `principal`, `reducer`, `tags`.

Common Properties

Name	Type	Description
<code>description</code>	<code>text</code>	Description of the entity.
<code>group</code>	<code>caseInsensitiveText</code>	The group to which the owner of the entity belongs.
<code>name</code>	<code>ngrammedText</code>	The overridden name of the entity. If the name has not been overridden, this value is empty. Names cannot contain spaces.
<code>operationType</code>	<code>ngrammedText</code>	The type of an operation: <ul style="list-style-type: none">• Pig - <code>SCRIPT</code>• Sqoop - <code>Table Export, Query Import</code>

Name	Type	Description
originalName	ngramedText	The name of the entity when it was extracted.
originalDescription	text	The description of the entity when it was extracted.
owner	caseInsensitiveText	The owner of the entity.
principal	caseInsensitiveText	For entities with type OPERATION_EXECUTION, the initiator of the entity.
tags	ngramedText	A set of tags that describe the entity.
type	ngramedText	<p>The type of the entity. The available types depend on the entity's source type:</p> <ul style="list-style-type: none"> • HDFS - DIRECTORY, FILE • HIVE - DATABASE, TABLE, FIELD, OPERATION, OPERATION_EXECUTION, SUB_OPERATION, PARTITION, RESOURCE, UNKNOWN, VIEW • MAPREDUCE - OPERATION, OPERATION_EXECUTION • OOZIE - OPERATION, OPERATION_EXECUTION • PIG - OPERATION, OPERATION_EXECUTION • SQOOP - OPERATION, OPERATION_EXECUTION, SUB_OPERATION • YARN - OPERATION, OPERATION_EXECUTION
Query		
queryText	string	The text of a Hive or Sqoop query.
Source		
clusterName	string	The name of the cluster in which the entity is stored.
sourceId	string	The ID of the source type.
sourceType	caseInsensitiveText	The source type of the entity: HDFS, HIVE, MAPREDUCE, Oozie, PIG, SQOOP, YARN.
sourceUrl	string	The URL of the source type.
Timestamps		
The available timestamp fields vary by the source type: <ul style="list-style-type: none"> • HDFS - <code>lastModified</code>, <code>lastAccessed</code> • HIVE - <code>created</code>, <code>lastAccessed</code> • MAPREDUCE, PIG, SQOOP, and YARN - <code>started</code>, <code>ended</code> 	date	<p>Timestamps in the Solr Date Format. For example:</p> <ul style="list-style-type: none"> • <code>lastAccessed:[* TO NOW]</code> • <code>created:[1976-03-06T23:59:59.999Z TO *]</code> • <code>started:[1995-12-31T23:59:59.999Z TO 2007-03-06T00:00:00Z]</code> • <code>ended:[NOW-1YEAR/DAY TO NOW/DAY+1DAY]</code> • <code>created:[1976-03-06T23:59:59.999Z TO 1976-03-06T23:59:59.999Z+1YEAR]</code> • <code>lastAccessed:[1976-03-06T23:59:59.999Z/YEAR TO 1976-03-06T23:59:59.999Z]</code>

Cloudera Navigator Metadata Component

HDFS Properties

Name	Type	Description
fileSystemPath	path	The path to the entity.
compressed	Boolean	Indicates whether the entity is compressed.
deleted	Boolean	Indicates whether the entity has been moved to the Trash folder.
deleteTime	date	The time the entity was moved to the Trash folder.
mimeType	ngramedText	The MIME type of the entity.
parentPath	string	The path to the parent entity for a child entity. For example: parent path: /default/sample_07 for the table sample_07 from the Hive database default.
permissions	string	The UNIX access permissions of the entity.
size	long	The exact size of the entity in bytes or a range of sizes. Range examples: size: [1000 TO *], size: [* TO 2000], and size: [* TO *] to find all fields with a size value.

MAPREDUCE and YARN Properties

Name	Type	Description
inputRecursive	Boolean	Indicates whether files are searched recursively under the input directories, or just files directly under the input directories are considered.
jobId	ngramedText	The ID of the job. For a job spawned by Oozie, the workflow ID.
mapper	string	The fully-qualified name of the mapper class.
outputKey	string	The fully-qualified name of the class of the output key.
outputValue	string	The fully-qualified name of the class of the output value.
reducer	string	The fully-qualified name of the reducer class.

OPERATION Properties

Name	Type	Description
Operation		
inputFormat	string	The fully-qualified name of the class of the input format.
outputFormat	string	The fully-qualified name of the class of the output format.
Operation Execution		
inputs	string	The name of the entity input to an operation execution. For entities of resource type MR, it is usually a directory. For entities of resource type Hive, it is usually a table.
outputs	string	The name of the entity output from an operation execution. For entities of resource type MR, it is usually a directory. For entities of resource type Hive, it is usually a table.

HIVE Properties

Name	Type	Description
Field		
dataType	ngramedText	The type of data stored in a field (column).
Table		
compressed	Boolean	Indicates whether a Hive table is compressed.
serDeLibName	string	The name of the library containing the SerDe class.
serDeName	string	The fully-qualified name of the SerDe class.
Partition		
partitionColNames	string	The table columns that define the partition.
partitionColValues	string	The table column values that define the partition.

Oozie Properties

Name	Type	Description
status	string	The status of the Oozie workflow: RUNNING, SUCCEEDED, or FAILED.

PIG Properties

Name	Type	Description
scriptId	string	The ID of the Pig script.

SQOOP Properties

Name	Type	Description
dbURL	string	The URL of the database from or to which the data was imported or exported.
dbTable	string	The table from or to which the data was imported or exported.
dbUser	string	The database user.
dbWhere	string	The where clause that identifies which rows were imported.
dbColumnExpression	string	An expression that identifies which columns were imported.

Accessing Metadata Using Cloudera Navigator

You can access metadata through the Navigator UI or through the Navigator API.

Navigator Metadata UI

Required Role:

Lineage Viewer

Policy Administrator

Metadata Administrator

Full Administrator

Cloudera Navigator Metadata Component

Searching Metadata

You perform search in the Navigator UI by typing search strings or constructing search strings using UI controls.

1. [Start and log into the Navigator UI.](#)

2. Do one of the following:

- Type a search string into the **Search** box that conforms to the [search syntax](#). The Search Results page displays as soon as you start typing.
- Click the **Query Builder** link. The Query Builder landing page displays with the result of the wildcard search (*). The Query Builder landing page displays Source Type and Type facets that match the search results with the number of results that match each value of those properties. You can filter the search results by clicking specific values for those properties or adding new properties.

The Full Query read-only box displays the search string constructed from the specified filters. Click **Show n Results** to display the Search Results page.

Search Results

The Search Results page has a Search box and two panes: the Query Builder pane and The Search Results pane.

The Search Results pane displays the number of matching entries 1 to 25 of 83 results in pages listing 25 entities per page. You can view the pages using the page control



at the bottom of each page.

Each entry

Hive sample_07
Type: Table Parent Path: /default Path: hdfs://tcdn51-2.ent.cloudera.com:8020/user/hive/warehouse/sample_07 Owner: admin Created: Oct 2 2014 9:57 AM Source: HIVE-1
Hue Metastore Manager: http://tcdn51-2.ent.cloudera.com:8888/metastore/table/default/sample_07

in the result list contains:

- Source type
- Entity name - the name is a link to a page that displays the entity [property editor](#) and [lineage diagram](#).
- Entity properties
- If Hue is running, a link to the Hue browser for the entity:
 - HDFS directories and files - File Browser
 - Hive database and tables - Metastore Manager
 - MapReduce, YARN, Pig - Job Browser

Specifying Property Values in the Query Builder Pane

The Query Builder pane contains a Search box and a set of graphical controls that allow you to select property values to filter search results. You can filter using the Search box or the graphical controls.

In the **Search** box, type the values of [default properties](#).

To filter on a property value for non-default properties, specify values as follows:

- **Boolean** - Check the checkbox.
- **Enumerated** - Start typing or click the field and then select from a drop-down list.
- **Dates** - Specified in the format mm/dd/yyyy hh:mm [AM|PM] in a date control. The server stores the timestamp in UTC and the UI displays the timestamp converted to the local timezone. In the date control:
 - **Date** - Click the down arrow ▼ to display a calendar and select a date, or click a subfield and click the spinner arrows ▲ or up and down arrow keys.

- **Time** - Click the hour, minute, and AM or PM fields and click the spinner arrows or up and down arrow keys to specify the value.
- Move between fields using the right and left arrow keys.

To add a property, click **Add another filter...** and select a property name.

Navigator API

The Navigator API allows you to search entity metadata using a REST API. For information about the API, see [Cloudera Navigator API](#).

Modifying Custom Metadata

The Cloudera Navigator Metadata component allows you to add and modify the following custom metadata associated with entities: display name, description, tags, and user-defined name-value pairs. You can modify custom metadata using the Navigator Metadata UI, MapReduce service and job properties, Navigator metadata files, and the Navigator Metadata API.

Required Role:

Policy Administrator

Metadata Administrator

Full Administrator

Modifying Custom Metadata Using the Navigator UI

1. Run a [search](#) in the Navigator UI.
2. Click an entity link returned in the search. The metadata pane displays on the left and the lineage page displays on the right.
3. In the top-right of the metadata pane, click . The Editing *entity* dialog box drops down.
4. Edit any of the fields as instructed. Press **Enter** or **Tab** to create new tag entries. For example, a Description, the tags `occupations` and `salaries`, and property `year` with value `2012` have been added to the file `sample_07.csv`:

Editing sample_07.csv



Provide a name to use when displaying the element:

Describe the element:

Occupational categories: salary and number of employees.

Provide a list of tags that relate to this element:

[occupations](#) [salaries](#)

Examples: user, metadata or logs

Provide any named values that are relevant:

year

: 2012



[Save](#)

[Cancel](#)



Note: You can specify special characters (for example, ".", " ") in the name, but it will make searching for the entity more difficult as some characters collide with special characters in the [search syntax](#).

5. Click **Save**. The new metadata appears in the metadata pane:

sample_07.csv

Occupational categories: salary and number of employees.

tags: occupations
salaries

source type: HDFS

category: FILE

path: /user/hdfs/sample_07.csv

owner: hdfs

group: supergroup

size: 44.98KiB

last accessed: Oct 8 2013 1:33 PM

last modified: Oct 8 2013 1:33 PM

year: 2012

Modifying MapReduce Custom Metadata

You can associate custom metadata with arbitrary configuration parameters for MapReduce jobs and job executions. The specific configuration parameters to be extracted by Navigator can be specified statically or dynamically.

To specify configuration parameters statically for all MapReduce jobs and job executions, do the following:

1. Do one of the following:

- Select **Clusters > Cloudera Management Service > Cloudera Management Service**.
- On the Status tab of the Home page, in **Cloudera Management Service** table, click the **Cloudera Management Service** link.

2. Click the **Configuration** tab.

3. Select **Scope > Navigator Metadata Server**.

4. Select **Category > Advanced**.

5. Click **Navigator Metadata Server Advanced Configuration Snippet for cloudera-navigator.properties**.

6. Specify values for the following properties:

- `nav.user_defined_properties` = comma-separated list of user-defined property names
- `nav.tags` = comma-separated list of property names that serve as tags. The property `nav.tags` can point to multiple property names that serve as tags, but each of those property names can only specify a *single* tag.

7. Click **Save Changes**.

8. Click the **Instances** tab.

9. Restart the role.

10 In the MapReduce job configuration, set the value of the property names you specified in step 6.

To specify configuration parameters dynamically:

1. Specify one or more of the following properties in a job configuration:

- job properties (type:OPERATION)
 - nav.job.user_defined_properties = comma-separated list of user-defined property names
 - nav.job.tags = comma-separated list of property names that serve as tags
- job execution properties (type:OPERATION_EXECUTION)
 - nav.jobexec.user_defined_properties = comma-separated list of user-defined property names
 - nav.jobexec.tags = comma-separated list of property names that serve as tags

The properties nav.job.tags and nav.jobexec.tags can point to multiple property names that serve as tags, but each of those property names can only specify a *single* tag.

2. In the MapReduce job configuration, set the value of the property names you specified in step 1.

Example: Setting Properties Dynamically

Add the tags onetag and twotag to a job:

1. Dynamically add the job_tag1 and job_tag2 properties:

```
conf.set("nav.job.tags", "job_tag1, job_tag2");
```

2. Set the job_tag1 property to onetag:

```
conf.set("job_tag1", "onetag");
```

3. Set the job_tag2 property to twotag:

```
conf.set("job_tag2", "twotag");
```

Add the tag atag to a job execution:

1. Dynamically add the job_tag property:

```
conf.set("nav.jobexec.tags", "job_exec_tag");
```

2. Set the job_exec_tag property to atag:

```
conf.set("job_exec_tag", "atag");
```

Add the user-defined property foo with the value bar:

1. Dynamically add the user-defined property bar:

```
conf.set("nav.job.user_defined_properties", "bar");
```

2. Set the value of the user-defined property foo to bar:

```
conf.set("foo", "bar")
```

Modifying HDFS Custom Metadata Using Metadata Files

You can add tags and properties to HDFS entities using metadata files. The reasons to use metadata files are to assign metadata to entities in bulk and to create metadata before the metadata is extracted. A metadata file is a JSON file with the following structure:

```
{
  "name" : "aName",
  "description" : "a description",
  "properties" : {
    "prop1" : "value1", "prop2" : "value2"
  },
  "tags" : [ "tag1" ]
}
```

To add metadata files to files and directories, create a metadata file with the extension `.navigator`, naming the files as follows:

- **File** - The path of the metadata file must be `.filename.navigator`. For example, to apply properties to the file `/user/test/file1.txt`, the metadata file path is `/user/test/.file1.txt.navigator`.
- **Directory** - The path of the metadata file must be `dirpath/.navigator`. For example, to apply properties to the directory `/user`, the metadata path must be `/user/.navigator`.

The metadata file is applied to the entity metadata when the extractor runs.

Modifying HDFS and Hive Custom Metadata Using the Navigator API

You can use the [Cloudera Navigator API](#) to modify the metadata of HDFS or Hive entities whether or not the entities have been extracted. If an entity has been extracted at the time the API is called, the metadata will be applied immediately. If the entity has not been extracted, the metadata is applied once the entity is extracted. Metadata is saved regardless of whether or not a matching entity is extracted, and Navigator does not perform any cleanup of unused metadata.

If you call the API before the entity is extracted, the metadata is stored with the entity's identity, source ID, metadata fields (name, description, tags, properties), and the fields relevant to the identifier. The rest of the entity fields (such as type) will not be present. To view all stored metadata, you can use the API to search for entities without an internal type:

```
curl http://hostname:port/api/v2/entities/?query=-internalType:* -u username:password
-X GET
```

The metadata provided via the API overwrites existing metadata. If, for example, you call the API with an empty name and description, empty array for tags, and empty dictionary for properties, the call removes this metadata. If you leave out the tags or properties fields, the existing values remain unchanged.

Modifying metadata using HDFS metadata files and the metadata API at the same time *is not* supported. You must use one or the other, because the two methods behave slightly differently. Metadata specified in files is merged with existing metadata whereas the API overwrites metadata. Also, the updates provided by metadata files wait in a queue before being merged, but API changes are committed immediately. This means there may be some inconsistency if a metadata file is being merged around the same time the API is in use.

You modify metadata using either the `PUT` or `POST` method. Use the `PUT` method if the entity has been extracted and the `POST` method if the entity has not been extracted. The syntax of the methods are:

- `PUT`

```
curl http://hostname:port/api/v2/entities/identity -u username:password -X PUT -H
"Content-Type: application/json" -d '{properties}'
```

where `properties` are:

- `name`: name metadata
- `description`: description metadata

Cloudera Navigator Metadata Component

- tags: tag metadata
- properties: property metadata

All existing naming rules apply, and if any value is invalid, the entire request will be denied.

- POST

```
curl http://hostname:port/api/v2/entities/ -u username:password -X POST -H "Content-Type: application/json" -d '{properties}'
```

where *properties* are:

- [sourceId](#) (required): The source ID must match an existing source ID. After the first extraction, you can retrieve the source IDs using the call

```
curl http://hostname:port/api/v2/entities/?query=type:SOURCE -u username:password -X GET
```

For example:

```
{ ...  
  "identity" : "a09b0233cc58ff7d601eaa68673a20c6",  
  "originalName" : "HDFS-1",  
  "sourceId" : null,  
  "firstClassParentId" : null,  
  "parentPath" : null,  
  "extractorRunId" : null,  
  "name" : "HDFS-1",  
  "description" : null,  
  "tags" : null,  
  "properties" : null,  
  "clusterName" : "Cluster 1",  
  "sourceUrl" : "hdfs://hostname:8020",  
  "sourceType" : "HDFS",  
  "sourceExtractIteration" : 4935,  
  "type" : "SOURCE",  
  "internalType" : "source"  
, ...}
```

If you have HDFS-1 and HDFS-2, you must specify the source that contains the entity you're expecting for it to match.

- parentPath: The path of the parent entity, as defined below:
 - HDFS file or directory: `fileSystemPath` of the parent directory (do not provide this field if the entity being affected is the root directory). Example `parentPath` for `/user/admin/input_dir`: `/user/admin`. If you apply metadata to a directory, the metadata does not propagate to any files and folders in that directory.
 - Hive database: If you are updating database metadata, you do not specify this field.
 - Hive table or view: Name of database containing this table or view. Example for table in default database: `default`.
 - Hive column: `database name/table/view name`. Example for column in `sample_07` table: `default/sample_07`.
- originalName (required): The name as defined by the source system.
 - HDFS file or directory: name of file or directory (`ROOT` if the entity is the root directory). Example `originalName` for `/user/admin/input_dir`: `input_dir`.
 - Hive database, table, view, or column: name of the database, table, view, or column.
 - Example for default database: `default`
 - Example for `sample_07` table: `sample_07`
- name: name metadata

- description: description metadata
- tags: tag metadata
- properties: property metadata

All existing naming rules apply, and if any value is invalid, the entire request will be denied.

HDFS PUT Example for /user/admin/input_dir Directory

```
curl http://hostname:7187/api/v2/entities/e461de8de38511a3ac6740dd7d51b8d0 -u
username:password -X PUT -H
"Content-Type: application/json" -d '{"name": "my_name", "description": "My description",
"tags": ["tag1", "tag2"], "properties": {"property1": "value1", "property2": "value2"} }'
```

HDFS POST Example for /user/admin/input_dir Directory

```
curl http://hostname:7187/api/v2/entities/ -u username:password -X POST -H
"Content-Type: application/json" -d '{"sourceId": "a09b0233cc58ff7d601eaa68673a20c6",
"parentPath": "/user/admin", "originalName": "input_dir",
"name": "my_name", "description": "My description",
"tags": ["tag1", "tag2"], "properties": {"property1": "value1", "property2": "value2"} }'
```

Hive POST Example for total_emp Column

```
curl http://hostname:7187/api/v2/entities/ -u username:password -X POST -H
"Content-Type: application/json" -d '{"sourceId": "4fbdadcc6899638782fc8cb626176dc7b",
"parentPath": "default/sample_07", "originalName": "total_emp",
"name": "my_name", "description": "My description",
"tags": ["tag1", "tag2"], "properties": {"property1": "value1", "property2": "value2"} }'
```

Metadata Extraction Policies



Note: Policies is a beta feature that is disabled by default. To enable policies, see [Enabling Policies](#).

A policy defines a set of actions performed when a class of entities is extracted from CDH. The following actions are supported:

- Adding [custom metadata](#) such as tags and properties.
- Sending a message to a JMS message queue. The message contains the message text specified in the policy and the metadata of the entity to which the policy applies. To enable sending messages you must configure a JMS server and queue. See [Configuring a JMS Server for Policy Messages](#).

Viewing Policies

Required Role:

Policy Viewer

Policy Administrator

Full Administrator

1. [Start and log into the Navigator UI](#).
2. Click the **Policies** tab.
3. In the left pane, click a policy.

Cloudera Navigator Metadata Component

Creating Policies

Required Role:

Policy Administrator

Full Administrator

1. [Start and log into the Navigator UI.](#)
2. Depending on the starting point, do one of the following:

Action	Procedure
Policies page	<ol style="list-style-type: none">1. Click the Policies tab.2. Click Create a New Policy.
Search Results page	<ol style="list-style-type: none">1. In the Search results page, click Create a policy.

3. Enter a name for the policy.
4. Specify the [search query](#) that defines the class of entities to which the policy applies.
5. In the **Actions for the entities affected by this policy** box, specify actions to be performed on the entities matching the search query. Actions can only be specified in the Form View; the Editor View is a read-only view of the generated Java code.
6. Click **Save**.

Cloning and Editing Policies

Required Role:

Policy Administrator

Full Administrator

1. [Start and log into the Navigator UI.](#)
2. Click the **Policies** tab.
3. In the left pane, click a policy.
4. Click **Clone Policy** or **Edit Policy**.
5. Edit the policy name, search query, or policy actions.
6. Click **Save**.

Deleting Policies

Required Role:

Policy Administrator

Full Administrator

1. [Start and log into the Navigator UI.](#)
2. Click the **Policies** tab.
3. In the left pane, click a policy.
4. Click **Delete** and click **OK** to confirm.

Introduction to Cloudera Navigator Lineage Diagrams

Required Role:

Lineage Viewer

Metadata Administrator

Full Administrator

A **lineage diagram** is a directed graph that depicts an entity and its relationships to other entities. A lineage diagram is limited to 1000 entities and 2000 relationships.

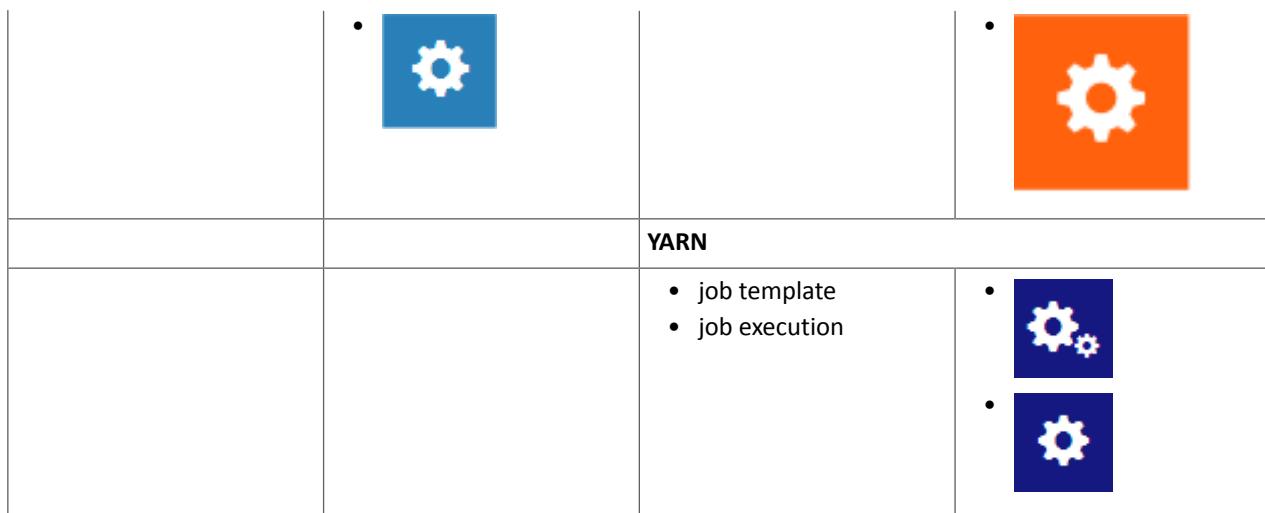
There are two types of lineage diagrams:

- **Template** - represents an entity that is a model for other entities
- **Instance** - represents an instance or execution of a template

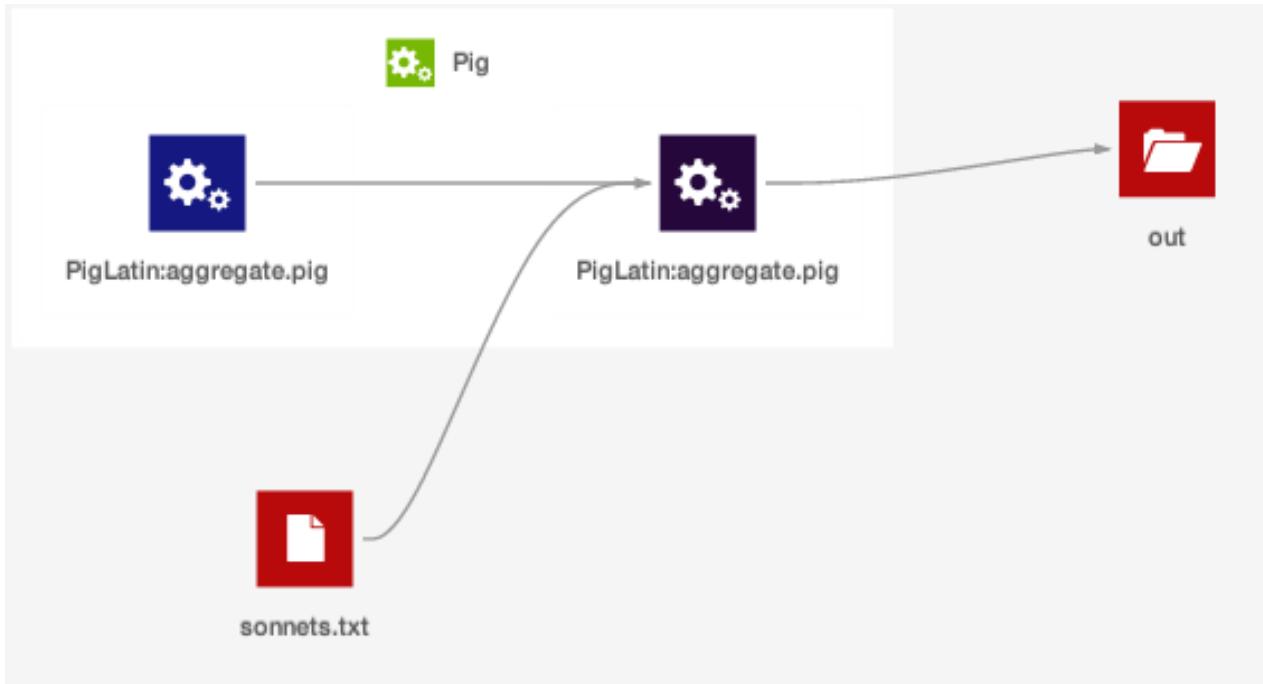
Entities

In a lineage diagram, entity types are represented by icons:

HDFS	Oozie
<ul style="list-style-type: none"> • File • Directory 	<ul style="list-style-type: none"> •  •  <ul style="list-style-type: none"> • job template • job execution <ul style="list-style-type: none"> •  • 
Hive	Pig
<ul style="list-style-type: none"> • Table • Query template • Query execution 	<ul style="list-style-type: none"> •  •  •  <ul style="list-style-type: none"> • Table • Pig script • Pig script execution <ul style="list-style-type: none"> •  •  • 
MapReduce	SQOOP
<ul style="list-style-type: none"> • job template • job execution 	<ul style="list-style-type: none"> •  <ul style="list-style-type: none"> • job template • job execution <ul style="list-style-type: none"> • 



Parent entities are represented by a white box enclosing other entities. The following lineage diagram illustrates the relationships between the YARN job `aggregate.pig` and Pig script `aggregate.pig` invoked by the parent Pig Oozie workflow and its source file and destination folder:



Note: In the following circumstances the entity type icon will appear as :

- Entities are not yet extracted. In this case will eventually be replaced with the correct entity icon after the entity is extracted and linked in Navigator. For information on how long it takes for newly created entities to be extracted, see [Metadata Extraction](#) on page 19.
- Hive entities have been deleted from the system before they could be extracted by Navigator.

Relationships

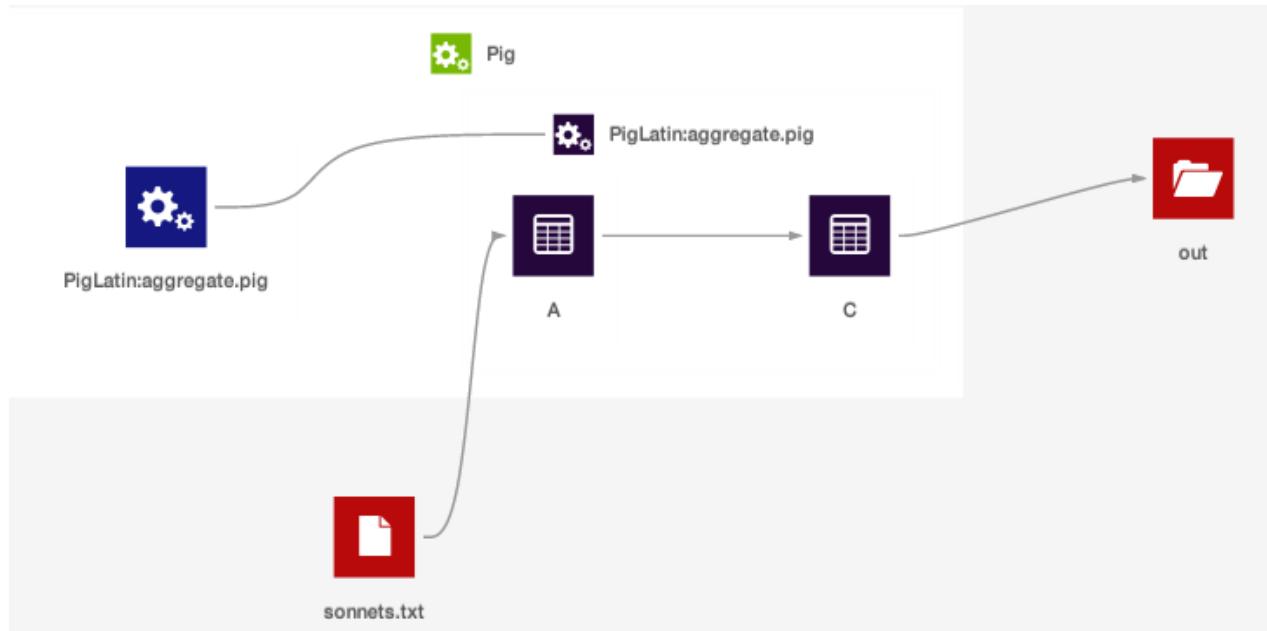
Relationships between the entities are represented graphically by gray lines, with arrows indicating the direction of the data flow. There are the following types of relationships:

Relationship Type	Description
DATA_FLOW	Describes a relationship between data and a processing activity. For example, between a file and a MapReduce job or vice versa.
ALIAS	Describes an alias relationship. For example, from a table to a synonym.
PARENT_CHILD	Describes a parent child relationship. For example, between a directory and a file.
LOGICAL_PHYSICAL	Describes the relationship between a logical entity and its physical entity. For example between a Hive query and a MapReduce job.
CONJOINT	Describes a non-directional relationship. For example, between a table and an index.
INSTANCE_OF	Describes the relationship between a template and its instance. For example, an operation execution is an instance of operation.
CONTROL_FLOW	Describes a relationship where source entity controls the data flow relationship for the target entity. For example, between the columns used in an <code>insert</code> clause and the <code>where</code> clause of a Hive query.

For lines connecting database columns, a dashed line indicates that the column is in the `where` clause; a solid line indicates that the column is in the `select` clause.

Manipulating Lineage Diagrams

You can click a parent entity to display its child entities. For example, you can click the Pig script to display its child tables:



- To improve the layout of a lineage diagram you can drag and drop entities (in this case `sonnets.txt` and `out`) located outside a parent box.
- You can use the mouse scroll wheel to zoom the lineage diagram in and out.
- You can move the lineage diagram in the lineage pane by pressing the mouse button and dragging it.

Displaying a Template Lineage Diagram

A **template lineage diagram** contains template entities, such as jobs and queries, that can be instantiated and the input and output entities to which they are related.

To display a template lineage diagram:

1. Perform a metadata [search](#).
2. In the list of results, click a result entry. For example, when you click the sample_09 result entry:

HIVE sample_09
type: hv_table path: hdfs://sb-cm47-1.ent.cloudera.com:8020/user/hive/warehouse/sample_09 owner: hdfs last accessed: Dec 31 1969 4:00 PM created: Oct 21 2013 3:34 PM

the Search screen is replaced with a page that displays the entity property sheet on the left and lineage diagram on the right:

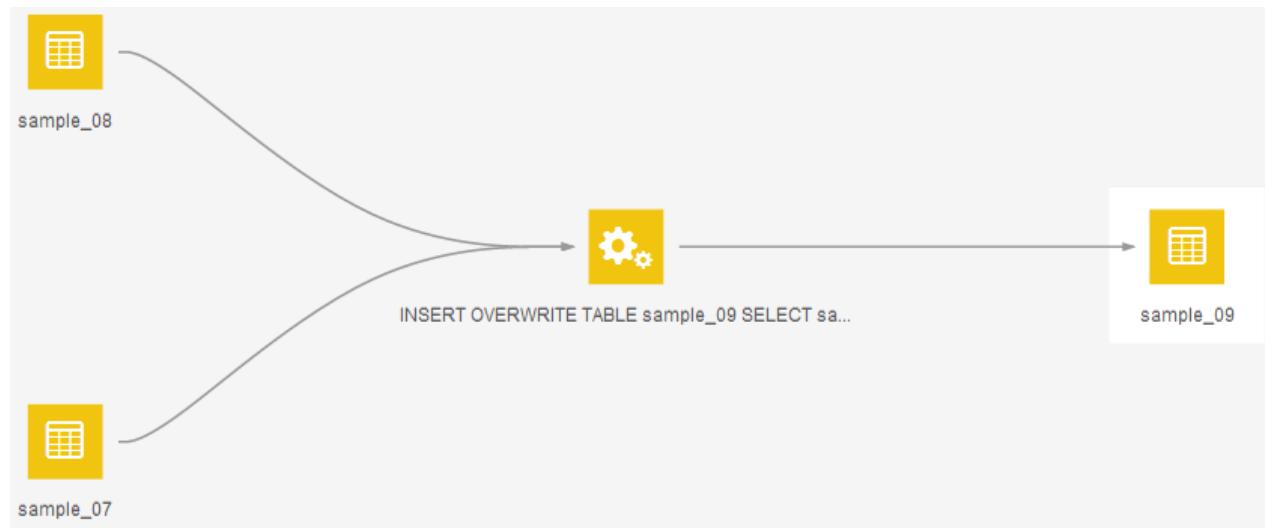
The screenshot shows the Cloudera Navigator interface. On the left, there is a property sheet for the entity "sample_09". The properties listed are:

- tags: (empty)
- source type: HIVE
- type: hv_table
- path: hdfs://sb-cm47-1.ent.cloudera.com:8020/user/hive/warehouse/sample_09
- input format: org.apache.hadoop.mapred.TextInputFormat
- output format: org.apache.hadoop.hive.io.HiveIgnoreKeyTextOutputFormat
- owner: hdfs
- last accessed: Dec 31 1969 4:00 PM
- created: Oct 21 2013 3:34 PM

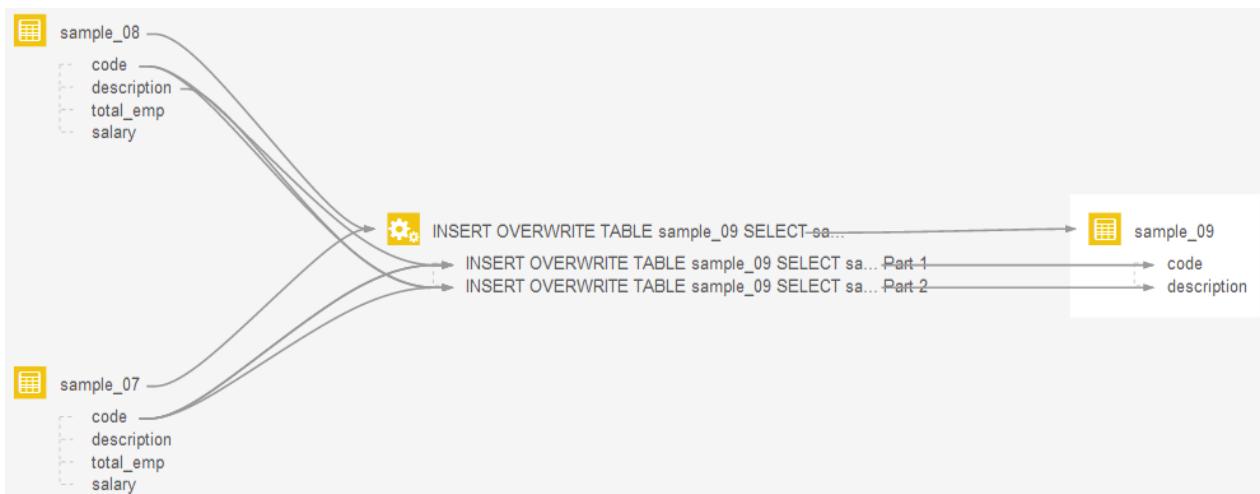
On the right, there is a "Lineage" tab selected, showing a lineage diagram. The diagram consists of three entities: "sample_08" (top), "sample_07" (bottom-left), and "sample_09" (bottom-right). Arrows indicate relationships: one arrow points from "sample_08" to a central gear icon, and another arrow points from "sample_07" to the same gear icon. From the gear icon, an arrow points to "sample_09". Below the gear icon is the SQL query: "INSERT OVERWRITE TABLE sample_09 SELECT sa...".

The selected entity sample_09 appears with a white box as a background.

This example lineage diagram illustrates the relationships between a Hive query execution entity and its source and destination tables:



When you click each entity icon, columns and lines connecting the source and destination columns display:



If you hover over a part, the source and destination columns are highlighted:

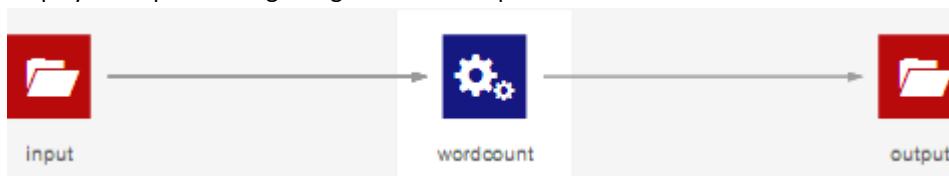


Displaying an Instance Lineage Diagram

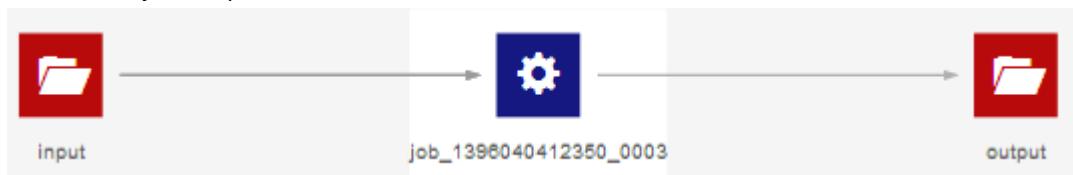
An ***instance lineage diagram*** displays instance entities, such as job and query executions, and the input and output entities to which they are related.

To display an instance lineage diagram:

1. Display a template lineage diagram. For example:



2. Click the **Instances** tab, which contains a list of links to instances of the template.
3. Click a link to display an instance lineage diagram. The job instance `job_1396040412350_0003` replaces the `wordcount` job template.



Displaying the Template Lineage Diagram for an Instance Lineage Diagram

You can navigate from an instance diagram to its template.

1. Display a instance lineage diagram.
2. Click the value of the **template** property to navigate to the instance's template.

Downloading a Lineage File

Lineage is externalized in a lineage file in JSON format.

1. Display a template or instance lineage diagram.
2. Click the  icon at the top left of the diagram.

A lineage file named `lineage.json` is downloaded. For example, the lineage file representing `job_1396040412350_0003` from the preceding section is:

```
{  
  "entities": {  
    "d212538318276a6ad8abdd308a4487cc": {  
      "level": 1,  
      "physical": [],  
      "logical": [],  
      "aliasOf": [],  
      "aliases": [],  
      "instances": [],  
      "children": [],  
      "workflows": [],  
      "identity": "d212538318276a6ad8abdd308a4487cc",  
      "originalName": "file0",  
      "sourceId": "012437f9eeb3c23dc69e679ac94a7fa2",  
      "firstClassParentId": null,  
      "parentPath": "/user/hdfs/input",  
      "extractorRunId": null,  
      "name": "file0",  
      "description": null,  
      "tags": null,  
      "fileSystemPath": "/user/hdfs/input/file0",  
      "type": "FILE",  
      "size": 22,  
      "created": "2014-07-08T22:03:32.126Z",  
      "lastModified": "2014-07-08T22:03:32.126Z",  
      "lastAccessed": "2014-07-08T22:03:31.612Z",  
      "permissions": 420,  
      "owner": "hdfs",  
      "group": "supergroup",  
      "blockSize": null,  
      "mimeType": "application/octet-stream",  
      "deleted": false,  
      "sourceType": "HDFS",  
      "replication": null,  
      "internalType": "fselement",  
      "nameField": "originalName",  
      "sourceName": "HDFS",  
      "isScript": false,  
      "hasDownstream": true,  
      "parent": "e461de8de38511a3ac6740dd7d51b8d0",  
      "activeChildren": []  
    },  
    "57c993fc305b553dae82210090d5da7a": {  
      "level": 1,  
      "physical": [],  
      "logical": [],  
      "aliasOf": [],  
      "aliases": [],  
      "instances": [  
        "fc671272b2c7518ec738d6b17f08b7ed"  
      ],  
      "children": [],  
      "workflows": [],  
      "identity": "57c993fc305b553dae82210090d5da7a",  
      "originalName": "file0",  
      "sourceId": "012437f9eeb3c23dc69e679ac94a7fa2",  
      "firstClassParentId": null,  
      "parentPath": "/user/hdfs/input",  
      "extractorRunId": null,  
      "name": "file0",  
      "description": null,  
      "tags": null,  
      "fileSystemPath": "/user/hdfs/input/file0",  
      "type": "FILE",  
      "size": 22,  
      "created": "2014-07-08T22:03:32.126Z",  
      "lastModified": "2014-07-08T22:03:32.126Z",  
      "lastAccessed": "2014-07-08T22:03:31.612Z",  
      "permissions": 420,  
      "owner": "hdfs",  
      "group": "supergroup",  
      "blockSize": null,  
      "mimeType": "application/octet-stream",  
      "deleted": false,  
      "sourceType": "HDFS",  
      "replication": null,  
      "internalType": "fselement",  
      "nameField": "originalName",  
      "sourceName": "HDFS",  
      "isScript": false,  
      "hasDownstream": true,  
      "parent": "e461de8de38511a3ac6740dd7d51b8d0",  
      "activeChildren": []  
    }  
  }  
}
```

```

"originalName": "wordcount",
"sourceId": "262c2128425eabeb29bb1c96ee0eb35f",
"firstClassParentId": null,
"parentPath": null,
"extractorRunId": null,
"name": "wordcount",
"description": null,
"tags": null,
"wfIds": null,
"inputFormat": "org.apache.hadoop.mapred.TextInputFormat",
"outputFormat": "org.apache.hadoop.mapred.TextOutputFormat",
"outputKey": "org.apache.hadoop.io.Text",
"outputValue": "org.apache.hadoop.io.IntWritable",
"mapper": "org.myorg.WordCount$Map",
"reducer": "org.myorg.WordCount$Reduce",
"sourceType": "YARN",
"type": "OPERATION",
"internalType": "mrjobspec",
"nameField": "name",
"sourceName": "YARN (MR2 Included)",
"isScript": false,
"unorchestrated": true,
"active": true,
"column": 0,
"renderOrdinal": 0,
"activeChildren": [],
"x": 0,
"y": -52.3046875
},
"2b5a90798459c168d9fb5ecc2fc46aa5": {
"level": 1,
"physical": [],
"logical": [],
"aliasOf": [],
"aliases": [],
"instances": [],
"children": [],
"workflows": [],
"identity": "2b5a90798459c168d9fb5ecc2fc46aa5",
"originalName": "part-00001",
"sourceId": "012437f9eeb3c23dc69e679ac94a7fa2",
"firstClassParentId": null,
"parentPath": "/user/hdfs/output",
"extractorRunId": null,
"name": "part-00001",
"description": null,
"tags": null,
"fileSystemPath": "/user/hdfs/output/part-00001",
"type": "FILE",
"size": 6,
"created": "2014-07-08T22:08:53.602Z",
"lastModified": "2014-07-08T22:08:53.602Z",
"lastAccessed": "2014-07-08T22:08:52.923Z",
"permissions": 420,
"owner": "hdfs",
"group": "supergroup",
"blockSize": null,
"mimeType": "application/octet-stream",
"deleted": false,
"sourceType": "HDFS",
"replication": null,
"internalType": "fselement",
"nameField": "originalName",
"sourceName": "HDFS",
"isScript": false,
"parent": "e9b3d1f7aee29134338df3de4cae1100",
"hasUpstream": true,
"activeChildren": []
},
"fe5445fb070d97c418d96200a218cae": {
"level": 1,
"physical": [],
"logical": []
}

```

Cloudera Navigator Metadata Component

```
"aliasOf": [],
"aliases": [],
"instances": [],
"children": [],
"workflows": [],
"identity": "fe5445fbd070d97c418d96200a218cae",
"originalName": "part-00002",
"sourceId": "012437f9eeb3c23dc69e679ac94a7fa2",
"firstClassParentId": null,
"parentPath": "/user/hdfs/output",
"extractorRunId": null,
"name": "part-00002",
"description": null,
"tags": null,
"fileSystemPath": "/user/hdfs/output/part-00002",
"type": "FILE",
"size": 9,
"created": "2014-07-08T22:08:53.619Z",
"lastModified": "2014-07-08T22:08:53.619Z",
"lastAccessed": "2014-07-08T22:08:52.464Z",
"permissions": 420,
"owner": "hdfs",
"group": "supergroup",
"blockSize": null,
"mimeType": "application/octet-stream",
"deleted": false,
"sourceType": "HDFS",
"replication": null,
"internalType": "fselement",
"nameField": "originalName",
"sourceName": "HDFS",
"isScript": false,
"parent": "e9b3d1f7aee29134338df3de4cae1100",
"hasUpstream": true,
"activeChildren": []
},
"916b141fb9ce45094df8ef97ecdde41c": {
"level": 1,
"physical": [],
"logical": [],
"aliasOf": [],
"aliases": [],
"instances": [],
"children": [],
"workflows": [],
"identity": "916b141fb9ce45094df8ef97ecdde41c",
"originalName": "file1._COPYING_",
"sourceId": "012437f9eeb3c23dc69e679ac94a7fa2",
"firstClassParentId": null,
"parentPath": "/user/hdfs/input",
"extractorRunId": null,
"name": "file1._COPYING_",
"description": null,
"tags": null,
"fileSystemPath": "/user/hdfs/input/file1._COPYING_",
"type": "FILE",
"size": 28,
"created": "2014-07-08T22:03:32.171Z",
"lastModified": "2014-07-08T22:03:32.244Z",
"lastAccessed": "2014-07-08T22:03:32.171Z",
"permissions": 420,
"owner": "hdfs",
"group": "supergroup",
"blockSize": null,
"mimeType": "application/octet-stream",
"deleted": true,
"sourceType": "HDFS",
"replication": null,
"internalType": "fselement",
"nameField": "originalName",
"sourceName": "HDFS",
"isScript": false,
"parent": "e461de8de38511a3ac6740dd7d51b8d0",
```

```

    "activeChildren": []
},
"66bff6eeac3c17c5b7eb7c9035704eef": {
    "level": 1,
    "physical": [],
    "logical": [],
    "aliasOf": [],
    "aliases": [],
    "instances": [],
    "children": [],
    "workflows": [],
    "identity": "66bff6eeac3c17c5b7eb7c9035704eef",
    "originalName": "part-00005",
    "sourceId": "012437f9eeb3c23dc69e679ac94a7fa2",
    "firstClassParentId": null,
    "parentPath": "/user/hdfs/output",
    "extractorRunId": null,
    "name": "part-00005",
    "description": null,
    "tags": null,
    "fileSystemPath": "/user/hdfs/output/part-00005",
    "type": "FILE",
    "size": 8,
    "created": "2014-07-08T22:08:53.668Z",
    "lastModified": "2014-07-08T22:08:53.668Z",
    "lastAccessed": "2014-07-08T22:08:52.419Z",
    "permissions": 420,
    "owner": "hdfs",
    "group": "supergroup",
    "blockSize": null,
    "mimeType": "application/octet-stream",
    "deleted": false,
    "sourceType": "HDFS",
    "replication": null,
    "internalType": "fselement",
    "nameField": "originalName",
    "sourceName": "HDFS",
    "isScript": false,
    "hasUpstream": true,
    "parent": "e9b3d1f7aee29134338df3de4cae1100",
    "activeChildren": []
},
"51db076ee11470b7f968bd5f33429e6b": {
    "level": 1,
    "physical": [],
    "logical": [],
    "aliasOf": [],
    "aliases": [],
    "instances": [],
    "children": [],
    "workflows": [],
    "identity": "51db076ee11470b7f968bd5f33429e6b",
    "originalName": "file0._COPYING_",
    "sourceId": "012437f9eeb3c23dc69e679ac94a7fa2",
    "firstClassParentId": null,
    "parentPath": "/user/hdfs/input",
    "extractorRunId": null,
    "name": "file0._COPYING_",
    "description": null,
    "tags": null,
    "fileSystemPath": "/user/hdfs/input/file0._COPYING_",
    "type": "FILE",
    "size": 22,
    "created": "2014-07-08T22:03:31.612Z",
    "lastModified": "2014-07-08T22:03:32.100Z",
    "lastAccessed": "2014-07-08T22:03:31.612Z",
    "permissions": 420,
    "owner": "hdfs",
    "group": "supergroup",
    "blockSize": null,
    "mimeType": "application/octet-stream",
    "deleted": true,
    "sourceType": "HDFS",
}

```

Cloudera Navigator Metadata Component

```
"replication": null,
"internalType": "fselement",
"nameField": "originalName",
"sourceName": "HDFS",
"isScript": false,
"parent": "e461de8de38511a3ac6740dd7d51b8d0",
"activeChildren": []
},
"c864e9c3bc3f5f7a99315c56830e811d": {
"level": 1,
"physical": [],
"logical": [],
"aliasOf": [],
"aliases": [],
"instances": [],
"children": [],
"workflows": [],
"identity": "c864e9c3bc3f5f7a99315c56830e811d",
"originalName": "_SUCCESS",
"sourceId": "012437f9eeb3c23dc69e679ac94a7fa2",
"firstClassParentId": null,
"parentPath": "/user/hdfs/output",
"extractorRunId": null,
"name": "_SUCCESS",
"description": null,
"tags": null,
"fileSystemPath": "/user/hdfs/output/_SUCCESS",
"type": "FILE",
"size": 0,
"created": "2014-07-08T22:08:53.689Z",
"lastModified": "2014-07-08T22:08:53.694Z",
"lastAccessed": "2014-07-08T22:08:53.689Z",
"permissions": 420,
"owner": "hdfs",
"group": "supergroup",
"blockSize": null,
"mimeType": "application/octet-stream",
"deleted": false,
"sourceType": "HDFS",
"replication": null,
"internalType": "fselement",
"nameField": "originalName",
"sourceName": "HDFS",
"isScript": false,
"parent": "e9b3d1f7aee29134338df3de4cae1100",
"hasUpstream": true,
"activeChildren": []
},
"9d7ca9e46a9e4624df0d5d10949a5fc6": {
"level": 1,
"physical": [],
"logical": [],
"aliasOf": [],
"aliases": [],
"instances": [],
"children": [],
"workflows": [],
"identity": "9d7ca9e46a9e4624df0d5d10949a5fc6",
"originalName": "part-00004",
"sourceId": "012437f9eeb3c23dc69e679ac94a7fa2",
"firstClassParentId": null,
"parentPath": "/user/hdfs/output",
"extractorRunId": null,
"name": "part-00004",
"description": null,
"tags": null,
"fileSystemPath": "/user/hdfs/output/part-00004",
"type": "FILE",
"size": 10,
"created": "2014-07-08T22:08:53.651Z",
"lastModified": "2014-07-08T22:08:53.651Z",
"lastAccessed": "2014-07-08T22:08:52.856Z",
"permissions": 420,
```

```

    "owner": "hdfs",
    "group": "supergroup",
    "blockSize": null,
    "mimeType": "application/octet-stream",
    "deleted": false,
    "sourceType": "HDFS",
    "replication": null,
    "internalType": "fselement",
    "nameField": "originalName",
    "sourceName": "HDFS",
    "isScript": false,
    "hasUpstream": true,
    "parent": "e9b3d1f7aee29134338df3de4cae1100",
    "activeChildren": []
},
"8c40fbf6b4584a0b213a257be2cae679": {
    "level": 1,
    "physical": [],
    "logical": [],
    "aliasOf": [],
    "aliases": [],
    "instances": [],
    "children": [],
    "workflows": [],
    "identity": "8c40fbf6b4584a0b213a257be2cae679",
    "originalName": "file1",
    "sourceId": "012437f9eeb3c23dc69e679ac94a7fa2",
    "firstClassParentId": null,
    "parentPath": "/user/hdfs/input",
    "extractorRunId": null,
    "name": "file1",
    "description": null,
    "tags": null,
    "fileSystemPath": "/user/hdfs/input/file1",
    "type": "FILE",
    "size": 28,
    "created": "2014-07-08T22:03:32.262Z",
    "lastModified": "2014-07-08T22:03:32.262Z",
    "lastAccessed": "2014-07-08T22:03:32.171Z",
    "permissions": 420,
    "owner": "hdfs",
    "group": "supergroup",
    "blockSize": null,
    "mimeType": "application/octet-stream",
    "deleted": false,
    "sourceType": "HDFS",
    "replication": null,
    "internalType": "fselement",
    "nameField": "originalName",
    "sourceName": "HDFS",
    "isScript": false,
    "hasDownstream": true,
    "parent": "e461de8de38511a3ac6740dd7d51b8d0",
    "activeChildren": []
},
"2690183198a2d6568188426ea9a82793": {
    "level": 1,
    "physical": [],
    "logical": [],
    "aliasOf": [],
    "aliases": [],
    "instances": [],
    "children": [],
    "workflows": [],
    "identity": "2690183198a2d6568188426ea9a82793",
    "originalName": "part-00000",
    "sourceId": "012437f9eeb3c23dc69e679ac94a7fa2",
    "firstClassParentId": null,
    "parentPath": "/user/hdfs/output",
    "extractorRunId": null,
    "name": "part-00000",
    "description": null,
    "tags": null,
}

```

Cloudera Navigator Metadata Component

```
"fileSystemPath": "/user/hdfs/output/part-00000",
"type": "FILE",
"size": 0,
"created": "2014-07-08T22:08:53.580Z",
"lastModified": "2014-07-08T22:08:53.580Z",
"lastAccessed": "2014-07-08T22:08:52.568Z",
"permissions": 420,
"owner": "hdfs",
"group": "supergroup",
"blockSize": null,
"mimeType": "application/octet-stream",
"deleted": false,
"sourceType": "HDFS",
"replication": null,
"internalType": "fselement",
"nameField": "originalName",
"sourceName": "HDFS",
"isScript": false,
"hasUpstream": true,
"parent": "e9b3d1f7aee29134338df3de4cae1100",
"activeChildren": []
},
"e9b3d1f7aee29134338df3de4cae1100": {
"level": 1,
"physical": [],
"logical": [],
"aliasOf": [],
"aliases": [],
"instances": [],
"children": [
"fe5445fb070d97c418d96200a218cae",
"c864e9c3bc3f5f7a99315c56830e811d",
"2b5a90798459c168d9fb5ecc2fc46aa5",
"4374529a34441bc8db30ee001bbb3563",
"2690183198a2d6568188426ea9a82793",
"66bff6eeac3c17c5b7eb7c9035704eef",
"9d7ca9e46a9e4624df0d5d10949a5fc6",
"e5586cd8c89ecef7552e125acb91c2cf"
],
"workflows": [],
"identity": "e9b3d1f7aee29134338df3de4cae1100",
"originalName": "output",
"sourceId": "012437f9eeb3c23dc69e679ac94a7fa2",
"firstClassParentId": null,
"parentPath": "/user/hdfs",
"extractorRunId": null,
"name": "output",
"description": null,
"tags": null,
"fileSystemPath": "/user/hdfs/output",
"type": "DIRECTORY",
"size": null,
"created": "2014-07-08T22:08:31.569Z",
"lastModified": "2014-07-08T22:08:53.689Z",
"lastAccessed": null,
"permissions": 493,
"owner": "hdfs",
"group": "supergroup",
"blockSize": null,
"mimeType": null,
"deleted": false,
"sourceType": "HDFS",
"replication": null,
"internalType": "fselement",
"nameField": "originalName",
"sourceName": "HDFS",
"isScript": false,
"hasUpstream": true,
"column": 1,
"renderOrdinal": 2,
"activeChildren": [
{
"level": 1,
```

```

"physical": [],
"logical": [],
"aliasOf": [],
"aliases": [],
"instances": [],
"children": [],
"workflows": [],
"identity": "c864e9c3bc3f5f7a99315c56830e811d",
"originalName": "_SUCCESS",
"sourceId": "012437f9eeb3c23dc69e679ac94a7fa2",
"firstClassParentId": null,
"parentPath": "/user/hdfs/output",
"extractorRunId": null,
"name": "_SUCCESS",
"description": null,
"tags": null,
"fileSystemPath": "/user/hdfs/output/_SUCCESS",
"type": "FILE",
"size": 0,
"created": "2014-07-08T22:08:53.689Z",
"lastModified": "2014-07-08T22:08:53.694Z",
"lastAccessed": "2014-07-08T22:08:53.689Z",
"permissions": 420,
"owner": "hdfs",
"group": "supergroup",
"blockSize": null,
"mimeType": "application/octet-stream",
"deleted": false,
"sourceType": "HDFS",
"replication": null,
"internalType": "fselement",
"nameField": "originalName",
"sourceName": "HDFS",
"isScript": false,
"parent": "e9b3d1f7aeee29134338df3de4cae1100",
"hasUpstream": true,
"activeChildren": []
},
{
"level": 1,
"physical": [],
"logical": [],
"aliasOf": [],
"aliases": [],
"instances": [],
"children": [],
"workflows": [],
"identity": "2690183198a2d6568188426ea9a82793",
"originalName": "part-00000",
"sourceId": "012437f9eeb3c23dc69e679ac94a7fa2",
"firstClassParentId": null,
"parentPath": "/user/hdfs/output",
"extractorRunId": null,
"name": "part-00000",
"description": null,
"tags": null,
"fileSystemPath": "/user/hdfs/output/part-00000",
"type": "FILE",
"size": 0,
"created": "2014-07-08T22:08:53.580Z",
"lastModified": "2014-07-08T22:08:53.580Z",
"lastAccessed": "2014-07-08T22:08:52.568Z",
"permissions": 420,
"owner": "hdfs",
"group": "supergroup",
"blockSize": null,
"mimeType": "application/octet-stream",
"deleted": false,
"sourceType": "HDFS",
"replication": null,
"internalType": "fselement",
"nameField": "originalName",
"sourceName": "HDFS",

```

Cloudera Navigator Metadata Component

```
        "isScript": false,
        "hasUpstream": true,
        "parent": "e9b3d1f7aee29134338df3de4cae1100",
        "activeChildren": []
    },
    {
        "level": 1,
        "physical": [],
        "logical": [],
        "aliasOf": [],
        "aliases": [],
        "instances": [],
        "children": [],
        "workflows": [],
        "identity": "2b5a90798459c168d9fb5ecc2fc46aa5",
        "originalName": "part-00001",
        "sourceId": "012437f9eeb3c23dc69e679ac94a7fa2",
        "firstClassParentId": null,
        "parentPath": "/user/hdfs/output",
        "extractorRunId": null,
        "name": "part-00001",
        "description": null,
        "tags": null,
        "fileSystemPath": "/user/hdfs/output/part-00001",
        "type": "FILE",
        "size": 6,
        "created": "2014-07-08T22:08:53.602Z",
        "lastModified": "2014-07-08T22:08:53.602Z",
        "lastAccessed": "2014-07-08T22:08:52.923Z",
        "permissions": 420,
        "owner": "hdfs",
        "group": "supergroup",
        "blockSize": null,
        "mimeType": "application/octet-stream",
        "deleted": false,
        "sourceType": "HDFS",
        "replication": null,
        "internalType": "fselement",
        "nameField": "originalName",
        "sourceName": "HDFS",
        "isScript": false,
        "parent": "e9b3d1f7aee29134338df3de4cae1100",
        "hasUpstream": true,
        "activeChildren": []
    },
    {
        "level": 1,
        "physical": [],
        "logical": [],
        "aliasOf": [],
        "aliases": [],
        "instances": [],
        "children": [],
        "workflows": [],
        "identity": "fe5445fbd070d97c418d96200a218cae",
        "originalName": "part-00002",
        "sourceId": "012437f9eeb3c23dc69e679ac94a7fa2",
        "firstClassParentId": null,
        "parentPath": "/user/hdfs/output",
        "extractorRunId": null,
        "name": "part-00002",
        "description": null,
        "tags": null,
        "fileSystemPath": "/user/hdfs/output/part-00002",
        "type": "FILE",
        "size": 9,
        "created": "2014-07-08T22:08:53.619Z",
        "lastModified": "2014-07-08T22:08:53.619Z",
        "lastAccessed": "2014-07-08T22:08:52.464Z",
        "permissions": 420,
        "owner": "hdfs",
        "group": "supergroup",
        "blockSize": null,
```

```

    "mimeType": "application/octet-stream",
    "deleted": false,
    "sourceType": "HDFS",
    "replication": null,
    "internalType": "fselement",
    "nameField": "originalName",
    "sourceName": "HDFS",
    "isScript": false,
    "parent": "e9b3d1f7aeee29134338df3de4cae1100",
    "hasUpstream": true,
    "activeChildren": []
},
{
    "level": 1,
    "physical": [],
    "logical": [],
    "aliasOf": [],
    "aliases": [],
    "instances": [],
    "children": [],
    "workflows": [],
    "identity": "4374529a34441bc8db30ee001bbb3563",
    "originalName": "part-00003",
    "sourceId": "012437f9eeb3c23dc69e679ac94a7fa2",
    "firstClassParentId": null,
    "parentPath": "/user/hdfs/output",
    "extractorRunId": null,
    "name": "part-00003",
    "description": null,
    "tags": null,
    "fileSystemPath": "/user/hdfs/output/part-00003",
    "type": "FILE",
    "size": 8,
    "created": "2014-07-08T22:08:53.636Z",
    "lastModified": "2014-07-08T22:08:53.636Z",
    "lastAccessed": "2014-07-08T22:08:52.499Z",
    "permissions": 420,
    "owner": "hdfs",
    "group": "supergroup",
    "blockSize": null,
    "mimeType": "application/octet-stream",
    "deleted": false,
    "sourceType": "HDFS",
    "replication": null,
    "internalType": "fselement",
    "nameField": "originalName",
    "sourceName": "HDFS",
    "isScript": false,
    "parent": "e9b3d1f7aeee29134338df3de4cae1100",
    "hasUpstream": true,
    "activeChildren": []
},
{
    "level": 1,
    "physical": [],
    "logical": [],
    "aliasOf": [],
    "aliases": [],
    "instances": [],
    "children": [],
    "workflows": [],
    "identity": "9d7ca9e46a9e4624df0d5d10949a5fc6",
    "originalName": "part-00004",
    "sourceId": "012437f9eeb3c23dc69e679ac94a7fa2",
    "firstClassParentId": null,
    "parentPath": "/user/hdfs/output",
    "extractorRunId": null,
    "name": "part-00004",
    "description": null,
    "tags": null,
    "fileSystemPath": "/user/hdfs/output/part-00004",
    "type": "FILE",
    "size": 10,
}

```

Cloudera Navigator Metadata Component

```
"created": "2014-07-08T22:08:53.651Z",
"lastModified": "2014-07-08T22:08:53.651Z",
"lastAccessed": "2014-07-08T22:08:52.856Z",
"permissions": 420,
"owner": "hdfs",
"group": "supergroup",
"blockSize": null,
"mimeType": "application/octet-stream",
"deleted": false,
"sourceType": "HDFS",
"replication": null,
"internalType": "fselement",
"nameField": "originalName",
"sourceName": "HDFS",
"isScript": false,
"hasUpstream": true,
"parent": "e9b3d1f7aee29134338df3de4cae1100",
"activeChildren": []
},
{
"level": 1,
"physical": [],
"logical": [],
"aliasOf": [],
"aliases": [],
"instances": [],
"children": [],
"workflows": [],
"identity": "66bff6eeac3c17c5b7eb7c9035704eef",
"originalName": "part-00005",
"sourceId": "012437f9eeb3c23dc69e679ac94a7fa2",
"firstClassParentId": null,
"parentPath": "/user/hdfs/output",
"extractorRunId": null,
"name": "part-00005",
"description": null,
"tags": null,
"fileSystemPath": "/user/hdfs/output/part-00005",
"type": "FILE",
"size": 8,
"created": "2014-07-08T22:08:53.668Z",
"lastModified": "2014-07-08T22:08:53.668Z",
"lastAccessed": "2014-07-08T22:08:52.419Z",
"permissions": 420,
"owner": "hdfs",
"group": "supergroup",
"blockSize": null,
"mimeType": "application/octet-stream",
"deleted": false,
"sourceType": "HDFS",
"replication": null,
"internalType": "fselement",
"nameField": "originalName",
"sourceName": "HDFS",
"isScript": false,
"hasUpstream": true,
"parent": "e9b3d1f7aee29134338df3de4cae1100",
"activeChildren": []
},
{
"level": 1,
"physical": [],
"logical": [],
"aliasOf": [],
"aliases": [],
"instances": [],
"children": [],
"workflows": [],
"identity": "e5586cdb89ecef7552e125acb91c2cf",
"parent": "e9b3d1f7aee29134338df3de4cae1100",
"activeChildren": []
}
]
```

```

        "x": 182,
        "y": -52.3046875
    },
    "4374529a34441bc8db30ee001bbb3563": {
        "level": 1,
        "physical": [],
        "logical": [],
        "aliasOf": [],
        "aliases": [],
        "instances": [],
        "children": [],
        "workflows": [],
        "identity": "4374529a34441bc8db30ee001bbb3563",
        "originalName": "part-00003",
        "sourceId": "012437f9eef3c23dc69e679ac94a7fa2",
        "firstClassParentId": null,
        "parentPath": "/user/hdfs/output",
        "extractorRunId": null,
        "name": "part-00003",
        "description": null,
        "tags": null,
        "fileSystemPath": "/user/hdfs/output/part-00003",
        "type": "FILE",
        "size": 8,
        "created": "2014-07-08T22:08:53.636Z",
        "lastModified": "2014-07-08T22:08:53.636Z",
        "lastAccessed": "2014-07-08T22:08:52.499Z",
        "permissions": 420,
        "owner": "hdfs",
        "group": "supergroup",
        "blockSize": null,
        "mimeType": "application/octet-stream",
        "deleted": false,
        "sourceType": "HDFS",
        "replication": null,
        "internalType": "fselement",
        "nameField": "originalName",
        "sourceName": "HDFS",
        "isScript": false,
        "parent": "e9b3d1f7aee29134338df3de4cae1100",
        "hasUpstream": true,
        "activeChildren": []
    },
    "e461de8de38511a3ac6740dd7d51b8d0": {
        "level": 1,
        "physical": [],
        "logical": [],
        "aliasOf": [],
        "aliases": [],
        "instances": [],
        "children": [
            "916b141fb9ce45094df8ef97ecdde41c",
            "8c40fbfb6b4584a0b213a257be2cae679",
            "51db076ee11470b7f968bd5f33429e6b",
            "d212538318276a6ad8abdd308a4487cc"
        ],
        "workflows": [],
        "identity": "e461de8de38511a3ac6740dd7d51b8d0",
        "originalName": "input",
        "sourceId": "012437f9eef3c23dc69e679ac94a7fa2",
        "firstClassParentId": null,
        "parentPath": "/user/hdfs",
        "extractorRunId": null,
        "name": "input",
        "description": null,
        "tags": null,
        "fileSystemPath": "/user/hdfs/input",
        "type": "DIRECTORY",
        "size": null,
        "created": "2014-07-08T22:02:26.664Z",
        "lastModified": "2014-07-08T22:03:32.262Z",
        "lastAccessed": null,
        "permissions": 493
    }
}

```

Cloudera Navigator Metadata Component

```
"owner": "hdfs",
"group": "supergroup",
"blockSize": null,
"mimeType": null,
"deleted": false,
"sourceType": "HDFS",
"replication": null,
"internalType": "fselement",
"nameField": "originalName",
"sourceName": "HDFS",
"isScript": false,
"hasDownstream": true,
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"renderOrdinal": 1,
"activeChildren": [
  {
    "level": 1,
    "physical": [],
    "logical": [],
    "aliasOf": [],
    "aliases": [],
    "instances": [],
    "children": [],
    "workflows": [],
    "identity": "d212538318276a6ad8abdd308a4487cc",
    "originalName": "file0",
    "sourceId": "012437f9eeb3c23dc69e679ac94a7fa2",
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    "extractorRunId": null,
    "name": "file0",
    "description": null,
    "tags": null,
    "fileSystemPath": "/user/hdfs/input/file0",
    "type": "FILE",
    "size": 22,
    "created": "2014-07-08T22:03:32.126Z",
    "lastModified": "2014-07-08T22:03:32.126Z",
    "lastAccessed": "2014-07-08T22:03:31.612Z",
    "permissions": 420,
    "owner": "hdfs",
    "group": "supergroup",
    "blockSize": null,
    "mimeType": "application/octet-stream",
    "deleted": false,
    "sourceType": "HDFS",
    "replication": null,
    "internalType": "fselement",
    "nameField": "originalName",
    "sourceName": "HDFS",
    "isScript": false,
    "hasDownstream": true,
    "parent": "e461de8de38511a3ac6740dd7d51b8d0",
    "activeChildren": []
  },
  {
    "level": 1,
    "physical": [],
    "logical": [],
    "aliasOf": [],
    "aliases": [],
    "instances": [],
    "children": [],
    "workflows": [],
    "identity": "51db076ee11470b7f968bd5f33429e6b",
    "originalName": "file0._COPYING_",
    "sourceId": "012437f9eeb3c23dc69e679ac94a7fa2",
    "firstClassParentId": null,
    "parentPath": "/user/hdfs/input",
    "extractorRunId": null,
    "name": "file0._COPYING_",
    "description": null,
    "tags": null,
```

```

"fileSystemPath": "/user/hdfs/input/file0._COPYING_",
"type": "FILE",
"size": 22,
"created": "2014-07-08T22:03:31.612Z",
"lastModified": "2014-07-08T22:03:32.100Z",
"lastAccessed": "2014-07-08T22:03:31.612Z",
"permissions": 420,
"owner": "hdfs",
"group": "supergroup",
"blockSize": null,
"mimeType": "application/octet-stream",
"deleted": true,
"sourceType": "HDFS",
"replication": null,
"internalType": "fselement",
"nameField": "originalName",
"sourceName": "HDFS",
"isScript": false,
"parent": "e461de8de38511a3ac6740dd7d51b8d0",
"activeChildren": []
},
{
  "level": 1,
  "physical": [],
  "logical": [],
  "aliasOf": [],
  "aliases": [],
  "instances": [],
  "children": [],
  "workflows": [],
  "identity": "8c40fbf6b4584a0b213a257be2cae679",
  "originalName": "file1",
  "sourceId": "012437f9eeb3c23dc69e679ac94a7fa2",
  "firstClassParentId": null,
  "parentPath": "/user/hdfs/input",
  "extractorRunId": null,
  "name": "file1",
  "description": null,
  "tags": null,
  "fileSystemPath": "/user/hdfs/input/file1",
  "type": "FILE",
  "size": 28,
  "created": "2014-07-08T22:03:32.262Z",
  "lastModified": "2014-07-08T22:03:32.262Z",
  "lastAccessed": "2014-07-08T22:03:32.171Z",
  "permissions": 420,
  "owner": "hdfs",
  "group": "supergroup",
  "blockSize": null,
  "mimeType": "application/octet-stream",
  "deleted": false,
  "sourceType": "HDFS",
  "replication": null,
  "internalType": "fselement",
  "nameField": "originalName",
  "sourceName": "HDFS",
  "isScript": false,
  "hasDownstream": true,
  "parent": "e461de8de38511a3ac6740dd7d51b8d0",
  "activeChildren": []
},
{
  "level": 1,
  "physical": [],
  "logical": [],
  "aliasof": [],
  "aliases": [],
  "instances": [],
  "children": [],
  "workflows": [],
  "identity": "916b141fb9ce45094df8ef97ecdde41c",
  "originalName": "file1._COPYING_",
  "sourceId": "012437f9eeb3c23dc69e679ac94a7fa2",

```

Cloudera Navigator Metadata Component

```
        "firstClassParentId": null,
        "parentPath": "/user/hdfs/input",
        "extractorRunId": null,
        "name": "file1._COPYING_",
        "description": null,
        "tags": null,
        "fileSystemPath": "/user/hdfs/input/file1._COPYING_",
        "type": "FILE",
        "size": 28,
        "created": "2014-07-08T22:03:32.171Z",
        "lastModified": "2014-07-08T22:03:32.244Z",
        "lastAccessed": "2014-07-08T22:03:32.171Z",
        "permissions": 420,
        "owner": "hdfs",
        "group": "supergroup",
        "blockSize": null,
        "mimeType": "application/octet-stream",
        "deleted": true,
        "sourceType": "HDFS",
        "replication": null,
        "internalType": "fselement",
        "nameField": "originalName",
        "sourceName": "HDFS",
        "isScript": false,
        "parent": "e461de8de38511a3ac6740dd7d51b8d0",
        "activeChildren": []
    }
],
"x": -182,
"y": -52.3046875
},
"fc671272b2c7518ec738d6b17f08b7ed": {
    "level": 1,
    "physical": [],
    "logical": [],
    "aliasOf": [],
    "aliases": [],
    "instances": [],
    "children": [],
    "workflows": [],
    "identity": "fc671272b2c7518ec738d6b17f08b7ed",
    "originalName": "job_1396040412350_0003",
    "sourceId": "262c2128425eabeb29bb1c96ee0eb35f",
    "firstClassParentId": null,
    "parentPath": null,
    "extractorRunId": null,
    "name": "job_1396040412350_0003",
    "description": null,
    "tags": null,
    "started": "2014-07-08T22:08:31.543Z",
    "ended": "2014-07-08T22:08:53.722Z",
    "principal": "hdfs",
    "inputs": [
        "hdfs://tcdn501-1.ent.cloudera.com:8020/user/hdfs/input"
    ],
    "outputs": [
        "hdfs://tcdn501-1.ent.cloudera.com:8020/user/hdfs/output"
    ],
    "wfInstId": null,
    "jobID": "job_1396040412350_0003",
    "sourceType": "YARN",
    "inputRecursive": false,
    "type": "OPERATION_EXECUTION",
    "internalType": "mrjobinstance",
    "nameField": "originalName",
    "sourceName": "YARN (MR2 Included)",
    "isScript": false,
    "hasUpstream": true,
    "template": "57c993fc305b553dae82210090d5da7a",
    "hasDownstream": true
},
"e5586cd8c89ecef7552e125acb91c2cf": {
    "level": 1,
```

```

    "physical": [],
    "logical": [],
    "aliasOf": [],
    "aliases": [],
    "instances": [],
    "children": [],
    "workflows": [],
    "identity": "e5586cdbc89ecef7552e125acb91c2cf",
    "parent": "e9b3d1f7aee29134338df3de4cae1100",
    "activeChildren": []
  },
  "relations": {
    "57bd1a6ddc6ff99ce878f9c024759bbf": {
      "identity": "57bd1a6ddc6ff99ce878f9c024759bbf",
      "type": "PARENT_CHILD",
      "propagatorId": null,
      "extractorRunId": "NOT_STORED",
      "parent": {
        "entityId": "e9b3d1f7aee29134338df3de4cae1100"
      },
      "children": {
        "entityIds": [
          "fe5445fb070d97c418d96200a218cae"
        ]
      },
      "unlinked": false,
      "propagatable": false
    },
    "bc51b7d63696a428f0546e4d6088c936": {
      "identity": "bc51b7d63696a428f0546e4d6088c936",
      "type": "PARENT_CHILD",
      "propagatorId": null,
      "extractorRunId": "NOT_STORED",
      "parent": {
        "entityId": "e461de8de38511a3ac6740dd7d51b8d0"
      },
      "children": {
        "entityIds": [
          "916b141fb9ce45094df8ef97ecdde41c"
        ]
      },
      "unlinked": false,
      "propagatable": false
    },
    "d9568c3415368847afaecd4b88478e3f": {
      "identity": "d9568c3415368847afaecd4b88478e3f",
      "type": "DATA_FLOW",
      "propagatorId": "0e1f4f973761cf05b3781934945b8098",
      "extractorRunId": "NOT_STORED",
      "targets": {
        "entityIds": [
          "fc671272b2c7518ec738d6b17f08b7ed"
        ]
      },
      "sources": {
        "entityIds": [
          "d212538318276a6ad8abdd308a4487cc",
          "8c40fbf6b4584a0b213a257be2cae679"
        ]
      },
      "unlinked": false,
      "propagatable": false
    },
    "f505a6ea5efe8d0d58f61e2e19e09644": {
      "identity": "f505a6ea5efe8d0d58f61e2e19e09644",
      "type": "PARENT_CHILD",
      "propagatorId": null,
      "extractorRunId": "NOT_STORED",
      "parent": {
        "entityId": "e9b3d1f7aee29134338df3de4cae1100"
      },
      "children": {
        "entityIds": [
          "e9b3d1f7aee29134338df3de4cae1100"
        ]
      }
    }
  }
}

```

Cloudera Navigator Metadata Component

```
        "entityIds": [
            "c864e9c3bc3f5f7a99315c56830e811d"
        ],
    },
    "unlinked": false,
    "propagatable": false
},
"dalb64977bca48ed1d4e0f74bbcacea7": {
    "identity": "dalb64977bca48ed1d4e0f74bbcacea7",
    "type": "PARENT_CHILD",
    "propagatorId": null,
    "extractorRunId": "NOT_STORED",
    "parent": {
        "entityId": "e9b3d1f7aeee29134338df3de4cae1100"
    },
    "children": {
        "entityIds": [
            "2b5a90798459c168d9fb5ecc2fc46aa5"
        ]
    },
    "unlinked": false,
    "propagatable": false
},
"74f685545f94873904c8a5ca5b7c9eaa": {
    "identity": "74f685545f94873904c8a5ca5b7c9eaa",
    "type": "INSTANCE_OF",
    "propagatorId": null,
    "extractorRunId": "NOT_STORED",
    "instances": {
        "entityIds": [
            "fc671272b2c7518ec738d6b17f08b7ed"
        ]
    },
    "template": {
        "entityId": "57c993fc305b553dae82210090d5da7a"
    },
    "unlinked": false,
    "propagatable": false
},
"2e3c88897fcc1df2853fa4490c286207": {
    "identity": "2e3c88897fcc1df2853fa4490c286207",
    "type": "PARENT_CHILD",
    "propagatorId": null,
    "extractorRunId": "NOT_STORED",
    "parent": {
        "entityId": "e461de8de38511a3ac6740dd7d51b8d0"
    },
    "children": {
        "entityIds": [
            "8c40fbf6b4584a0b213a257be2cae679"
        ]
    },
    "unlinked": false,
    "propagatable": false
},
"c35093d842e090c17b3374ef22fe5383": {
    "identity": "c35093d842e090c17b3374ef22fe5383",
    "type": "PARENT_CHILD",
    "propagatorId": null,
    "extractorRunId": "NOT_STORED",
    "parent": {
        "entityId": "e9b3d1f7aeee29134338df3de4cae1100"
    },
    "children": {
        "entityIds": [
            "4374529a34441bc8db30ee001bbb3563"
        ]
    },
    "unlinked": false,
    "propagatable": false
},
"29caebf3d0a7a8d38d9a4a49bb2c016c": {
    "identity": "29caebf3d0a7a8d38d9a4a49bb2c016c",
```

```

    "type": "DATA_FLOW",
    "propagatorId": "cf0c7b96382b834021f51638b135da9e",
    "extractorRunId": "NOT_STORED",
    "targets": {
        "entityIds": [
            "2690183198a2d6568188426ea9a82793",
            "2b5a90798459c168d9fb5ecc2fc46aa5",
            "fe5445fdb070d97c418d96200a218cae",
            "4374529a34441bc8db30ee001bbb3563",
            "9d7ca9e46a9e4624df0d5d10949a5fc6",
            "66bff6eeac3c17c5b7eb7c9035704eef",
            "c864e9c3bc3f5f7a99315c56830e811d"
        ]
    },
    "sources": {
        "entityIds": [
            "fc671272b2c7518ec738d6b17f08b7ed"
        ]
    },
    "unlinked": false,
    "propagatable": false
},
"a2a35d94ba084495469290f8413e91ee": {
    "identity": "a2a35d94ba084495469290f8413e91ee",
    "type": "DATA_FLOW",
    "propagatorId": "cf0c7b96382b834021f51638b135da9e",
    "extractorRunId": "NOT_STORED",
    "targets": {
        "entityIds": [
            "fe5445fdb070d97c418d96200a218cae",
            "2b5a90798459c168d9fb5ecc2fc46aa5",
            "2690183198a2d6568188426ea9a82793",
            "4374529a34441bc8db30ee001bbb3563",
            "66bff6eeac3c17c5b7eb7c9035704eef",
            "9d7ca9e46a9e4624df0d5d10949a5fc6"
        ]
    },
    "sources": {
        "entityIds": [
            "fc671272b2c7518ec738d6b17f08b7ed"
        ]
    },
    "unlinked": false,
    "propagatable": false
},
"3a817d057f264d972c8c0e8dda4f9c3e": {
    "identity": "3a817d057f264d972c8c0e8dda4f9c3e",
    "type": "PARENT_CHILD",
    "propagatorId": null,
    "extractorRunId": "NOT_STORED",
    "parent": {
        "entityId": "e9b3d1f7aeee29134338df3de4cae1100"
    },
    "children": {
        "entityIds": [
            "2690183198a2d6568188426ea9a82793"
        ]
    },
    "unlinked": false,
    "propagatable": false
},
"e0dfacd87d398fdc8ffb91f30d675e43": {
    "identity": "e0dfacd87d398fdc8ffb91f30d675e43",
    "type": "PARENT_CHILD",
    "propagatorId": null,
    "extractorRunId": "NOT_STORED",
    "parent": {
        "entityId": "e9b3d1f7aeee29134338df3de4cae1100"
    },
    "children": {
        "entityIds": [
            "66bff6eeac3c17c5b7eb7c9035704eef"
        ]
    }
}

```

Cloudera Navigator Metadata Component

```
        },
        "unlinked": false,
        "propagatable": false
    },
    "cf0c7b96382b834021f51638b135da9e": {
        "identity": "cf0c7b96382b834021f51638b135da9e",
        "type": "DATA_FLOW",
        "propagatorId": null,
        "extractorRunId": "NOT_STORED",
        "targets": {
            "entityIds": [
                "e9b3d1f7aee29134338df3de4cae1100"
            ]
        },
        "sources": {
            "entityIds": [
                "fc671272b2c7518ec738d6b17f08b7ed"
            ]
        },
        "unlinked": false,
        "propagatable": false
    },
    "16384c6acdb0c1f4fd81624ec5e00de2": {
        "identity": "16384c6acdb0c1f4fd81624ec5e00de2",
        "type": "PARENT_CHILD",
        "propagatorId": null,
        "extractorRunId": "NOT_STORED",
        "parent": {
            "entityId": "e9b3d1f7aee29134338df3de4cae1100"
        },
        "children": {
            "entityIds": [
                "9d7ca9e46a9e4624df0d5d10949a5fc6"
            ]
        },
        "unlinked": false,
        "propagatable": false
    },
    "3745ae37cf1da17592754b9aed5d6f21": {
        "identity": "3745ae37cf1da17592754b9aed5d6f21",
        "type": "PARENT_CHILD",
        "propagatorId": null,
        "extractorRunId": "NOT_STORED",
        "parent": {
            "entityId": "e461de8de38511a3ac6740dd7d51b8d0"
        },
        "children": {
            "entityIds": [
                "51db076ee11470b7f968bd5f33429e6b"
            ]
        },
        "unlinked": false,
        "propagatable": false
    },
    "0432c75f4c29379500dc51dc5887e196": {
        "identity": "0432c75f4c29379500dc51dc5887e196",
        "type": "PARENT_CHILD",
        "propagatorId": null,
        "extractorRunId": "NOT_STORED",
        "parent": {
            "entityId": "e461de8de38511a3ac6740dd7d51b8d0"
        },
        "children": {
            "entityIds": [
                "d212538318276a6ad8abdd308a4487cc"
            ]
        },
        "unlinked": false,
        "propagatable": false
    },
    "989443d7728154fb577d239ae0e0d677": {
        "identity": "989443d7728154fb577d239ae0e0d677",
        "type": "PARENT_CHILD",
        "propagatable": false
    }
}
```

```

"propagatorId": null,
"extractorRunId": "NOT_STORED",
"parent": {
  "entityId": "e9b3d1f7aee29134338df3de4cae1100"
},
"children": {
  "entityIds": [
    "e5586cd8c89ecef7552e125acb91c2cf"
  ]
},
"unlinked": false,
"propagatable": false
},
"3043bc0b3969889eaba53d74da1df08b": {
  "identity": "3043bc0b3969889eaba53d74da1df08b",
  "type": "DATA_FLOW",
  "propagatorId": "cf0c7b96382b834021f51638b135da9e",
  "extractorRunId": "NOT_STORED",
  "targets": {
    "entityIds": [
      "fe5445fb070d97c418d96200a218cae",
      "2b5a90798459c168d9fb5ecc2fc46aa5",
      "2690183198a2d6568188426ea9a82793",
      "4374529a34441bc8db30ee001bbb3563",
      "66bff6eeac3c17c5b7eb7c9035704eef",
      "9d7ca9e46a9e4624df0d5d10949a5fc6"
    ]
  },
  "sources": {
    "entityIds": [
      "fc671272b2c7518ec738d6b17f08b7ed"
    ]
  },
  "unlinked": false,
  "propagatable": false
},
"0e1f4f973761cf05b3781934945b8098": {
  "identity": "0e1f4f973761cf05b3781934945b8098",
  "type": "DATA_FLOW",
  "propagatorId": null,
  "extractorRunId": "NOT_STORED",
  "targets": {
    "entityIds": [
      "fc671272b2c7518ec738d6b17f08b7ed"
    ]
  },
  "sources": {
    "entityIds": [
      "e461de8de38511a3ac6740dd7d51b8d0"
    ]
  },
  "unlinked": false,
  "propagatable": false
}
}
}

```

Tracing through the relationships shows that job_1396040412350_0003, which has the identity fc671272b2c7518ec738d6b17f08b7ed, has the INSTANCE_OF relationship with wordcount and the DATA_FLOW relationship with /user/hdfs/input and /user/hdfs/output.

Tables

Displaying Table Schema

A table schema contains information about the names and types of the columns of a table.

1. Perform a metadata [search](#) for an entity of source type Hive.

Cloudera Navigator Metadata Component

2. In the list of results, click a result entry of type **Table**. The Search screen is replaced with a page that displays the entity property sheet on the left and lineage diagram on the right.

The screenshot shows the Cloudera Navigator interface for a table named "sample_09". On the left, there is a property sheet with the following details:

- tags: (empty)
- source type: HIVE
- type: hv_table
- path: hdfs://sb-cm47-1.ent.cloudera.com:8020/user/hive/warehouse/sample_09
- input format: org.apache.hadoop.mapred.TextInputFormat
- output format: org.apache.hadoop.hive.ql.io.HiveIgnoreKeyTextOutputFormat
- owner: hdfs
- last accessed: Dec 31 1969 4:00 PM
- created: Oct 21 2013 3:34 PM

On the right, the "Lineage" tab is selected, displaying a lineage diagram. It shows three entities: "sample_09" (top), "sample_07" (bottom-left), and another "sample_09" (bottom-right). Arrows indicate the flow of data: one arrow points from "sample_07" to the top "sample_09", and another arrow points from the top "sample_09" to the bottom-right "sample_09". A gear icon is positioned between the two arrows, with the SQL command "INSERT OVERWRITE TABLE sample_09 SELECT sa..." written below it.

3. Click the **Schema** tab. The table schema displays.

The screenshot shows the Cloudera Navigator interface with the "Schema" tab selected. The schema for the table "sample_09" is displayed as a table with two columns:

code	string
description	string

Displaying Pig Tables

A table contains information about the names and types of the columns of a Pig table.

1. Perform a metadata [search](#) for an entity of source type **Pig**.
- In the list of results, click a result entry of type **Table**.
 - 1. In the list of results, click a result entry of type **Operation_Execution**.
 - 2. Click the **Tables** tab. A list of links to tables involved in the operation displays.

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