Collibra

Collibra Data Intelligence Cloud

Collibra Data Quality & Observability

Version 2022.11

Collibra

Collibra Collibra Data Quality & Observability guide

Release date: November 6, 2022 / Revision date: Fri Nov 04, 2022

You can find the most up-to-date technical documentation on our documentation site at

https://productresources.collibra.com/doc/collibra/latest/Content/DataQuality/to_data-quality.htm

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Introducing Collibra Data Quality

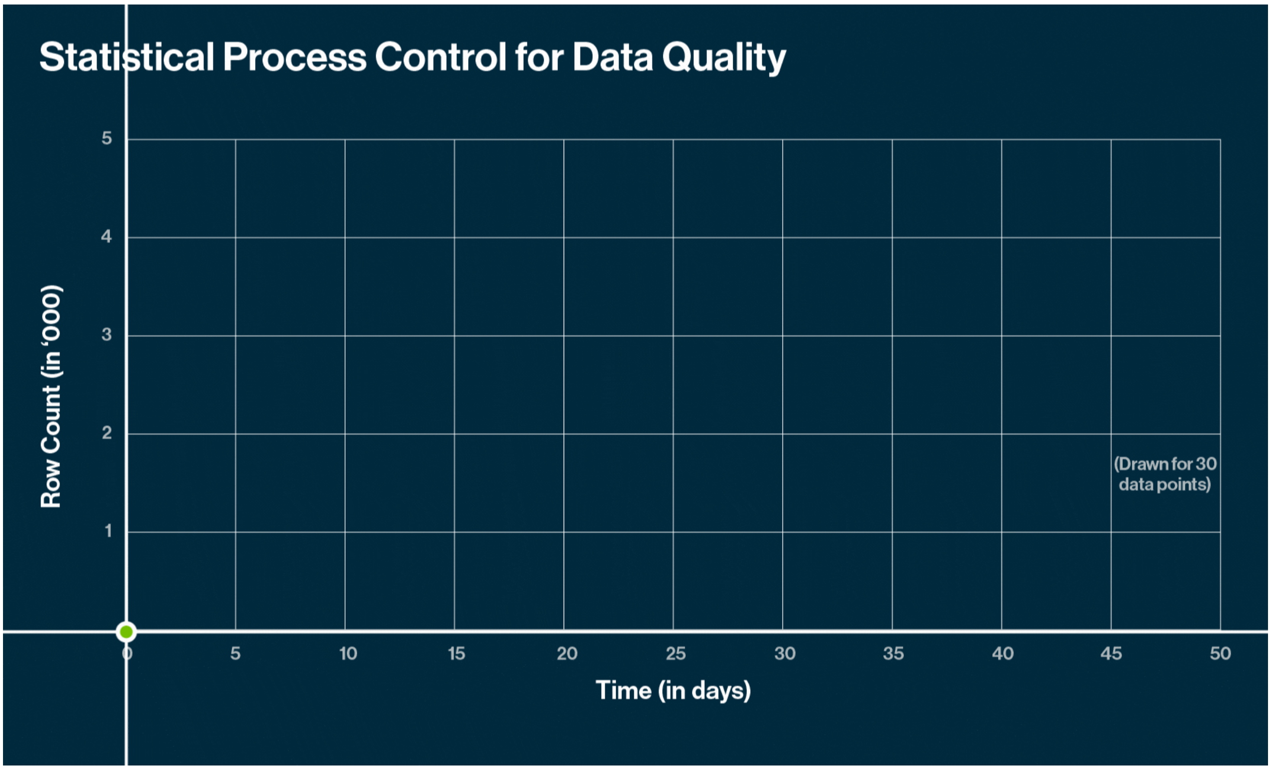
Autogenerate Rules, Anomaly Detection, Reconciliation

Collibra Data Quality

Use predictive data quality to improve trust in your data

Request a Collibra Data Quality demo

Automatic Data Quality without the need for Rules. Collibra Data Quality provides a fast and elegant way to manage your data sets by learning through observation rather than human input. Collibra Data Quality applies the latest advancements in Data Science and Machine Learning to the problem of Data Quality. Surfacing data issues in minutes instead of months.



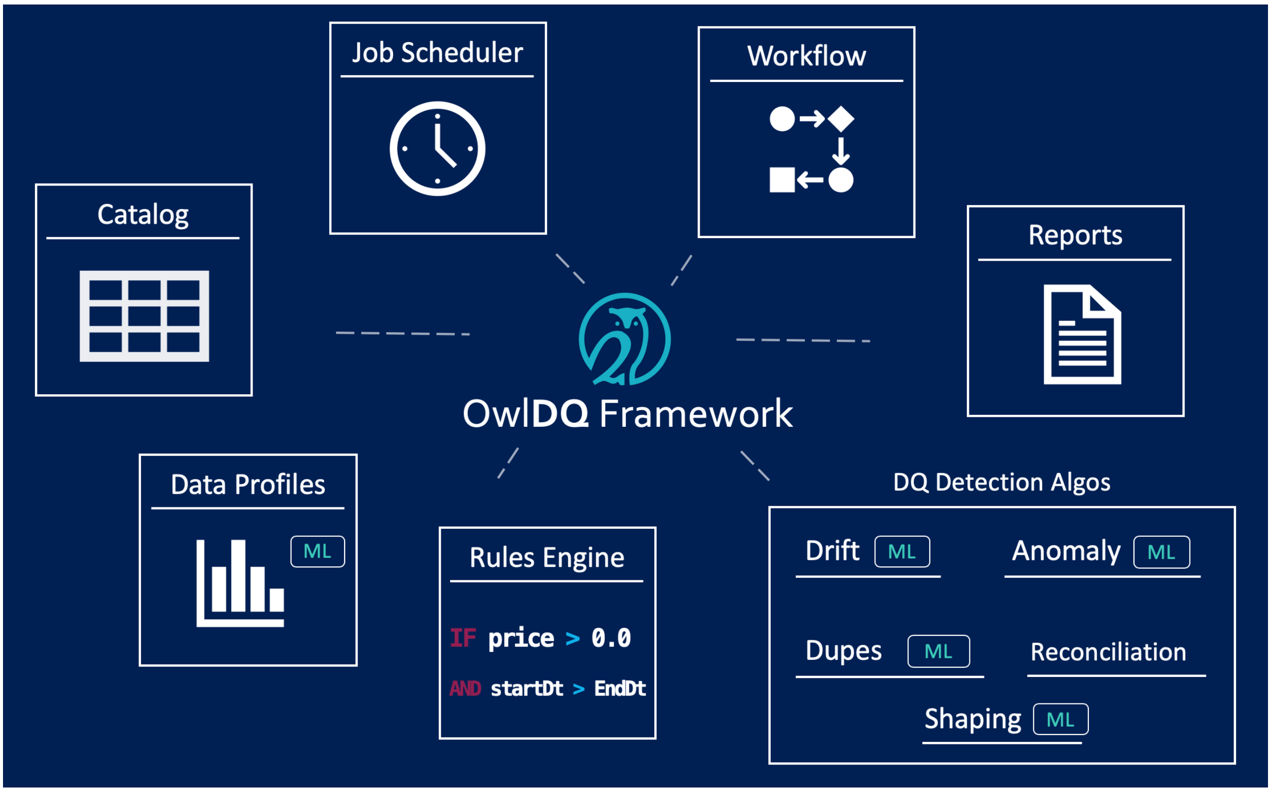
Getting Started with Collibra DQ

Deep Learning vs Machine Learning

What Does DQ Mean to You?

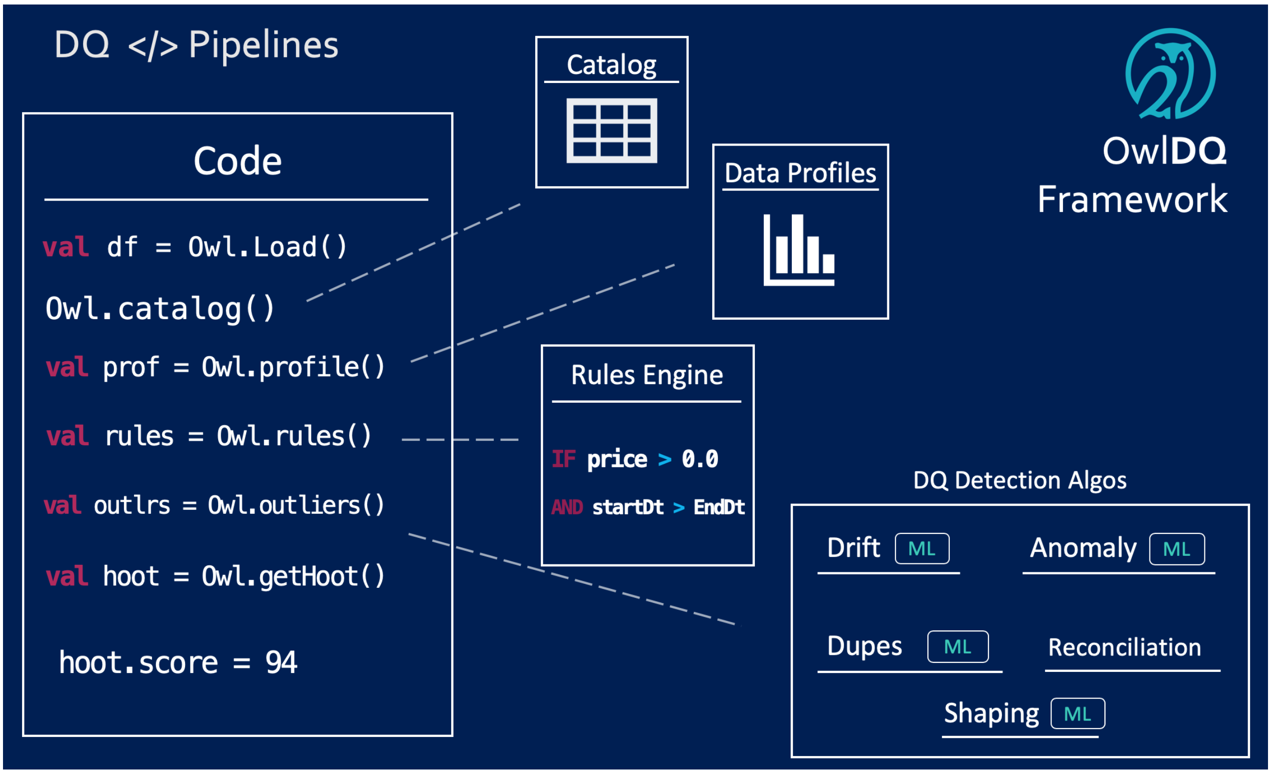
A Pluggable and Complete Data Quality Framework

If you are adding data quality to your data pipelines the below visual illustrates the number of products and pieces you will need consider to successfully complete your overall governance program. The Collibra Data Quality suite allows you to use either native CDQ components or integrate the 3rd party components of your choice. By using our best practice guide and framework you can complete the DQ lifecycle easily.



Data Pipelines that Tie into the DQ Framework

Collibra Data Quality offers a coding framework for developers or ETL designers that want to built real-time data quality into their broader data pipeline. This provides the same algos and DQ checks as the Collibra Data Quality UI Wizard but with direct access into your code points. Consistency is a must to have a program you trust.



```
val df = Owl.Load()
Owl.catalog()
val prof = Owl.profile()
val rules = Owl.rules()
val outlrs = Owl.outliers()
val hoot = Owl.getHoot()

hoot.score = 94
```

```
IF price > 0.0
AND startDt > EndDt
```

Getting Started

Standard Install

Standard	The install script for a standard install. *All software and data resides in your VPC.* Install time: `7 minutes`	Click Here
Containerized	Uses Helm Charts and K8s. For users who want WebApp and Compute components in containers. Compute pools are supported. *All software and data resides in your VPC.* Install time: `12 minutes`	Click Here

Edge	Provides a cloud application in Collibra Cloud but an Edge component on your premise to safeguard your data. *Customer data and connection credentials residste in your VPC. Application data is stored on Collibra Cloud.* Install time: `1 hour`	Click Here

GCP Install

Marketplace	The Google Marketplace option is a simple, 1-click image installation. This is the quickest option for single-server install in GCP. *All software and data resides in your VPC.* Install time: `5 minutes`	Click Here
Google Cloud Deployment Manager	Hooks into GCP cloud services like GKE for ephemeral compute and RDS for cloud database. *All software and data resides in your VPC.*	Coming soon

AWS Install

Marketplace	The Amazon Marketplace option is a simple, 1-click image installation. This is the quickest option for single-server install in AWS Cloud. *All software and data resides in your VPC.* Install time: `5 minutes`	Click Here
CloudFormation	Hooks into AWS cloud services like EKS for ephemeral compute and RDS for cloud database. *All software and data resides in your VPC.* Install time: `12 minutes`	Click Here

Please see the Agreements for the terms and conditions on Collibra's evaluation offerings.

> **Tip** For more information, please contact **info@collibra.com**

Release Notes

2022.11

Warning
The MS SQL driver that comes with JDK11 standalone packages does not currently work in the JDK11 environment. MSSQL requires a seperate JAR for JDK11. Please contact your Customer Success Manager for the compatible driver.

Dremio is not currently supported for JDK11 standalone packages. If you plan to run JDK11, add `-Dcdjd.io.netty.tryReflectionSetAccessible=true` to owlmanage.sh as a JVM option for your Web and Spark instances. Please contact your Customer Success Manager for assistance.

As of October 18, 2022, all images for the 2022.10 release have a Critical CVE (CVE-2022-42889). If you picked up the 2022.10 release before October 18, 2022, there should be no issue with your scans. If issues persist, please contact your Customer Success Manager for a new build.

Note
After you complete an upgrade or a new installation of Collibra DQ, you are now required to enter a license name by following a one-time prompt on the login page, using the `LICENSE_NAME` environment variable in the setup script, or by using the `global.configMap.data.license_name` Helm chart variable.

New Features

Platform

- The following pages now support the new React MUI:
  - Scorecards
  - List View
  - Assignments
  - Pulse View
  - Alerts

  > **Note** React is turned off by default for the 2022.11 release. If you would like to try the new React pages, you can toggle it on from the Admin Console, or contact your Customer Success Manager for assistance.

DQ Job

- You can now terminate jobs from the Jobs page if they are in progress, incorrectly submitted, or stuck in Staged status. When you terminate a job, two alerts are generated.
  - Jobs in the Spark UI display Finished statuses, even though they are terminated from the DQ UI.

Alerts

- You can now generate alerts for the following stale data stat rules:
  - `$daysWithoutData`
  - `$runsWithoutData`
  - `$daysSinceLastRun`
- You can now generate alerts for jobs stuck in Staged status for more than one hour.

Admin

- You can now configure LDAP for user access in multi-tenant environments.

Connections

- You can now use key-pair authentication for Snowflake connections.
    - When you append to the Connection URL string, your entry must be comma separated.
    - When you manually modify the Driver Properties field, your entry must be semicolon separated.

Cloud Storage

- Azure Blob Storage is now a supported target storage system.

Snowflake Pushdown (beta)

- Schema Change monitoring from the AdaptiveRules tab is now enabled by default.
    - Schema is now separated from basic profiling.
- The new DatasetDefDTO API now returns Pushdown information.
- Dataset security checks are now implemented for Pushdown jobs.

Enhancements

Explorer

- The Job Estimate dialogue now has improved guidance on executors and cores. The Job Estimate now estimates when a max core, max executor, and max memory is reached.

DQ Job

- Job schedule time zone is now a read-only field and can no longer be configured. Existing scheduled jobs reflect their current settings, but all other scheduled jobs are now based on the time zone of the DQ server (UTC). (ticket #88797, 89736, 92611, 95231)

Dupes

- A new warning message now displays when increasing the duplicate check limit from the UI. (ticket #95604)

Security

- Kubernetes service accounts associated with AWS IAM pod roles for controlling access to AWS services for cloud native DQ deployments on AWS EKS are now supported.
- When DATASET SECURITY is enabled, DATASET ACCESS is now required to edit, map, or retrieve datasets or business units. (ticket #92934)

Fixes

Rules

- Fixed an issue that prevented freeform rules containing double backslashes from saving. (ticket #96636, 96640)
- Fixed an issue that caused rules containing open brackets (`[`) to display break records incorrectly. (ticket #94399)
- Fixed an issue that caused rules containing regex to throw out of range exceptions. (ticket #98435)

DQ Job

- Fixed an issue where run time was not displayed on the findings page because run_id column type in the metastore did not include time zone. (ticket #96050)
- Fixed an issue that caused Parquet files to fail during the LOAD activity. (ticket #96191)
    - Other NFS file types, including ORC, CSV, and Avro, also run successfully.

Alerts

- Fixed an issue when saving batch names that used spaces between delimiters, which caused an invalid error to occur. (ticket #97028)

Validate Source

- The Add Column Names feature is now removed from the Source tab. (ticket #96066)
    - Instead, use the query to edit/limit columns or use Update Scope.
- Fixed an issue where disabling source check on a cloned dataset resulted in an error. You can now disable source validation on cloned datasets. (ticket #97795)

Dupes

- The Advanced Filter is now hidden from the Dupes tab. (ticket #96065)

Shapes

- Fixed an issue when editing a dataset that reverted the Shape Detection setting (Off, Auto, or Manual) applied when it was created. (ticket #95471, 95473)

Schema

- Fixed an issue with schema detection on files where schema detection was performed on all columns when a subset of columns was selected. (ticket #92476)
    - Use the`headercheckoff` flag when it is necessary to see only when columns are added or dropped.
- Fixed an issue where schema changes were not correctly identified and updated. (ticket #96013)

Behavior

- Fixed an issue with behavior lookback(`-bhlb`) that caused Row Count changes to be misrepresented. (ticket #94840)

Connections

- Azure Blob connections in standalone environments require the following jars to be added to the `$SPARK_HOME/jars` folder:
    - hadoop-azure-3.2.0.jar
    - wildfly-openssl-1.1.3.Final.jar

API

- Fixed an issue with the DB import process to ensure JobSchedule records import without error. (ticket #98405)

Known Limitations

DQ Job

- Job termination is not supported for jobs in Unknown status.

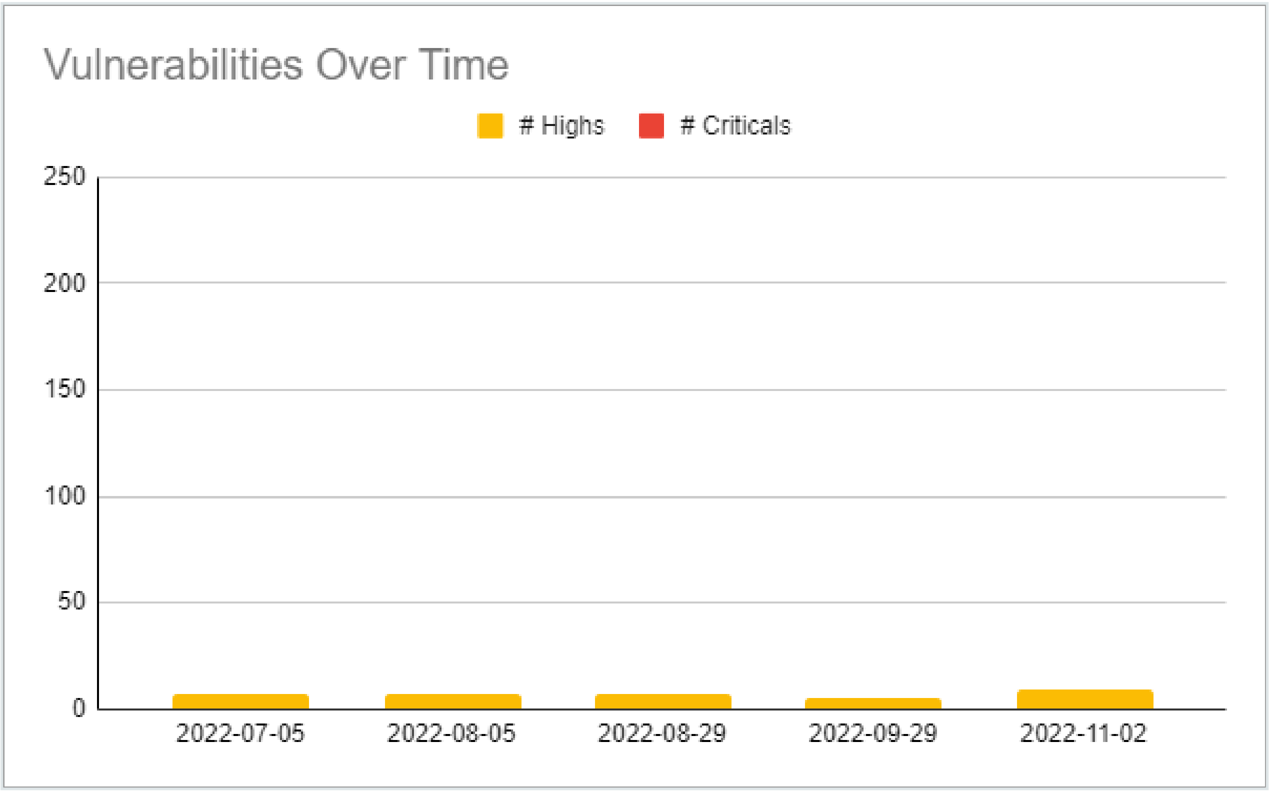
Validate Source

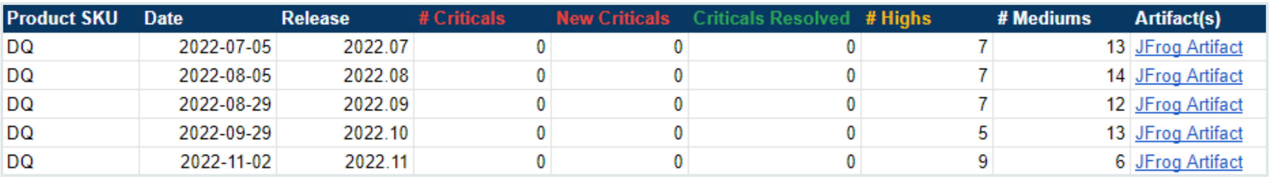
- Cloning and saving, enabling, or disabling the source tab is associated with the original dataset name and fails on the screen when an update is made, but does not affect the actual job run.

Connections

- When adding driver properties using the +Add Property option for Snowflake connections, semicolons are incorrectly appended to key values. Instead, use comma format to separate key values.

DQ Security Metrics





Product SKU	Date	Release	# Criticals	New Criticals	Criticals Resolved	# Highs	# Mediums	Artifact(s)
DQ	2022-07-05	2022.07	0	0	0	7	13	JFrog Artifact
DQ	2022-08-05	2022.08	0	0	0	7	14	JFrog Artifact
DQ	2022-08-29	2022.09	0	0	0	7	12	JFrog Artifact
DQ	2022-09-29	2022.10	0	0	0	5	13	JFrog Artifact
DQ	2022-11-02	2022.11	0	0	0	9	6	JFrog Artifact

2022.10

New Features

> **Warning** For the Collibra Data Quality 2022.10 release, all Docker images run on JDK11. Standalone packages contain JDK8 and JDK11 options. If you are an existing customer who requires JDK11, please upgrade your runtime before upgrading to 2022.10. Most Hadoop environment versions (EMR/HDP/CDH) still run on JDK8, so customers using these environments can upgrade with the JDK8 packages. If you

> prefer to upgrade to JDK11, you must follow the documentation of your respective Hadoop environment to upgrade to JDK11 before deploying the 2022.10 release.

Rules

- You can now define a rule to detect the number of days a job runs without data by using `$daysWithoutData`.
- You can now define a rule to detect the number of days a job runs with 0 rows by using `$runsWithoutData`.
- You can now define a rule to detect the number of days since a job last ran by using `$daysSinceLastRun`.

Profile

- You can now use a string length feature by toggling the Profile String Length checkbox when you create a data set.
  - When Profile String Length is checked, the min/max length of a string column is saved to table dataset_field

Validate Source

- You can now write rules against a loaded source data frame when `-postclearcache` is configured in the agent.

> **Note** The DQ UI will be converted to the React MUI framework with the 2022.11 release. Prior to the 2022.11 release, you can turn the React flag on, but note that some features may be temporarily limited.

Enhancements

DQ Job

- Start Time and Update Time are now based on the server time zone of the DQ Web App.

Scheduler

- The Job Schedule page now has pagination.

Scorecards

- From Pulse View, you can now view missing runs, runs with 0 rows, and runs with failed scores.

Admin/Catalog

- Connection details are now masked when non-admin users attempt to view or modify database connection details from the Catalog page. Only users with role_admin or role_connection_manager have the ability to view connection details on this page. (ticket #94430)

API

- The /v2/getRunIdDetailsByDataset endpoint now provides the following:
    - The RunIDs for a given data set.
    - All completed DQ Jobs for a given data set.

Snowflake Pushdown (beta)

- You can now detect shapes that do not conform to a data field. Pushdown jobs scan all columns for shapes by default.
- You can now view Histogram and Data Preview details for the Profile activity.

Connections

- The Snowflake JDBC driver is now updated to 3.13.14.

Fixes

Rules

- Fixed an issue with the Rule Validator that resulted in missing table errors. The Validator now correctly detects columns. (ticket #93430)

DQ Job

- Fixed an issue that caused queries with joins to fail on the load activity when Full Profile Pushdown was enabled. Pushdown profiling now supports SQL joins. (ticket #92409)
- Fixed an issue that caused jobs to fail at the load activity when using the CTE query. Please note that CTE support is currently limited to Postgres connections. (ticket #88287, 89150)
- Fixed an issue that caused inconsistencies between the time zones represented in the Start Time and Update Time columns.

Agent

- Fixed the loadBalancerSourceRanges for web and spark_history services in EKS environments. (ticket #95398)
    - The helm property `global.ingress.*` has been removed to separate the config for web and spark_history. Please update the property as follows:__global.web.ingress.*``global.spark_history.ingress.*
- Added support to specify the inbound CIDRs for the Ingress using the property `.global.web.service.loadBalancerSourceRanges`. (ticket #95398)
    - Though Ingress is supported as part of Helm charts, we recommend attaching your own Ingress to the deployment if you need further customization.
    - This requires a new Helm chart.
- Fixed an issue that caused Livy file estimates to fail for GCS on K8s deployments.
- Fixed an issue that caused jobs to fail for GCS on K8s deployments.

Validate Source

- The Add Column Names feature is scheduled for removal with the upcoming 2022.11 release. (ticket #96066)
  - This was a previous functionality before being able to limit the query directly (`srcq`) and Update Scope was added.
  - Use the query to edit/limit columns and also use Update Scope.
- Fixed an issue that caused the incorrect message to display for [VALUE_THRESHOLD] when validate source was specified for a matched case. (ticket #94435)

Dupes

- The Advanced Filter is scheduled for removal from the Dupes page with the upcoming 2022.11 release. (ticket #96065)

Explorer

- Fixed an issue that caused BigQuery connections to incorrectly update the library (-`lib`) path when a subset of columns was selected. (ticket #96768)

Scheduler

- Fixed an issue that prevented the scheduler from running certain scheduled jobs in multi-tenancy setups. Email server information is now captured from the correct tenant. (ticket #92898)

Known Limitations

Rules

- When a data set has 0 rows returned, stat rules applied to the data set are not executed. While a full fix is planned for a future release, this limitation is only partially fixed as of 2022.10.

DQ Job

- CTE query support is currently limited to Postgres connections. DB2 and MSSQL are currently unsupported.

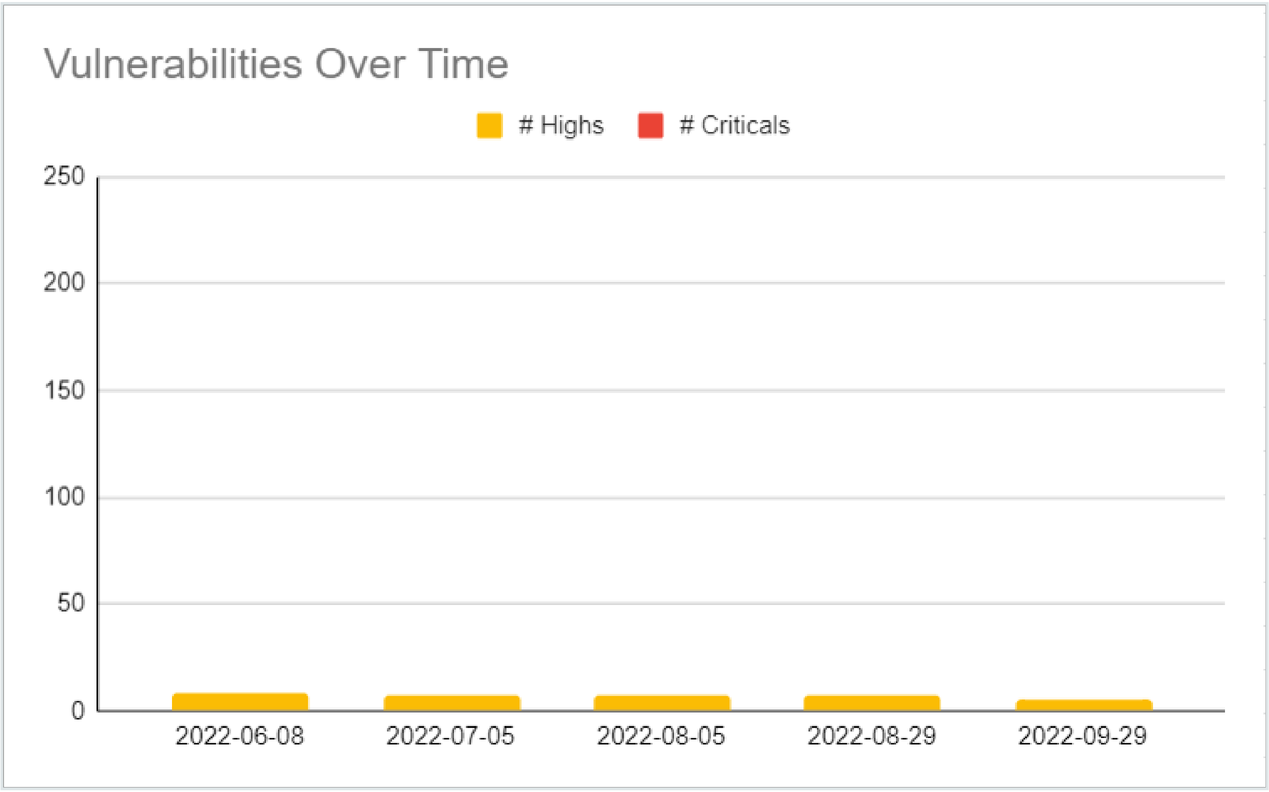
Catalog

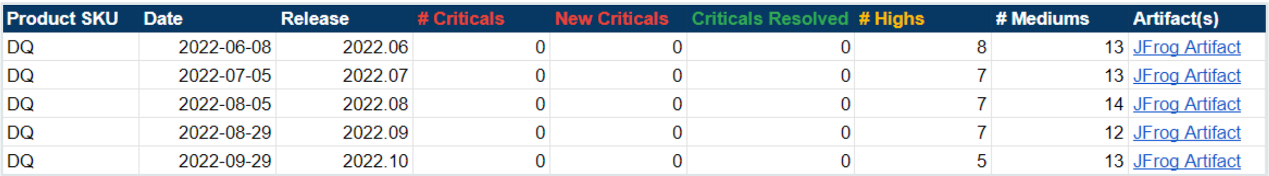
- When using the new bulk actions feature, updates to your job are not immediately visible in the UI. Once you apply a rule, run a DQ Job against that data set. From the Rules tab, a row with the newly applied rule is visible.

Snowflake Pushdown (beta)

- Freeform (SQLF) rules cannot use a data set name but instead must use `@dataset` because Snowflake does not explicitly understand data set names.
- When using the SQL Query workflow, selecting a subset of columns in your SQL query must be enclosed in double quotes to prevent the job from running infinitely and without failing.
- Min/Max precision and scale are only calculated for `double` data types. All other data types are currently out of scope.

DQ Security Metrics





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DQ	2022-08-29	2022.09	0	0	0	7	12	JFrog Artifact
DQ	2022-09-29	2022.10	0	0	0	5	13	JFrog Artifact

2022.09

Enhancements

Rules

- The Conditions column on the Rules tab now displays SQLG and SQLF rule definitions on hover.

DQ Job

- The Jobs chart now shows a dotted gray line to represent jobs in Submitted status.
- The Jobs chart now supports an hourly view option.
- When you run a Pushdown Job that has a data set that returns 0 rows, an unclear message displays.

Schema

- From the Config tab in Explorer, a Check Header checkbox under DQ Job is now available for when column names contain special characters. The Check Header checkbox is checked by default.
    - When checked, schema findings do not display when detected.
    - When unchecked, schema findings display when detected.

Behavior

- Mean values are now rounded on the Findings page.

Explorer

- SOH delimiters for files are now supported.
- The Only checkbox on all Build Layer tabs is now removed.
- The Profile activity is now always enabled and no longer has an on/off switch.

Alerts

- Only one email per alert is now sent when alerts are set up for a scheduled job.
- You can now check the logs to see when an alert does not send in order to resend the email.

Scheduler

- The findings page now displays a green indicator next to the Schedule icon when you schedule a job to run automatically. If Scheduler is inactive, a red indicator displays.

API

- The v2/gethoot API now properly returns rule dimension information for data sets. (ticket #89973)

Connections

- The Databricks connection template has changed, due to an upgrade of the driver. Any existing connection that uses the old driver must be updated. Refer to the new template. (ticket #19950)
- The drivers for Athena, BigQuery, MongoDB, GCS, Hive/Impala were also upgraded but no connection change is required.

Spark

- The 2022.11 release uses Spark 3.2.2.

> **Note** We recommend using Spark 3.x for standalone installs/upgrades.

Fixes

Explorer

- Fixed an issue that prevented the Job Estimator from properly displaying row estimates when the run date was modified during a new job run. (ticket #90860)
- Fixed an issue that prevented DQ jobs created using NFS connection types from displaying under the Remote File Connections dropdown. (ticket #92479)

- Fixed an issue that caused the file type parser to throw an error message when the default comma delimiter was not detected. The parser now detects a file's delimiter and updates the delimiter type in the UI automatically. (ticket #89489, 92480)

Files

- The error message for Failed Merging Schema now has extra logging to clarify the cause of failed schema merges for both Livy sessions and non-Livy paths. (ticket #92694)

Security

- Fixed an issue with the v2/getcatalogtableshasrulesfromcxn API that triggered a 403 status code when Dataset Security was enabled. (ticket #93298, 94258)

Agent

- Fixed an issue that caused the Agent Check to no longer attempt check-ins to the metastore on K8s deployments, which resulted in red (unhealthy) status. (ticket #92055, 92963)
- Fixed an issue that prevented concurrent users from properly running Livy sessions. (ticket #92963, 90432)

Known Limitations

Rules

- The Rule Builder page becomes unusable if the user creates, validates, saves a new rule and then re-edits.
    - The workaround for this limitation is to do a full page refresh.
- When a user attempts to validate a rule that contains a stat, an exception error is returned.

Security

- The Assignments Queue feature is only available for local users. Support for externally connected users, such as SAML and AD connector, is not currently available.

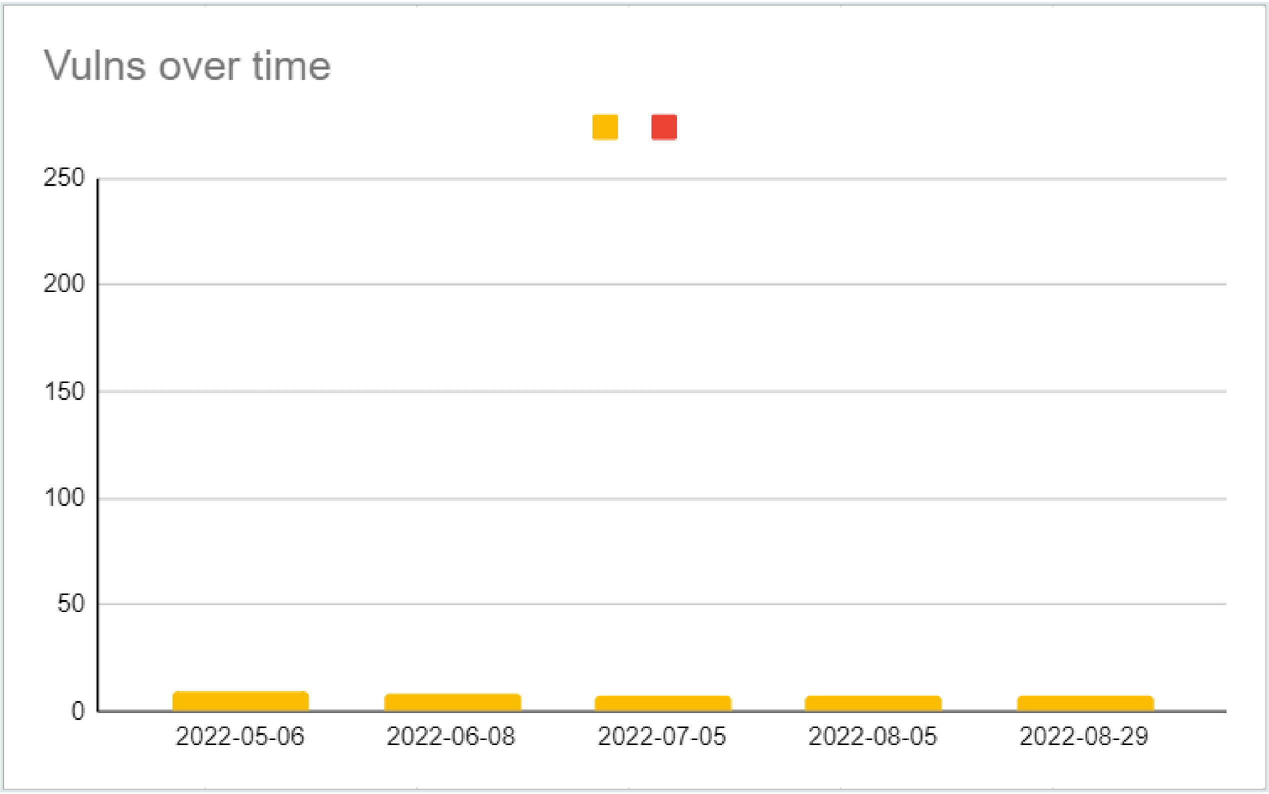
Alerts

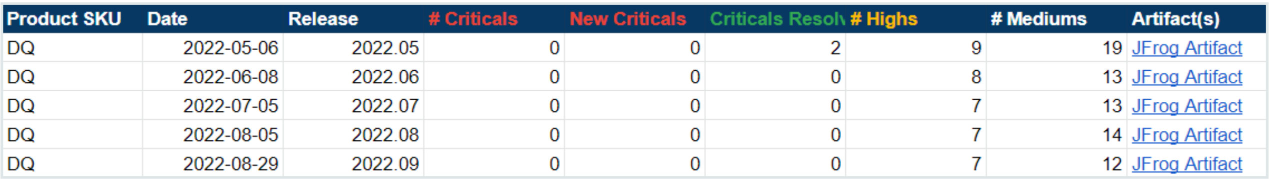
- When alert recipient email addresses are separated by semicolons `;`, alerts emails are not sent to the intended recipients.
    - A workaround for this limitation is to separate alert recipient email addresses with commas `,` instead of semicolons.

Snowflake Pushdown

- When a Job is run, which has a data set that returns 0 rows, an unclear message displays.
- When a native rule is created that contains an embedded stat, its calculated value will not display on the Job results page.
- Data Set security is not supported.
- Disabling autometrics will not take effect, therefore, all autometrics are executed.
- Creating a DQ job using only "SQL Query" workflow doesn't allow you to set the rundate value.

DQ Security Metrics





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DQ	2022-07-05	2022.07	0	0	0	7	13	JFrog Artifact
DQ	2022-08-05	2022.08	0	0	0	7	14	JFrog Artifact
DQ	2022-08-29	2022.09	0	0	0	7	12	JFrog Artifact

2022.08

New Features

Rules

- You can now write SQLG-type Stat Rules on mean.

Enhancements

Connections

- You can now authenticate Oracle JDBC connections with Kerberos TGT, Keytab, and Password. (tickets #75267, 76030)
- You can now authenticate SQL Server JDBC connections with Kerberos Keytab in addition to basic authentication.

Rules

- Rule Summary enhancements:
  - You can now select different time periods for analysis.
  - You can now view charts from three different pages, including Rule Detail Summary, Rule Breaks, and Rule Dimension Summary.

Security

- Vulnerabilities identified by Jfrog
  - Vulns 0, criticals 0, high severity 7
  - The majority of the current mediums are due to merging the dq-streaming module into core.
  - For a visual readout, see the DQ Security Metrics section below.

Agent

- You can now optionally configure individual time zones of DQ Job, Web, and Agent. You should only use this configuration when your instance and containers run in different system time zones. (tickets #87024, 87155)

Behavior

- The Behavior tab now has a new column, Delta Percent Change (Δ % Change).
- You can now hover over new tooltips in the following columns:
    - Baseline
    - % Change
    - Δ % Change
    - Zscore
    - Score

Outliers

- Outlier checks are now optimized to skip in certain circumstances. Outlier checks are only skipped when the history load of a specified date column is empty.
- You can now update and modify record flags from the command line with `-rc`, `-rcKeys`, `-rcDateCol`, and `-rcTbin`.

API

- The v2/gethoot API now properly returns rule dimension information for data sets.
- The v3/jobs/run API now has improvements to the 400 Bad Request error messages in specific circumstances.

Reports

- The PDF option is now removed from the Data Set Findings page. To print dynamic column tables, use CSV or Excel options instead. (ticket #89739)

DQ Connector

- The version of Collibra Integration Library is now updated to 2.4.12.

Fixes

Connections

- The new GCS jars are required to use GCS spark-history-server. (ticket #90623)

DQ Job

- Fixed an issue that caused jobs using .TXT files to incorrectly render custom column names. (ticket #81808)
    - Files with .TXT extensions are now treated as delimited files. Files with .TXT extensions that are not delimited files should use their respective file type from the file type dropdown.
- Fixed an issue with deployments on K8s where jobs failed when the volume name exceeded 63 characters. (ticket #85372)

Agent

- Fixed an issue that caused the v2/updateagent API to fail when numCores was empty. (tickets #89737, 92404, 92680)
    - The numCores field is no longer a required field.

Validate Source

- Fixed an issue that caused validate source jobs to fail when the pkey was mapped to different column names. (ticket #88778)

Rules

- When using Freeform SQL rules with wild-card operators, rules again correctly pass validation. (ticket #89644)

- Fixed an issue with regex rules that use the characters `)`, `,` , and `;` in the rlike, which caused DQ to append spaces to those characters and prevented the regex from operating correctly. (tickets #89417, 92958)
- Fixed an issue that caused rules with column values containing parentheses `( )` to break due to the addition of padding before and after closing parentheses. (ticket #85176)
- Fixed an issue that caused rules with special characters such as @ to display incorrectly on the Rules page, Conditions tab, and when exported to Excel.
- Fixed an issue that prevented data sets with attached rules and roles from being renamed. (tickets #85731, 92059, 94315)

Profile

- Fixed an issue where certain results in TopN Values and Data Preview displayed in scientific notation. Scientific notation is now removed from the display. (tickets #82163, 89738)

Explorer

- Fixed an issue that allowed CLOB data types to be visible in the Drag Columns to Target map in the Source tab. (ticket #86902)

API

- The REST API endpoint v2/updateRoleDatasets again correctly saves roles to data sets.

Known Limitations

Rules

- The Findings page displays results from computational stat rules on mean as a single-quote string. For example, '573523.87' > 6763
- Column-level sorting for the Rule Summary feature is not currently available.

Admin

- When adding a Sensitive Label or a Data Category, the Edit and Update functions do not display the selected record. To properly display the record, you must first refresh the page before editing or updating.

Session Activity

- While the application UI is being redesigned, it is possible that when the application times out on the legacy side of the application, you might not be able to see it on the new React MUI side. This can happen when you have the DQ application open on multiple tabs.
  - We are not currently tracking session timeout from the legacy UI to React.

Beta features

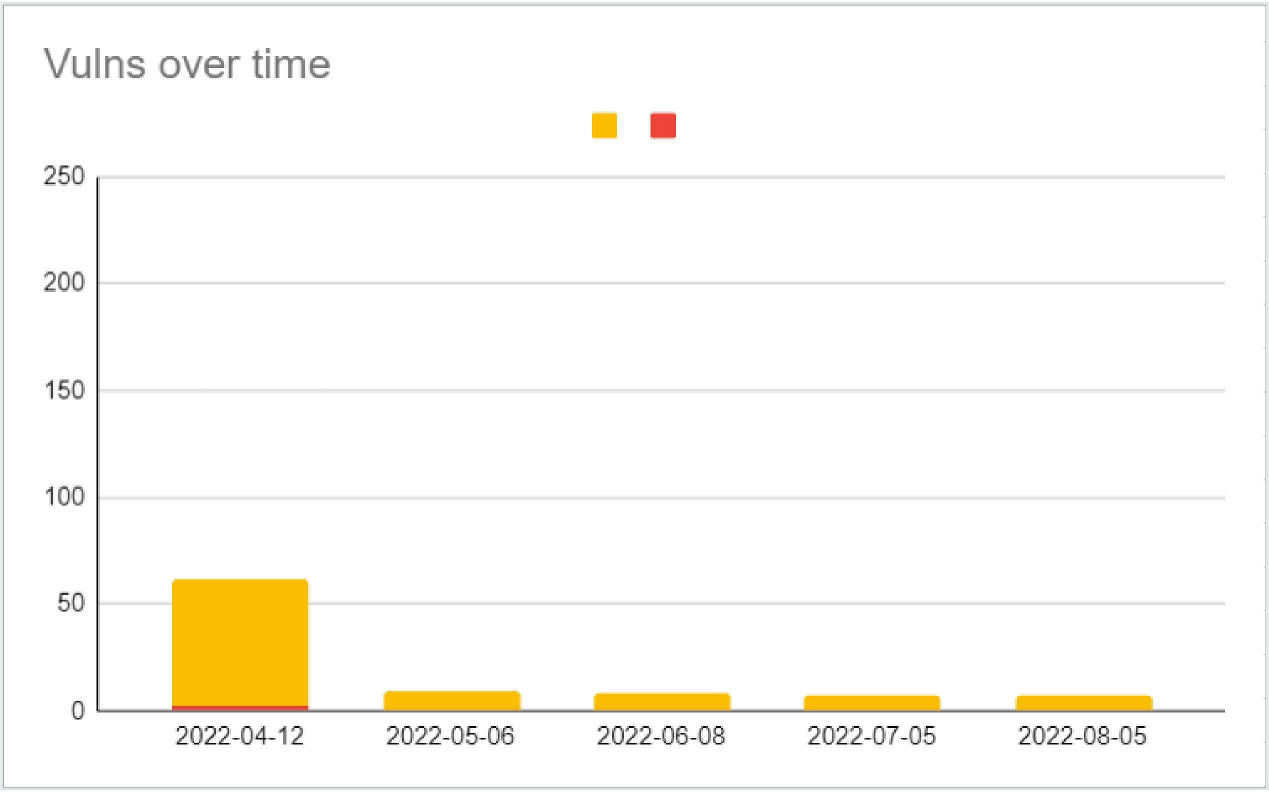
DQ Job

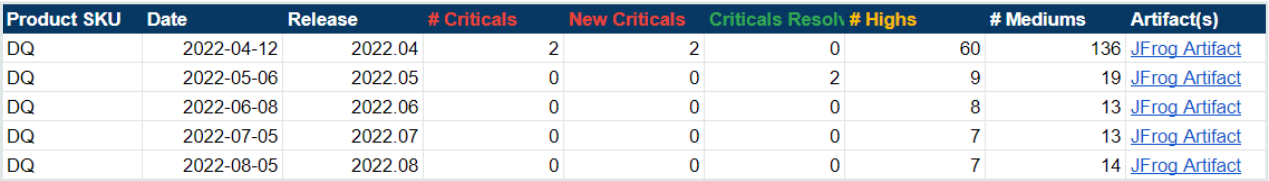
- Collibra is proud to launch a brand new feature, Snowflake Pushdown. Snowflake Pushdown allows for even faster processing and removes the need to set up a separate Spark compute platform to run Collibra Data Quality. Snowflake Pushdown is a private beta feature only available by request. Since this is a beta feature, some limitations are expected as we continue to improve its functionality. Contact your CSM to learn more about this feature.

DQ Security Metrics

> **Warning** There is a critical CVE `CVE-2016-1000027` that shows up in the image scan due to Spring version. This is a false positive and should be added to the exception list of the customer scan tools. We don't use `HttpInvokerServiceExporter` anywhere in the application and are not impacted by it.

- There is no fix version available for it from Spring. More details are available at Sonatype vulnerability CVE-2016-1000027 in Spring-web project · Issue #24434 · spring-projects/spring-framework





Product SKU	Date	Release	# Criticals	New Criticals	Criticals Resolv	# Highs	# Mediums	Artifact(s)
DQ	2022-04-12	2022.04	2	2	0	60	136	JFrog Artifact
DQ	2022-05-06	2022.05	0	0	2	9	19	JFrog Artifact
DQ	2022-06-08	2022.06	0	0	0	8	13	JFrog Artifact
DQ	2022-07-05	2022.07	0	0	0	7	13	JFrog Artifact
DQ	2022-08-05	2022.08	0	0	0	7	14	JFrog Artifact

2022.07

> **Note** Standalone packages for the 2022.07 release have a version naming convention of `-RC`. This will revert back to the standard naming convention with the 2022.08 release, and has no impact on the safety or stability of standalone packages. {% endhint %}

Fixes / Enhancements

- DQ Job
    - Fixed an issue that prevented data from appearing in the Source tab when Source Observation RunID was clicked from the Assignments page.
    - Fixed an issue that caused Annotations with special characters to be truncated in the Labels tab.
    - Fixed an issue that caused the Column (name) column of the Rules tab to display incorrectly when Run Discovery was used.
    - Fixed an issue where the Retrain button on the Record tab was disabled.
    - You can again invalidate observations with single quotes `'` from the Shapes tab.
    - The Hints tab now displays any available data.
    - You can no longer change agents from the Scheduler modal.
- Rules
    - SQLF is now supported for Generic rules.
    - When running a custom rule through Rule Discovery, the column names Repo and Column again display correctly.
- Alerts
    - You can now send emails using unauthenticated SMTP servers.
- Security
    - Vulnerabilities identified by Jfrog
        - Vulns 0, criticals 0, high severity 7
        - For a visual readout, see the DQ Security Metrics section below.
    - Fixed an issue that allowed jobs to be run from the command line regardless of connection permissions.
        - When Connection Security is enabled, lock the SQL Editor to prevent unauthorized access to other connections. (#87916)
    - Fixed an issue that allowed View Only users to access some profile results and export the data to a CSV file.
        - Added an authorization check for data set access to the profile export feature, which allows only users with data set access to export the profile. (#87720)
    - Backslashes \ are no longer supported characters for AD usernames without disabling XSS for the /v2/updateadsecurityconfiguration API. (#88499)

  - Fixed an issue that prevented navigation back to the log in page when tenant access was denied. (#89024)
- Profile
  - From the Labels tab, backslashes are now stripped from annotations when they are used for separation within strings.
- Admin
  - From Audit Trail, when administrators modify roles mapped to data sets or data sets mapped to roles, changes are now documented automatically, and display original and updated values.
  - The Agent Group (H/A) and its associated endpoints are now deprecated.
  - From Usage, you can now access a table and tiles reflective of your monthly usage metrics.
  - Salesforce account ID can now be configured for use with Pendo logs.
  - *Tech Preview* [TP] ServiceNow integration
    - You can now assign incidents (validate action) to ServiceNow groups and users with the following fields included in the same request: caller_id, description, short_description, cmdb_ci.
- Explorer
  - Fixed an issue with date range on Oracle connections, which caused end date to change to start date when Transform was selected.
  - The Job Estimate modal again displays the correct number of rows for Sybase connections.
  - Fixed an issue with Source to Target where double quotes `"` were removed from the source file in database to file targets.
- Scorecards
  - Enhanced the layout of the Assignment Queues page.
- API
  - v2/getallscheduledjobs is now available as an enhancement of the original, v2getscheduledjobs.
    - A UI integration is planned for a future release.
- Schedule
  - Added an Active column to the scheduler export.
    - The RunJob column was removed. (#88799)
- Reporting
  - Fixed an issue that created misalignment of column headers in PDF exports. (#89739)

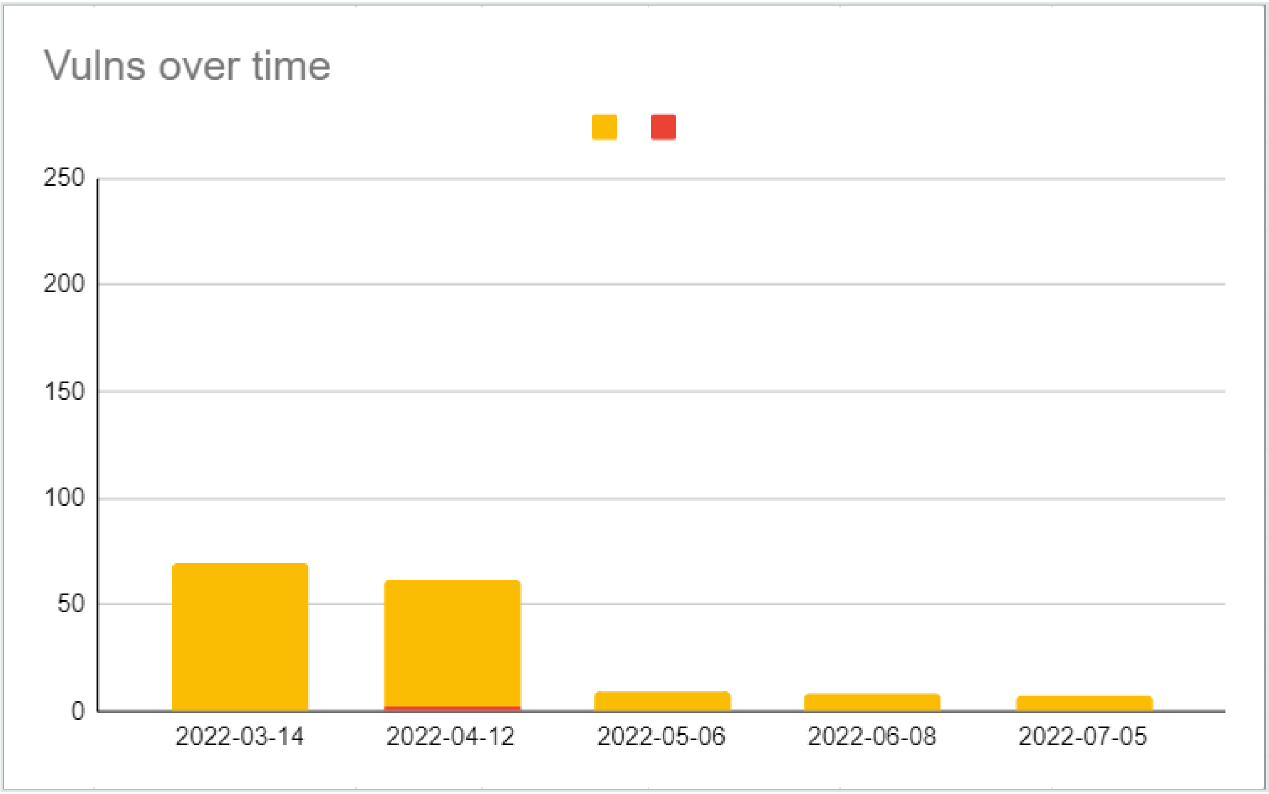
Known Limitations

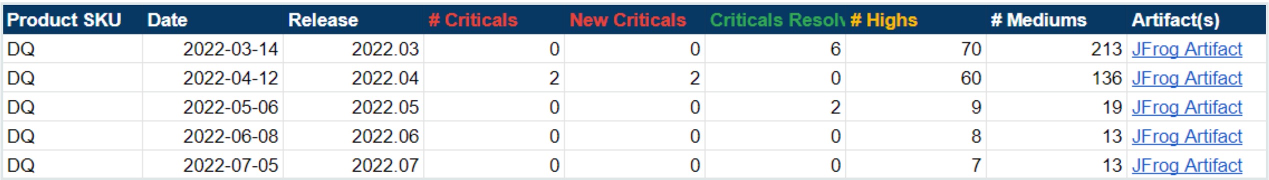
- Rules
  - To use the new SQLF feature for Generic rules, you must manually update the Generic rule type from SQLG to SQLF.
    - A UI feature for this is planned for a future release.
  - Stat rules such as $rowCount do not work for secondary data sets or previous runId of the same data set via @t1 syntax.
    - To work around this limitation, run a subquery to select count(*) from the secondary data set or the previous runId.
- Explorer
  - Drill-ins and jobs on Sybase connections run successfully, but connections to Sybase with encrypted passwords are currently unsupported.
- Files
  - When using CSV files, you cannot use a comma `,` in the name.
- Admin
  - *Tech Preview* [TP] ServiceNow integration
    - Special characters `!@#$%^&*()` in the description are not supported and will not persist to the ServiceNow assignment queue at this time.
    - Empty or invalid ServiceNow group name does not return an error in CDQ.
      - As a result, the ServiceNow assignment is generated with the default admin account as the owner if left empty or invalid.
      - You must have a valid ServiceNow group name or its related sys_id.
    - The new REACT UI is not yet supported for the ServiceNow Group integration.

DQ Security Metrics

> **Warning** There is a critical CVE `CVE-2016-1000027` that shows up in the image scan due to Spring version. This is a false positive and should be added to the exception list of the customer scan tools. We don't use `HttpInvokerServiceExporter` anywhere in the application and are not impacted by it.

- There is no fix version available for it from Spring. More details are available at Sonatype vulnerability CVE-2016-1000027 in Spring-web project · Issue #24434 · spring-projects/spring-framework {% endhint %}





Product SKU	Date	Release	# Criticals	New Criticals	Criticals Resolv	# Highs	# Mediums	Artifact(s)
DQ	2022-03-14	2022.03	0	0	6	70	213	JFrog Artifact
DQ	2022-04-12	2022.04	2	2	0	60	136	JFrog Artifact
DQ	2022-05-06	2022.05	0	0	2	9	19	JFrog Artifact
DQ	2022-06-08	2022.06	0	0	0	8	13	JFrog Artifact
DQ	2022-07-05	2022.07	0	0	0	7	13	JFrog Artifact

2022.06

Fixes / Enhancements

- DQ Job
  - Fixed an issue with the Learning Phase in the Behavior feature. (ticket #82907)
    - Once CDQ has the minimum number of completed successful scans, the learning status now changes to PASSING or BREAKING based on the results.

- Outliers
    - Fixed an issue where file lookback did not identify expected outliers. (#87967)
- Alerts
    - When configuring email alerts, SMTP Username and SMTP password fields are still required fields. (#86033)
        - Validation relaxation is planned for the 2022.07 release.
- Rules
    - Fixed an issue which caused rule breaks to report the opposite of what was defined when a Generic Rule utilizing regex/rlike was created. (#86977)
    - Fixed an issue where Data Classes with Date column types selected did not detect timestamps. (#83000)
    - Fixed an issue where Data Classes using the operators <, > or = caused the inverse rule created from this process to throw exceptions. (#83000)
    - When switching a data class from a regex to expression and then editing again, the regex checkbox is now correctly checked.
- Agent
    - The Explorer page and Scheduler modal now display the same agents. (#86175)
- Security
    - Vulnerabilities identified by Jfrog
        - Vulns 0, criticals 0, high severity 8
        - For a visual readout, see the DQ Security Metrics section below.
    - General advisory:
        - There is a critical CVE `CVE-2016-1000027` that shows up in the image scan due to Spring version. This is a false positive and should be added to the exception list of the customer scan tools. We don't use `HttpInvokerServiceExporter` anywhere in the application and are not impacted by it.
            - There is no fix version available for it from Spring. More details are available at Sonatype vulnerability CVE-2016-1000027 in Spring-web project · Issue #24434 · spring-projects/spring-framework
    - Major vulnerabilities related to Spring, ESAPI, and Swagger have been addressed.
    - No cross DB reference is allowed in explorer while accessing SQL database connections.
    - Sensitive UI fields such as username no longer allow autocomplete.
    - If configured, the ENV variable `XSS_CANONICALIZE_INPUT_ENABLED` should be removed from configmap or owl-env.sh.

  - When dataset security is turned on, you can now add role based authorization for editing existing datasets. (#87720)
  - You can now override the following mail settings from the App Config page within the Configuration section of the Admin Console:
    - "mail.transport.protocol" -- default = smtp
    - "mail.smtp.auth" -- default = true: If true, attempt to authenticate the user using the AUTH command
    - "mail.smtp.auth.login.disable" -- default = false: If true, prevents use of the AUTH LOGIN command
    - "mail.smtp.starttls.enable" -- default = true: If true, enables the use of the STARTTLS command (if supported by the server) to switch the connection to a TLS-protected connection before issuing any login commands.
    - "mail.smtp.ssl.enable" -- default = false: If set to true, use SSL to connect and use the SSL port by default. Defaults to false for the "smtp" protocol and true for the "smtps" protocol.
    - "mail.smtp.ehlo" -- default = true
    - "mail.debug" -- default = true
    - "mail.smtp.ssl.trust" -- default = : If set, and a socket factory hasn't been specified, enables use of a MailSSLSocketFactory. If set to "*", all hosts are trusted. If set to a whitespace separated list of hosts, those hosts are trusted. Otherwise, trust depends on the certificate the server presents. (#76775, 88089)
- Profile
  - Mean value is now rounded appropriately within the Profile page.
    - For example: The value 2.4334334343345 is now rounded to 2.434.
- Connections
  - From the Athena driver, you can now use `MetadataRetrievalMethod=Query` for database queries from the Connection URL. (#86139)
  - Fixed an issue where error messages on failed connections did not display informational text. (#85527)
  - Fixed an issue where NFS file connections under Remote File connections caused jobs to fail. (#88156)
    - Added File protocol for Spark load for NFS file system.
    - Added nfs:// prefix wile adding a NFS connection.
      - This will prepend the URI with the file:// protocol when an NFS file connection is loaded via Spark.

- Catalog
  - The Graph option is no longer available in Quick links.
- Admin
  - The Pendo integration is now active by default.
    - No sensitive information is collected; only high-level usage stats are collected.
    - All new customers starting with 2022.06 onward will receive a new license.
    - If you install a standalone environment, modify the <install-dir>/config/owl-env.sh file by adding your license name `export DQ_INTEGRATION_PENDO_ACCOUNTID=<your-license-name>`
    - This new integration will not block or impair the functionality of the app in any way.
    - For more information on Collibra's subprocessors, please review Collibra's Subprocessors page.
  - The Agent Group (H/A) and its associated endpoints are now deprecated. (#83086)
  - Fixed an issue where the "Add Data Category" button was missing without required permissions. (#86625)
  - When a session expires on an Admin page, you are now redirected to the login page.
  - The Admin Limits page now displays informational text indicating that only limits of Tenant - Admin type are displayed on the page.
  - Fixed an issue when editing an existing data category which caused the 'Add new' modal to open instead of the 'Edit' modal. (#89617)
  - From Configuration Settings, DB Limits is now called Data Retention Policy.
- Explorer
  - You can now view calculated views for SAP Hana when creating a DQ Job on the Explorer page. (#83147, 84328)
  - Fixed an issue which caused the Date range condition to incorrectly display results when using an Oracle connection. (#85802)
  - Fixed an issue which threw an error message when Transform was checked with Date Range condition when using a Postgres connection. (#85802)
  - Fixed an issue where an equals sign = used in a `-transform` expression from Run CMD caused jobs to fail. (#71547)

    - Fixed an issue where schema and table names containing underscores _ were not accepted.
    - Fixed an issue that allowed jobs to run with a row limit of less than 1.
    - Fixed an issue where incorrect files loaded for preview from BLOB containers with Livy enabled.
    - CLOB data types are unsupported. (#86902)
    - Improved performance and logic when drilling into a database and schema from the Explorer page.
- API
    - You can now access API quick links page from the Admin Console React page.
    - When using Swagger, UI text now indicates when a field is case sensitive.
- Reporting
    - *Tech Preview* [TP] Rule Summary page enhancements
        - You can now filter rule breaks by most frequent violations, most severe violations, and least violations.
        - You can now view interactive pie charts with rules and dimension summaries.
- UI
    - The styling of the expandable legacy navigation pane and the react menu are now updated.
- Legal
    - Added a disclaimer to the DQ login page with a link to the Collibra Evaluation Agreement.

Known Limitations

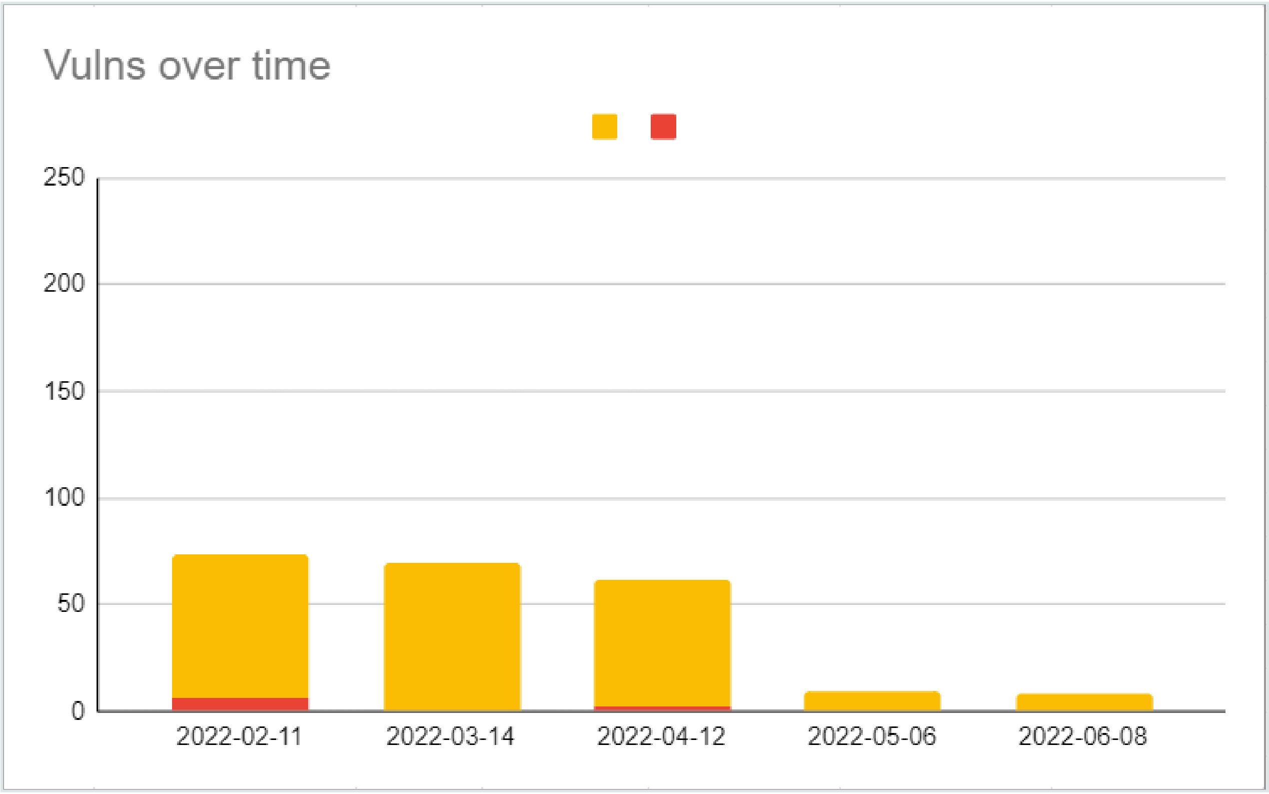
- Validate Source
    - When comparing JDBC (target) to remote files such as S3 (source), there is a known Spark bug for "Recursive view detected".
        - This validate source combination is not possible in 2022.06 using Spark 3.2.
    - When using Bigquery as the source, the -libsrc needs to be manually modified to include the core (Spark Bigquery connector) directory.
        - For example, /home/centos/owl/drivers/bigquery**/core**
- Profile
    - Spark does not currently support varchar data types. All varchar data types are converted to String. Other unsupported data types may also be converted

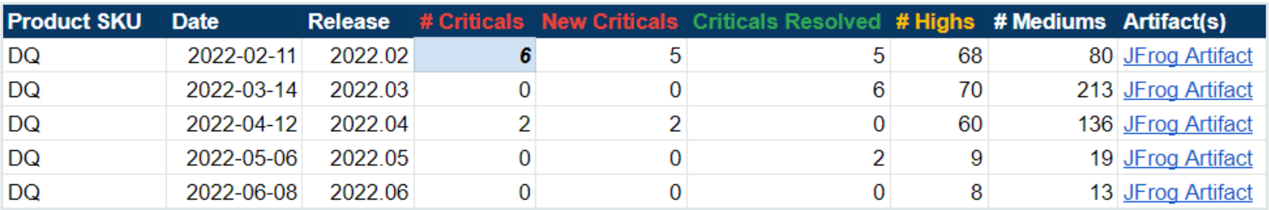
incorrectly.

- Security
    - Permissions on the Export task have not yet been addressed when dataset security is turned on and you add a role based authorization for editing existing datasets. (#87720)

DQ Security Metrics

> **Warning** There is a critical CVE `CVE-2016-1000027` that shows up in the image scan due to Spring version. This is a false positive and should be added to the exception list of the customer scan tools. We don't use `HttpInvokerServiceExporter` anywhere in the application and are not impacted by it. There is no fix version available for it from Spring. More details are available at Sonatype vulnerability CVE-2016-1000027 in Spring-web project · Issue #24434 · spring-projects/spring-framework





Product SKU	Date	Release	# Criticals	New Criticals	Criticals Resolved	# Highs	# Mediums	Artifact(s)
DQ	2022-02-11	2022.02	***6***	5	5	68	80	JFrog Artifact
DQ	2022-03-14	2022.03	0	0	6	70	213	JFrog Artifact
DQ	2022-04-12	2022.04	2	2	0	60	136	JFrog Artifact
DQ	2022-05-06	2022.05	0	0	2	9	19	JFrog Artifact
DQ	2022-06-08	2022.06	0	0	0	8	13	JFrog Artifact

Collibra DQ release archive

2022.05

Fixes / Enhancements

- DQ Job
    - You can no longer update the dataset name (`-ds`) from the command line.
        - A helpful error message now appears if changes are made to `-ds`.
    - Stop Job action is no longer enabled for K8s.
    - Fixed an issue for Dremio jobs where jobs hang when editing or cloning an existing dataset.
- Outliers
    - Added "username" to outlier boundary table to track who creates the boundary.
        - The Outlier boundary again saves correctly after the addition of a username.
    - Fixed an issue that caused jobs to fail when Day from By dropdown was selected.
- Rules
    - Rule Preview drill-in capabilities are now improved:
        - You can now configure Preview Limits based on the individual rule.
            - Freeform and Simple rules are currently supported for the Preview Limit feature.
        - You can now set any positive number as the Rules Preview Limit.
            - When you update a Preview Limit value, you must re-run to apply the updated limit value.
        - On the DQ Job page, the details of an individual rule now displays a paginated sub-table of all the break records.
        - When a rule is labeled as BREAKING for rule types other than Freeform and SQL, UI text now displays, "Data preview records are only available for Freeform and Simple rules."

    - You can now hover over stat rules to see their conditions.
    - Data Concepts is renamed Data Categories.
    - Semantics is renamed Data Classes.
    - When a Data Class is assigned to a dataset via Profile controls, a rule is now created.
- Security
    - Vulnerabilities identified by Jfrog
        - Vulns 0, criticals 0, high severity 9
        - For a visual readout, see the DQ Security Metrics section below.
    - The OS vulnerabilities from the images of Collibra DQ 2022.04 have been resolved by using the base image of RHEL8 to build the images for Collibra DQ 2022.05. The following OS utilities will not be available in the 2022.05 release images:
        - Unified, OpenSSL crypto/stack
        - Full YUM stack
        - OS tools, including tar, gzip, and vi
    - AD users can again use auth/signin REST API.
    - The Highcharts CVSS2: 9.3/CVSS3: 9.8 vulnerability is resolved.
    - The LOGJAM (CVE-2015-400) SSL/TLS vulnerability is resolved.
    - The SpringShell (CVE-2022-22965) vulnerability is resolved.
    - TLS < 1.2 is no longer supported.
    - When Azure AD SSO sends a groups.link assertion, the application now tries to resolve the groups via the link.
        - You can now activate this setting by using the property, SAML_GROUP_LINK_PROP.
- Profile
    - You can now edit or delete semantics by clicking anywhere in the semantics cell of the Profile column table.
    - You can now save annotations with special characters.
        - Special characters that are not currently supported include percent sign `%`, backslash `\`, and caret `^`.
    - Fixed an issue where columns of broken rules were not highlighted.
- Connections
    - You can now view a list of all packaged and optionally packaged drivers on our new Builds page.

    - The Databricks JDBC driver is now available.
    - You can now add Databricks datasets using the Databricks Simba driver.
- Catalog
    - Fixed an issue where the deletion of a dataset caused orphaned links to datasets in other areas of Collibra DQ.
- Admin
    - *Tech Preview* [TP] You can now use the ServiceNow integration through a proxy server from the Assignment Queues screen.
    - You can now access the new Usage page to view monthly historical usage statistics.
    - AD users with Admin privileges can now add Business Units.
    - AD users with Admin privileges can now manage local users.
    - The Agent Groups (H/A) feature is marked for deprecation and will be removed from the app in the 2022.06 release.
- Explorer
    - You can again edit schema and table name from the Catalog page.
    - You can now navigate to a specific behavior tab directly from the Assignments page.
    - Fixed an issue when viewing Schemas in View Data wizard.
- Scorecard
    - Single-space ` ` , underscore _, and period . are now supported characters when saving Scorecard name.
- API
    - Improved API calls for the UserManagement Save function.
- Reporting
    - *Tech Preview* [TP] Rule Summary page enhancements
        - You can now filter rule breaks by a specified date range and view charts for Most Used Rule Types, Dataset with Most Rule, and Top Rules Run.

Known Limitations

> **Warning** Delta Files
>
> A bug was introduced as a result of removing CVEs in 2022.05. If you use Delta files - delta it is not advised to upgrade until an update is available.

- Explorer
  - Except for underscore _, special characters are not currently supported in schema or table names.
- Admin
  - *Tech Preview* [TP] ServiceNow integration
    - Only the local Docker container proxy has been tested and verified.
    - The Test Connection button's validating credentials capabilities is currently limited if the ServiceNow URL is valid.
    - The Validate All Rules function currently results in a failure.
    - You cannot edit an active ServiceNow assignment.
      - Invalidate/Validate or Resolve actions result in a failure.
    - You can assign a ServiceNow ticket with an embedded URL when escaped with double quotes.
      - No assignment is sent without this process.
- Multi-Tenant
  - Tenant names should be lower case. Use lower case characters, when creating a tenant from the multi tenant admin page. The current limitation is around the schema that is generated
- Reporting
  - *Tech Preview* Rule Summary page enhancements
    - Sorting any column returns an error.
    - User must use date picker as manual date entry is not honored.
    - The start and end date are out of order when navigating to the page.
    - The last page on the paginated list does not change when date criteria is updated.

2022.04

Install

> **Note** For standalone installations, within the setup.sh script find/replace the variable for **spark_package**.
> Change spark-3.0.1-bin-hadoop3.2.tgz to spark-3.1.2-bin-hadoop3.2.tgz

```
spark_package=${SPARK_PACKAGE:-"spark-3.0.1-bin-hadoop3.2.tgz"}
# replace with
spark_package=${SPARK_PACKAGE:-"spark-3.1.2-bin-hadoop3.2.tgz"}
```

Fixes / Enhancements

- DQ Job
    - Entering negative values for the downscore is no longer supported and will now produce an error message.
    - You can now invalidate schema with special characters.
    - Spark table names of historical dataset loaded and other spark tables are now available on Jobs Log table.
    - Long type values larger than `Integer.Max` no longer breaks the Profile.
    - View Findings now displays user's full name, if applicable, in Validate Modal. Assignment queue page also displays the full name of user, if applicable.
- Alerts
    - You can once again use the Cancel action button on the Alerts page.
    - You can now set up alerts to reach multiple email recipients.
    - If email_server table is not yet configured, a helpful message will now display in the Description column in the job log directing you to register an email Server under Admin - Alerts. The job will still run successfully.
- Rules
    - You can now modify Rules definitions from the primary DQ Job dashboard without loading the Rules page.
    - Mean value check once again triggers correctly for Integer and Long columns.
        - This fix triggers the mean value check for Integer and Long columns and shows an infinity percentage change in behavior for a period, depending on -bhlb. After this period, it should disappear.
    - For Native SQL rules, jobs now behave the same whether or not a semicolon ";" is included in the SQL query.
    - You can now use a hyphen "-" in a dataset name.
        - Acceptable special characters now include a hyphen "-", period ".", and underscore "_".

    - Added a tooltip that displays which condition is being checked in a DQ Job when using a Stat rule when you hover your cursor over a condition in the Condition column.
    - Improved the exception message for when there are no values for a specific column while using a Stat rule.
    - The WebUI passing boundaries range has been updated to ().
    - For Freeform rules, IS Null and IS NOT NULL no longer return invalid results in the Validation tab.
    - Added a pop-up success message for when the correct syntax rule passes for Freeform rules with secondary datasets after the Validate button is clicked.
- Security
    - Vulnerabilities identified by Jfrog
        - Vulns 2, criticals 2, high vulnerabilities
        - For a visual readout, see the DQ Security Metrics section below.
    - Authorization restriction is now enforced for the following endpoints:
        - /v2/deletefiledir
        - /v2/getRunIdsByDataset
        - /v2/putDatasetWeight
        - /v2/checkListofFilesPath
        - /v2/getlistagents
        - /v2/checkDriver
        - /v2/getconnectionssensitive
        - /v2/getemailgroups
        - /v2/getemailserver
        - /v2/addemailgroup
        - /v2/validateEmailAddress
        - /v2/getlistoffiles
        - /v2/getlistoffilespath
        - /v2/getlistoffiles
        - /v2/getDriverDir
        - /v2/getlistrolesbydataset
        - /v2/getlistrolesbydistnctdatasets
        - /v2/getlistrolesbyfunctiontypename
        - /v2/getlistusersbyauthority
        - /v2/getlocalDBRoles
        - /v2/getsecuritysettingsbytype

    - /v2/getowlcheckinventory
    - /v2/getconnectionspwdmgrsensitive
    - /v2/getsecuritysettingsbycoltype
    - /v2/getdbuserlist
    - /v2/getdbuserdetailsbyuser
    - /v2/getexternaladgroupstointernalroles
    - /v2/getlistdatasets
    - /v2/getlistdatasetsbyrole
    - /v2/getaudittrailitems
    - /v2/get-all-audit
    - /v2/get-datasets-audit-trail-items
    - /v2/get-all-dataset-audit
    - /v2/getactivityaudit
    - /v2/getallactivityaudit
    - /v2/getlocaldbrolesbyuser
    - /v2/getdatasetaclsecurity
    - /v2/getexternaladgrouplist
    - /v2/getexternaladuserlist
    - /v2//external-service-configuration
  - Local user accounts now have an account lockout feature implemented with the following restrictions:
    - A user's account will be locked if a password is entered incorrectly more than 10 times (configurable via app config).
    - The locked account can only be unlocked by Admin user in user management screen.
    - If an Admin is locked, another Admin can unlock their account.
    - If all the Admins are locked, enable the account via DB (ubdate users table "accountNonLocked" colun to "1").
    - User cannot use forgot password to reset password while the account is locked.
  - CORS restriction is now enforced for SAML and multi-tenancy.
    - This breaks SAML unless the IDP is configured as a trusted origin in DQ, so the following property must be added to environment variables in order for DQ and SAML to work: CORS_ALLOWED_ORIGINS=\({IDP-BASE-URL},\)
      - Replace $ with the value of the actual IDP URL (For example: https://ping.auth.com)

            - Replace $ with the value of the actual DQ Base URL (For example: https://dq-env.com)
    - SAML login no longer automatically triggers on the login page during an existing session when accessing DQ base URL. For SAML login, you should instead use /saml/login.
        - API requests (v2/v3) return proper JSON response in case of failures.
        - auth/signin API is updated to provide JWT token for MT & local users.
- Profile
    - Mean value once again displays in the Volume column.
    - When connecting to MSSQL server on Windows from a Linux DQ environment, the connection no longer fails.
        - We recommend (not required) a TLS connection for MSSQL connections from a DQ Linux environment with a properly signed certificate setup on MSSQL server to connect only via TLS.
    - You can now edit annotations in the Labels tab.
- S3
    - Added an enhancement for -addlib flag.
- Connections
    - Added new Jconn4 driver for encrypted connections.
    - Tech Preview - You can now save a local (NFS) file directory as a connection type.
    - See our newest Supported Connections page for a definitive guide to driver support.
    - BigQuery is now certified for production, but removed from packaged install for K8s docker.
- Explorer
    - When toggling between fullfile and Union LookBack options, `-fullfile` and `-fllb` flags can no longer be generated together in the DQ Job command line.
    - Data Preview for Temp files loading in Explorer now correctly shows the order of columns of the original Temp file.
    - You can now drill in and search files within the connection.
    - You can now browse multiple local (NFS) file connections.
- Scorecard
    - You can now create scorecards with special characters "^[A-Za-z0-9]+$" in their names.

- Dupes
  - Added linkID column for exact match in both UI and REST API. linkID can now be either included or excluded from Dupes for exact match.
  - linkID is now shown at the aggregate level for Exact Match.
    - We recommend using this feature from a primary key perspective for its first iteration.
    - The aggregate function used is min().
      - For example: if you have 6 occurrences, you will get 1 example linkID, the min.
- API
  - Updated the /v2/getlistdataschemapreviewdbtablebycols API call method from GET to POST to support the long query (-q) or very large columns table.
  - Added a new SAML load balancer so the syestem picks the appropriate schema and SAML server URL for Swagger.

Known Limitations

- Profile
  - Special characters are not currently supported in annotations in the Label tab.
- Scorecard
  - Space " ", underscore "_", and period "." are not yet supported for scorecard edit.

2022.03

Fixes / Enhancements

- DQ Job
  - The -validatevaluesshowmissingkeys options now allows the extrapolation of missing keys between target and source.
  - Newly created jobs will no longer be marked incorrectly with enclosing double quotes.
  - File names with spaces are now handled with double quotes within the application.
- Alerts
  - Email notifications now have Collibra branding and terminology.
  - Fixed Cancel Action for Delete functionality on Alert page.

- Outliers
  - Fixed the issue where Numerical Outlier drill in graph wasn't displaying when per-Change is NaN.
- Rules
  - Added additional HealthCare Data Classes to Rule Library.
  - Fixed input validation rule of POST - /v3/rules/ endpoints. The following validation rules have been applied to RuleDTO.ruleName field:
    - Maximum size is 100.
    - Must comply with the following regular expression: ^[a-zA-Z0-9_]+$
  - The rules on the Hoot page now show the correct exception data when expanded if there are two or more rules with exceptions attached to the dataset.
- Security
  - Vulnerabilities identified by Jfrog
    - Vulns 0, critical, 6 high vulnerabilities
  - Password length has increased to a maximum of 72 characters.
  - Forgot password screen will now always show success message in UI regardless of success or failure.
  - Fixed an issue of a throwing error message when adding/editing user roles.
  - Added error checks if the password manager script throws any errors.
  - Added the helper text "Enforce user roles to run the job" to DQ Job Security row.
  - User password field removed while updating user in user management screen.
    - Admin can only set password for another user wile creating new user, but not while updating/modifying them.
    - To change a password, users can now use either the profile page or the self-service (Forgot password) feature.
  - XSS security
    - Fixed the vulnerability on scorecard, jobs, rules and catalog pages.
    - Fixed the vulnerability via remote connection.
  - Mitigated the endpoint "/v2/getrawpreview" vulnerable to Local File inclusion attack.
  - DQ HTTP session cookie is now secured by default when HTTPS is enabled.

{% hint style="info" %} Rule Discovery Terminology Alignment

Data Concepts => Data Categories

Semantics => Data Classes {% endhint %}

- Profile
  - Precision and Scale metrics are correct when using multi executors.
- Admin
  - Edge download page within Admin Console (for Cloud customers).
- Validate Source
  - *Tech Preview* [TP] Update Source Scope.
    - Added "Update Source Scope" in the Query section of the Source tab.
- Connection
  - Added handling for errors during log cleanup process.
- API
  - Improved API calls for the Save function.

Known Limitations

- Validate Source
  - *Tech Preview* [TP] Update Source Scope.
    - Only works for JDBC connections. Feature is hidden for remote, temp, local files.
    - Valsrc query won't be updated automatically when modifying column mappings. Use 'Preview' button to reset the feature if column mappings need to be changed.

2022.02

> **Note** For new Standalone Collibra DQ installations, please double check 'Number of Core(s)' field when setting up 'Edit Agent'.

{% hint style="info" %} Added UUIDs for Jobs may take additional time on initial startup after upgrade {% endhint %}

Enhancements

- DQ Job
  - Added UUIDs for jobs for better tracking between web and core
  - Improved DQ Job page load performance by optimizing calls

- Fixed issue DQ jobs would fail when -rd is in "yyyy-mm-dd HH" format
- Outliers
  - *Tech Preview* [TP] Outlier Calibration
    - Feature flag can be set within owl-env.sh or configMap with `export outlier_calibration_enabled=true` (Default is off)
    - Ability to suppress Outlier observations for a user-determined length of time that would have otherwise surfaced as anomalies
    - Once feature is enabled, accessible within Outliers tab on DQ Job page
- Alerts
  - Ability to navigate to dataset specific Alerts from DQ Job page
  - Ability to test SMTP alert configurations when adding an email relay
  - Fixed issue where 'Reply Email' field did not properly accept user input value
    - Please note there are no (Collibra imposed) domain restrictions on Reply Email field
- Security
  - Stricter password policy is enforced on all user/tenant management screens/APIs.
    - The restriction is as follows: Minimum length of 8 characters
    - Maximum length of 20 characters.
    - At least one upper-case letter.
    - At least one numeric character.
    - At least one special character (supported are !,%,&,@,#,$,^,*,?,_,~)
    - User ID and password cannot be the same.
    - Password cannot contain user ID.
  - Change Password functionality on user profile requires a current password of the user.
  - Mitigated 64 critical, 15 high, and 12 medium vulnerabilities identified by JFrog
  - Upgrade Log4J to 2.17.1
    - Please follow *Note to Standalone Collibra DQ Customer Upgrades*: We have upgraded to Log4J 2.17, please refer to Standalone Upgrade for additional steps
  - Added connection security checks to users to prevent running jobs and query the tables that are not authorized per connection. This is applicable when `DB Connection Security` is enabled in the Admin Console under `General`.
  - Implemented stricter session management

    - Implemented CORS restriction to mitigate potential CSRF vulnerability
        - Enforced strict CORS policy by not allowing any domain. In order to allow other domains and tweak this behavior, we have exposed the following properties as environment variables in owl-env:
        - CORS_ALLOWED_ORIGINS=http://facebook.com,http://google.com
        - CORS_ALLOWED_METHODS=GET,POST,OPTIONS,DELETE,PUT,PATCH
        - CORS_ALLOWED_HEADERS=X-Requested-With,Origin,Content-Type,Accept,Authorization
        - CORS_EXPOSE_HEADERS=
        - CORS_ALLOW_CREDENTIALS=false
        - CORS_MAX_AGE=0
- *Tech Preview* [TP] DQ Connector
    - Fixed issue where tenant specified on DQ Connector configuration (issuer of the jwt token field within DGC Edge Management page) was not properly accepted; only rules that existed with 'public' schema were brought over; now the DQ Connector will accept the proper values
- Agent
    - Upon potential deletion of an agent, added server side validation to indicate number of scheduled jobs so that users can understand if jobs fail going forward
- Rules
    - Enhanced stability on Parallel Rule execution to ensure all rules load by reverting back to fixed thread counts
    - Display exceptions upon rule execution failure to improve rule management experience
    - Improvements to user experience in Rule Library tab (within Rules page) including filters and column alignment
    - Quick Rule dropdown within the Rules page will save with default severity of 1 point and a threshold of 1 percent
    - Enhanced validation for rules generated in Profile tab
    - Fixed issue where removing semantic tag may not have removed corresponding auto-generated rule
    - Rule name character limit of 100
    - Rule Builder page now returns error messages where the dataset contained 0 records

- Catalog
  - Renaming Dataset from Catalog page keeps associated rules
    - Clone only creates the dataset shell (with DQ job run configs, no additional rules, etc.) will be copied
  - Bulk actions support for Data Concepts
  - Fixed issue where child of business unit could be assigned as parent
  - Fixed issue where clearing individual filters were not functioning
- Validate Source
  - *Tech Preview* [TP] New collapsible section for Query in Source tab; enables users to use custom srcq, similar to query on section on Home tab so that users do not need to edit -srcq in cmd line editor on Run tab
  - Introducing new observation types via `-valscrshowmissingkey` flag
    - Key not in source
    - Key not in target
  - Source Name should be fetched as part of getcatalogandconnsrcnamebydataset API call for a given dataset
  - Fixed issue which prevented Hive from working as Target
- Export / Import
  - Fixed issue that import could not accommodate more than one table insert
  - Fixed bug where certain values were inadvertently inserted into RegEx rules upon Export
  - New endpoints added for Export and Import API
- Connection
  - Fixed Out Of Memory issue with Dremio
    - Explicitly added limit clause in the preview query within Update Scope
    - Dremio driver requires double quotes in Schema, Table, and Column names e.g. "SchemaName"."TableName"
  - Fixed Oracle TIMESTAMPLTZ conversion error
- Explorer
  - Fixed issue where 'Analyze Table' option did not populate for Hive
  - Fixed the static date values showing up in Managed Template and Run Check while running the job via v2/runtemplate API call from swagger UI
- Files
  - File names with spaces are now handled with double quotes t
  - Implemented Supported File Type Check at time of uploading the Temp Files via Explorer

        - Default supported file types are “csv,json,parquet,avro,delta".
        - In order to add/update the supported file types and ensure validation, a new environment variable needs to be added in owl-env.sh as below: `export ALLOWED_UPLOAD_FILE_TYPES="csv,json,parquet,avro,delta"`
        - Tip: For remote files with delimiter, please use the csv dropdown options for files with .txt extension
    - *Tech Preview* [TP] Users have ability to assign an agent when using temp file and local file Explorer paths without manually appending -master to agent or job (previous known limitation)
    - LIMIT values are now properly accepted on the Scope & Range query panel
- Dupes
    - Fixed issue where column selections were not retained from the original DQ Job with Dupes ON for future runs

Known Limitations

- Rules
    - Cannot currently create rule with API /v3/rules; will be fixed in future release
        - Please use /v2/createrule API
- Profile
    - Stat Rules
        - Tool tips will only generate when Max Precision and Max Scale are greater than 0
- DQ Job
    - /v2/runtemplate API still creates 'zombie' job
        - Please use /v3/jobs/run
- LinkID
    - LinkID column selection is case sensitive; breaks may not appear if case does not match
- Outliers
    - Outlier Calibrate
        - Outliers cannot retrain on-demand; to suppress existing Outliers, must rerun the DQ Job for those date(s)
        - In-app labels do not exist for Outliers which have been subject to past, current, or future calibration; references only exist within the `outlier_boundary` table in the metastore

[Informational Only] New Tables Introduced To Metastore In 2022.02

- `outlier_boundary`

[Informational Only] Changes To Metastore Made In 2022.02

```
ALTER TABLE validate_source_metadata ADD COLUMN IF NOT EXISTS
validate_values_show_missing_keys boolean DEFAULT false
ALTER TABLE opt_source ADD COLUMN IF NOT EXISTS validate_val-
ues_show_missing_keys boolean DEFAULT false

ALTER TABLE opt_source ADD COLUMN IF NOT EXISTS filter_cols
character varying[]

ALTER TABLE user_profile ADD COLUMN IF NOT EXISTS external_
user_id VARCHAR

ALTER TABLE owlcheck_q ADD COLUMN IF NOT EXISTS agent_job_uuid
UUID
ALTER TABLE job_log ADD COLUMN IF NOT EXISTS job_uuid UUID
ALTER TABLE platform_logs ADD COLUMN IF NOT EXISTS job_uuid
UUID
ALTER TABLE platform_logs DROP CONSTRAINT IF EXISTS platform_
logs_job_uuid_ux
ALTER TABLE platform_logs ADD CONSTRAINT platform_logs_job_
uuid_ux UNIQUE (job_uuid)
ALTER TABLE opt_owl ADD COLUMN IF NOT EXISTS job_uuid UUID
```

2022.01

Enhancements

- DQ Job
  - Fixed issue where backrun "-br" flag was inadvertently added on future runs (error contained in 2021.12) if the initial DQ Job setup Explorer selected backrun
  - Improved validation to not allow for slashes in dataset name
- Validate Source
  - Fixed potential DQ Job failure with Source turned on for some legacy installations when upgrading from older versions to 2021.11 and newer
- Explorer
  - `DB_VIEWS_ON` can be added with TRUE or FALSE values by adding new App Config (Add Custom within Admin -> Configuration)

  - -Addlib flag now working across JDBC connections
  - Update Scope now supports rdEnd
- Rules
  - When creating rules, run-time limit for each rule (in minutes) can be set on the Rule page UI and on the V3 API (by setting `runTimeLimit` property). The default is 30 minutes if not explicitly set. This 30 minute limit sets the overall timeout limit for all rules in a particular job. For example, if there are 10 rules with 9 rules with 30 min limit and 1 rule as 90 min limit, then the DQ Job will wait up to 90 min for all 10 rules to finish. This is because all rules must finish before the Rule stage in DQ Job to finish and move to the next stage. We do not support async stages where one long running rule is running while the job itself moves on to the next stage.
  - Added ability to specify score of 0 to a rule
  - Improvement to Stat Rules to fail without exception when result is not within range
- Profile
  - Fixed ability to remove a business unit from a dataset
  - Fixed issue where data concepts were not correctly displaying on a dataset's Profile page
  - Fixed sensitive labels not being assigned from Discovery
  - Treat certain doubles, floats, decimal types as Decimal format that preserves length and prevents Java from truncating to E11 format
  - Removed commas when displaying date columns
- Security
  - SAML Login fix for IDPs that use POST binding as default
- S3
  - Enhanced support where "." in column headers were causing large jobs to not complete
    - Underscores now replace periods and large jobs should no longer hang
- Connections
  - Updated default Snowflake template connection properties
    - Corrected 'db' parameter placeholder on connection string versus former 'databaseName'
  - Added Connectivity to BigQuery troubleshooting information

Known Limitations

- Local files using NO_AGENT require a valid $SPARK_HOME on the machine where the web server is running.
- Supported data types
  - CLOB datatypes are unsupported
- Explorer
  - -Addlib not yet supported for Remote Files e.g. S3

[Informational Only] Changes To Metastore Made In 2022.01

```
ALTER TABLE owl_rule ADD COLUMN IF NOT EXISTS run_time_limit
DOUBLE PRECISION NOT NULL DEFAULT 30.0;
ALTER TABLE owl_rule ADD COLUMN IF NOT EXISTS scoring_scheme
INT4 NOT NULL DEFAULT 0;

ALTER TABLE job_log ALTER COLUMN stage TYPE character varying;
-- stage set to varchar because RULE logs rule_nm into stage
ALTER TABLE job_log ALTER COLUMN log_desc TYPE character vary-
ing;
ALTER TABLE job_log ALTER COLUMN log_hint TYPE character
varying;
```

2021.12

Note to Standalone Collibra DQ Customer Upgrades: We have upgraded to Log4J 2.17, please refer to Standalone Upgrade for additional steps

Enhancements

- Rules
  - Semantic and data concept management: Run Discovery feature
    - Run Discovery feature can be accessed from Catalog by selecting 'Data Concept' option from Actions or clicking the 'Run Discovery' button on the Rules tab of the DQ Job page. This will run a DQ Scan to detect for the semantics assigned to the selected data concept

        - Algorithm now selects best match if column matches 2 or more data classes based on % match and name distance
    - *Tech Preview* [TP] Configurable rule break preview limit
        - Global default is 6 max rows per rule
        - Any change from 6 must be specified with previewLimit (API /v2/createrule) or in the Preview Limit field (UI)
        - Maximum of 50 from UI
    - Introducing additional Stat Rules including minPrecision, maxPrecision, minScale, maxScale
- Behavior
    - Min and max value checks are now triggered for all numeric columns when selected, even if column contains zeroes in lookback period
    - AR column view graph now shows theMean value for current day (runId). No re-run of DQ Job is necessary. The displayed Mean makes it clear that the % change is the % change from the mean, not runId - 1 day.
    - Findings in behaviors that were directly correlated to a row count shift as the root cause have been optimized, such that a major deviation in row count will no longer down-score related fields in the dataset to reduce noise
- Catalog
    - Catalog now features intelligent ranking based on Recency, Most Scanned, User
- Outliers
    - Outliers (advanced) allows for gaps in dates when establishing lookback period, which is established by history with row count > x (specified by user)
    - Fixed issue where outlier data preview graphics were not displayed
    - Fixed issue where outlier results did not honor the initial scope where clause, in particular for Remote Files (S3)
- Connections
    - BigQuery: Enhanced support for cataloging host name
- Pulse View
    - Pulse view can filter Connections and Users
    - Pulse view can serve as proxy verification on whether scheduled jobs were successfully completed
- Profile
    - Viewable precision and scale statistics for double, float, and decimal data types

- Shapes
    - Fixed issue where data shape preview not available when same shape is detected on the same row for different columns
- Files
    - *Tech Preview* [TP] Users have ability to assign an agent when using temp file and local file Explorer paths
        - Known limitation: -master must be freeform appended to the agent or to each job
    - Support for multicharacter delimiters
    - Improved delimiter support to distinguish string commas versus actual CSV commas to align data to respective columns
- Agent
    - Fixed issue where certain completed jobs could not be re-run on the DQ Jobs page. In other words, NO_AGENT was the only available option in the Agent dropdown. Now, users can select valid agents in the dropdown and this will persist for future scheduled jobs
- Schedule
    - Implemented validation to enforce user to choose days when picking schedule to avoid Java error messages
- Explorer
    - Fixed issue where '&' was not properly supported when adding additional parameters
- API
    - JSESSIONID session time is configurable
    - Bearer token and JSESSIONID authentication paths are properly forked
- Pattern
    - Patterns activity now shows Count (number of times the current dataset has the Pattern breaks). This Count is interpreted the same way as Outlier activity Count

2021.11

Enhancements

- Rules
    - *Tech Preview* [TP] Rule Discovery
        - The application now supports dynamic semantics checks. This allows you to create custom semantics that can be checked for when running a DQ check on a data set. Previously the application checked against a predefined set of semantics. You also have access to controls to organize and apply these semantics checks. The following is a list of changes:
            - There is a new data concepts management page. You can access it from Catalog or Admin Console. You can assign multiple semantics to a data concept.
            - When running a DQ check, you can select a data concept. The semantics assigned to this data concept will be checked against each column of dataset.
            - You have a list of predefined semantics that are not editable. You also have the ability to create/edit/delete custom semantics.
            - Repo on rules page has been added to Rules Library where semantics will be viewable.
- Resource Limits
    - You can edit the Performance Settings to supply limits to executors, cores, memory and cells so that a user can be warned if submitting a job that requires a lot of resources and admins can control maximum resources submitted.

Enhancements

- Explorer
    - *Tech Preview* [TP] Dynamic query reload allows you to view JOIN query columns in other activities.
        - User can update and reload the schema table with the custom query in the scope section by clicking the [Update Scope] button. It will enable using the new columns from the custom query in all activities (Profile, Outlier, Dupes,

        Patterns, Source)
        - Since the first tab is for compositing the query, updating fields will change the user's custom query. Therefore, all areas are locked except the "query" field in the first tab to keep the query unchanged after updating the scope table
    - Support for some special characters in table name.
    - Fixed the ability to add additional libs that were previously not being properly saved on subsequent runs. Under DQ Job tag, please utilize -fllb boolean (union lookback) and libsrc input box for lib directory path (will materialize as -addlib).
- Connections
    - *Tech Preview* [TP] BigQuery Views and Joins
    - Please add the following to the BigQuery connection property

```
viewsEnabled=true
```

- API
    - You can perform multiple imports without conflicts.
    - You can have an incremental import such as updating matching records / insert new / leave existing. There is no requirement to delete tables first before running import.
- Profile
    - Fixed backrun timebin to work with weeks and quarters instead of days.
- Outliers
    - Split historical load to avoid historical query rounding up.
    - *Tech Preview* [TP] Outliers (advanced).
- Source
    - Fixed an issue where settings were not sticky for subsequent runs.
- Security
    - SAML Enhancements
        - New configuration settings are available when the Load Balancer is set for SSL Termination.
        - You can now set theMulti-tenancy support through SAML RelayState to route SSO to the proper tenant.

Patches

- 2021.11.1 Explorer
    - Allow ampersand in metastore host name for additional parameters
    - In below example, support for ampersand needed for required SSL flags

```
metastore01.us-east1-b.c.customer-dq-prod.in-
ternal:5432/dev?sslmode=required&currentSchema=public
```

Known Limitations

- Rules
    - Semantics and data concepts:
        - Not supported in pushdown mode
        - Exporting RegEx semantics not currently supported
    - While it is possible to create joins and cross-dataset rules using Freeform SQL, it is best practice to create a view and handle the join prior to running the DQ Job.
- Behavior
    - Schema is not eligible for invalidate
- Files
    - Local files using UPLOAD_PATH, UPLOAD_FILE_PATH, and temp files are only eligible to be deployed using the default NO_AGENT option. These are only intended for quick tests and not intended for production-scale use. Best practice is to use a remote file system connection (S3, Google storage or ADLS).
    - Delimiter support for special characters is limited. Supported file delimiters are comma, pipe, tab, semicolon, double quote and single quote. Custom delimiters will work for many characters, but not all combinations.
    - Temp files and NO_AGENT should have -master local[*] or -master spark://:7077 defined in freeform append of the agent options
- DQ Job
    - When submitting jobs via API from a different machine with a different timezone, timezone discrepancies are not accounted for automatically. Best practice is to align each component to use UTC.

    - Jobs submitted via API with a run date that include HH:MM in the -rd (run date) will submit to the job queue and leave a remnant ‘STAGED’ job
- Connections
    - Postgres limits max connections per spark job. The default is 100. Please refer to Postgres official documentation how to increase max_connection and shared_buffers.
        - https://www.postgresql.org/docs/9.6/runtime-config-connection.html
    - BigQuery
        - Updating scope to include joins in BigQuery can only be materialized when tables are part of the same dataset collection
        - Should you receive an error for pre-existing BigQuery jobs, please add -dssafeoff to the cmd line or select ‘Allow Overwrite’ to enable this from Edit mode in the Explorer
- Alerts
    - After an upgrade to 2021.11, you may need to set the environment variable `ALERT_SCHEDULE_ENABLED=true` in **owl-env.sh** and restart **owl-web** to enable email alerts to work again.

2021.10

Enhancements

- DQ Job
    - Refactored DQ Job Score to Gauge Chart
- Explorer
    - Fixed issue where permissions are checked on datasets that do not yet exist
- Connections
    - Sybase 'Test / Preview' now available
    - Updated web model of saving additional connection properties
    - Fixed scenario where editing connection yields null instead of empty for multiple values
- Rules
    - Placeholder new searchable Rule Summary Page for Rule statistics / insights

- Alerts
  - Updated Alert Mailer to TLS 1.2 to resolve Third Party Error exception
  - Fixed issue where alerts are deleted even when clicking cancel button
- Behavior
  - Fixed issue where user must refresh to have invalidated item removed from UI
- Search
  - Fixed search on Audit Datasets and Dataset Management page
- Scorecards
  - Date ranges are now customizable
- Validate Source
  - Added feature that provides 'trim' option on String columns when running source-target validation, extra spaces in the cell are trimmed on both ends (left and right)
- Dupes
  - Resolved issue with white spaces in column headers blocking duplicate detection
- Security
  - Added configuration for setting the SAML_ENTITY_BASEURL, which sets the Consumer service url for the SP Metadata
- Shapes
  - Fixed issue where custom values override even after toggling Shapes back to auto or off
- Console
  - Fixed uncaught TypeError on login screen
  - Fixed GET timeout error on registration page
- Export/Import API
  - Users will be able to run the export/import API calls to conduct multiple promotions on the repo, schedule, and rule tables.

Patches

- 2021.10.1 Import / Export API without constraint conflicts
  - Import must match exactly to the format of our export in order to parse out columns and values to perform an update when existing records are already there

```
owl_rule
owl_check_repo
```

```
job_schedule
rule_repo
```

Known Limitations

- File sizes
  - Individual files greater than 5gb will experience performance degradation in Explorer for Standalone installs. Best practice is to save in smaller chunks and use bypass schema in the Explorer if needed.
  - Individual files greater than 25gb will experience performance degradation in Core for Standalone installs.
- Files
  - Explorer / browser will generally have difficulty supporting > 250 columns in files
- Profiling
  - Pushdown profiling on Bigquery, Redshift, Athena and Presto is available for specific datatypes.
  - Backrun option and flag will persist beyond the first run (-br). Please remove this flag if you do not want to backrun again.
- Explorer
  - QUARTER and WEEK are not supported time bins in this release.
  - On non-csv files, Explorer will not automatically infer file types. Users must change file type to the required value and click Step 2 "Load File". Nothing will change in Step 1 "File Information". A future enhancement will be added to automatically check filetypes by reading the first file
  - Dataset names should not contain special characters
- Rules
  - Out of the box semantic rules cannot be edited (STATECHECK, GENDERCHECK, etc). Users can still apply their own global rules which can be customized.
  - LinkId does not support alias columns that are not part of the -LinkId definition
- Connections
  - Connection names should not contain spaces
- Validate Source
  - Complex Validate Source queries can only be edited from the CMD line or JSON directly before hitting Run.

- Security
  - Active Directory in Azure SQL can connect via LDAP (basic auth) or Kerberos.
- S3 / GS / ADLS
  - Remote storage connections should be defined using the root bucket only.
- Estimate Job is only available for files when Livy is being used.
- Stop Job on jobs page is limited and does not work for all installation types.
- Bigquery connector does not work with views

Builds

Builds follow a naming convention to indicate which Optional Drivers drivers are packaged.

> **Note** Please note the optional drivers only impact container versions of Collibra Data Quality and does not impact Standalone installation packages.

Available Containers

2022.10

Collibra Data Quality

- 2022.10-ADGCSILM-1568
- 2022.10-ABDGCSILM-1569
- 2022.10-ABDGCSHILM-1570
- 2022.10-1572

Spark

- 3.2.2-2022.10-ADGCSILM-1568
- 3.2.2-2022.10-ABDGCSILM-1569
- 3.2.2-2022.10-ABDGCSHILM-1570
- 3.2.2-2022.10-1572

2022.09

Collibra Data Quality

- 2022.09-ADGCSILM-1386
- 2022.09-ABDGCSILM-1387
- 2022.09-ABDGCSHILM-1388
- 2022.09-1390

Spark

- 3.2.2-2022.09-ADGCSILM-1386
- 3.2.2-2022.09-ABDGCSILM-1387
- 3.2.2-2022.09-ABDGCSHILM-1388
- 3.2.2-2022.09-1390

2022.08

Collibra Data Quality

- 2022.08-L-1132
- 2022.08-AHM-1133
- 2022.08-H-1134
- 2022.08-HM-1135
- 2022.08-D-1136
- 2022.08-AL-1137
- 2022.08-AD-1138
- 2022.08-ABGCSHMS-1139
- 2022.08-AGCSHLM-1140
- 2022.08-M-1141
- 2022.08-GCSL-1142
- 2022.08-ADH-1143

Spark

- 3.2.0-2022.08-L-1132
- 3.2.0-2022.08-AHM-1133
- 3.2.0-2022.08-H-1134
- 3.2.0-2022.08-HM-1135
- 3.2.0-2022.08-D-1136
- 3.2.0-2022.08-AL-1137
- 3.2.0-2022.08-AD-1138
- 3.2.0-2022.08-ABGCSHMS-1139
- 3.2.0-2022.08-AGCSHLM-1140
- 3.2.0-2022.08-M-1141
- 3.2.0-2022.08-GCSL-1142
- 3.2.0-2022.08-ADH-1143

2022.07

Collibra Data Quality

- 2022.07-L-939
- 2022.07-AHM-940
- 2022.07-H-941
- 2022.07-HM-942
- 2022.07-D-943
- 2022.07-AL-944
- 2022.07-AD-945
- 2022.07-ABGCSHMS-947
- 2022.07-M-946

Spark

- 3.2.0-2022.07-L-939
- 3.2.0-2022.07-AHM-940
- 3.2.0-2022.07-H-946
- 3.2.0-2022.07-HM-942
- 3.2.0-2022.07-D-943
- 3.2.0-2022.07-AL-944
- 3.2.0-2022.07-AD-945
- 3.2.0-2022.07-ABGCSHMS-947
- 3.2.0-2022.07-M-946

2022.06

Collibra Data Quality

- 2022.06-L-819
- 2022.06-AHM-820
- 2022.06-H-821
- 2022.06-HM-822
- 2022.06-D-823
- 2022.06-AL-824
- 2022.06-AD-825
- 2022.06-ABGCSHMS-826
- 2022.06-M-830

Spark

- 3.2.0-2022.06-L-819
- 3.2.0-2022.06-AHM-820

- 3.2.0-2022.06-H-821
- 3.2.0-2022.06-HM-822
- 3.2.0-2022.06-D-823
- 3.2.0-2022.06-AL-824
- 3.2.0-2022.06-AD-825
- 3.2.0-2022.06-ABGCSHMS-826
- 3.2.0-2022.06-M-830

2022.05

Collibra Data Quality

- 2022.05-L-714
- 2022.05-AL-715
- 2022.05-H-716
- 2022.05-AHM-717
- 2022.05-ABGCSHMS-719
- 2022.05-D-721
- 2022.05-AD-723
- 2022.05-BDG-751
- 2022.05.2-L-737
- 2022.05.2-AHM-738
- 2022.05.2-HM-739
- 2022.05.2-H-740

Spark

- 3.2.0-2022.05-L-714
- 3.2.0-2022.05-AL-715
- 3.2.0-2022.05-H-716
- 3.2.0-2022.05-AHM-717
- 3.2.0-2022.05-ABGCSHMS-719
- 3.2.0-2022.05-D-721
- 3.2.0-2022.05-AD-723
- 3.2.0-2022.05-BDG-751
- 3.2.0-2022.05.2-L-737
- 3.2.0-2022.05.2-AHM-738
- 3.2.0-2022.05.2-HM-739
- 3.2.0-2022.05.2-H-740

2022.04

Collibra Data Quality

- 2022.04-L-303
- 2022.04-AL-302
- 2022.04-296
- 2022.04-A-295
- 2022.04-ALL-294 2
- 2022.04-ABHGCSGCRS-291

Spark

- 3.2.0-2022.04-L-303
- 3.2.0-2022.04-AL-302
- 3.2.0-2022.04-296
- 3.2.0-2022.04-A-295
- 3.2.0-2022.04-ALL-294
- 3.2.0-2022.04-ABHGCSGCRS-291

The default build is considered the Secure Build with no optional drivers included and no critical vulnerabilities.

Config Map Example

These are the configs to change the versions. For a complete list of versions for CDQ and Spark, refer to the Available Containers section above.

```
--set global.version.owl=2022.05-720 --set global.version.spark=3.2.0-2022.05-720
```

Pull Examples

docker pull https://gcr.io/owl-hadoop-cdh/owl-agent:2022.05-L-714

docker pull https://gcr.io/owl-hadoop-cdh/owl-livy:3.2.0-2022.05-L-714

docker pull https://gcr.io/owl-hadoop-cdh/owl-web:2022.05-L-714 docker pull https://gcr.io/owl-hadoop-cdh/spark:3.2.0-2022.05-L-714

Description

Example: 2022.05-L-714

2022-05: Release number (Year and Month)

L: Optional Livy package included **714** - A unique number appended to each build

Default Drivers

Always Packaged

- SQL Server
- Oracle
- Snowflake
- Redshift
- S3
- ADLS
- Postgres
- Mysql
- Teredata
- Sybase
- Db2
- Dremio

Optional Drivers

Please select drivers

- ABGCSHLMS (Drivers Initial in alphabetical order):
    - A : Athena
    - B : BigQuery
    - D = Databricks
    - GCS : Google Cloud Storage Connector
    - H : Hive
    - L : Livy

- M : MongoDB
- S : Solr

Chapter 4

APIs

Rest

Please see the REST APIs section for more details.

```
import requests
import json

# Variables
owl = 'https://<ip_address>'             #Edit
user = '<user>'                          #Edit
password = '<password>'                  #Edit
tenant = 'public'                        #Edit
dataset = '<your_dataset_name>'          #Edit
runDate = '2021-08-08'                   #Edit
agentName = 'your_agent_name'            #Edit

# Authenticate
url = owl+'/auth/signin'
payload = json.dumps({"username": user, "password": password,
"iss": tenant })
headers = {'Content-Type': 'application/json'}
response = requests.request("POST", url, headers=headers, data-
a=payload, verify=False)
owl_header = {'Authorization': 'Bearer ' + response.json()
['token']}

# Run
response = requests.post(url = owl + '/v3/-
job-
s/run-
?agentName='+agentName+'&dataset='+dataset+'&runDate='+runDate,
headers=owl_header, verify=False)
jobId = str(response.json()['jobId'])

# Wait
time.sleep(100)

# Results
response = requests.get(url = owl + '/v3/-
jobs/'+jobId+'/findings', headers=owl_header,  verify=False)
```

Notebook

Please see the Databricks example for more information

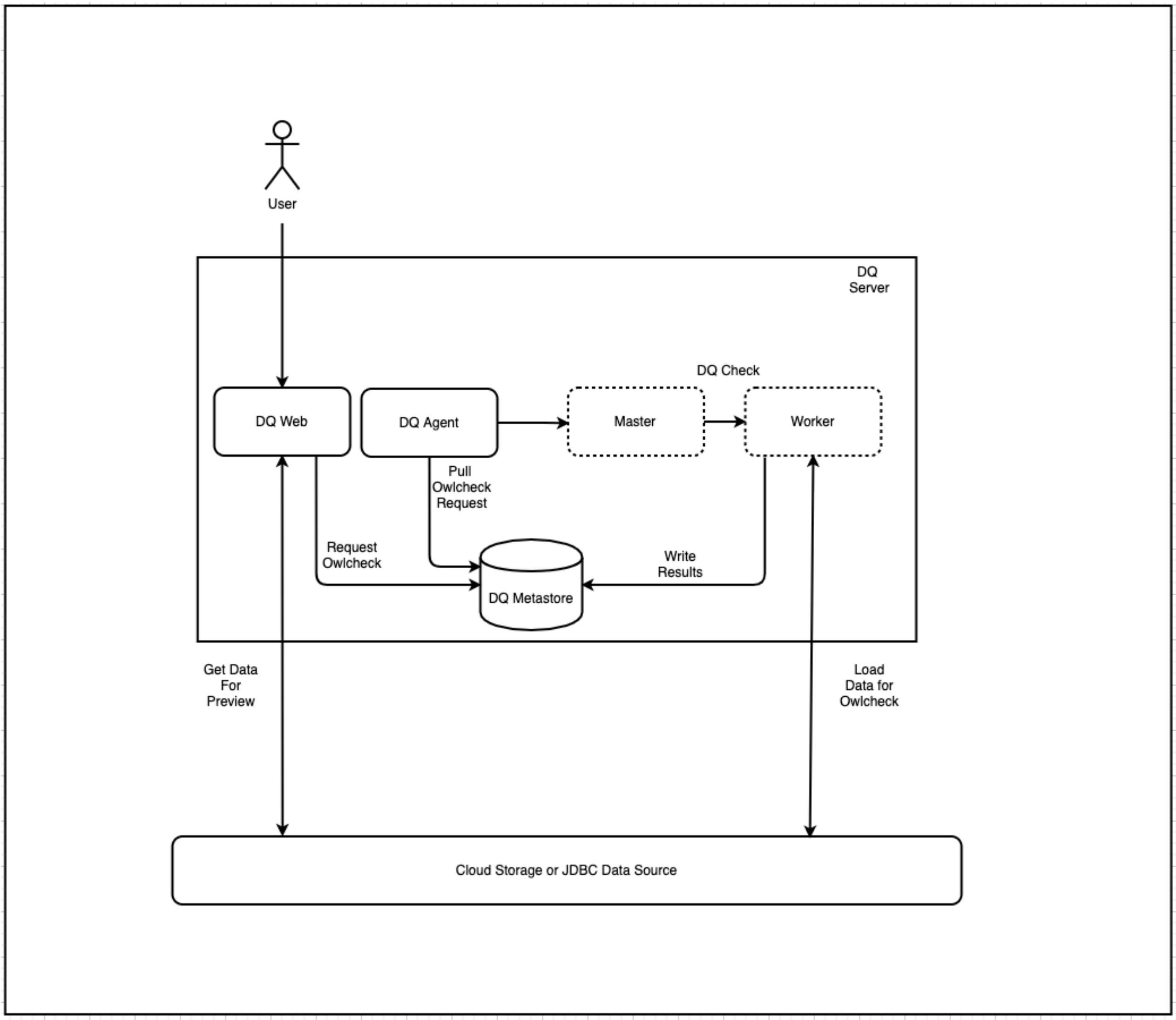
```
val dataset = "cdq_notebook"
var date = "2018-01-11"

// Options
val opt = new OwlOptions()
opt.dataset = dataset
opt.runId = date
opt.host = pgHost
opt.port = pgPort
opt.pgUser = pgUser
opt.pgPassword = pgPass

// Pre Routine
val cdq = com.owl.core.util.OwlUtils.OwlContext(df, opt)
.register(opt)

// Scan
cdq.owlCheck()
val results =  cdq.hoot()
```

Chapter 5

Collibra DQ Installation

Standalone

When large scale and high concurrency checks are not required, DQ can be installed and operated entirely on a single host. In this mode, DQ will leverage a **Spark Standalone pseudo cluster** where the master and workers run and use resources from the same server. DQ also requires a Postgres database for storage and Java 8 for running the DQ web application. It is possible to install each of the Spark, Postgres, and Java 8 components separately and install DQ on top of existing components. However, we offer a full installation package that installs these components in off-line mode and install DQ in one server.



Standalone Install

1. Setup Tutorial Assumptions

We assume that a server running Centos 7 or RHEL 7 is setup and ready to install DQ in the home directory (base path: `OWL_BASE`) under subdirectory `owl`(install path: `$OWL_BASE/owl`). There is no requirement for DQ to be installed in the home directory, but the DQ Full Installation script may lead to permission-denied issue during local Postgres server installation if paths other than home directory are used. If so, please adjust your directory permission to allow the installation script a write access to the Postgres data folder.

This tutorial assumes that you are installing DQ on a brand new compute instance on Google Cloud Platform. Google Cloud SDK setup with proper user permission is assumed. This is optional, as you are free to create Full Standalone Installation setup on any cloud service provider or on-premise.

Please refer to the ***GOAL***** ** paragraph for the intended outcome of each step and modify accordingly

> **Note** The full install package supports Centos 7 and RHEL 7. If another OS flavor is required, please follow the basic install process.

```
# Create new GCP Compute Instance named "install"
gcloud compute instances create install \
    --image=centos-7-v20210701 \
    --image-project=centos-cloud \
    --machine-type=e2-standard-4

# SSH into the instance as user "centos"
gcloud compute ssh --zone "us-central1-a" --project "gcp-
example-project" "centos@full-standalone-installation"
```

GOAL

1. Create a new compute instance on a cloud provider (if applicable).
2. Access the server where DQ will be installed.

2. Download DQ Full Package

Download full package tarball using the signed link to the full package tarball provided by the DQ Team. Replace `<signed-link-to-full-package>` with the link provided.

```
### Go to the OWL_BASE (home directory of the user is most com-
mon)
### This example we will use /home/owldq installing as the user
owldq

cd /home/owldq

### Download & untar
curl -o dq-full-package.tar.gz "<signed-link-to-full-package>"
tar -xvf dq-full-package.tar.gz

### Clean-up unnecessary tarball (optional)
rm dq-full-package.tar.gz
```

GOAL

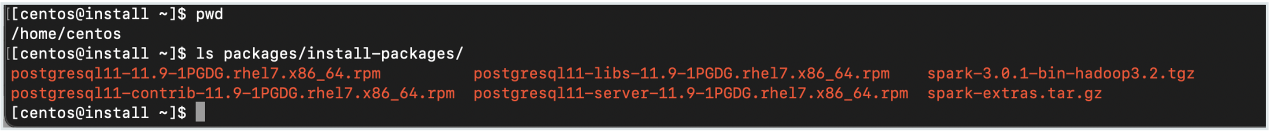
1. Download the full package tarball and place it in the `$OWL_BASE` (home directory). Download via `curl` or upload directly via FTP. The tarball name is assumed to be `dq-full-package.tar.gz`for sake of simplicity.
2. Untar`dq-full-package.tar.gz` to `OWL_BASE`.

3. Install DQ + Postgres + Spark

First set some variables for `OWL_BASE` (where to install DQ. In this tutorial, you are already in the directory that you want to install), `OWL_METASTORE_USER` (the Postgres username used by DQ Web Application to access Postgres storage), and `OWL_METASTORE_PASS` (the Postgres password used by DQ Web Application to access Postgres storage).

```
### base path that you want owl installed. No trailing

export OWL_BASE=$(pwd)
export OWL_METASTORE_USER=postgres
# minimum complexity recommended (18 length, upper, lower, num-
ber, symbol)
# example below
export OWL_METASTORE_PASS=H55Mt5EbXh1a%$aiX6
```

`dq-package-full.tar.gz` that you untarred contains installation packages for Java 8, Postgres 11, and Spark. There is no need to download these components. These off-line installation components are located in `$(pwd)/package/install-packages`.



```
[[centos@install ~]$ pwd
/home/centos
[[centos@install ~]$ ls packages/install-packages/
postgresql11-11.9-1PGDG.rhel7.x86_64.rpm          postgresql11-libs-11.9-1PGDG.rhel7.x86_64.rpm    spark-3.0.1-bin-hadoop3.2.tgz
postgresql11-contrib-11.9-1PGDG.rhel7.x86_64.rpm  postgresql11-server-11.9-1PGDG.rhel7.x86_64.rpm  spark-extras.tar.gz
[centos@install ~]$ 
```

One of the files extracted from the tarball is `setup.sh`. This script installs DQ and the required components. If a component already exist (e.g. Java 8 is already installed and `$JAVA_HOME` is set), then that component is not installed (i.e. Java 8 installation is skipped).

To control which components are installed, use `-options=...` parameter. The argument provided should be comma-delimited list of components to install (valid inputs: `spark`, `postgres`, `owlweb`, and `owlagent`. `-options=postgres,spark,owlweb,owlagent` means "install Postgres, Spark pseudo cluster, Owl Web Application, and Owl Agent". Note that Java is not part of the options. Java 8 installation is automatically checked and installed/skipped depending on availability.

You must at minimum specify `-options=spark,owlweb,owlagent` if you independently installed Postgres or using an external Postgres connection (as you can see in Step #3 if you choose that installation route)

```
### The following installs PostgresDB locally as part of OwlDQ
install

./setup.sh \
    -owlbase=$OWL_BASE \
    -user=$OWL_METASTORE_USER \
    -pgpassword=$OWL_METASTORE_PASS \
    -options=postgres,spark,owlweb,owlagent
```

> **Note** If prompted to install Java 8 because you do not have Java 8 installed, accept to install from local package.

You will be prompted for where to install Postgres like the following image:

```
Postgres DB needs to be intialized. Default location = <OWL_
BASE>/postgres/data
to change path please enter a FULL valid path for Postgres and
hit <enter>
DB Path [ <OWL_BASE>/owl/postgres/data ] =
```

If the data files for the Postgres database need to be hosted at a specific location, provide it during this prompt. **Make sure the directory is writable**. Otherwise, just press <Enter> to install the data files into `$OWL_BASE/owl/postgres/data`. The default suggested path does not have permission issue if you chose home directory as `OWL_BASE`

If no exceptions occurred and installation was successful, then the process will complete with the following output.

```
installing owlweb
starting owlweb
starting owl-web
installing agent
not starting agent
install complete
please use owl owlmanage utility to configure license key and
start owl-agent after owl-web successfully starts up
```

GOAL

1. Specify `OWL_BASE` path where DQ will be installed and specify Postgres environment variables.
2. Install DQ Web with Postgres and Spark linked to DQ Agent (**all files will be in `$OWL_BASE/owl` sub-directory**) using `setup.sh` script provided. The location of `OWL_BASE` and Postgres are configurable, but we advise you to take the defaults.

4. Install DQ + Spark and use existing Postgres (advanced)

> **Note** Skip Step 3 if you opted to install Postgres and performed Step 2 instead.
>
> We recommend Step 3 over Step 2 for advanced DQ Installer.

If you have already installed DQ from the previous step, then skip this step. This is only for those who want to use external Postgres (e.g. use GCP Cloud SQL service as the Postgres metadata storage). If you have an existing Postgres installation, then everything in the previous step applies except the Postgres data path prompt and the `setup.sh` command.

Refer to the Step #2 for details on what `OWL_BASE`, `OWL_METASTORE_USER` , and `OWL_METASTORE_PASS` are.

```
# base path that you want owl installed. No trailing

export OWL_BASE=$(pwd)
export OWL_METASTORE_USER=postgres
# minimum complexity recommended (18 length, upper, lower, num-
ber, symbol)
# example below
export OWL_METASTORE_PASS=H55Mt5EbXh1a%$aiX6
```

Run the following installation script. Note the missing "postgres" in `-options` and new parameter `-pgserver`. This `-pgserver` could point to any URL that the standalone instance has access to.

```
# The following does not install PostgresDB and
# uses existing PostgresDB server located in localhost:5432 with
"postgres" database
./setup.sh \
    -owlbase=$OWL_BASE \
    -user=$OWL_METASTORE_USER \
    -pgpassword=$OWL_METASTORE_PASS \
    -options=spark,owlweb,owlagent \
    -pgserver="localhost:5432/postgres"
```

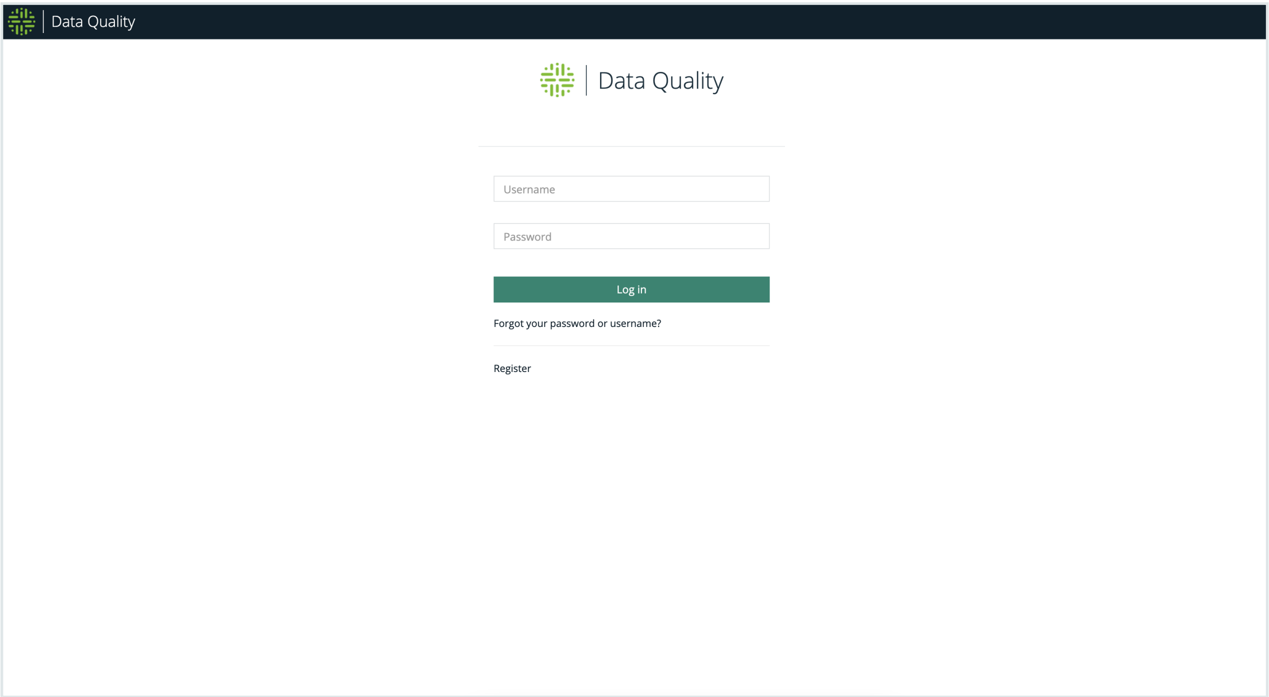
The database named `postgres` is used by default as DQ metadata storage. Changing this database name is out-of-scope for Full Standalone Installation. Contact DQ Team for assistance.

GOAL

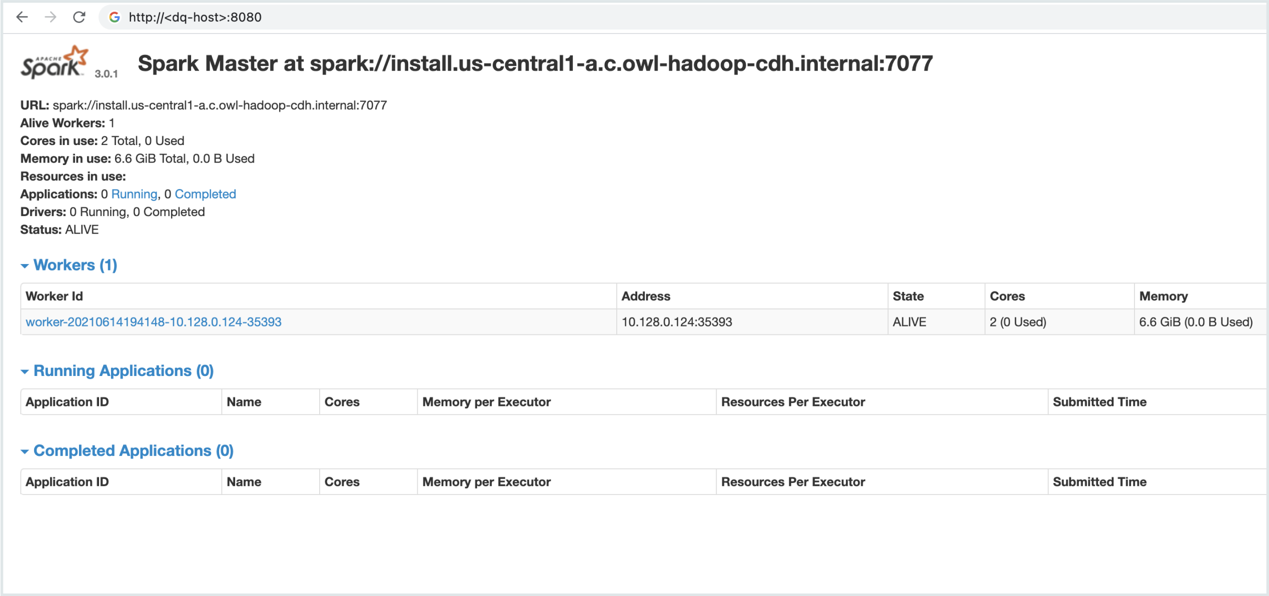
1. Specify `OWL_BASE` path where DQ will be installed and specify Postgres environment variables
2. Install DQ Web and Spark linked to DQ Agent (**all files will be in `$OWL_BASE/owl` sub-directory**) using `setup.sh` script provided and link DQ Web to an existing Postgres server. {% endhint %}

5. Verify DQ and Spark Installation

The installation process will start the DQ Web Application. This process will handle initializing the Postgres metadata storage schema in Postgres (under the database named `postgres`). This process must complete successfully before the DQ Agent can be started. Wait approximately 1 minute for the Postgres metadata storage schema to be populated. If you can access DQ Web using `<url-to-dq-web>:9000` using a Web browser, then this means you have successfully installed DQ.



Next, verify that the Spark Cluster has started and is available to run DQ checks using `<url-to-dq-web>:8080` Take note of the Spark Master url (starting with `spark://...`). This will be required during DQ Agent configuration.



Spark Master at spark://install.us-central1-a.c.owl-hadoop-cdh.internal:7077

URL: spark://install.us-central1-a.c.owl-hadoop-cdh.internal:7077
Alive Workers: 1
Cores in use: 2 Total, 0 Used
Memory in use: 6.6 GiB Total, 0.0 B Used
Resources in use:
Applications: 0 Running, 0 Completed
Drivers: 0 Running, 0 Completed
Status: ALIVE

Workers (1)

Worker Id	Address	State	Cores	Memory
worker-20210614194148-10.128.0.124-35393	10.128.0.124:35393	ALIVE	2 (0 Used)	6.6 GiB (0.0 B Used)

Running Applications (0)

Application ID	Name	Cores	Memory per Executor	Resources Per Executor	Submitted Time

Completed Applications (0)

Application ID	Name	Cores	Memory per Executor	Resources Per Executor	Submitted Time

6. Set License Key

In order for DQ to run checks on data, the DQ Agent must be configured with a license key. Replace `<license-key>` with a valid license key provided by Collibra.

```
cd $OWL_BASE/owl/bin
./owlmanage.sh setlic=<license-key>

# expected output:
# > License Accepted new date: <expiration-date>
```

7. Set License Name

It is required that you set a license name upon your initial deployment of Collibra DQ.

Replace `<your-license-name>` with a valid license name provided by Collibra.

```
vi /<install-dir>/owl/config/owl-env.sh
export LICENSE_NAME=<your-license-name>
```

8. Set DQ Agent Configuration

Next, start the DQ Agent process to enable processing of DQ checks.

```
# 1 start the agent so agent.properties will be created
cd $OWL_BASE/owl/bin
./owlmanage.sh start=owlagent

# 2 stop the agent add this line to agent.properties
./owlmanage.sh stop=owlagent

# 3 add this line to agent.properties
sparksubmitmode=native
sparkhome=</your/spark/home/folder>

# 4 start the agent again
./owlmanage.sh start=owlagent

# 5 Verify "agent.properties" contains the correct details
cd $OWL_BASE/owl/config
cat $OWL_BASE/owl/config/agent.properties
```

When the script successfully runs, `$OWL_BASE/owl/config` folder will contain a file called `agent.properties`. This file contains agent id # of agents installed in this machine. Since this is the first non-default agent installed, the expected agent id is 2. Verify `agent.properties` file is created. Your`agent.properties` is expected to have different timestamp, but you should see `agentid=2`

```
cd $OWL_BASE/owl/config
cat agent.properties

# expected output:
> #Tue Jul 13 22:26:19 UTC 2021
> agentid=2
```

Once the DQ Agent starts, it needs to be configured in DQ Web in order to successfully submit jobs to the local Spark (pseudo) cluster.

The new agent has been setup with the template base path `/opt` and install path `/opt/owl`. The `owlmanage.sh start=owlagent` script does not respect `OWL_BASE` environment. **We need to edit the Agent Configuration to follow our** `OWL_BASE`

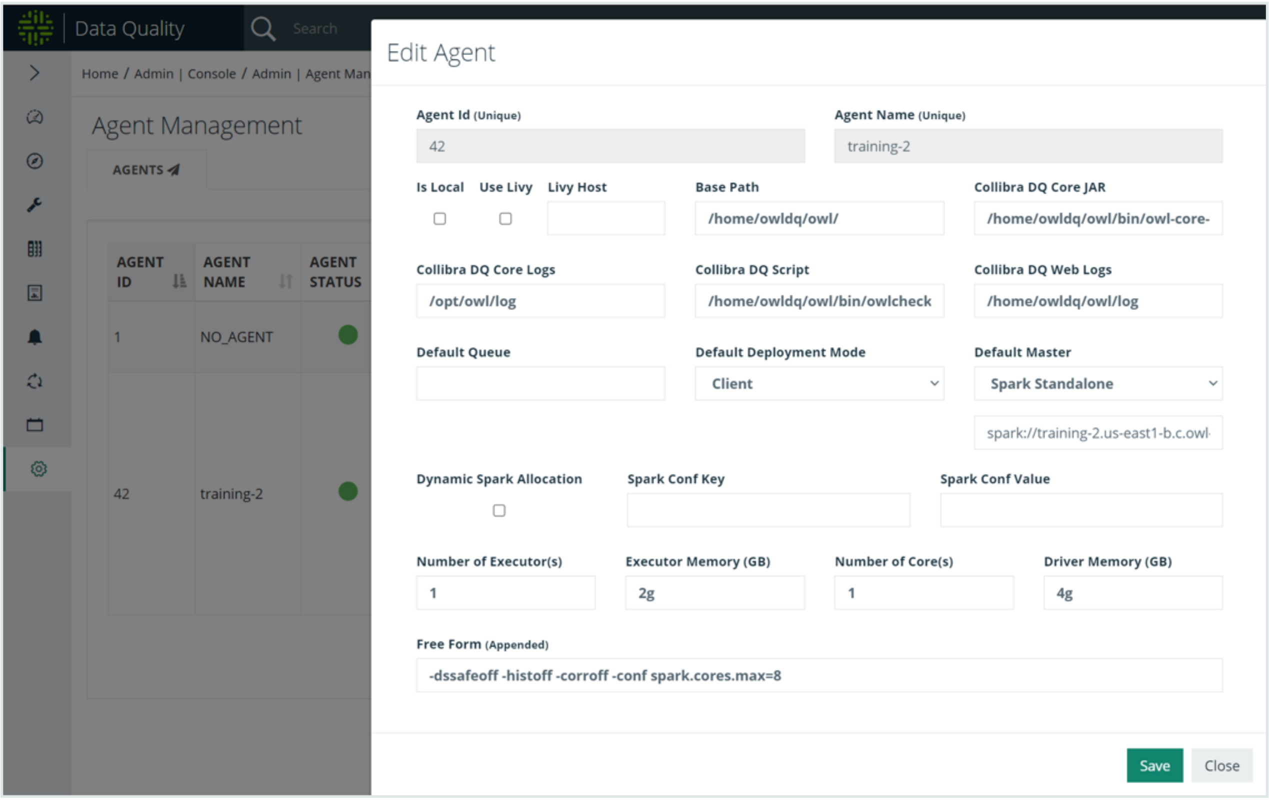
Follow the steps on Agent section to configure the newly created DQ Agent and edit the following parameters in DQ Agent #2.

- Replace all occurrence of `/opt/owl` with your `$OWL_BASE/owl/` in **Base Path**, **Collibra DQ Core JAR**, **Collibra DQ Core Logs**, **Collibra DQ Script**, and **Collibra DQ Web Logs**.
  - Note that **Base Path** here does not refer to `OWL_BASE`
- Replace **Default Master** value with the Spark URL from Fig 3
- Replace **Number of Executors(s)**, **Executor Memory (GB)**, **Driver Memory (GB)** to a reasonable default (depending on how large your instance is)

Refer to Agent section for parameters descriptions.

Number of Core(s) must be specified.

To limit Spark cores from being used for each job, a common configuration for the **Free Form (Appended)** field is `-conf spark.cores.max=8`.



AGENT ID	AGENT NAME	AGENT STATUS
1	NO_AGENT	●
42	training-2	●

Edit Agent

Agent Id (Unique)	Agent Name (Unique)
42	training-2

Is Local	Use Livy	Livy Host	Base Path	Collibra DQ Core JAR
☐	☐		/home/owldq/owl/	/home/owldq/owl/bin/owl-core-

Collibra DQ Core Logs	Collibra DQ Script	Collibra DQ Web Logs
/opt/owl/log	/home/owldq/owl/bin/owlcheck	/home/owldq/owl/log

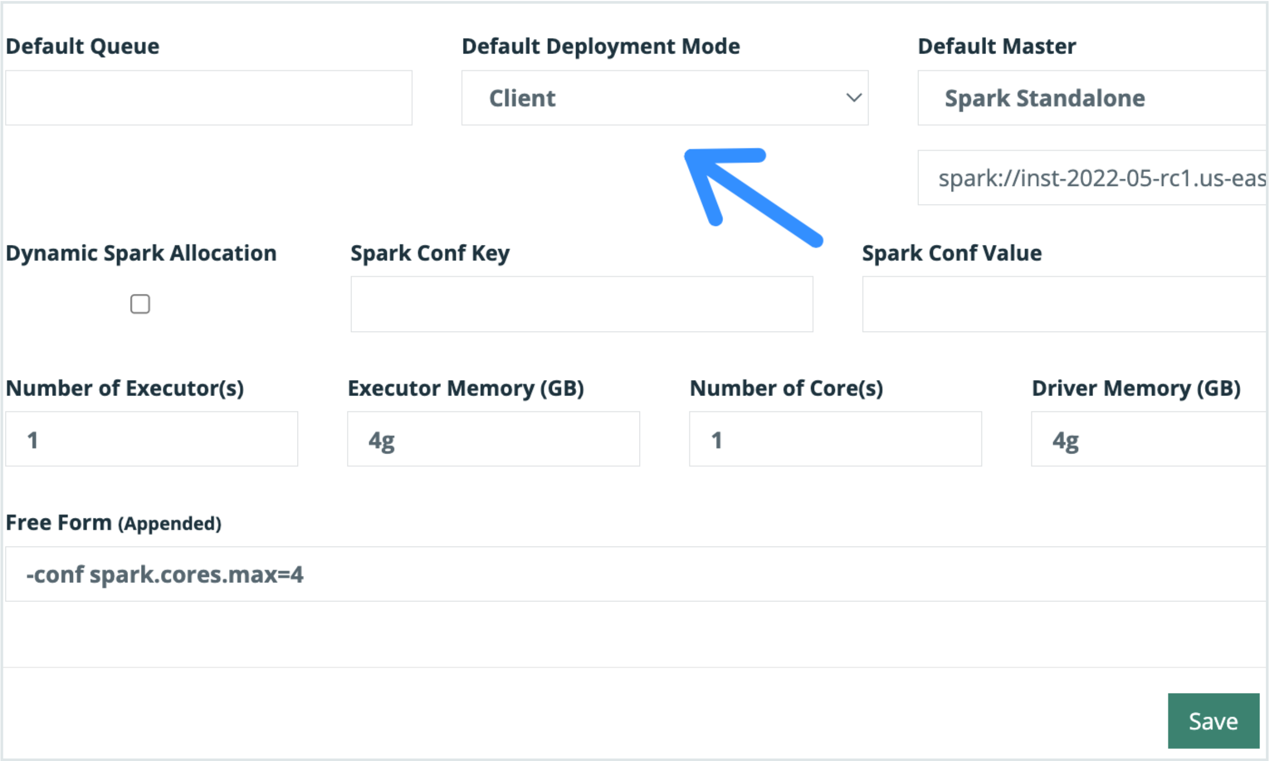
Default Queue	Default Deployment Mode	Default Master
	Client	Spark Standalone spark://training-2.us-east1-b.c.owl-

Dynamic Spark Allocation	Spark Conf Key	Spark Conf Value
☐		

Number of Executor(s)	Executor Memory (GB)	Number of Core(s)	Driver Memory (GB)
1	2g	1	4g

Free Form (Appended)

-dssafeoff -histoff -corroff -conf spark.cores.max=8



Default Queue

Default Deployment Mode: Client

Default Master: Spark Standalone

spark://inst-2022-05-rc1.us-eas

Dynamic Spark Allocation: □

Spark Conf Key

Spark Conf Value

Number of Executor(s): 1

Executor Memory (GB): 4g

Number of Core(s): 1

Driver Memory (GB): 4g

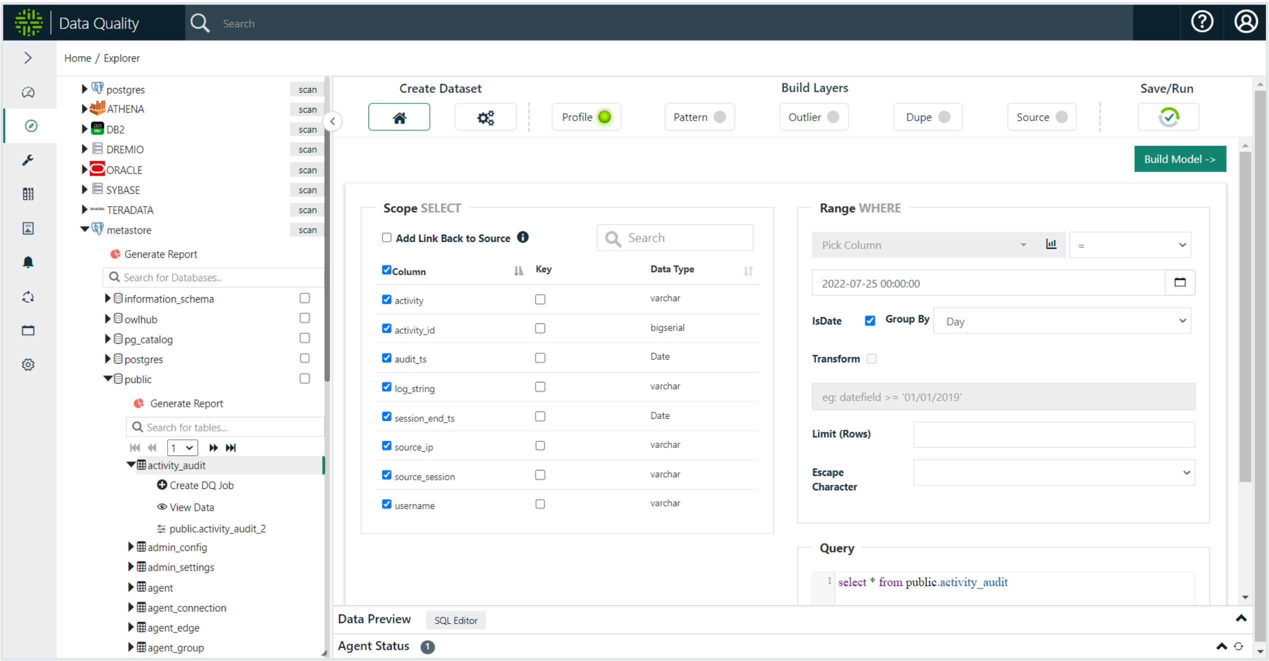
Free Form (Appended): -conf spark.cores.max=4

8. Create DB Connection for DQ Job

Follow the steps on Agent section to add `metastore` database connection. For demo purposes, we will run a DQ Job against local DQ Metadata Storage.

Follow the steps on Agentsection to configure newly created DQ Agent.

Click the compass icon in the navigation pane to navigate to the Explorer page. Click the "metastore" connection, select the "public" schema, and select the first table in the resulting list of tables. From the preview and scope page, click Build Model. When the Profile page populates, click Save/Run.



Column	Key	Data Type
☑ activity	□	varchar
☑ activity_id	□	bigserial
☑ audit_ts	□	Date
☑ log_string	□	varchar
☑ session_end_ts	□	Date
☑ source_ip	□	varchar
☑ source_session	□	varchar
☑ username	□	varchar

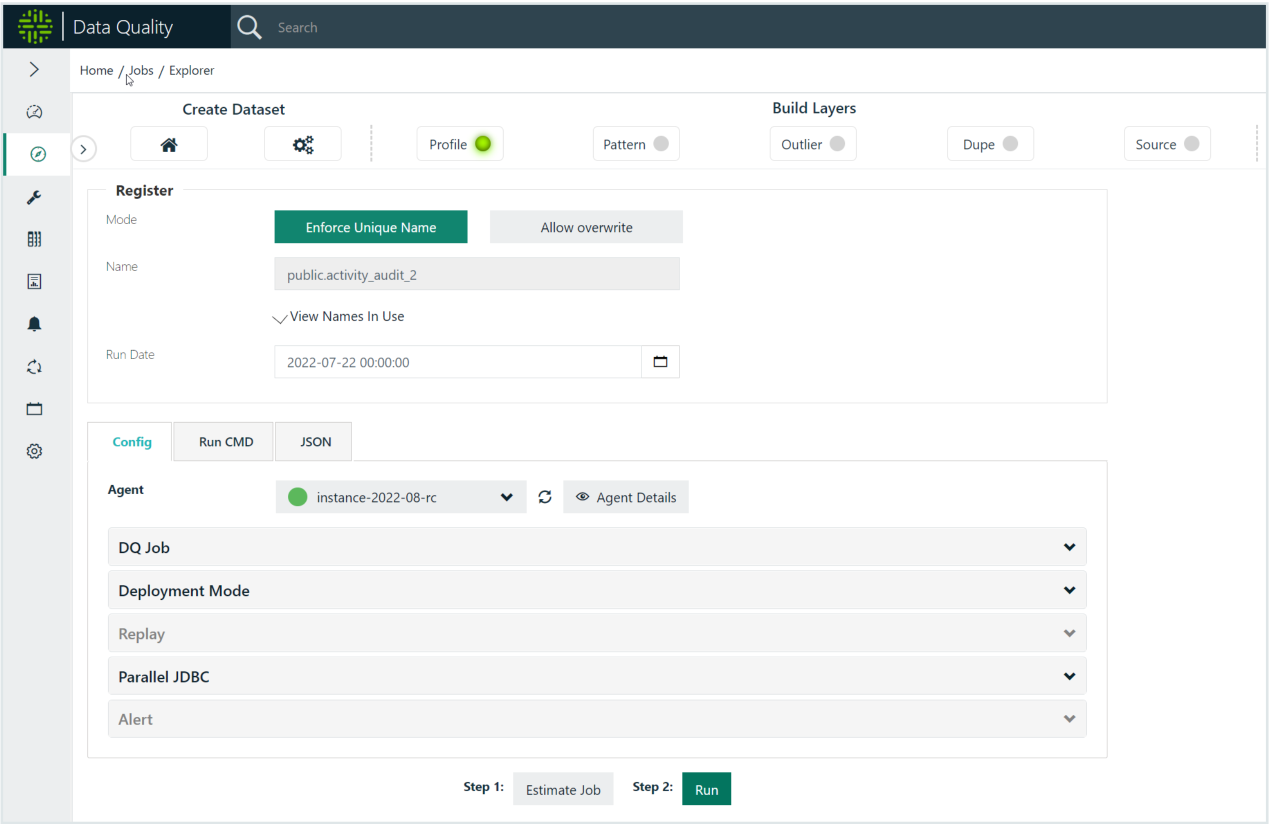
2022-07-25 00:00:00

IsDate ☑ Group By Day

eg: datefield >= '01/01/2019'

```
select * from public.activity_audit
```

On the Run page, click Estimate Job, acknowledge the resource recommendations, and click Run.



Mode: Enforce Unique Name

Name: public.activity_audit_2

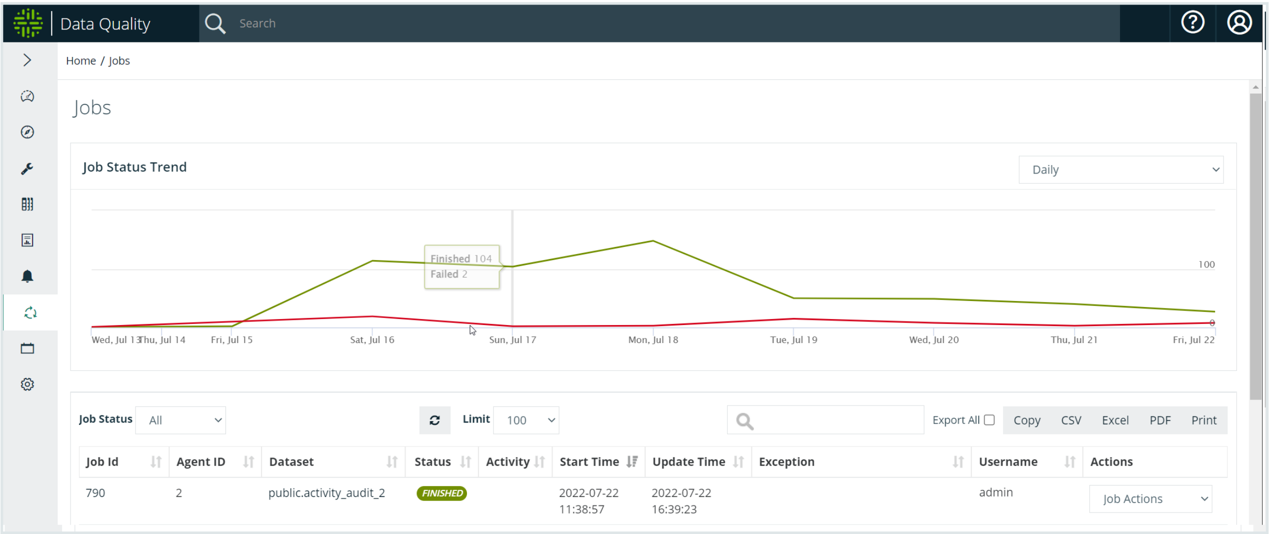
Run Date: 2022-07-22 00:00:00

Agent: instance-2022-08-rc

Step 1: Estimate Job Step 2: Run

Click the revolving arrows icon in the left navigation panel to navigate to the Jobs page.

Wait 10 seconds and then click the refresh button above the Status column until the status shows that the DQ job is Finished. We recommend refreshing several times, pausing for a few seconds in between clicks. While a job runs, the Activity column tracks the sequence of activities DQ performs before it completes a job. A successful job shows its status as Finished last.



Job Id	Agent ID	Dataset	Status	Activity	Start Time	Update Time	Exception	Username	Actions
790	2	public.activity_audit_2	FINISHED		2022-07-22 11:38:57	2022-07-22 16:39:23		admin	Job Actions

Troubleshooting + Helpful Commands

```
### Setting permissions on your pem file for ssh access

chmod 400 ~/Downloads/ssh_pem_key
```

Make sure working directory has permissions

For example, if I SSH into the machine with user `owldq` and use my default home directory location `/home/owldq/`

```
### Ensure appropriate permissions
### drwxr-xr-x

chmod -R 755 /home/owldq
```

Reinstall Postgres

```
### Postgres data directly initialization failed
### Postgres permission denied errors
### sed: can't read /home/owldq/owl/postgres/data/postgresql.conf: Permission denied

sudo rm -rf /home/owldq/owl/postgres
chmod -R 755 /home/owldq

### Reinstall just postgres
./setup.sh -owlbase=$OWL_BASE -user=$OWL_METASTORE_USER -pgpassword=$OWL_METASTORE_PASS -options=postgres
```

Changing Postgres password from SSH

```
### If you need to update your postgres password, you can leverage SSH into the VM
### Connect to your hosted instance of Postgres

sudo -i -u postgres
psql -U postgres
\password
#Enter new password: ### Enter Strong Password
#Enter it again: ### Re-enter Strong Password
\q
exit
```

Permissions for ssh keys when starting Spark

```
### Spark standalone permission denied after using ./start-all.sh

ssh-keygen -t rsa -N "" -f ~/.ssh/id_rsa
cat ~/.ssh/id_rsa.pub >> ~/.ssh/authorized_keys
```

Permissions if log files are not writeable

```
### Changing permissiongs on individual log files

sudo chmod 777 /home/owldq/owl/pids/owl-agent.pid
sudo chmod 777 /home/owldq/owl/pids/owl-web.pid
```

Getting the hostname of the instance

```
### Getting the hostname of the instance

hostname -f
```

Checking/deleting space of spark worker directory

```
### Checking worker nodes disk space

sudo du -ah | sort -hr | head -5
sudo find /home/owldq/owl/spark/work/* -mtime +1 -type f -delete
```

Increase Thread pool / Thread Pool Exhausted

```
# vi owl-env.sh
# modify these lines

export SPRING_DATASOURCE_POOL_MAX_WAIT=500
export SPRING_DATASOURCE_POOL_MAX_SIZE=30
export SPRING_DATASOURCE_POOL_INITIAL_SIZE=5

# restart web and agent
```

Active Database Queries

```
select * from pg_stat_activity where state='active'
```

Too many open files configuration

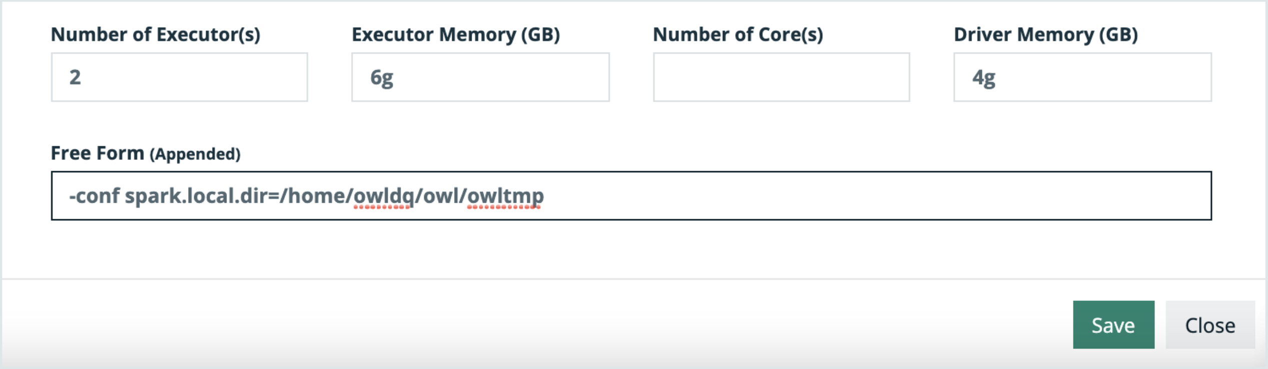
```
### "Too many open files error message"
### check and modify that limits.conf file
### Do this on the machine where the agent is running for Spark
standalone version

ulimit -Ha
cat /etc/security/limits.conf

### Edit the limits.conf file
sudo vi /etc/security/limits.conf

### Increase the limit for example
### Add these 3 lines
fs.file-max=500000
*               soft    nofile           58192
*               hard    nofile           100000
### do not comment out the 3 lines (no '#'s in the 3 lines
above)
```

Redirecting Spark Scratch

```
### Redirect Spark scratch to another location
SPARK_LOCAL_DIRS=/mnt/disks/sdb/tmp

### Set Spark to delete older files
export SPARK_WORKER_OPTS="${SPARK_WORKER_OPTS} -Dspark.-
worker.cleanup.enabled=true -Dspark.worker.cleanup.interval=1800
-Dspark.worker.cleanup.appDataTtl=3600"
```

Or change Spark storage with an agent configuration `-conf`

`spark.local.dir=/home/owldq/owl/owltmp`



Number of Executor(s): 2

Executor Memory (GB): 6g

Number of Core(s):

Driver Memory (GB): 4g

Free Form (Appended): -conf spark.local.dir=/home/owldq/owl/owltmp

Tip: Add Spark Home Environment Variables to Profile

```
### Adding ENV variables to bash profile

### Variable 'owldq' below should be updated wherever installed
e.g. centos

vi ~/.bash_profile
export SPARK_HOME=/home/owldq/owl/spark
export PATH=$SPARK_HOME/bin:$PATH

### Add to owl-env.sh for standalone install

vi /home/owldq/owl/config/owl-env.sh
export SPARK_HOME=/home/owldq/owl/spark
export PATH=$SPARK_HOME/bin:$PATH
```

Check Processes are Running

```
### Checking PIDS for different components

ps -aef|grep postgres
ps -aef|grep owl-web
ps -aef|grep owl-agent
ps -aef|grep spark
```

Starting Components

```
### Restart different components

cd /home/owldq/owl/bin/
./owlmanage.sh start=postgres
./owlmanage.sh start=owlagent
./owlmanage.sh start=owlweb

cd /home/owldq/owl/spark/sbin/
./stop-all.sh
./start-all.sh
```

Configuration Options

Setup.sh arguments

-non-interactive skip asking to accept JAVA license agreement

-skipSpark skips the extraction of spark components

-stop do not automatically start up all components (orient,owl-web,zeppelin,postgres)

-port= set owlweb application to use defined port

-user= Optional Parameter (default will be current user) set the user to run owl as.

-**owlbase=** set base path to where you want owl installed

-owlpackage= Optional Parameter (default is current working directory) set owl package directory

-help display this help and exit

-options= the different owl components to install (comma separated list) --- owlagent,owlweb,zeppelin,postgres,orient,spark

-pgpassword= password to use to set for the postgres metastore (unattended install)

-pgserver= name of the postgres server example = owl-postgres-host.example.com:5432/owldb (unattended install)

-opassword= password for the orient graph DB (unattended install)

Example:

- The tar ball has been extracted to this folder on my EC2 Instance: **** `/home/ec2-user/packages/`
- Owl will be running as the **** `ec2-user`
- The owl-web application will run on port `9000`
- The base location for the setup.sh script to create the will be: `/home/ec2-user/`

```
./setup.sh -port=9000 -user=ec2-user -owlbase=/home/ec2-user -
owlpackage=/home/ec2-user/packages
```

Example installing just the agent (perhaps on an Edge node of a hadoop cluster):

- The Package has been extracted to this folder on my EC2 Instance: **** `/home/ec2-user/packages/`
- Owl-agent will be running as the **** `ec2-user`
- The base location for the setup.sh script to create the owl folder and place all packages under owl will be: `/home/ec2-user/`

```
./setup.sh -user=ec2-user -owlbase=/home/ec2-user -
owlpackage=/home/ec2-user/package -options=owlagent
```

When installing different features questions will be asked:

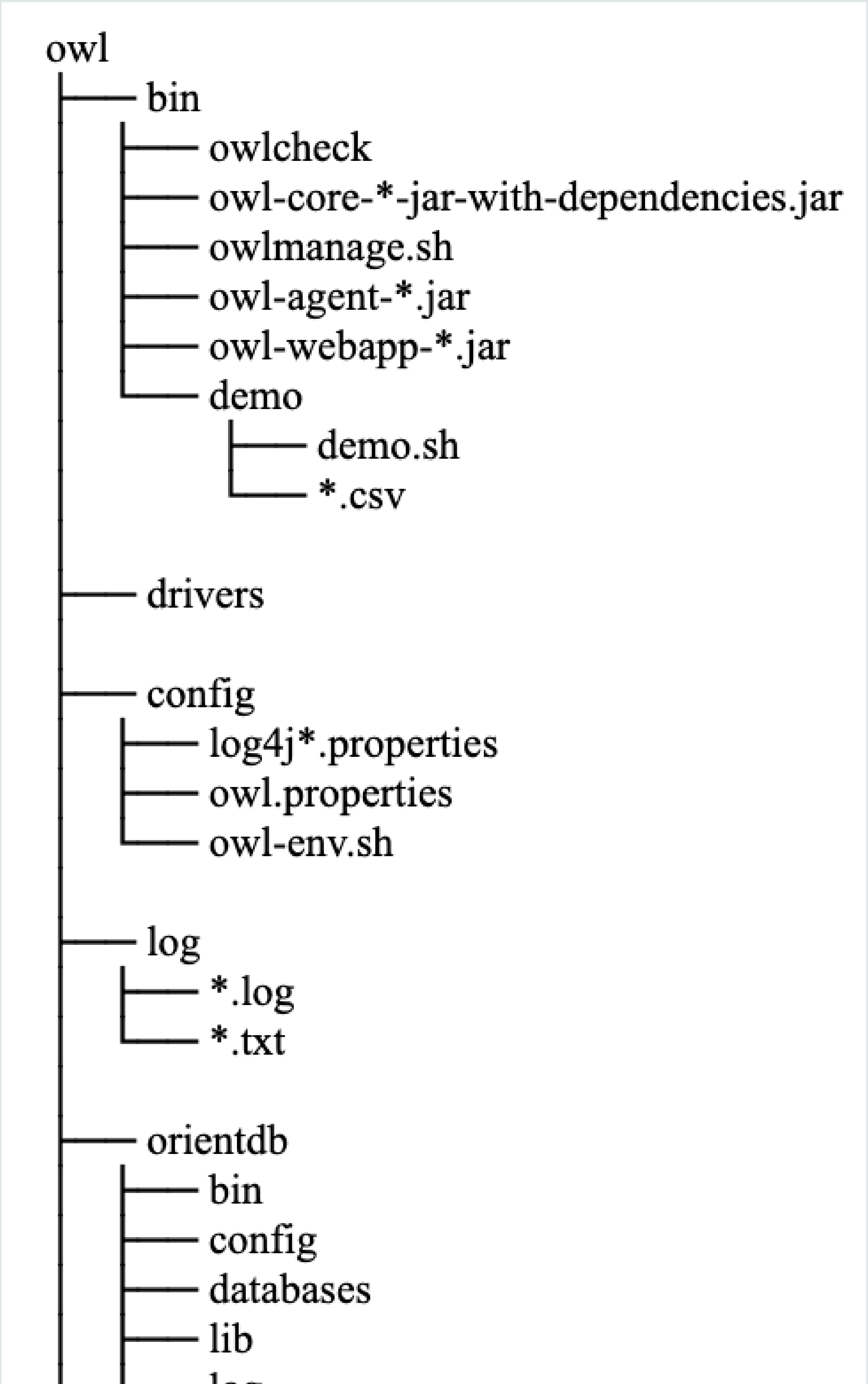
- postgres = Postgres DBPassword needs to be supplied
- orient = Orient DBPassword needs to be supplied
- If postgres is not being installed (such as agent install only) postgres metastore server name needs to be supplied

Launching and Administering Collibra DQ

When the setup.sh script finishes by default software is automatically started. The setup.sh also creates the owlmanage.sh script which allows for stopping and starting of all owl services or some components of services.The setup script will also generate an owl-env.sh script that will hold the main variables that are reused across components (see owl-env.sh under the config directory).

Owl Directory Structure after running Setup.sh

```
export ORIENTDB_HOST="localhost"
```



```
owl
├── bin
│   ├── owlcheck
│   ├── owl-core-*-jar-with-dependencies.jar
│   ├── owlmanage.sh
│   ├── owl-agent-*.jar
│   ├── owl-webapp-*.jar
│   └── demo
│       ├── demo.sh
│       └── *.csv
│
├── drivers
│
├── config
│   ├── log4j*.properties
│   ├── owl.properties
│   └── owl-env.sh
│
├── log
│   ├── *.log
│   └── *.txt
│
├── orientdb
│   ├── bin
│   ├── config
│   ├── databases
│   ├── lib
│   ├── log
```

Configuration / ENV settings within owl-env.sh

Contents of the Owl-env.sh script and what the script is used for.

OWL-ENV.SH Scripts	Meaning
export ORIENTDB_PORT="2424"	Port that OrientDB is using.
export SPARK_CONF_DIR="/home/collibra/owl/cdh-spark-conf"	The directory on your machine where the Spark conf directory resides.
export INSTALL_PATH="/home/collibra/owl"	The installation directory of Collibra DQ.
export JAVA_HOME="/home/collibra/jdk1.8.0_131"	Java Home for Owl to leverage
export LOG_PATH="/home/collibra/owl/log"	Log path
export BASE_PATH="/home/collibra"	The base location under which the Collibra DQ directory resides
export SPARK_MAJOR_VERSION=2	Spark Major version. Collibra DQ only supports 2+ version of Spark.
export OWL_LIBS="/home/collibra/owl/libs"	Lib Directory to inject in spark -submit jobs.
export USE_LIBS=0 #1 is on, 0 is off	Use the lib directory or not. 0 is the default.
export SPARKSUBMITEXE="spark-submit"	Spark submit executable command. CDH using spark2-submit as an example.
export ext_pass_manage=0 #0 to disable 1 to enable	If using a password management system. You can enable for password to be pulled from it.
export ext_pass_script-t="/opt/owl/bin/getpassword.sh"	Leverage password script to execute a get password script from the vault.
TIMEOUT=900 #15 minutes in seconds	Owl-Web user time out limits.
PORT=9003 #owl-web port NUMBER	The default port to use for owl-web.

OWL-ENV.SH Scripts	Meaning
SPRING_LOG_LEVEL=ERROR	The logging level to be displayed in the owl-web.log
SPRING_DATASOURCE_DRIVER_CLASS_NAME-E=org.postgresql.Driver	The driver class name for postgres metastore (used by web).
export SPRING_DATASOURCE_URL-L=jdbc:postgresql://localhost:5432/postgres	JDBC connection string to Collibra DQ Postgres metastore.
export SPRING_DATASOURCE_USERNAME=collibra	Collibra DQ Postgres username.
export SPRING_DATASOURCE_PASSWORD-D=3+017wfY1l1vmsvGYAyUcw5zGL	Collibra DQPostgres password.
export AUTOCLEAN=TRUE/FALSE	TRUE/FALSE Enable/Disable automatically delete old data sets.
export DATASETS_PER_ROW=200000	Delete data sets after this threshold is hit (must be greater than the default to change).
export ROW_COUNT_THRESHOLD=300000	Delete rows after this threshold is hit (must be greater than the default to change).
export SERVER_HTTP_ENABLED=true	Enabling HTTP to owl web
export OWL_ENC=OFF #JAVA for java encryption	Enable Encryption (NOTE need to add to owl.properties also). Has to be in form owl.enc=OFF within owl.properties file to disable, and in this form owl.enc=JAVA to enable. the owl.properties file is located in the owl install path /config folder (/opt/owl/config).
PGDBPATH=/home/collibra/owl/owl-postgres/bin/data	Path for Postgres DB
export RUNS_THRESHOLD=5000	Delete runs after this threshold is hit (must be greater than the default to change).
export HTTP_SECONDARY_PORT=9001	Secondary HTTP port to use which is useful when SSL is enabled.

OWL-ENV.SH Scripts	Meaning
export SERVER_PORT=9000	Same as PORT.
export SERVER_HTTPS_ENABLED=true	Enabling of SSL.
export SERVER_SSL_KEY_TYPE=PKCS12	Certificate trust store.
export SERVER_SSL_KEY_PASS-S=t2lMFWEHsQha3QaWnNaR8ALaFPH15Mh9	Certificate key password.
export SERVER_SSL_KEY_ALIAS=owl	Certificate key alias.
export SERVER_REQUIRE_SSL=true	Override HTTP on and force HTTPS regardless of HTTP settings.
export MULTITENANTMODE=FALSE	Flipping to TRUE will enable multi tenant support.
export multiTenantSchemaHub=owlhub	Schema name used for multi tenancy.
export OWL_SPARKLOG_ENABLE=false	Enabling deeper spark logs when toggled to true.
export LDAP_GROUP_RESULT_DN_ATTRIBUTE	The attribute to the full path of the group object, for example, **CN=OwlAppAdmin ,OU=OwlGroups,OU=Groups,DC=owl, DC=com.** Default is **distinguishedname.**
export LDAP_GROUP_RESULT_NAME_ATTRIBUTE	The attribute to the simple name of the group, for example, **OwlAppAdmin.** Default is **CN.**

OWL-ENV.SH Scripts	Meaning
export LDAP_GROUP_RESULT_CONTAINER_BASE	Property used in the scenario where the LDAP_GROUP_RESULT_DN_ATTRIBUTE does not return a value. In this case, the LDAP_GROUP_RESULT_NAME_ ATTRIBUTE prepends to this value, which creates a fully qualified LDAP path. For example, **OU=OwlGroups ,OU=Groups,DC=owl,DC=com**. Default is <**null**>.

Configuration / owl.properties file

Example	Meaning
key=XXXXXX	The license key.
spring.datasource.url=jdbc:postgresql://localhost:5432/postgres	The connection string to the Collibra DQ metastore (used by owl-core).
spring.datasource.password=xxxxxx	The password to the Collibra DQ metastore (used by owl-core).
spring.datasource.username=xxxxxx	The username to the Collibra DQ metastore (used by owl-core).
spring.datasource.driver-class-name-e=com.owl.org.postgresql.Driver	Shaded Postgres driver class name.
orientdb.user=root	Orient username.
orientdb.pass=xxxxx	Orient password.
spring.agent.datasource.url	**jdbc:postgresql://$host:$port/owltrunk**
spring.agent.datasource.username	**{user}**

Example	Meaning
spring.agent.datasource.password	{password}
spring.agent.datasource.driver-class-name	org.postgresql.Driver

Starting Spark

Spark Standalone Mode - Spark 3.2.0 Documentation

Launch Scripts

To launch a Spark standalone cluster with the launch scripts, you should create a file called conf/workers in your Spark directory, which must contain the hostnames of all the machines where you intend to start Spark workers, one per line. If conf/workers does not exist, the launch scripts defaults to a single machine (localhost), which is useful for testing. Note, the master machine accesses each of the worker machines via ssh. By default, ssh is run in parallel and requires password-less (using a private key) access to be setup. If you do not have a password-less setup, you can set the environment variable SPARK_SSH_FOREGROUND and serially provide a password for each worker.

Once you've set up this file, you can launch or stop your cluster with the following shell scripts, based on Hadoop's deploy scripts, and available in `SPARK_HOME/sbin`:

- `sbin/start-master.sh` - Starts a master instance on the machine the script is executed on.
- `sbin/start-workers.sh` - Starts a worker instance on each machine specified in the `conf/workers` file.
- `sbin/start-worker.sh` - Starts a worker instance on the machine the script is executed on.
- `sbin/start-all.sh` - Starts both a master and a number of workers as described above.
- `sbin/stop-master.sh` - Stops the master that was started via the `sbin/start-master.sh` script.
- `sbin/stop-worker.sh` - Stops all worker instances on the machine the script is executed on.

- `sbin/stop-workers.sh` - Stops all worker instances on the machines specified in the `conf/workers` file.
- `sbin/stop-all.sh` - Stops both the master and the workers as described above.

Note that these scripts must be executed on the machine you want to run the Spark master on, not your local machine.

```
### Starting Spark Standalone

cd /home/owldq/owl/spark/sbin
./start-all.sh

### Stopping Spark
cd /home/owldq/owl/spark/sbin
./stop-all.sh
```

```
### Starting Spark with Separate Workers

SPARK_WORKER_OPTS=" -Dspark.worker.cleanup.enabled=true -Dspark.-
worker.cleanup.interval=1799 -Dspark.-
worker.cleanup.appDataTtl=3600"

### 1 start master
/home/owldq/owl/spark/sbin/start-master.sh

### 2 start workers
SPARK_WORKER_INSTANCES=3;/home/owldq/owl/spark/sbin/start-
slave.sh spark://$(hostname):7077 -c 5 -m 20g
```

Standalone Install (Script)

Requirements

Resource	Notes	Provided by
OS	Red Hat 7 or Centos 7	Customer
Memory	16 GB Ram	
Cores	8	

Resource	Notes	Provided by
Storage	50 GB Disk	
Permission	sudo	
Install Script	Download using the curl command below	Collibra

Access the machine through either a cloud shell or SSH. The snippet below is an example SSH command.

```
ssh -i <your_key> <user>@<public-ipv4-ip-address>
```

```
ssh -i ~/.ssh/abc.pem centos@22.000.111.3333
```

Your pem file should have correct permissions. A simple command to confirm the permissions is `sudo chmod 400 <your_key>`

Commands

After you enter your SSH into the Centos or Redhat VM, run these commands from the command line:

Step 1 - Download the script

```
curl -o cdq_install.sh https://owl-packages.s3.amazonaws.com/MP/cdq_install.sh
```

Step 2 - Modify script permission

```
sudo chmod +x cdq_install.sh
```

Step 3 - Run the script

```
echo | ./cdq_install.sh
```

> **Note** The most common directory to use for installation is your user directory (/home/<user>). You do not need to create any directories. The install script will create the correct directory structure. The user should have sudo access to perform the installation and the directory should not be a restricted system directory. {% endhint %}

Step 4 - Click URL

Login to the application using user: `admin` password: `admin123` for the first time.

```
http://<server_name/ip>:9000
```

> **Note** Make sure you have access to the server and port. Adding the correct security group or whitelisting your IP address is a common step to be able to access an application running on a cloud server. {% endhint %}

BYOL (Optional)

Using the same command, you can bring your own license or use a different download link.

```
./cdq_install.sh "<Installer Download Link>" "<License Key>"
```

Confirmation (Optional)

Once the installation script is complete, check the details of the processes on the server.

```
ps -ef | grep -i spark
ps -ef | grep -i owl-web
ps -ef | grep -i owl-agent
ps -ef | grep -i postgres
```

When all of the processes are up and running, log into your standalone instance of Collibra Data Quality.

Configure your Agent and Adding Connections as normal.

Complete Installation Script

Troubleshooting

Common error messages

If you receive an error with the message, "Application already running on port 8080," enter the following command:

```
sudo netstat -plten |grep java
```

You can then use a `kill` command to kill the process.

```
kill -9 <appId>
```

> **Note** If you receive a "permission denied" error message, make sure that you are using `sudo`.

Getting Started with AWS

Prerequisites

To get started, you need a Collibra Data Quality account.

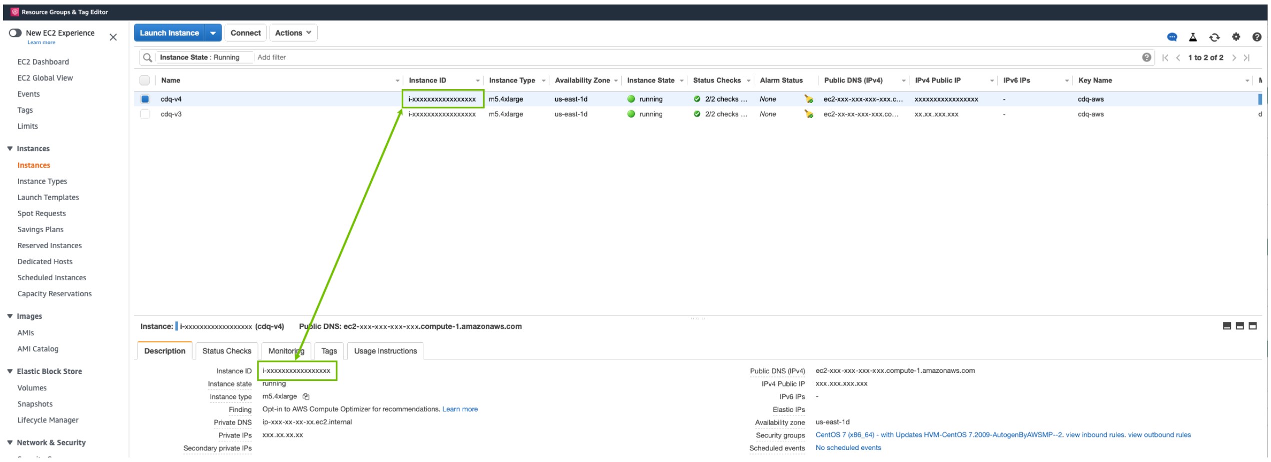
Connecting to Collibra Data Quality

1. To connect to your environment, enter your URL.

Example: https://<your_host_name>:9000

2. Enter "admin" as your **Username** and your unique Instance ID as your **Password**.

> **Note** Username: admin Password: CDQ<your_instance_id>

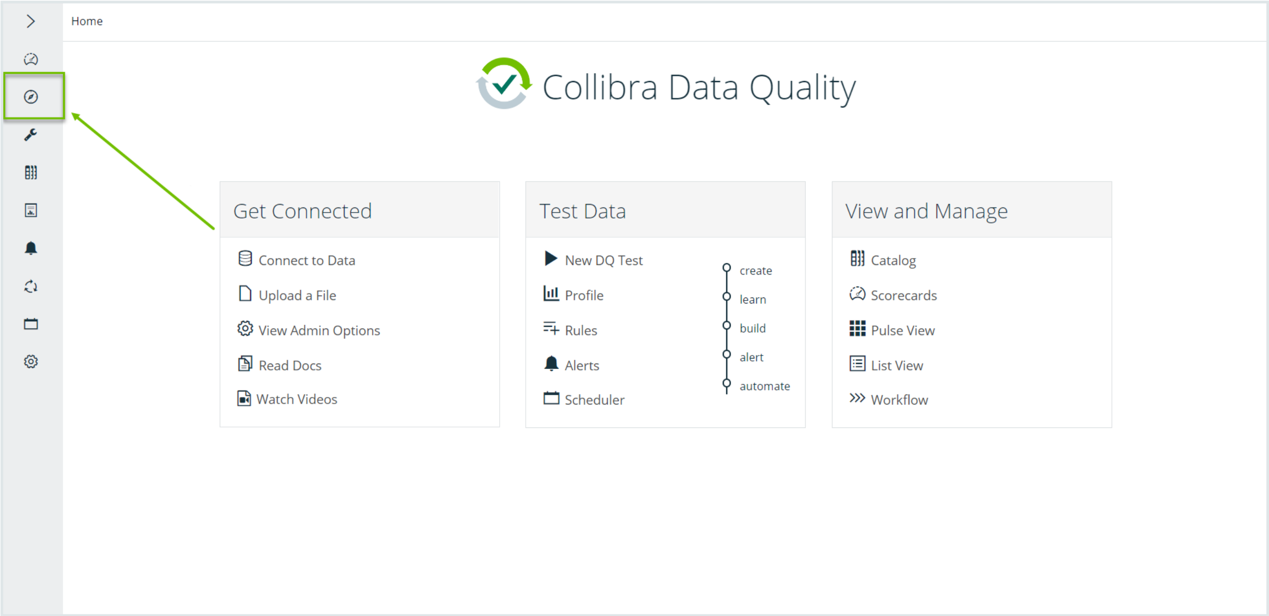


Name	Instance ID	Instance Type	Availability Zone	Instance State	Status Checks	Alarm Status	Public DNS (IPv4)	IPv4 Public IP	IPv6 IPs	Key Name
cdq-v4	i-xxxxxxxxxxxxxxxxx	m5.4xlarge	us-east-1d	running	2/2 checks ...	None	ec2-xxx-xxx-xxx-xxx.c...	xxxxxxxxxxxxxxxxx	-	cdq-aws
cdq-v3	i-xxxxxxxxxxxxxxxxx	m5.4xlarge	us-east-1d	running	2/2 checks ...	None	ec2-xx-xx-xxx-xxx.co...	xx.xx.xxx.xxx	-	cdq-aws

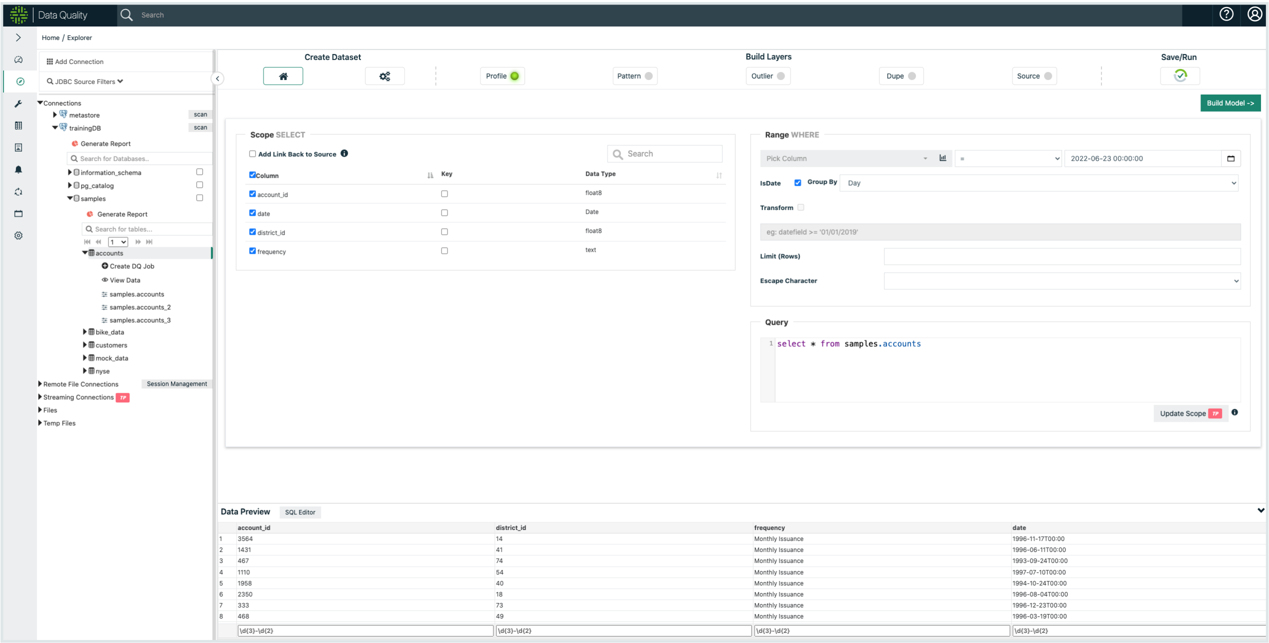
Instance: i-xxxxxxxxxxxxxxxxx (cdq-v4) Public DNS: ec2-xxx-xxx-xxx-xxx.compute-1.amazonaws.com

Instance ID	i-xxxxxxxxxxxxxxxxx	Public DNS (IPv4)	ec2-xxx-xxx-xxx-xxx.compute-1.amazonaws.com
Instance state	running	IPv4 Public IP	xxx.xxx.xxx.xxx
Instance type	m5.4xlarge	IPv6 IPs	-
Finding	Opt-in to AWS Compute Optimizer for recommendations. Learn more	Elastic IPs	
Private DNS	ip-xxx-xx-xx-xx.ec2.internal	Availability zone	us-east-1d
Private IPs	xxx.xx.xx.xx	Security groups	CentOS 7 (x86_64) - with Updates HVM-CentOS 7.2009-AutogenByAWSMP--2. view inbound rules. view outbound rules
Secondary private IPs		Scheduled events	No scheduled events

3. From the home page, click the **Explorer** tab.



4. From Explorer, select a connection from the **Connections** dropdown to access your data set.



☐ Add Link Back to Source

☑ Column	Key	Data Type
☑ account_id	☐	float8
☑ date	☐	Date
☑ district_id	☐	float8
☑ frequency	☐	text

Pick Column = 2022-06-23 00:00:00

IsDate ☑ Group By Day

Transform ☐

eg: datefield >= '01/01/2019'

Limit (Rows)

Escape Character

```
select * from samples.accounts
```

	account_id	district_id	frequency	date
1	3564	14	Monthly Issuance	1996-11-17T00:00
2	1431	41	Monthly Issuance	1996-06-11T00:00
3	467	74	Monthly Issuance	1993-09-24T00:00
4	1110	54	Monthly Issuance	1997-07-10T00:00
5	1958	40	Monthly Issuance	1994-10-24T00:00
6	2350	18	Monthly Issuance	1996-08-04T00:00
7	333	73	Monthly Issuance	1996-12-23T00:00
8	468	49	Monthly Issuance	1996-03-19T00:00
	\d{3}-\d{2}	\d{3}-\d{2}	\d{3}-\d{2}	\d{3}-\d{2}

What's next?

- Visit the Explorer (no-code) for more information on quickly connecting to your data sets.
- Visit Collibra Data Quality's Youtube channel for more tutorials.
- Register for Collibra Data Quality's Product Showcase to learn more about Collibra Data Quality.

Standalone Install (AWS CloudFormation)

This section describes how to install and configure Collibra Data Quality using the AWS CloudFormation stack.

Prerequisites

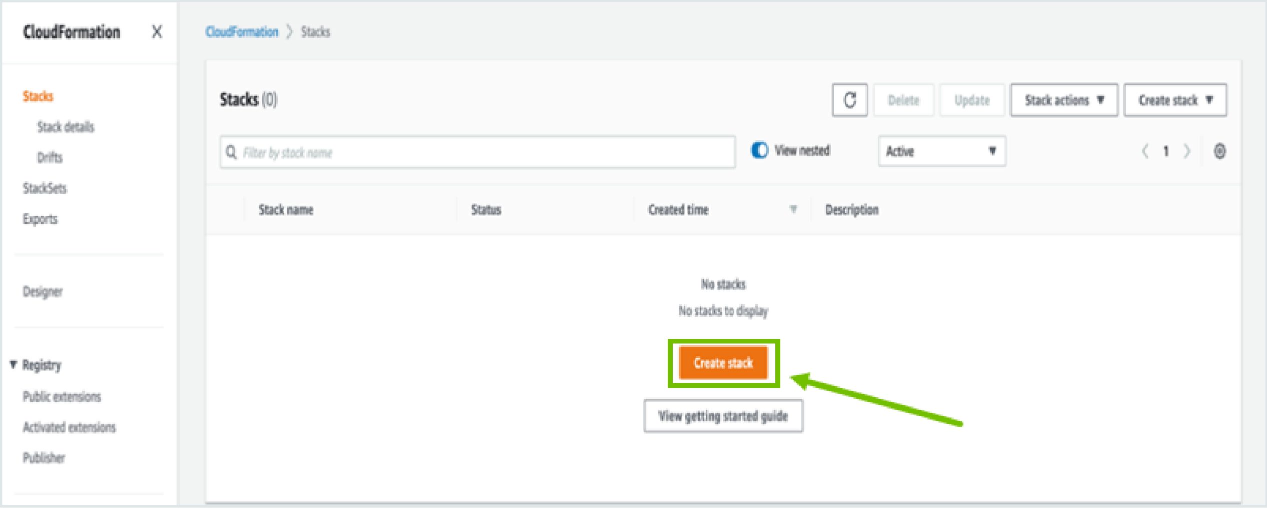
To install Collibra Data Quality using the AWS CloudFormation stack, you need an AWS user account with permissions to provision AWS resources.

Steps

1. Login to your AWS account and navigate to **CloudFormation** from the search bar.

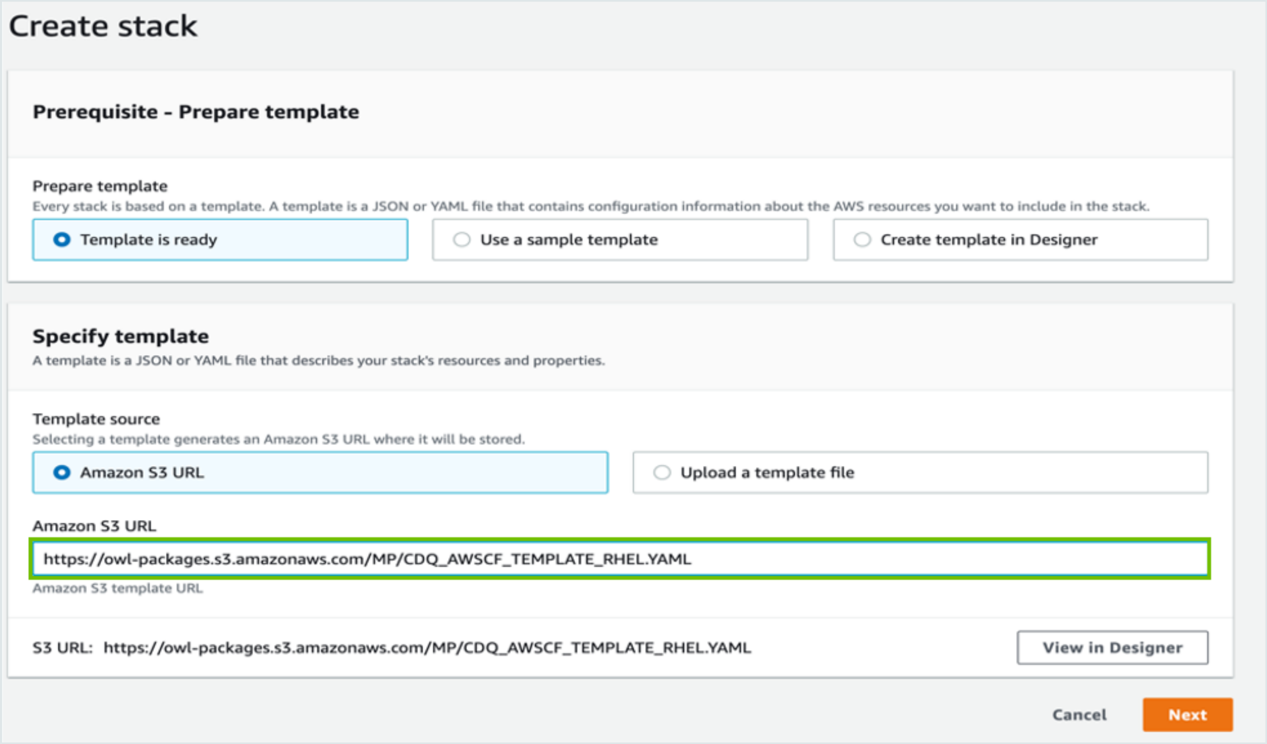
2. In CloudFormation, click the **Create stack** button and provide the S3 location for the template.

```
https://owl-packages.s3.amazonaws.com/MP/CDQ_AWSCF_TEMPLATE_
RHEL.YAML
```



3. Click **Next**.

4. Follow the prompts and select the appropriate instance type, VPC, subnet, and key values based on your AWS account. Rest accepts everything by default.



Create stack

Prerequisite - Prepare template

Prepare template

Every stack is based on a template. A template is a JSON or YAML file that contains configuration information about the AWS resources you want to include in the stack.

● Template is ready ○ Use a sample template ○ Create template in Designer

Specify template

A template is a JSON or YAML file that describes your stack's resources and properties.

Template source

Selecting a template generates an Amazon S3 URL where it will be stored.

● Amazon S3 URL ○ Upload a template file

Amazon S3 URL

https://owl-packages.s3.amazonaws.com/MP/CDQ_AWSCF_TEMPLATE_RHEL.YAML

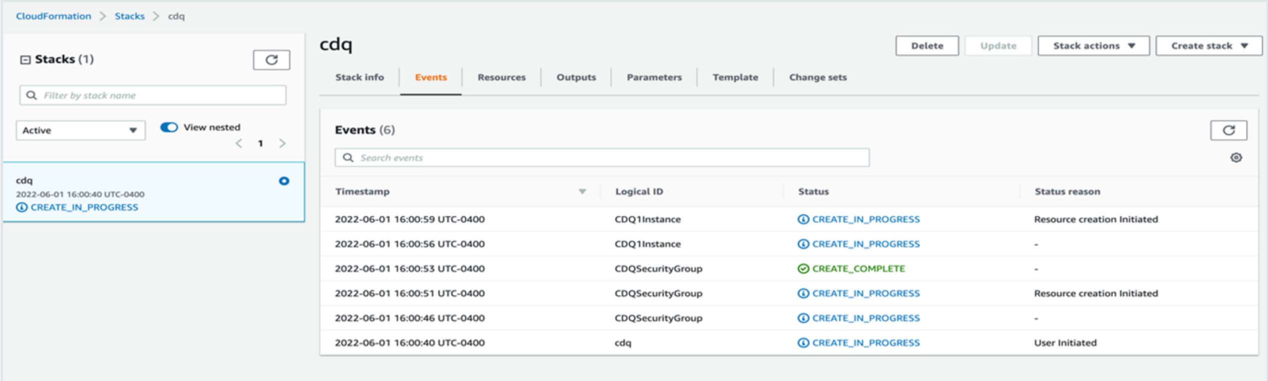
Amazon S3 template URL

S3 URL: https://owl-packages.s3.amazonaws.com/MP/CDQ_AWSCF_TEMPLATE_RHEL.YAML

5. Click **Next**.

> **Note** This process takes 10-15 minutes to spin up the EC2 instance and deploy Collibra DQ.

6. In the **Events** tab, you can monitor status of your stack.



CloudFormation > Stacks > cdq

Stacks (1)

Active ▼ View nested

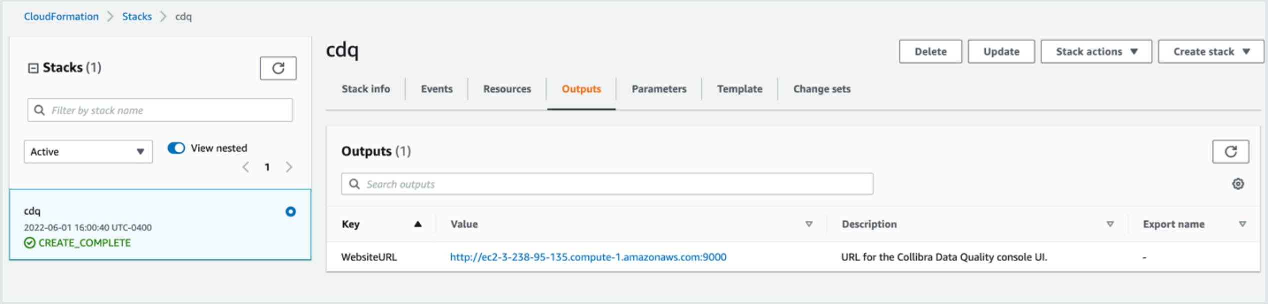
cdq
2022-06-01 16:00:40 UTC-0400
CREATE_IN_PROGRESS

cdq

Events (6)

Timestamp	Logical ID	Status	Status reason
2022-06-01 16:00:59 UTC-0400	CDQ1Instance	CREATE_IN_PROGRESS	Resource creation Initiated
2022-06-01 16:00:56 UTC-0400	CDQ1Instance	CREATE_IN_PROGRESS	-
2022-06-01 16:00:53 UTC-0400	CDQSecurityGroup	CREATE_COMPLETE	-
2022-06-01 16:00:51 UTC-0400	CDQSecurityGroup	CREATE_IN_PROGRESS	Resource creation Initiated
2022-06-01 16:00:46 UTC-0400	CDQSecurityGroup	CREATE_IN_PROGRESS	-
2022-06-01 16:00:40 UTC-0400	cdq	CREATE_IN_PROGRESS	User Initiated

7. Once your stack is created, click the **Outputs** tab to access the CDQ Login URL.



Key	Value	Description	Export name
WebsiteURL	http://ec2-3-238-95-135.compute-1.amazonaws.com:9000	URL for the Collibra Data Quality console UI.	-

8. In the **Value** column, click the CDQ Login URL.

> **Note** Your CDQ instance comes with sample data and prewired DB connections.

9. To uninstall and release the resource, delete the stack.

Standalone Install (Google Cloud Platform)

This section provides information on how to deploy Collibra Data Quality on Google Cloud Platform.

Prerequisites

You have:

- A Google user account.
- A project for Google Cloud Platform to deploy Collibra Data Quality.
- Deployment Manager permissions provisioned by an admin.

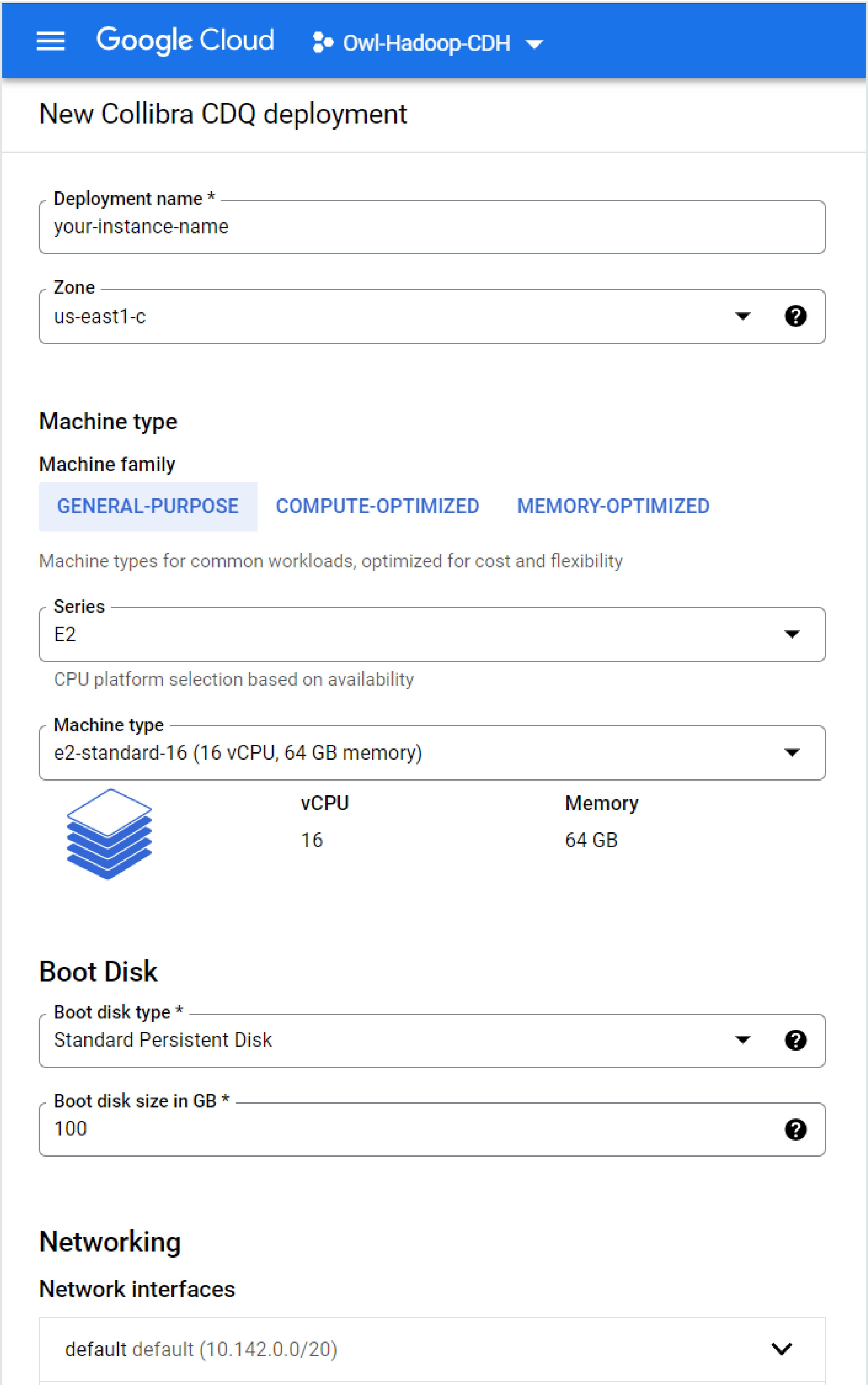
Steps

1. Step 1: Create a new Collibra Data Quality deployment
2. Step 2: Launch a new Collibra Data Quality deployment

Step 1: Create a new Collibra Data Quality deployment

1. Sign in to your Google Cloud Marketplace account and choose your **working project** for Collibra Data Quality deployment.

2. In the search bar, search for ***Collibra*** and press enter. >> The search results populate.
3. Select **Collibra CDQ**. >> The Collibra CDQ product page opens.
4. Select **Launch**. >> The New Collibra CDQ deployment page opens.
5. In the **New Collibra CDQ deployment** page, specify the following information:



New Collibra CDQ deployment

Deployment name *
your-instance-name

Zone
us-east1-c

Machine type

Machine family

Machine types for common workloads, optimized for cost and flexibility

Series
E2

CPU platform selection based on availability

Machine type
e2-standard-16 (16 vCPU, 64 GB memory)

vCPU	Memory
16	64 GB

Boot Disk

Boot disk type *
Standard Persistent Disk

Boot disk size in GB *
100

Networking

Network interfaces

default default (10.142.0.0/20)

Field	Description
Deployment name	The name of your Collibra Data Quality deployment.
Zone	Select the zone closest to your region.
Series	The default is E2.
Machine type	The default is e2-standard-16 (16 vCPU, 64 GB memory).
Boot disk type	The default is Standard Persistent Disk.
Boot disk size in GB	The default is 100.

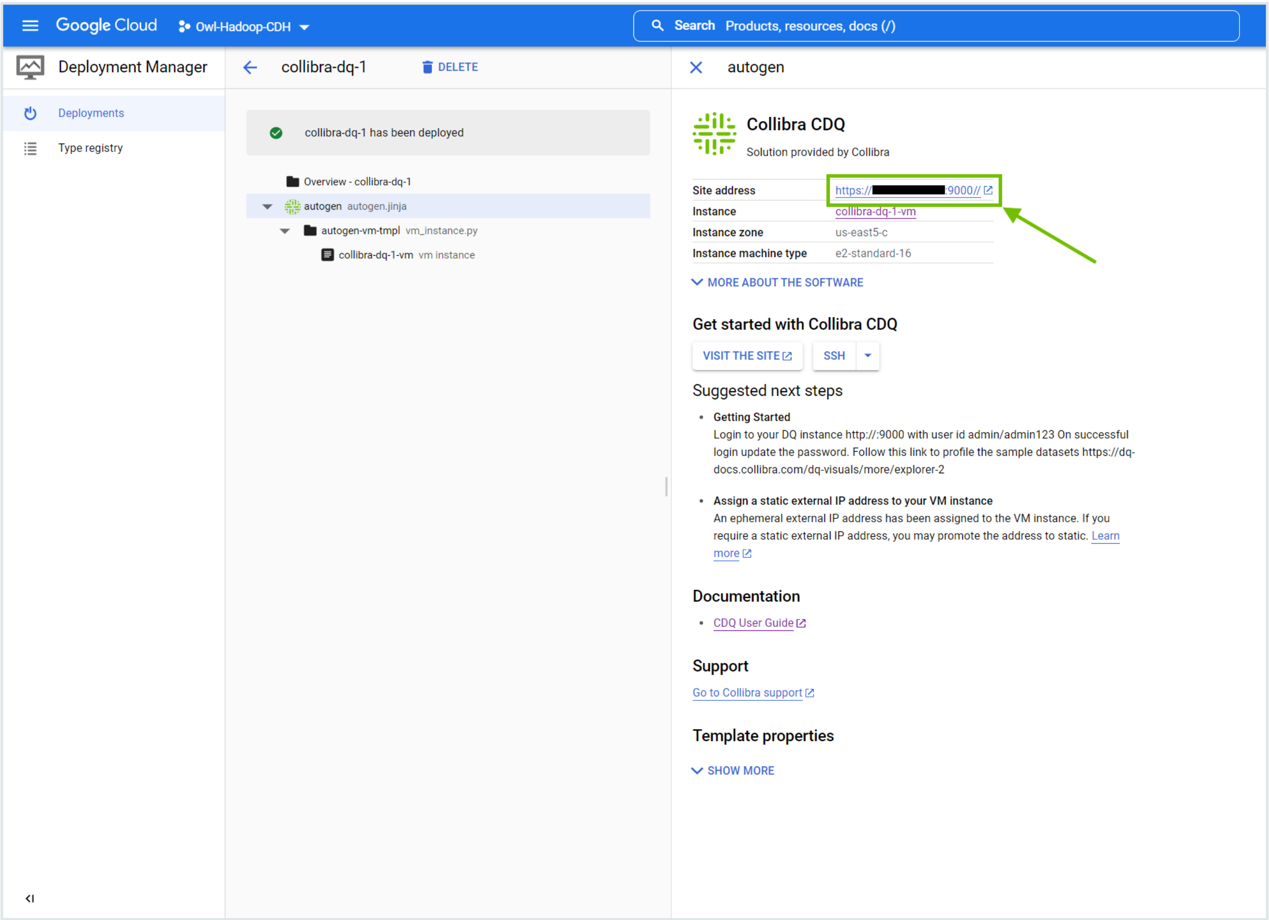
6. Read and accept the **Terms of Service**.

7. Select **Deploy**. >> The **Deployment Manager** page opens.

> **Note** GCP also sends you a confirmation email containing a direct link to the Deployment Manager Page.

Step 2: Launch a new Collibra Data Quality deployment

1. From the **Deployment Manager**, select the **site address** to sign in to your Collibra Data Quality instance.



collibra-dq-1 has been deployed

Collibra CDQ

Solution provided by Collibra

Site address	https://[redacted]:9000//
Instance	collibra-dq-1-vm
Instance zone	us-east5-c
Instance machine type	e2-standard-16

Get started with Collibra CDQ

Suggested next steps

- **Getting Started**
  Login to your DQ instance http://:9000 with user id admin/admin123 On successful login update the password. Follow this link to profile the sample datasets https://dq-docs.collibra.com/dq-visuals/more/explorer-2
- **Assign a static external IP address to your VM instance**
  An ephemeral external IP address has been assigned to the VM instance. If you require a static external IP address, you may promote the address to static. Learn more

Documentation

- CDQ User Guide

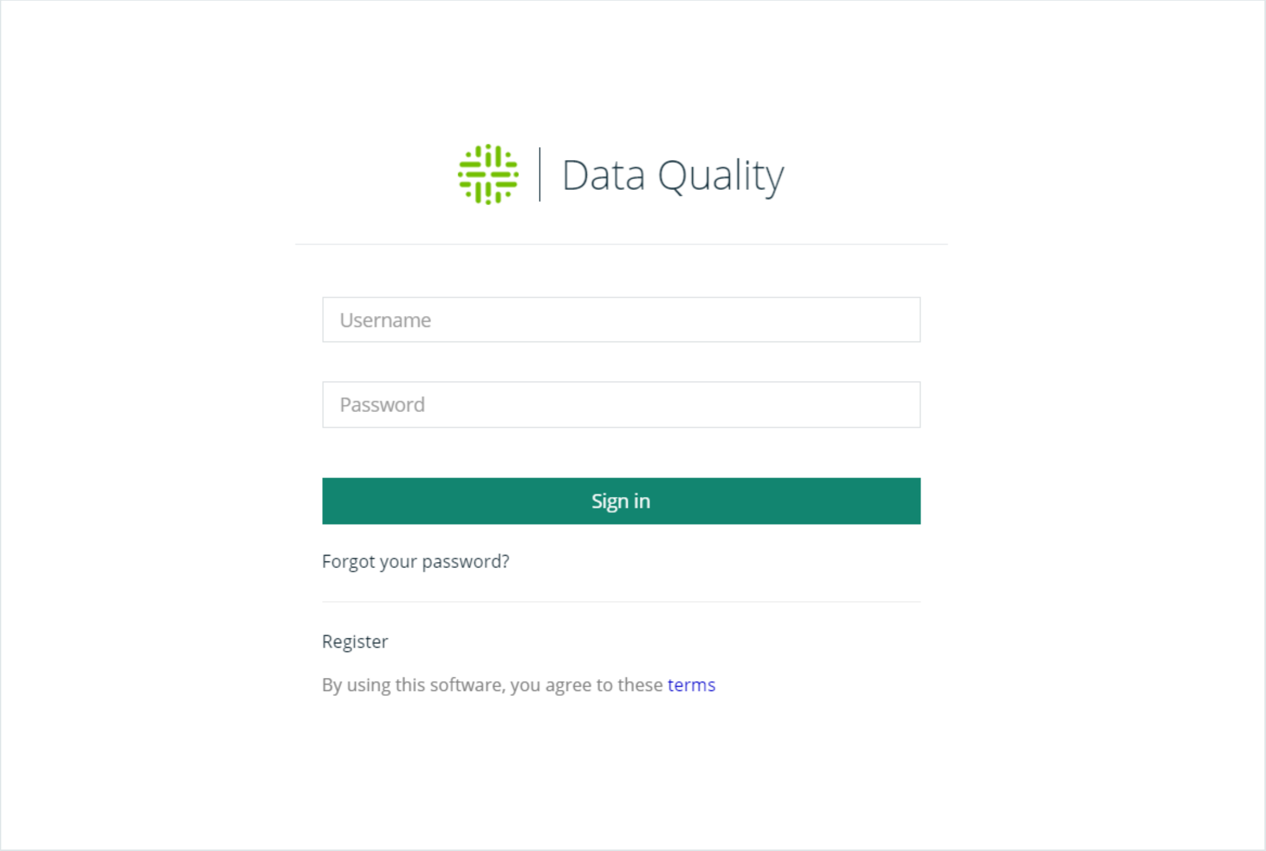
Support

Go to Collibra support

Template properties

2. Sign in to your instance using the following one-time username and password: `admin / admin123` >> The Collibra Data Quality landing page opens.

> **Note** You must change your password after successfully signing in for the first time. Select the avatar in the upper right of your screen and select the Change Password tab and follow the prompts to change your password.



By using this software, you agree to these terms

Troubleshooting your deployment

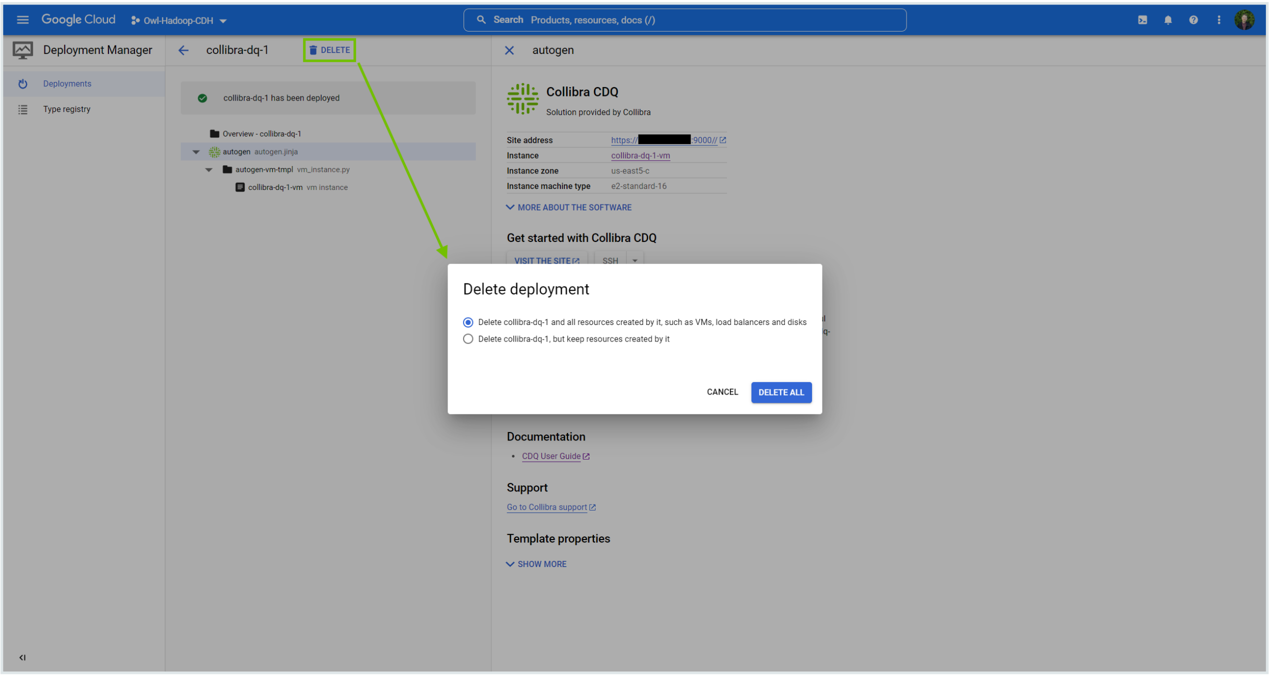
After a successful deployment of Collibra Data Quality on GCP, it is possible that you receive an error message when you select your site address. If this happens, you can:

- Check your network access and verify that you have the appropriate network tags.
- Check that the firewall entry is properly defined for your install.
- Check the URL and remove the **s** from http**s**. Also remove the second trailing forward slash / after :9000. Correct: http://<your.instance>:9000/

Deleting your deployment

To delete your deployment, go to the **Deployment Manager**. Select **Delete** at the top of the screen and then from the dialog box, choose to either

- Delete your deployment and all of its resources.
- Delete your deployment but keep its resources.



collibra-dq-1 has been deployed

Site address	https://[redacted]:9000//
Instance	collibra-dq-1-vm
Instance zone	us-east5-c
Instance machine type	e2-standard-16

Delete deployment

● Delete collibra-dq-1 and all resources created by it, such as VMs, load balancers and disks

○ Delete collibra-dq-1, but keep resources created by it

CANCEL DELETE ALL

When you select a deletion method, your deployment is permanently removed from the list of deployments on the Deployment Manager page.

What's next?

- Visit the Explorer (no-code) for more information on quickly connecting to your data sets.
- Visit Collibra Data Quality's Youtube channel for more tutorials.

Standalone Upgrade

> **Note** Before proceeding with any upgrades, please remember to backup your DQ Metastore.

> **Warning** Please remember that rolling back Collibra DQ to a prior version is not supported. Please contact Collibra Support with any questions.

Download DQ Upgrade Package

> **Note** Beginning December 2021, all Collibra DQ customers upgrading or patching will receive the Full package (vs. the Base package) and should follow the same upgrade steps as below.

Download tarball using the signed link to the full package tarball provided by Collibra. Replace `<signed-link-to-full-package>` with the link provided.

```
### Go to the OWL_BASE (home directory of the user is most com-
mon)
### This example we will use /home/owldq installing as the user
owldq

cd /home/owldq

### Download & untar
curl -o dq-full-package.tar.gz "<signed-link-to-full-package>"
tar -xvf dq-full-package.tar.gz

### Clean-up unnecessary tarball (optional)
rm dq-full-package.tar.gz
```

Upgrade Steps

1. Copy the contents of the provided package e.g. owl-<newversion>-<SPARK301>-package-full.tar.gz to the system being upgraded (extract contents).
    - Best practice: Untar the contents into a uniquely named folder, for example, 2022-10-dq-upgrade.
2. Stop the Collibra DQ Web process with the following commands:
    a. `dc /owlhome/owl/bin`
    b. `./owlmanage.sh stop=owlweb`
3. Stop the Collibra DQ Agent process with the following commands:
    a. `cd /owlhome/owl/bin`
    b. `./owlmanage.sh stop=owlagent`
4. Move the old jars from `owl/bin` with the following commands:
    a. `mv owl-webapp-<oldversion>-<spark301>.jar /tmp`
    b. `mv owl-agent-<oldversion>-<spark301>.jar /tmp`

   c. `mv owl-core-<oldversion>-<spark301>.jar /tmp`
5. Copy the new jars into the owl/bin folder from the extracted package with the following commands:
   a. `mv owl-webapp-<newversion>-<spark301>.jar /home/owldq/owl/bin`
   b. `mv owl-agent-<newversion>-<spark301>.jar /home/owldq/owl/bin`
   c. `mv owl-core-<newversion>-<spark301>.jar /home/owldq/owl/bin`
6. Start the Collibra DQ Web application with the following command:
   - `./owlmanage.sh start=owlweb`
7. Start the Collibra DQ Web application with the following command:
   - `./owlmanage.sh start=owlagent`
8. Validate the number of active services with the following command:

   - `ps -ef | grep owl`

Additional Notes / Steps Due To Log4J (December 2021)

Additional Step 1: Place Log4j-1.2-api-2.17.1.jar (as of 2022.02) into /<install-home>/owl/spark/jars.

> **Note** Was Log4j-1.2-api-2.17.0.jar in 2021.12 and 2022.01.

Who: All Collibra DQ customers, particularly those leveraging CLI mode.

1. Navigate to the same folder where the Collibra provided upgrade package was extracted.
2. Navigate to <location of 2022-02-dq-upgrade>/packages/install-packages.
3. Extract the needed log4j-1.2-api-2.17.1.jar via the command:`tar -xvf spark-extras.tar.gz spark-extras/log4j-1.2-api-2.17.1.jar`.
4. Move the log4j-1.2-api-2.17.1.jar file into /<install-path>/spark/jars folder.

FAQ

Q: (When) do I need to move Log4j-1.2-api-2.17.1.jar before or after swapping the main Collibra DQ jars?

- A: The sequence does not matter.

Q: (What) if I don't follow these additional upgrade steps?

- A: If your `SPARK_SUBMIT_MODE` within owl-env.sh is set to `SPARK_SUBMIT_MODE=native`, Collibra DQ will function properly without the above additional upgrade step, with the exception of CLI mode.

Additional Step 2: Remove a legacy properties file.

Who: Only Collibra DQ customers upgrading Agents installed on Cloudera CDP Hadoop Edge Nodes.

1. Navigate to /<agenthome>/owl/config/.
2. Remove the `log4j-cluster.properties` file.

FAQ

Q: (When) do I need to remove log4j-cluster.properties before or after swapping the main Collibra DQ jars?

- A: Remove the file before restarting owl-agent. Otherwise, stop owl-agent again, remove the file, then restart owl-agent.

Q: (What) if I don't follow these additional steps?

- A:If you use agents on Hadoop edge nodes, you will receive errors when running DQ Jobs as a result of engaging a method that no longer exists.

Q: What should I do if I am not a vendor-supported Cloudera CDP version?

- A: Our testing and guidance mainly applies to vendor-supported (non-EOL) Cloudera CDP versions. Other Hadoop variants may handle logging differently and may require the legacy properties file. In short, feel free to first upgrade without this step, then remove the log4j-cluster.properties file if DQ Jobs are running into issues.

Upgrading data source drivers

When new data source drivers are available, they are listed in the Release Notes or recommended to you directly by Collibra. Determine which drivers need to be updated and follow these steps:

1. Confirm with Collibra Support which drivers need to be updated.
2. From the previously extracted tarball provided to you by Collibra, locate the drivers.tar.gz file and extract the contents into a new directory called "drivers".
3. Replace the drivers:
    - Replace OWL_BASE/owl/drivers/<old-driver> with the new drivers extracted from the tarball OWL_BASE/owl/drivers/<new-driver>.
      For example, if you replace an old Databricks driver with a new one, the file path might look like OWL_BASE/owl/drivers/databricks.

Standalone Sizing

Small Tier - 16 Core, 128G RAM (r5.4xlarge / E16s v3)

Component	RAM	Cores
Web	2g	2
Postgres	2g	2
Spark	100g	10
Overhead	10g	2

Medium Tier - 32 Core, 256G RAM (r5.8xlarge / E32s v3)

Component	RAM	Cores
Web	2g	2
Postgres	2g	2
Spark	250g	26
Overhead	10g	2

Large Tier - 64 Core, 512G RAM (r5.16xlarge / E64s v3)

Component	RAM	Cores
Web	4g	3
Postgres	4g	3
Spark	486g	54
Overhead	18g	4

Estimates

Sizing should allow headroom and based on peak concurrency and peak volume requirements. If concurrency is not a requirement, you just need to size for peak volume (largest tables). Best practice to efficiently scan is to scope the job by selecting critical columns. See Performance Tuning for more information.

Bytes per Cell	Rows	Columns	Gigabytes	Gigabytes for Spark (3x)
16	1,000,000.00	25	0.4	1.2
16	10,000,000.00	25	4	12
16	100,000,000.00	25	40	120
16	1,000,000.00	50	0.8	2.4
16	10,000,000.00	50	8	24
16	100,000,000.00	50	80	240
16	1,000,000.00	100	1.6	4.8
16	10,000,000.00	100	16	48
16	1,000,000,000.00	100	1600	4800
16	100,000,000.00	100	160	480

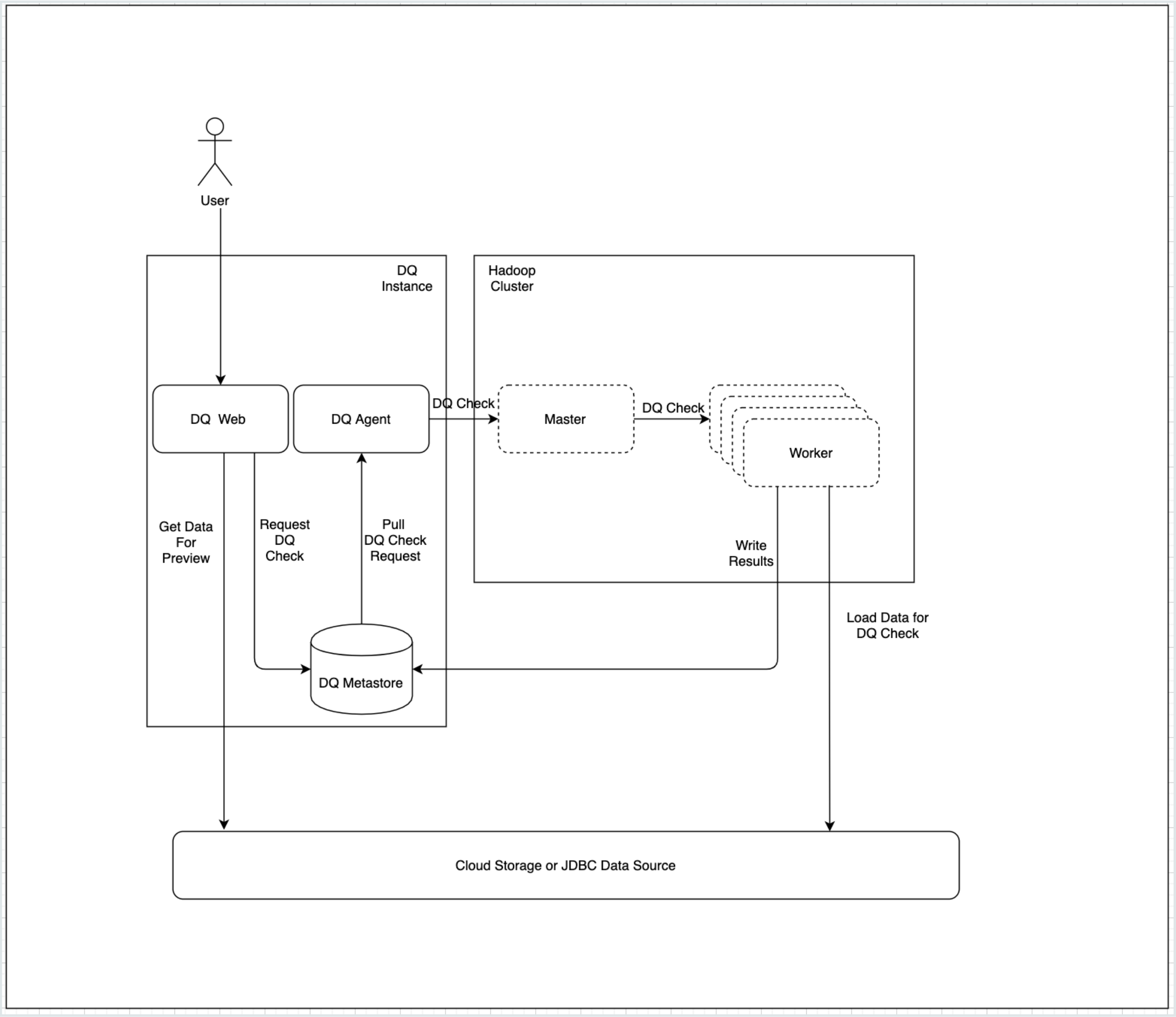
Bytes per Cell	Rows	Columns	Gigabytes	Gigabytes for Spark (3x)
16	1,000,000.00	200	3.2	9.6
16	10,000,000.00	200	32	96
16	100,000,000.00	200	320	960
16	1,000,000,000.00	200	3200	9600

Cluster

If your program requires more horsepower or (spark) workers than the example tiers above which is fairly common in Fortune 500 companies then you should consider the horizontal and ephemeral scale of a cluster. Common examples are Amazon EMR, Cloudera CDP, etc. Collibra DQ is built to scale up horizontally and can scale to hundreds of nodes.

Hadoop

For large scale processing and concurrency, a single vertically scaled Spark server is not enough. To address large scale processing, DQ has the ability to push compute to an external Hadoop cluster. This page describes the process by which the DQ Agent can be configured to push DQ jobs to Hadoop.



Hadoop Install

> **Note** In some cases, the required Hadoop client configuration requires the DQ Agent to run on an Hadoop Edge node within the cluster. This can happen because native dependency packages are required, network isolation from subnet that is hosting DQ server, complex security configuration, ect. In these circumstances, simply deploy the DQ Agent on a cluster Edge Node that contains the required configurations and packages. In this setup, the DQ Agent will use the existing Hadoop configuration and packages to run DQ checks on the Hadoop cluster.

Hadoop Config Setup

Hadoop configuration can be incredibly complex. There can be hundreds of "knobs" across dozens of different components. However, DQ's goal is to simply leverage Hadoop to allocate compute resources in order to execute DQ checks (Spark jobs). This means that the only client side configurations required are:

- Security protocol definition
- Yarn Resource Manager endpoints
- Storage service (HDFS or Cloud storage).

Once the Hadoop client configuration is defined, it is only a matter of pointing the DQ Agent at the folder that contains the client configuration files. The DQ Agent is then able to use the Hadoop client configuration to submit jobs to the specified Hadoop cluster.

> **Note** DQ jobs running on Hadoop are Spark jobs. DQ will use the storage platform defined in the "fs.defaultFS" setting to distribute all of the required Spark libraries and specified dependency packages like drivers files. This allows DQ to use a version of Spark that is different than the one provided by the cluster. If it is a requirement to use the Spark version provided by the target Hadoop cluster, obtain and use a copy of the yarn-site.xml and core-site.xml from the cluster.

Create Config Folder

```
cd $OWL_HOME
mkdir -p config/hadoop
echo "export HADOOP_CONF_DIR=$OWL_HOME/config/hadoop" >> config/owl-env.sh
bin/owlmanage.sh restart=owlagent
```

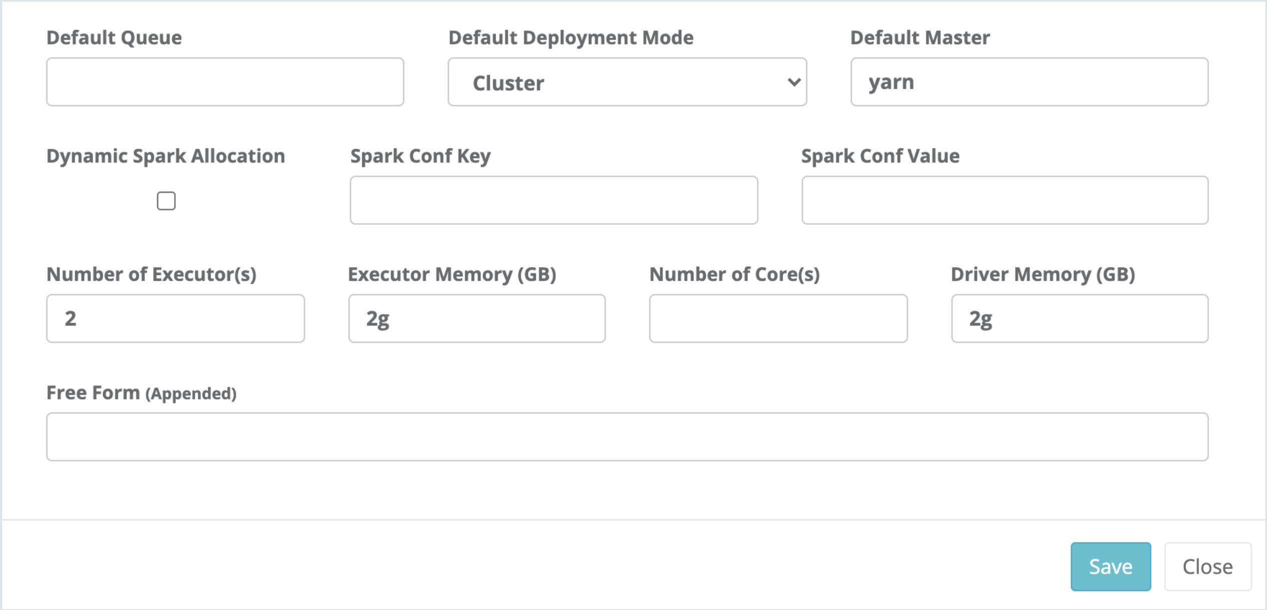
Minimum Config (Kerberos Disabled, TLS Disabled)

This configuration would typical only be applicable in Cloud Hadoop scenarios (EMR/Dataproc/HDI). Cloud Hadoop clusters are ephemeral and do not store any data as the data is stored in and is secured by Cloud Storage.

```
export RESOURCE_MANAGER=<yarn-resoruce-manager-host>
export NAME_NODE=<namenode>

echo "
<configuration>
  <property>
    <name>hadoop.security.authentication</name>
    <value>simple</value>
  </property>
  <property>
    <name>hadoop.rpc.protection</name>
    <value>authentication</value>
  </property>
  <property>
    <name>fs.defaultFS</name>
    <value>hdfs://$NAME_NODE:8020</value>
  </property>
</configuration>
" >> $OWL_HOME/config/hadoop/core-site.xml

echo "
<configuration>
  <property>
    <name>yarn.resourcemanager.scheduler.address</name>
    <value>$RESOURCE_MANAGER:8030</value>
  </property>
  <property>
    <name>yarn.resourcemanager.address</name>
    <value>$RESOURCE_MANAGER:8032</value>
  </property>
  <property>
    <name>yarn.resourcemanager.webapp.address</name>
    <value>$RESOURCE_MANAGER:8088</value>
  </property>
</configuration>
" >> $OWL_HOME/config/hadoop/yarn-site.xml
```

> **Note** When deploying a Cloud Service Hadoop cluster from any of the major Cloud platforms, it is possible to use Cloud Storage rather than HDFS for dependency package staging and distribution. To achieve this, create a new storage bucket and ensure that both the Hadoop cluster and the instance running DQ Agent have access to it. This is usually accomplished using a Role that is attached to the infrastructure. For example, AWS Instance Role with bucket access policies. Then, set "fs.defaultFS" in core-site.xml to the bucket path instead of HDFS.

Once the Hadoop client configuration has been created, navigate to Agent Management console from the Admin Console and configure the agent to use Yarn (Hadoop resource scheduler) as the Default Master and set the Default Deployment Mode to "Cluster".



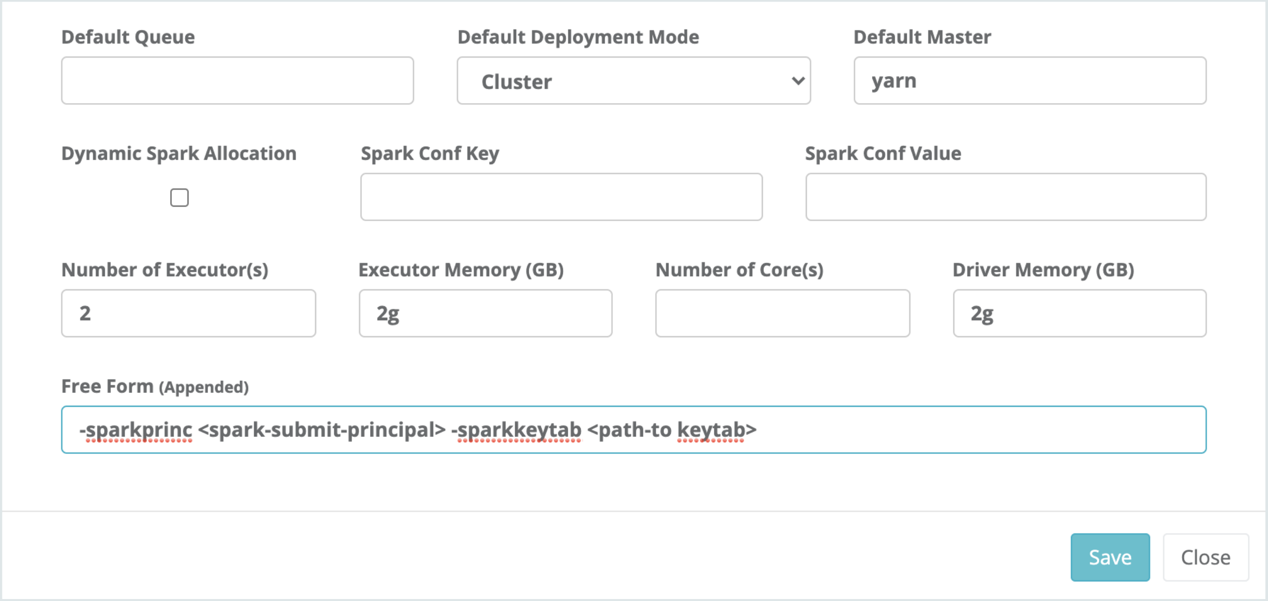
Default Queue	Default Deployment Mode	Default Master	
	Cluster	yarn	
Dynamic Spark Allocation	Spark Conf Key	Spark Conf Value	
☐			
Number of Executor(s)	Executor Memory (GB)	Number of Core(s)	Driver Memory (GB)
2	2g		2g
Free Form (Appended)			

Kerberos Secured with Resource Manager TLS enabled

Typically, Hadoop cluster that are deployed on-premises are multi-tenant and not ephemeral. This means they must be secured using Kerberos. In addition, all endpoints with HTTP endpoints will have TLS enabled. In addition HDFS may be configured for a more secure communication using additional RPC encryption.

```
export RESOURCE_MANAGER=<yarn-resoruce-manager-host>
export NAME_NODE=<namenode>
export KERBEROS_DOMAIN=<kerberos-domain-on-cluster>
export HDFS_RPC_PROTECTION=<authentication || privacy || integrity>

echo "
<configuration>
  <property>
    <name>hadoop.security.authentication</name>
    <value>kerberos</value>
  </property>
  <property>
    <name>hadoop.rpc.protection</name>
    <value>$HDFS_RPC_PROTECTION</value>
  </property>
  <property>
    <name>fs.defaultFS</name>
    <value>hdfs://$NAME_NODE:8020</value>
  </property>
</configuration>
" >> $OWL_HOME/config/hadoop/core-site.xml

echo "
<configuration>
  <property>
    <name>hadoop.security.authentication</name>
    <value>HDFS/_HOST@$KERBEROS_DOMAIN</value>
  </property>
</configuration>
" >> $OWL_HOME/config/hadoop/hdfs-site.xml

echo "
<configuration>
  <property>
    <name>yarn.resourcemanager.scheduler.address</name>
    <value>$RESOURCE_MANAGER:8030</value>
  </property>
  <property>
    <name>yarn.resourcemanager.address</name>
    <value>$RESOURCE_MANAGER:8032</value>
  </property>
  <property>
    <name>yarn.resourcemanager.webapp.https.address</name>
    <value>$RESOURCE_MANAGER:8090</value>
  </property>
</configuration>
" >> $OWL_HOME/config/hadoop/yarn-site.xml
```

When the target Hadoop cluster is secured by Kerberos, DQ checks require a Kerberos credential. This typically means that the DQ Agent will need to be configured to include a Kerberos keytab with each DQ check. Access the DQ Agent configuration page from the Admin Console and configure the "Freeform Append" setting with the -sparkprinc <spark-submit-principal> -sparkkeytab <path-to-keytab>.



Default Queue:

Default Deployment Mode: Cluster

Default Master: yarn

Dynamic Spark Allocation: □

Spark Conf Key:

Spark Conf Value:

Number of Executor(s): 2

Executor Memory (GB): 2g

Number of Core(s):

Driver Memory (GB): 2g

Free Form (Appended): -sparkprinc <spark-submit-principal> -sparkkeytab <path-to keytab>

EMR / Dataproc / HDI

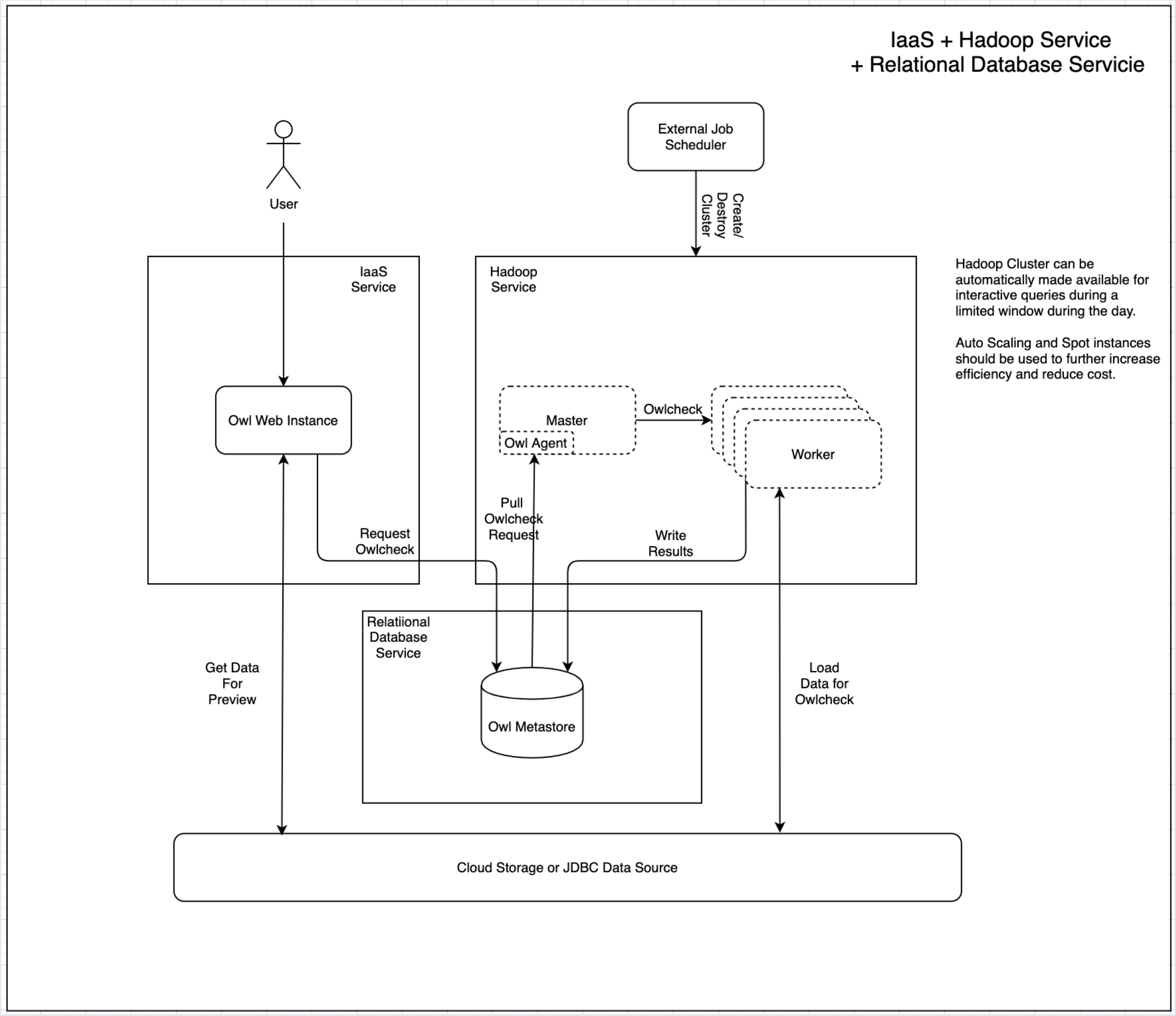
Running Apache Spark on Kubernetes differs from running this on virtual machine-based Hadoop clusters, which is the current mechanism provided by the existing CloudProc Dataproc service or competitive offerings like Amazon Web Services (AWS) Elastic MapReduce (EMR) and Microsoft's Azure HDInsight (HDI).

Each cloud provider will have unique steps and configuration options. More detail on enabling agents for this deployment option be found in the Hadoop Integration section.

A detailed guide for EMR is provided below.

Collibra Data Quality & Observability on EMR Architecture

Collibra DQ is able to use EMR as the compute space for data quality jobs (Owlchecks). While it is possible to simply operate a long running EMR cluster, EMR's intended operation model is ephemeral infrastructure. Using EMR as an ephemeral compute space is the most cost effective approach both in terms of operational effort and infrastructure costs. Collibra DQ makes it possible to seamlessly leverage EMR in this operating model. When there is not an EMR cluster available, Collibra DQ users are still able to browse datasets and DQ results in Web. However, if a user attempts to deploy an Owlcheck, they will simply see a red light icon next to the target agent. If the user still wants to request an Owlcheck, it will simply wait in queue until the target agent comes back online the next time an EMR cluster is available.


IaaS + Hadoop Service
+ Relational Database Servicie
External Job Scheduler
Create/ Destroy Cluster
User
IaaS Service
Hadoop Service
Hadoop Cluster can be automatically made available for interactive queries during a limited window during the day.
Auto Scaling and Spot instances should be used to further increase efficiency and reduce cost.
Owl Web Instance
Master
Owl Agent
Owlcheck
Worker
Pull Owlcheck Request
Request Owlcheck
Write Results
Relatiional Database Service
Owl Metastore
Get Data For Preview
Load Data for Owlcheck
Cloud Storage or JDBC Data Source

Prepare for Deployment

> **Note** Before enabling Collibra DQto use EMR as the compute space, make sure that Owl Web and the Owl Metastore are already deployed (https://docs.owl-analytics.com/installation/full-install).

1. Create a "bootstrap bucket" location in S3 where Collibra DQ binaries and bootstrap script (install-agent-emr.sh) will be staged. The EMR cluster instances will need to include an attached Role that has access to this location in order to bootstrap the cluster. This location should not contain any data or any kind of sensitive materials and thus should not require any special permissions. It just needs to be accessible by EMR clusters for bootstrap purposes.
2. Create or modify an instance Profile Role that will be attached to EMR clusters so that it enables read access to the bootstrap bucket location. This Role is separate from the EMR service role that EMR will use to deploy the infrastructure.
3. Stage the bootstrap script and the Collibra DQ binary package in the bootstrap location created above.
4. Make sure that the VPC where the Collibra DQ Metastore is deployed is accessible from the VPC where EMR clusters will be deployed.
5. Make sure that Security Groups applied to the Collibra DQ Metastore are configured to allow access from EMR master and worker Security Groups.
6. Decide whether to use EMR 5.x or EMR 6.x. This is important because EMR 6 introduces Spark 3 and Scala 2.12. If EMR 6 is chosen, make sure Collibra DQ binaries were compiled for Spark 3 and Scala 2.12.
7. (OPTIONAL) Create and store a private key to access EMR instances.

Deploy EMR Cluster

There are several ways to deploy EMR, however, for dev-ops purposes, the simplest path is usually to use the AWS CLI utility. The example below will deploy and EMR cluster bootstrapped with Collibra DQ binaries and a functioning agent to deploy Owlchecks.

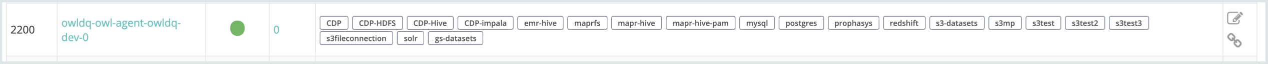
> **Note** When defining the Bootstrap Location argument, do not include "s3://". For example: If Bootstrap Location is s3://bucket/prefix then BOOTSTRAP_ LOCATION="bucket/prefix".

```
aws emr create-cluster \
--auto-scaling-role EMR_AutoScaling_DefaultRole \
--applications Name=Hadoop Name=Spark Name=Hive Name=Tez \
--name owl-emr \
--release-label emr-6.2.0 \
--region ${EMR_REGION} \
--ebs-root-volume-size 10 \
--scale-down-behavior TERMINATE_AT_TASK_COMPLETION \
--enable-debugging \
--bootstrap-actions \
"[{\"Path\":\"s3://${BOOTSTRAP_LOCATION}/install-agent-emr.sh\",
\
\"Args\":[ \
\"${OWL_VERSION}\", \
\"${OWL_AGENT_ID}\", \
\"${METASTORE_HOST}:${METASTORE_PORT}/${METASTORE_DB}?-
currentSchema=owlhub\", \
\"${METASTORE_USER}\", \
\"${METASTORE_PASSWORD}\", \
\"${BOOTSTRAP_LOCATION}\", \
\"${LICENSE_KEY}\", \
\"native\"], \"Name\":\"install-owl-agent\"}]" \
--ec2-attributes "{ \
\"KeyName\":\"${EMR_INSTANCE_PRIVATE_KEY_NAME}\", \
\"InstanceProfile\":\"${BOOTSTRAP_ACCESS_ROLE}\", \
\"SubnetId\":\"${EMR_SUBNET}\", \
\"EmrManagedSlaveSecurityGroup\":\"${EMR_WORKER_SECURITY_
GROUP}\", \
\"EmrManagedMasterSecurityGroup\":\"${EMR_WORKER_SECURITY_
GROUP}\" \
}" \
--service-role ${EMR_SERVICE_ROLE} \
--log-uri s3n://${EMR_LOG_LOCATION} \
--instance-groups "[ \
{\"In-
stanceCoun-
t\":1,\"InstanceGroupType\":\"MASTER\",\"InstanceType\":\"${EMR_
MASTER_INSTANCE_TYPE}\",\"Name\":\"Master - 1\"}, \
{\"In-
stanceCoun-
t\":3,\"InstanceGroupType\":\"CORE\",\"InstanceType\":\"${EMR_
CORE_INSTANCE_TYPE}\",\"Name\":\"Core - 2\"} \
]"
```

Configure Agent

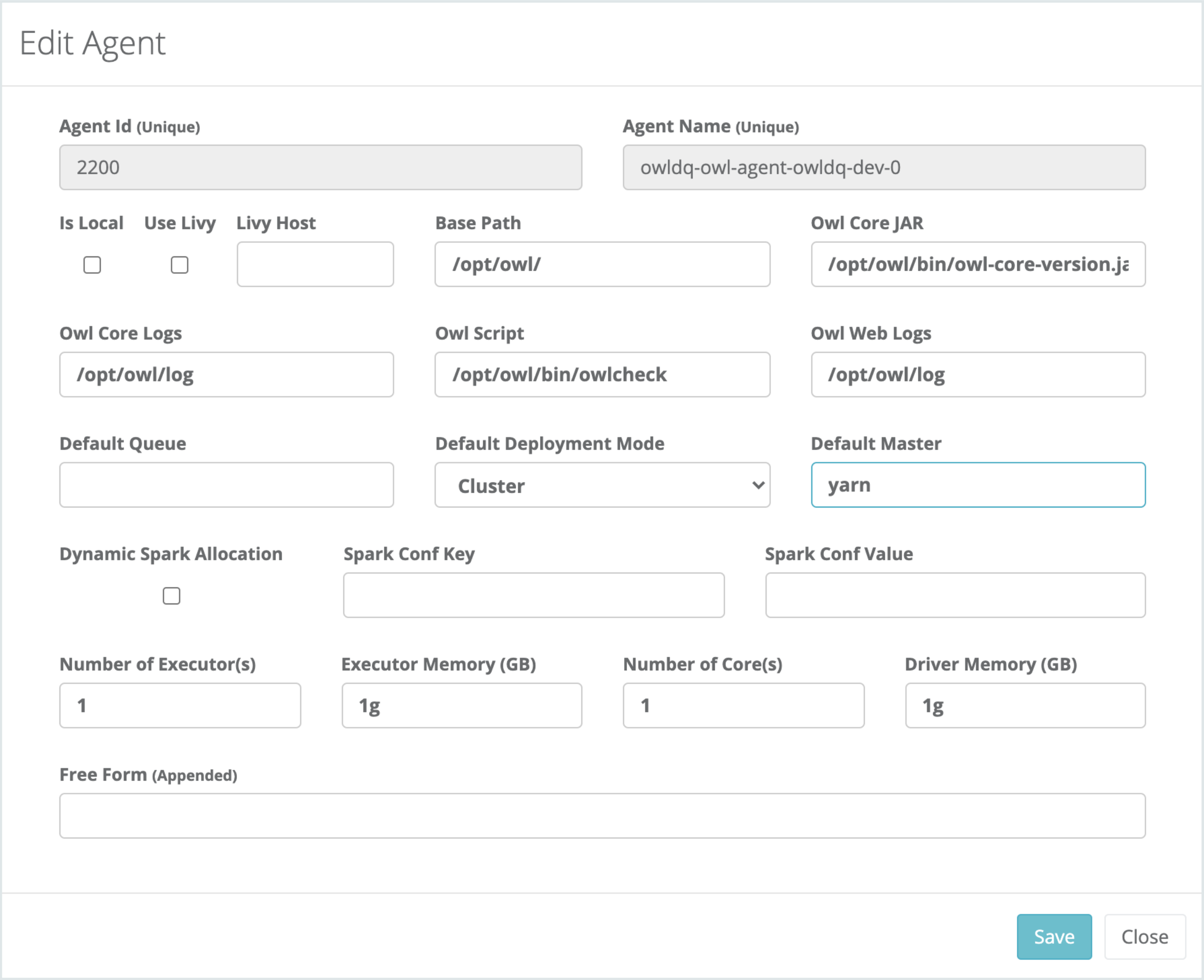
Once the EMR cluster and Owl Agent is deployed, it needs to be configured in Owl Web.

1. Log into Owl Web, click the gear icon in the Navigation Pane and select "Admin Console".
2. In the Admin Console, click on the "Remote Agent" tile.
3. The newly created agent should have a green light icon.



2200	owldq-owl-agent-owldq-dev-0	●	0	CDP CDP-HDFS CDP-Hive CDP-impala emr-hive maprfs mapr-hive mapr-hive-pam mysql postgres prophasys redshift s3-datasets s3mp s3test s3test2 s3test3 s3fileconnection solr gs-datasets	

4. Click the Pen/Pencil icon to the far right to configure the agent's settings. Make sure that Deploy Mode is set to "Cluster" and Default Master is set to "yarn".



Edit Agent

Agent Id (Unique): 2200

Agent Name (Unique): owldq-owl-agent-owldq-dev-0

Is Local: □

Use Livy: □

Livy Host:

Base Path: /opt/owl/

Owl Core JAR: /opt/owl/bin/owl-core-version.ja

Owl Core Logs: /opt/owl/log

Owl Script: /opt/owl/bin/owlcheck

Owl Web Logs: /opt/owl/log

Default Queue:

Default Deployment Mode: Cluster

Default Master: yarn

Dynamic Spark Allocation: □

Spark Conf Key:

Spark Conf Value:

Number of Executor(s): 1

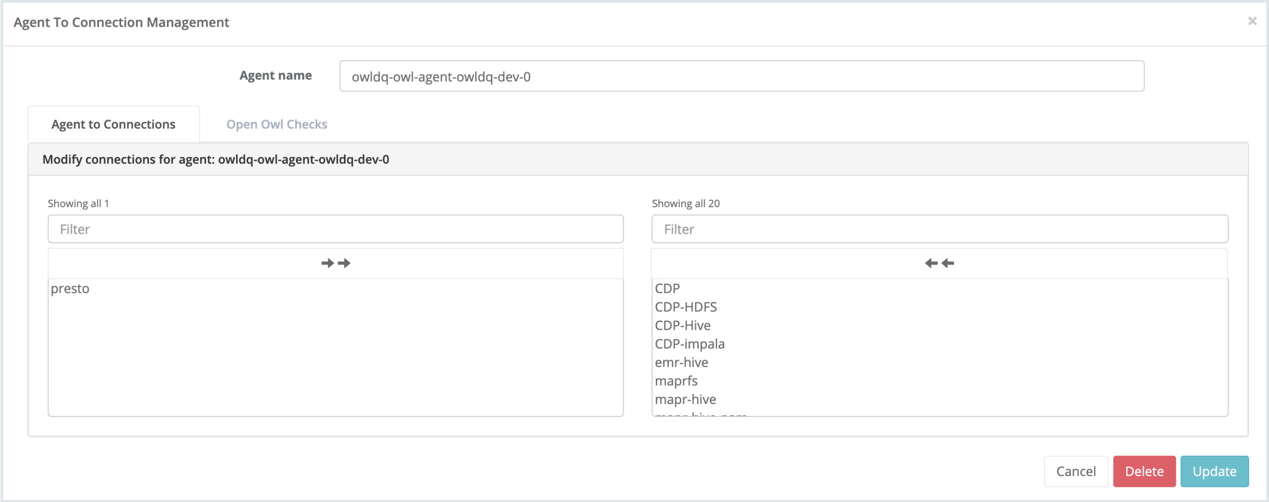
Executor Memory (GB): 1g

Number of Core(s): 1

Driver Memory (GB): 1g

Free Form (Appended):

5. Click the chain link icon to the far right to configure what datasources the agent is able to deploy Owlchecks for.



Agent To Connection Management

Agent name: owldq-owl-agent-owldq-dev-0

Agent to Connections | Open Owl Checks

Modify connections for agent: owldq-owl-agent-owldq-dev-0

Showing all 1

Filter

presto

Showing all 20

Filter

CDP
CDP-HDFS
CDP-Hive
CDP-impala
emr-hive
maprfs
mapr-hive

Any datasources that are not listed in the right hand pane will not be visible to this agent.

Run Owlchecks

Everything is now ready for users to use EMR to run Owlchecks on data. Review Explorer documentation for detailed instructions.

Explorer (no-code)

Cloud native

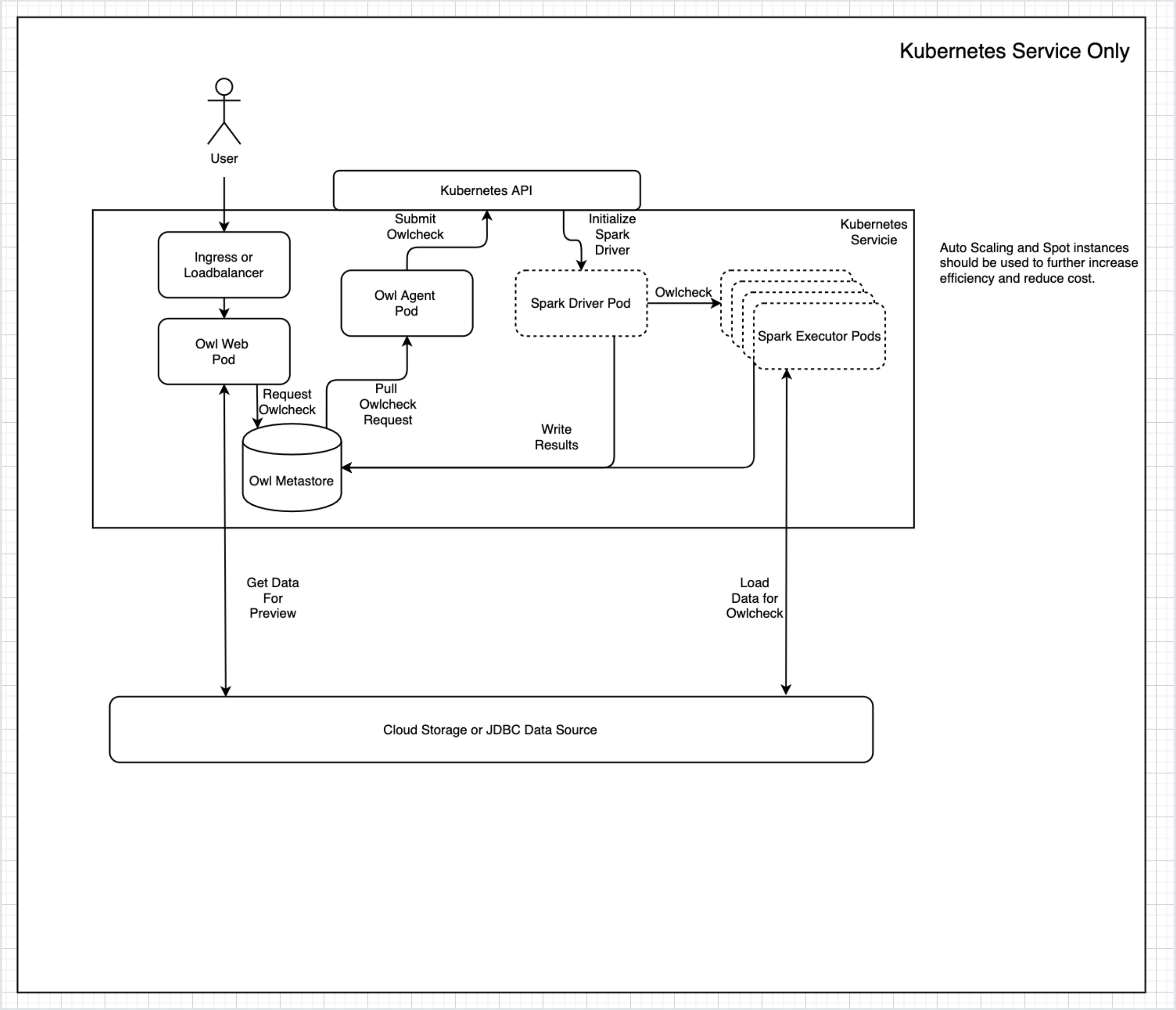
Introduction to cloud native architecture

According to the Cloud Native Computing Foundation ("CNCF") Charter:

Cloud native technologies empower organizations to build and run scalable applications in modern, dynamic environments such as public, private, and hybrid clouds. Containers, service meshes, microservices, immutable infrastructure, and declarative APIs exemplify this approach.

These techniques enable loosely coupled systems that are resilient, manageable, and observable. Combined with robust automation, they allow engineers to make high-impact changes frequently and predictably with minimal toil.

Collibra Data Quality wholeheartedly embraces these principles in its design and deployment. The diagram below depicts Collibra Data Quality & Observability's cloud native deployment architecture:



In this "form factor", you can deploy Collibra DQ in any public or private cloud while maintaining a consistent experience, performance, and management runbook.

Collibra DQ microservices

To achieve cloud native architecture, Collibra DQ is decomposed into several components, each of which is deployed as a microservice in a container.

- **Owl Web** - The main point of entry and interaction between Collibra DQ and end users or integrated applications. Owl Web provides both a rich, interactive user experience and a robust set of APIs for automated integration.
- **Owl Agent** - You can think of the Agent as the "foreman" of Collibra DQ. When a user or application requests a data quality check through Owl Web, Owl Agent will marshal compute resources to perform the work. Owl Agent does not actually do any of the data quality work. Instead, it translates the request submitted by Owl Web into a technical descriptor of the work that needs to be done and then launches the requested DQ job.
- **Owl Metastore** - This is where Collibra DQ stores all the metadata, statistics, and results of DQ jobs. It is also then main point of communication between Owl Web and Owl Agent. The metastore also contains the results of DQ jobs performed by transient containers (workers) in the compute space.
- **History Server** - Collibra DQ relies on Apache Spark to actually scan data and perform the bulk of data quality activities. To facilitate troubleshooting and performance tuning of DQ jobs, Collibra DQ uses an instance of Spark History Server to enable easy access to Spark logs.
- **Spark** - Apache Spark is the distributed compute framework that powers the Collibra DQ data quality engine. Spark enables DQ jobs to rise to the task of data quality on Terabyte scale datasets. Spark containers are completely ephemeral and only live for as long as necessary to complete a given DQ job.

Containerization

The binaries and instruction sets described in each of the Collibra DQ microservices are encompassed within Docker container images. Each of the images is versioned and maintained in a secured cloud container registry repository. To initiate a Collibra DQ cloud native deployment, you must first obtain credentials to either pull the containers directly or download them to a private container registry.

> **Warning** Support for Collibra DQ cloud native deployment is limited to deployments using the containers provided from the Collibra container registry.
>
> Reach out to your customer contact for access to pull the Collibra containers.

Kubernetes

Kubernetes is a distributed container scheduler and has become synonymous with cloud native architecture. While Docker containers provide the logic and runtime at the application layer, most applications still require network, storage, and orchestration between multiple hosts in order to function. Kubernetes provides all of these facilities while abstracting away all of the complexity of the various technologies that power the public or private cloud hosting the application.

Collibra DQ Helm chart

While Kubernetes currently provides the clearest path to gaining the benefits of a cloud native architecture, it is also one of the more complex technologies in existence. This has less to do with Kubernetes itself and more with the complexity of the constituent technologies it is trying to abstract. Technologies like attached distributed storage and software defined networks are entire areas of specialization that require extensive expertise to navigate. Well implemented Kubernetes platforms hide all of this complexity and make it possible for anyone to leverage these powerful concepts. However, a robust application like Collibra DQ requires many descriptors (K8s manifests) to deploy its various components and all of the required supporting resources like network and storage.

This is where Helm comes in. Helm is a client side utility (since v3) that automatically generates all the descriptors needed to deploy a cloud native application. Helm receives instructions in the form of a **Helm chart** that includes templated and parameterized versions of Kubernetes manifests. Along with the Helm chart, you can also pass arguments like names of artifacts, connection details, enable and disable commands, and so on. Helm resolves the user defined parameters within the manifests and submits them to Kubernetes for deployment. This enables you to deploy the application without necessarily having a detailed understanding of the networking, storage or compute that underpins the application.

For example, the command below deploys Collibra DQ with all of the components depicted in the Introduction to cloud native architecture into Google Kubernetes Engine with Google Cloud Storage (GCS) as the storage location for Spark logs. The only perquisite is that the image pull secret, representing credentials to access the container registry, and secret containing the credentials for a service account with access to GCS are already deployed to the namespace.

```
helm upgrade --install --namespace <namespace> \
--set global.version.owl=<owl-version> \
--set global.version.spark=<owl-spark-version> \
--set global.configMap.data.license_key=<owl-license-key> \
--set global.spark_history.enabled=true \
--set global.spark_history.logDirectory=gs://logs/spark-history/
\
--set global.cloudStorage.gcs.enableGCS=true \
<deployment-name> \
/path/to/chart/owldq
```

> **Note** The full universe of possible customizations is quite extensive and provides a great deal of flexibility in order to be applicable in a wide variety of platforms. However, when deploying on a known platform (EKS, GKE, AKS), the number of required inputs is quite limited. In common cases, you run a single CLI command including basic parameters like disable history server, configure the storage bucket for logs, specify the image repository, and so on.

Cloud native requirements

Minimum requirements

You need a machine with the following files and packages to run the installation. You can run these from a laptop or separate VM and they do not need to be issued on the Kubernetes cluster itself.

Prerequisites

- Helm
- kubectl
- Cloud command line SDK, such as gcloud CLI, AWS CLI or similar

Files

- The helm chart.
- JKS files with secrets created in kubectl:
  - *owldq-ssl-secret*
  - *owldq-pull-secret**
- A *spark-gcs-secret* you create from your service account file or token.

> **Note** * Available upon request from Collibra.

Application system requirements

Component	Processor	Memory	Storage
Owl Web	1 core	2 GB	10 MB PVC
Owl Agent	1 core	1 GB	100 MB PVC
Owl Metastore	1 core	2 GB	10 GB PVC
Spark*	2 cores	2 GB	-

> **Note** * This is the minimum quantity of resources required to run an a Spark job in Kubernetes. This amount of resources would only provide the ability to scan a few megabytes of data with no more than a single job running at a given time. Proper sizing of the compute space must take into account the largest dataset that may be scanned, as well as the desired concurrency.

Network service considerations

Owl Web is the only required component that needs to be directly accessed from outside of Kubernetes. History Server is the only other component that can be accessed directly by users, however, it is optional.

If the target Kubernetes platform supports a LoadBalancer service type, you can configure the Helm chart to directly deploy the externally accessible endpoint.

> **Note** For testing purposes, you can also configure the Helm chart to deploy a NodePort service type.

For the Ingress service type, deploy OwlDQ without an externally accessible service and then attach the Ingress service separately. This applies when you use a third-party Ingress controller such as NGINX, Contour, etc.

> **Note** The Helm chart is able to deploy an Ingress on GKE and EKS platforms, however, there is a wide variety of possible Ingress configurations that have not been tested.

Obtaining credentials

Kubernetes stores credentials in the form of secrets. Secrets are base64 encoded files that you can mount into application containers and that application components can reference at runtime. You use *pull secrets* to access secured container registries to obtain application containers.

SSL certificates

To enable SSL for secure access to Owl Web, a keystore that contains a signed certificate, keychain, and private key is required. This keystore must be available in the target namespace before you deploy Collibra DQ.

> **Note** By default, Collibra DQ looks for a secret called `owldq-ssl-secret` to find the keystore.

> **Note** Although it is possible to deploy with SSL disabled, is not recommended.

Cloud storage credentials

If you enable History Server, a distributed filesystem is required. Currently, Collibra DQ supports S3 and GCS for Spark history log storage.

> **Note** Azure Blob and HDFS on the near term roadmap.

Target storage system	Credentials requirements
S3	An IAM Role with access to the target bucket needs to be attached to the Kubernetes nodes of the namespace where Collibra DQ is being deployed.
GCS	You must create a secret from the JSON key file of a service account with access the the log bucket. The secret must be available in the namespace before you deploy Collibra DQ. By default, Collibra DQ looks for a secret called `spark-gcs-secret`, if GCS is enabled for Spark history logs. You can change this via a helm chart argument.

Container pull secret

Collibra Data Quality & Observability containers are stored in a secured repository in Google Container Registry. For Collibra DQ to successfully pull the containers when deployed, a pull secret with access to the container registry must be available in the target namespace.

> **Note** By default, Collibra DQ looks for a pull secret named `owldq-pull-secret`. You can change this via a helm chart argument.

Spark service account

To enable Owl Agent and the Spark driver to create and destroy compute containers, you must have a service account with a role that allows get/list/create/delete operations on pods/services/secrets/configMaps in the target namespace. By default, Collibra DQ attempts to create the required service account and the required RoleBinding to the default Edit role. Edit is a role that is generally available in a Kubernetes cluster. If the Edit role is not available, you can manually create it.

Accessing the platform

To deploy anything to a Kubernetes cluster, the first step is to install the required client utilities and configure access:

- **kubectl**: The main method of communication with a Kubernetes cluster. All configuration or introspection tasks will be preformed using kubectl.
- **helm v3**: Used to deploy the OwlDQ helm chart without hand coding manifests.

After you install the utilities, the next step is to configure a kube-context that points to and authenticates to the target platform. On cloud platforms like GKE and EKS, this process is completely automated through their respective CLI utilities.

```
aws eks --region <region-code> update-kubeconfig --name
<cluster_name>
```

```
gcloud container clusters get-credentials <cluster-name>
```

In private clouds, this process will vary from organization to organization, however, the platform infrastructure team should be able to provide the target kube-context entry.

Preparing secrets

Once access to the target platform is confirmed, you can begin the preparation of the namespace. Typically the namespace that Collibra DQ is going to be deployed into is pre-allocated by the platform team.

```
kubectl create namespace <namespace>
```

> **Note** There is a lot more that can go into namespace creation such as resource quota allocation, but that is generally a task for the platform team.

Create an SSL keystore secret

```
kubectl create secret generic owldq-ssl-secret \
--from-file /path/to/keystore.jks \
--namespace <namespace>
```

> **Warning** The file name that you use in the `--from-file` argument should be *keystore.jks*. If the file name is anything else, you must include an additional argument specifying the keystore file name in the Helm command.

Create a container pull secret

JSON key file credential

```
kubectl create secret docker-registry owldq-pull-secret \
--docker-server=<owldq-registry-server> \
--docker-username=_json_key \
--docker-email=<service-account-email> \
--docker-password="$(cat /path/to/key.json)" \
--namespace <namespace>
```

Short lived access token

```
kubectl create secret docker-registry owldq-pull-secret \
--docker-server=<owldq-registry-server> \
--docker-username=oauth3accesstoken \
--docker-email=<service-account-email> \
--docker-password="<access-token-text>" \
--namespace <namespace>
```

> **Warning** GCP Oauth tokens are usually only good for 1 hour. This type of credential is excellent if the goal is to pull containers into a private registry. It can be used as the pull secret to access containers directly, however, the secret would have to be recreated with a fresh token before restarting any of the Colbra DQ components.

Create a GSC credential secret

```
kubectl create secret generic spark-gcs-secret \
--from-file /path/to/keystore.jks \
--namespace <namespace>
```

> **Warning** The file name that you use in the `--from-file` argument should be *spark-gcs-secret*. If the file name is anything else, you must include an additional argument specifying the gcs secret name in the Helm command.

Cloud native install

Deploy Collibra Data Quality & Observability

Once you have created a namespace and added all of the required secrets, you can begin the deployment of Collibra DQ.

Minimal install

Install Web, Agent, and metastore. Collibra DQ is inaccessible until you manually add an Ingress or another type of externally accessible service.

> **Warning** All of the following examples will pull containers directly from the Collibra DQ secured container registry. In most cases, InfoSec policies require that containers are sourced from a private container repository controlled by the local Cloud Ops team. Make sure to to add `--set global.image.repo=</url/of/private-repo>` so that you use only approved containers.

```
helm upgrade --install --namespace <namespace> \
--set global.version.owl=<owl-version> \
--set global.version.spark=<owl-spark-version> \
--set global.configMap.data.license_key=<owl-license-key> \
--set global.web.service.type=ClusterIP \
--set global.configMap.data.license_name=<your-license-name> \
<deployment-name> \
/path/to/chart/owldq
```

> **Note** The metastore container must start first as the other containers use it to write data. On your initial deployment, the other containers might start before the metastore and fail.

Externally accessible service

Perform the Minimal install and add a preconfigured NodePort or LoadBalancer service to provide access to the Web.

> **Warning** A LoadBalancer service type requires that the Kubernetes platform is integrated with a Software Defined Network solution. This will generally be true for the Kubernetes services offered by major cloud vendors. Private cloud platforms more commonly use Ingress controllers. Check with the infrastructure team before attempting to use LoadBalancer service type.

```
helm upgrade --install --namespace <namespace> \
--set global.version.owl=<owl-version> \
--set global.version.spark=<owl-spark-version> \
--set global.configMap.data.license_key=<owl-license-key> \
--set global.configMap.data.license_name=<your-license-name> \
--set global.web.service.type=<NodePort || LoadBalancer> \
<deployment-name> \
/path/to/chart/owldq
```

Externally accessible with SSL enabled

Perform the install with external service but with SSL enabled.

> **Note** Ensure you have already deployed a keystore containing a key to the target namespace with a secret name that matches the `global.web.tls.key.secretName` argument (*owldq-ssl-secret* by default). Also, ensure that the secret's key name matches the `global.web.tls.key.store.name` argument (*dqkeystore.jks* by default).

```
helm upgrade --install --namespace <namespace> \
--set global.version.owl=<owl-version> \
--set global.version.spark=<owl-spark-version> \
--set global.configMap.data.license_key=<owl-license-key> \
--set global.configMap.data.license_name=<your-license-name> \
--set global.web.service.type=<NodePort || LoadBalancer> \
--set global.web.tls.enabled=true \
--set global.web.tls.key.secretName=owldq-ssl-secret \
--set global.web.tls.key.alias=<key-alias> \
--set global.web.tls.key.type=<JKS || PKCS12> \
--set global.web.tls.key.pass=<keystore-pass> \
--set global.web.tls.key.store.name=keystore.jks \
<deployment-name> \
/path/to/chart/owldq
```

Externally accessible and History Server for GCS Log Storage

Perform the install with external service and Spark History Server enabled. In this example, the target log storage system is GCS.

```
helm upgrade --install --namespace <namespace> \
--set global.version.owl=<owl-version> \
--set global.version.spark=<owl-spark-version> \
--set global.configMap.data.license_key=<owl-license-key> \
--set global.configMap.data.license_name=<your-license-name> \
--set global.web.service.type=<NodePort || LoadBalancer> \
--set global.spark_history.enabled=true \
--set global.spark_history.logDirectory=gs://logs/spark-history/
\
--set global.spark_history.service.type=<NodePort || LoadBal-
ancer> \
--set global.cloudStorage.gcs.enableGCS=true \
<deployment-name> \
/path/to/chart/owldq
```

Externally Accessible and History Server for S3 Log Storage

Perform the install with external service and Spark History Server enabled. In this example, the target log storage system is S3.

> **Note** For Collibra DQ to be able to write Spark logs to S3, makes sure that an Instance Profile IAM Role with access to the log bucket is attached to all nodes serving the target namespace.

```
helm upgrade --install --namespace <namespace> \
--set global.version.owl=<owl-version> \
--set global.version.spark=<owl-spark-version> \
--set global.configMap.data.license_key=<owl-license-key> \
--set global.configMap.data.license_name=<your-license-name> \
--set global.web.service.type=<NodePort || LoadBalancer> \
--set global.spark_history.enabled=true \
--set global.spark_history.logDirectory=s3a://logs/spark-history/ \
--set global.spark_history.service.type=<NodePort || LoadBalancer> \
--set global.cloudStorage.s3.enableS3=true \
<deployment-name> \
/path/to/chart/owldq
```

Externally accessible with external metastore

Perform the install with external service and an external metastore, for example AWS RDS, Google Cloud SQL, or just PostgresSQL on its own instance.

> **Warning** Collibra DQ currently supports PostgreSQL 9.6 and newer.

```
helm upgrade --install --namespace <namespace> \
--set global.version.owl=<owl-version> \
--set global.version.spark=<owl-spark-version> \
--set global.configMap.data.license_key=<owl-license-key> \
--set global.configMap.data.license_name=<your-license-name> \
--set global.web.service.type=<NodePort || LoadBalancer> \
--set global.metastore.enabled=false
--set global.configMap.data.metastore_url-
l=jdbc:postgresql://<host>:<port>/<database>
--set global.configMap.data.metastore_user=<user> \
--set global.configMap.data.metastore_pass=<password> \
<deployment-name> \
/path/to/chart/owldq
```

Troubleshooting + Helpful Commands

This guide is to provide the most common commands to run when troubleshooting a DQ environment that is deployed on Kubernetes. For a basic overview of Kubernetes and other relevant knowledge.

```
### Provide documentation on syntax and flags in the terminal

kubectl help

### To see how to use Kubernetes resources

kubectl api-resources -o wide
```

Viewing Kubernetes Resources

```
### Get Pods, their names & details in all Namespaces

kubectl get pods -A -o wide

### Get all Namespaces in a cluster

kubectl get namespaces

### Get Services in all Namespaces

kubectl get services -A -o wide

### List all deployments in all namespaces:

kubectl get deployments -A -o wide
```

Logs & Events

```
### List Events sorted by timestamp in all namespaces

kubectl get events -A --sort-by=.metadata.creationTimestamp

### Get logs from a specific pod:

kubectl logs [my-pod-name]
```

Resource Allocation

```
### If the Kubernetes Metrics Server is installed,
### the top command allows you to see the resource consumption
for nodes or podscode

kubectl top node
kubectl top pod

### If the Kubernetes Metrics Server is NOT installed, use

kubectl describe nodes | grep Allocated -A 10
```

Configuration

```
### Get current-context

kubectl config current-context

### See all configs for the entire cluster

kubectl config view
```

Authorization Issues

```
### Check to see if I can read pod logs for current user & context

kubectl auth can-i get pods --subresource=log

### Check to see if I can do everything in my current namespace ("*" means all)

kubectl auth can-i '*' '*'
```

EKS / GKE / AKS

For organizations that are familiar with containers and managed Kubernetes services, Collibra Data Quality & Observability offers a cloud native deployment option. Please refer to the Cloud Native section for more detail.

Cloud native

Cloud native requirements

Cloud native install

> **Note** The containers are part of a private repository which requires access. Please contact Collibra directly for more information.

Cloud

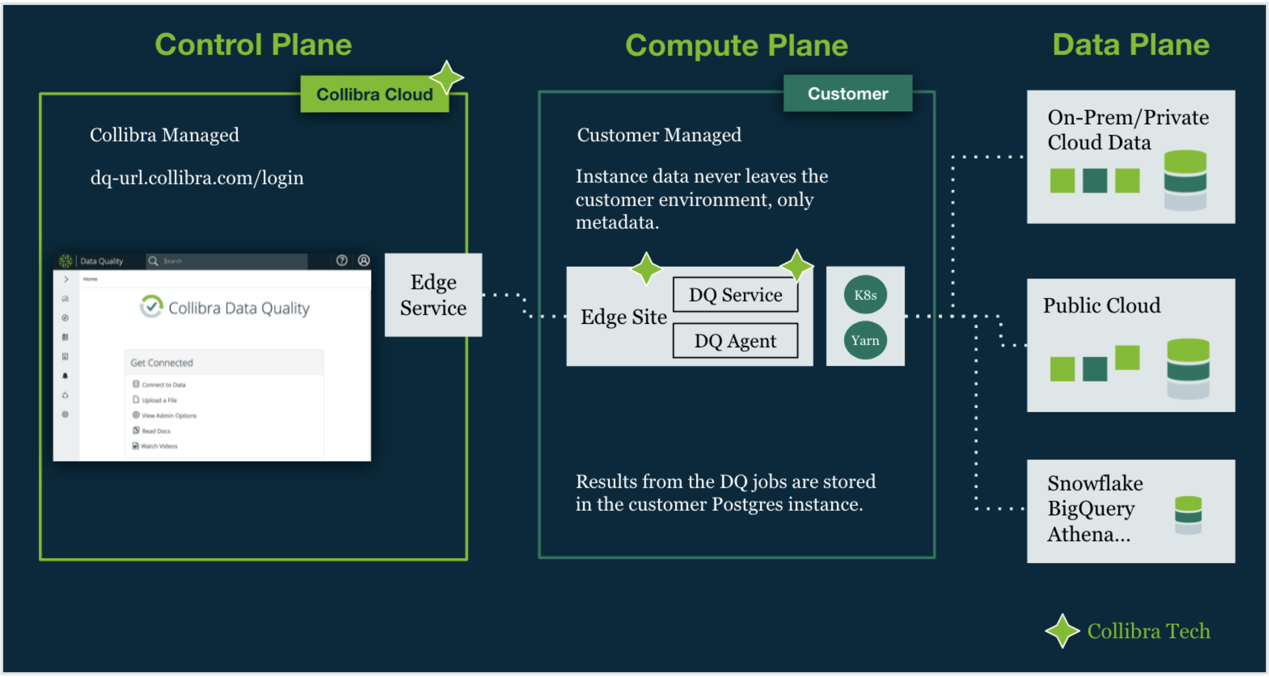
Installation details for the Edge component for DQ Cloud.

> **Note** DQ Cloud is in public beta, which means that it is an upcoming feature that is made available to all customers before it is fully ready for general availability so it can be tested and evaluated early. Please contact a Collibra representative or click here to learn more.

Requirements

Resource	Notes	Provisioned by
Collibra DQ	Version 2022.02+ with Edge mode enabled	Collibra
Collibra Edge Site	Version 2022.02+	Customer
Postgres	Version 11+	Customer

Diagram



Prerequisites

VM

This is where your Edge site is installed.

- RedHat 8 or Centos 8
- SSH Access
- 55 GB of free storage
- 64 GB memory
- 16 cores
- Egress (outbound) network access on port 443
- Network access to Postgres installed in step 2

> **Note** For medium to large workloads of more than 100M rows by 100 columns, we recommend that your VM has a minimum of 32 cores, 128 GB memory, and 500 GB of free storage.

Edge installation requirements can be found **here**.

Postgres

This is where your DQ Job results are stored.

- Version 11 or later
- A minimum of 100 GB of free storage
- A minimum of 4 cores
- Network access to and from the VM where Edge is installed
- User with ownership rights over the target database

1. Obtain a Secure Collibra DQ Web URL

This is provisioned by Collibra. Along with the URL, credentials will be provided to access your instance.

> **Note** This offering is in public beta and only available for select Collibra customers. Please contact a Collibra representative to learn more.

2. Install Postgres

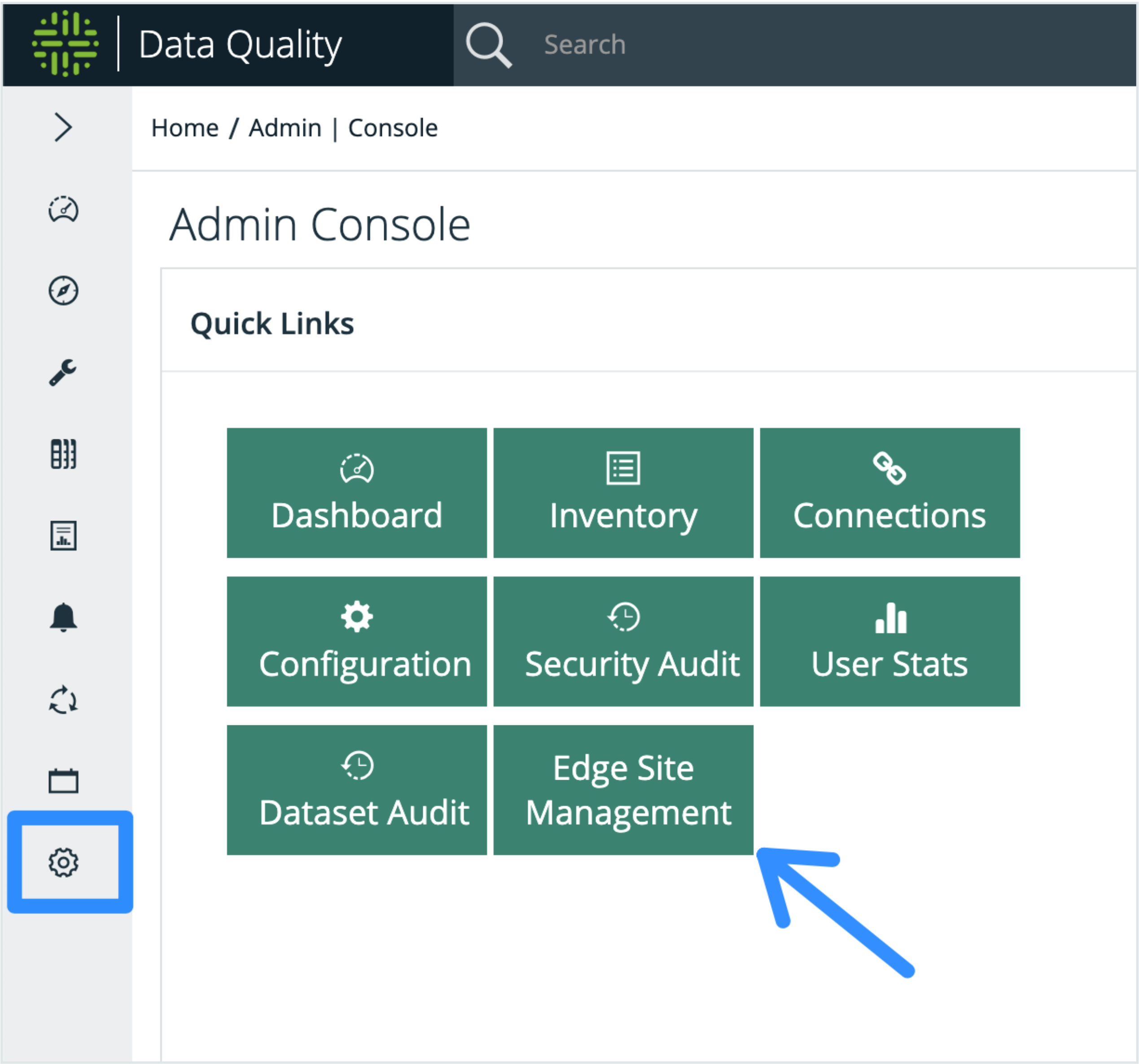
This is provisioned by the customer. There are several way to install Postgres. You should follow your existing company process to provision a Postgres instance (RDS, Azure SQL, Cloud SQL, or standard install using a package manager). Please ensure version 11+.

> **Important** Remember your Postgres IP and login credentials. This is required when deploying the Edge site.

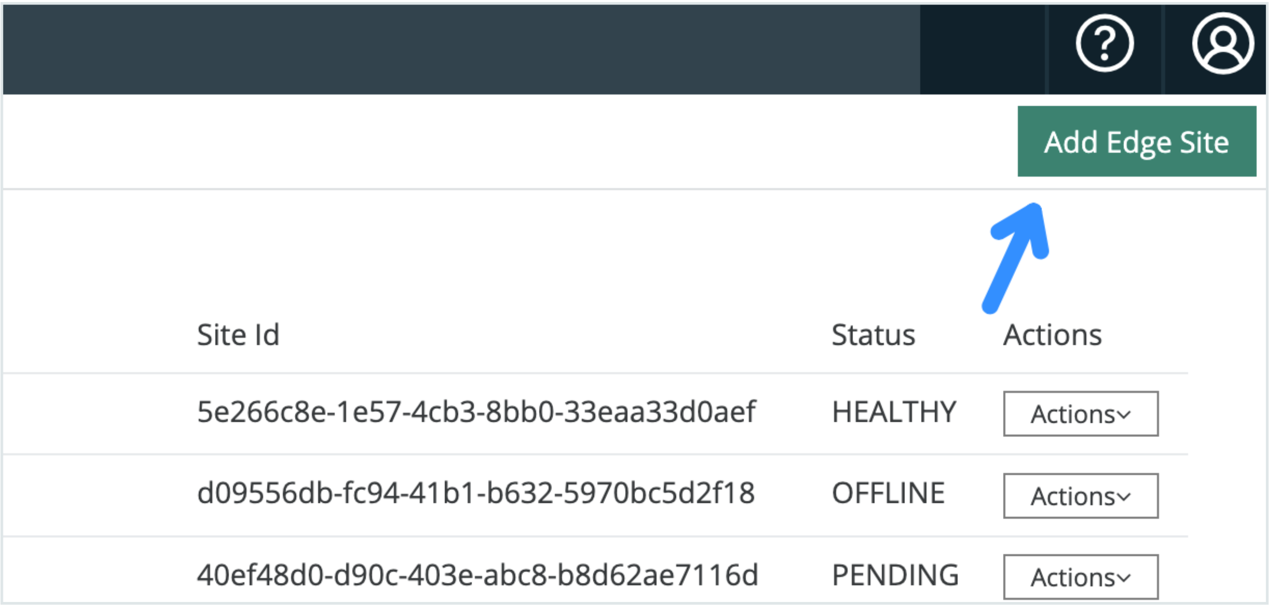
3. Install Edge

Refer to Edge documentation for system requirements.

Navigate to the Edge Site Management panel in the Admin Console

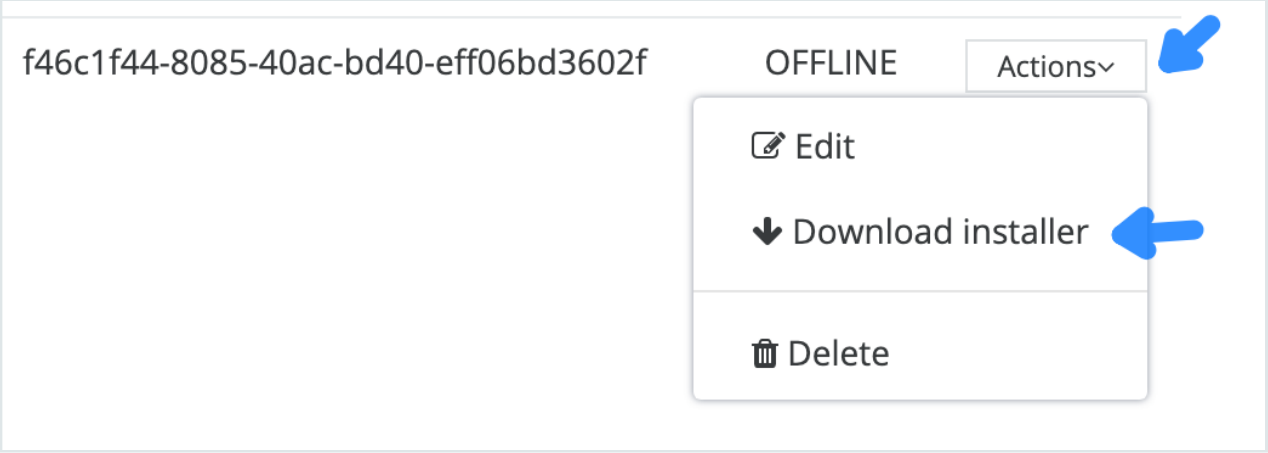


Add an Edge Site and provide a name and description



Site Id	Status	Actions
5e266c8e-1e57-4cb3-8bb0-33eaa33d0aef	HEALTHY	Actions
d09556db-fc94-41b1-b632-5970bc5d2f18	OFFLINE	Actions
40ef48d0-d90c-403e-abc8-b8d62ae7116d	PENDING	Actions

Using the Actions drop-down, download the Edge installer package locally



f46c1f44-8085-40ac-bd40-eff06bd3602f	OFFLINE	Actions

Upload the Edge installer package to your VM that meets the Edge system requirements above. An example scp command is below, but you can do this several ways.

```
scp -i ~/Downloads/vm-key.pem ~/Downloads/<installer>.tgz user-
@<host-or-ip>:/home/user/<installer>.tgz
```

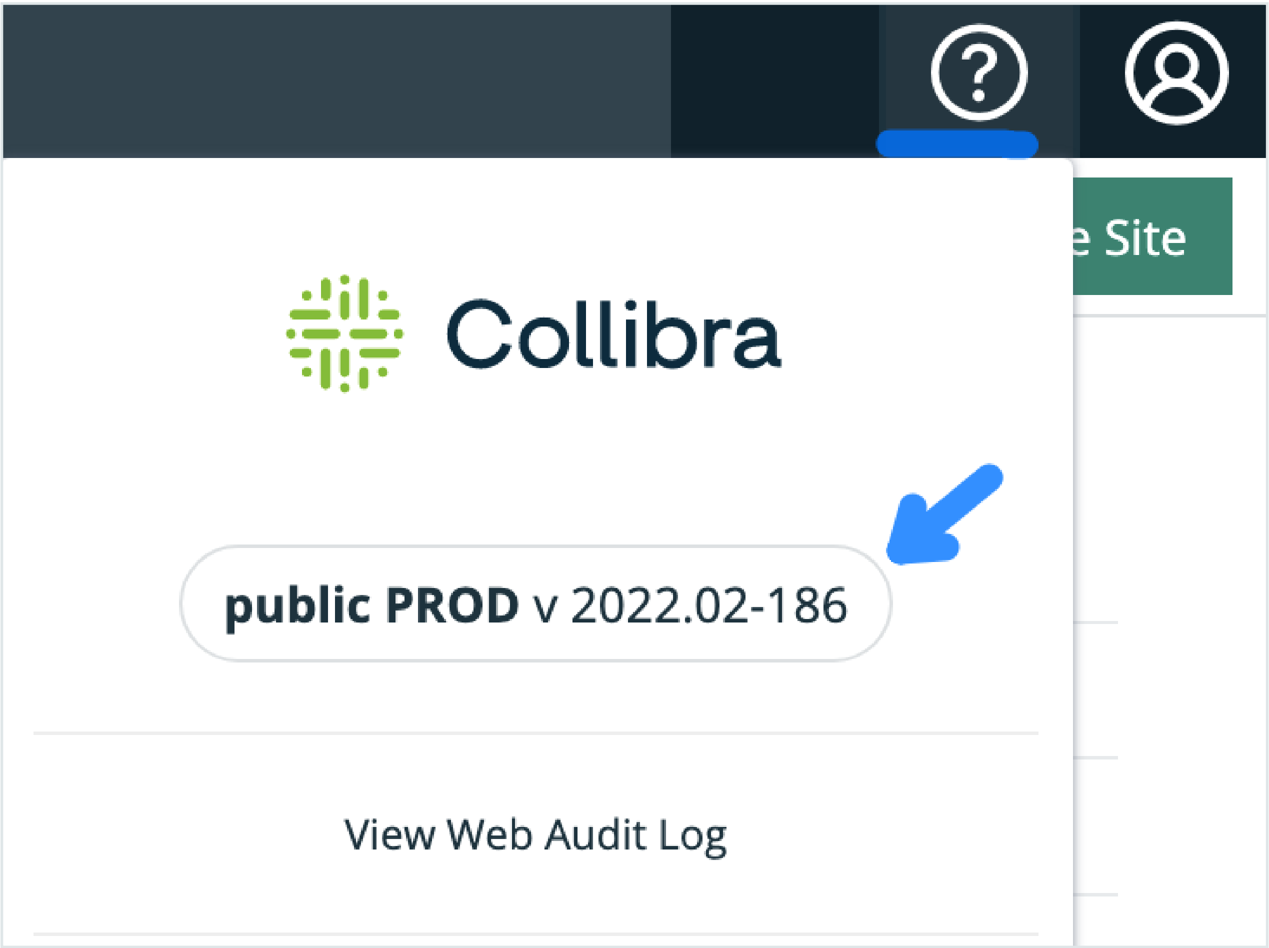
SSH to your VM after uploading the installer package. Untar the .tgz

```
tar -xvf <installer>.tgz
```

Install prerequisite Edge packages.

```
sudo yum install -y container-selinux selinux-policy-base

sudo yum install -y https://rp-
m.rancher.io/k3s/stable/common/centos/7/noarch/k3s-selinux-0.2-
1.el7_8.noarch.rpm

sudo firewall-cmd --zone=trusted --add-interface=lo --permanent

sudo firewall-cmd --zone=trusted --add-interface=cni0 --per-
manent

sudo firewall-cmd --reload
```

Confirm you have the right Collibra DQ version pointer e.g. **2022.02-186** from your Cloud instance.



public PROD v 2022.02-186

Remember your Postgres IP and credentials from the previous step.

Install Edge w/ DQ w/ the correct parameters

```
sudo /home/centos/install-master.sh --storage-path /var/edge
properties.yaml -r registries.yaml --set collibra_edge.-
collibra.dq.enabled=true,collibra_edge.-
collibra.dq.targetRevision=2022.02-186,collibra_
edge.collibra.dq.sparkVersion=3.2.0,collibra_edge.-
collibra.dq.metastoreUrl=jdbc:postgresql://<your-postgres-
ip>:5432/postgres,collibra_edge.collibra.dq.metastoreUser=<your-
postgres-user>,collibra_edge.collibra.dq.metastorePass=<your-
postgres-password>
```

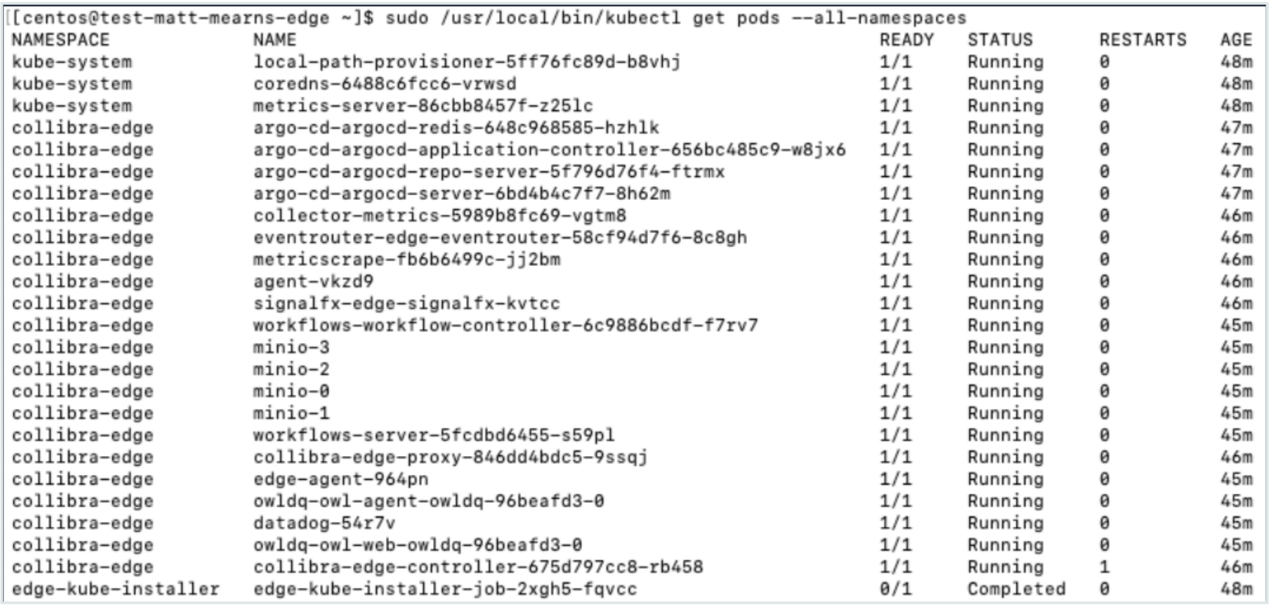
The snippet below is the same as the code block above.

The bold sections are the areas you will edit

sudo /home/**<your-directory>**/install-master.sh --storage-path /var/edge properties.yaml -r registries.yaml --set collibra_edge.collibra.dq.enabled=true,collibra_edge.collibra.dq.targetRevision=2022.02-**<version>**,collibra_edge.collibra.dq.sparkVersion=3.2.0,collibra_edge.collibra.dq.metastoreUrl=jdbc:postgresql://**<postgres-ip>**:5432/postgres,collibra_edge.collibra.dq.metastoreUser=**<postgres-user>**,collibra_edge.collibra.dq.metastorePass=**<postgres-password>**

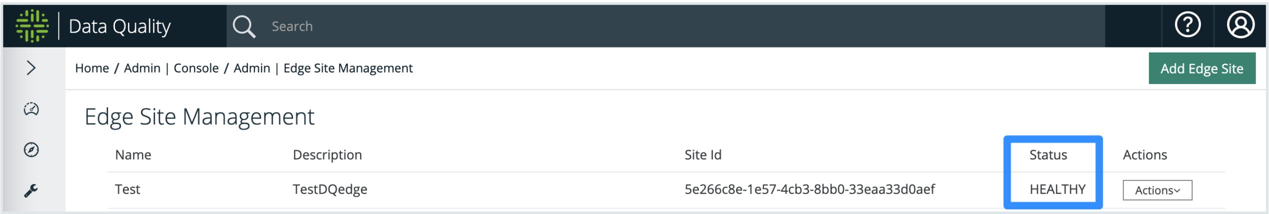
Check that all the processes are running / completed

```
sudo /usr/local/bin/kubectl get pods --all-namespaces
```



```
[[centos@test-matt-mearns-edge ~]$ sudo /usr/local/bin/kubectl get pods --all-namespaces
NAMESPACE             NAME                                                 READY   STATUS      RESTARTS   AGE
kube-system           local-path-provisioner-5ff76fc89d-b8vhj              1/1     Running     0          48m
kube-system           coredns-6488c6fcc6-vrwsd                             1/1     Running     0          48m
kube-system           metrics-server-86cbb8457f-z25lc                      1/1     Running     0          48m
collibra-edge         argo-cd-argocd-redis-648c968585-hzhlk                1/1     Running     0          47m
collibra-edge         argo-cd-argocd-application-controller-656bc485c9-w8jx6   1/1     Running     0          47m
collibra-edge         argo-cd-argocd-repo-server-5f796d76f4-ftrmx          1/1     Running     0          47m
collibra-edge         argo-cd-argocd-server-6bd4b4c7f7-8h62m               1/1     Running     0          47m
collibra-edge         collector-metrics-5989b8fc69-vgtm8                   1/1     Running     0          46m
collibra-edge         eventrouter-edge-eventrouter-58cf94d7f6-8c8gh        1/1     Running     0          46m
collibra-edge         metricscrape-fb6b6499c-jj2bm                         1/1     Running     0          46m
collibra-edge         agent-vkzd9                                          1/1     Running     0          46m
collibra-edge         signalfx-edge-signalfx-kvtcc                         1/1     Running     0          46m
collibra-edge         workflows-workflow-controller-6c9886bcdf-f7rv7       1/1     Running     0          45m
collibra-edge         minio-3                                              1/1     Running     0          45m
collibra-edge         minio-2                                              1/1     Running     0          45m
collibra-edge         minio-0                                              1/1     Running     0          45m
collibra-edge         minio-1                                              1/1     Running     0          45m
collibra-edge         workflows-server-5fcdbd6455-s59pl                    1/1     Running     0          45m
collibra-edge         collibra-edge-proxy-846dd4bdc5-9ssqj                 1/1     Running     0          46m
collibra-edge         edge-agent-964pn                                     1/1     Running     0          45m
collibra-edge         owldq-owl-agent-owldq-96beafd3-0                     1/1     Running     0          45m
collibra-edge         datadog-54r7v                                        1/1     Running     0          45m
collibra-edge         owldq-owl-web-owldq-96beafd3-0                       1/1     Running     0          45m
collibra-edge         collibra-edge-controller-675d797cc8-rb458            1/1     Running     1          46m
edge-kube-installer   edge-kube-installer-job-2xgh5-fqvcc                  0/1     Completed   0          48m
```

Your Edge site will appear as HEALTHY upon successful installation



Edge Site Management

Name	Description	Site Id	Status	Actions
Test	TestDQedge	5e266c8e-1e57-4cb3-8bb0-33eaa33d0aef	HEALTHY	Actions⌄

Uninstall Edge if there were mistakes/typos in the process

```
sudo /usr/local/bin/uninstall-edge.sh --force
```

Uninstalling an Edge Site using this command is OK. Do not delete an Edge Site using the UI.

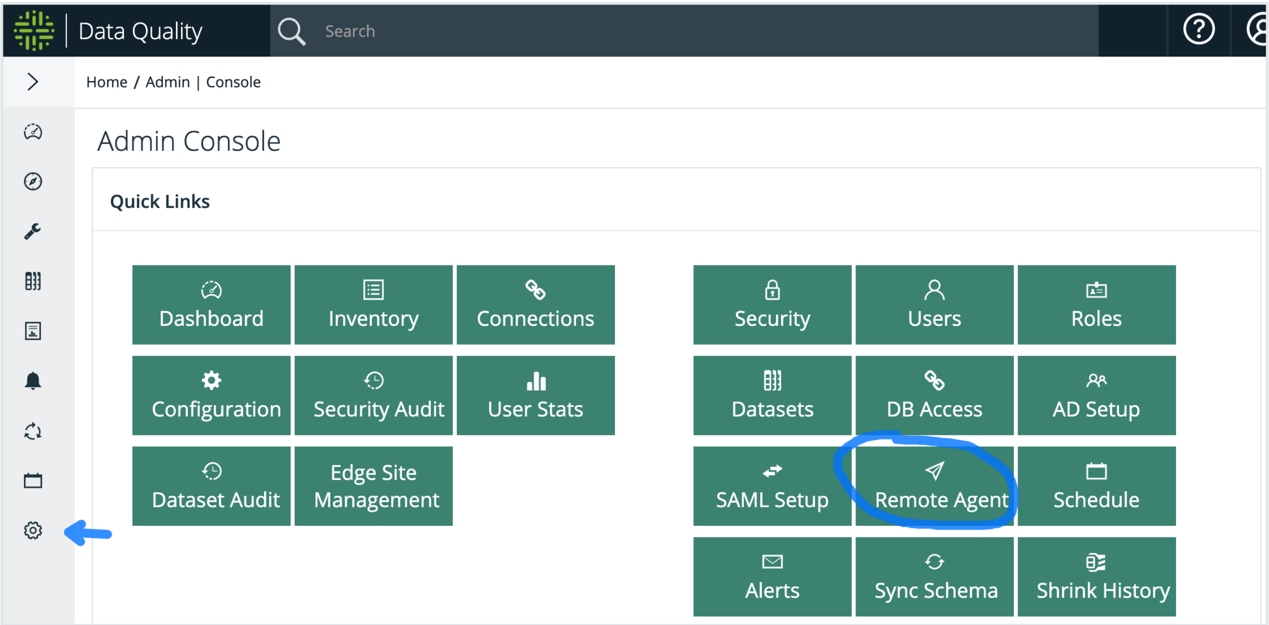
Reinstall the prerequisites if you perform the uninstall

```
sudo yum localinstall --skip-broken -y https://rp-
m.rancher.io/k3s/stable/common/centos/7/noarch/k3s-selinux-0.2-
1.el7_8.noarch.rpm
```

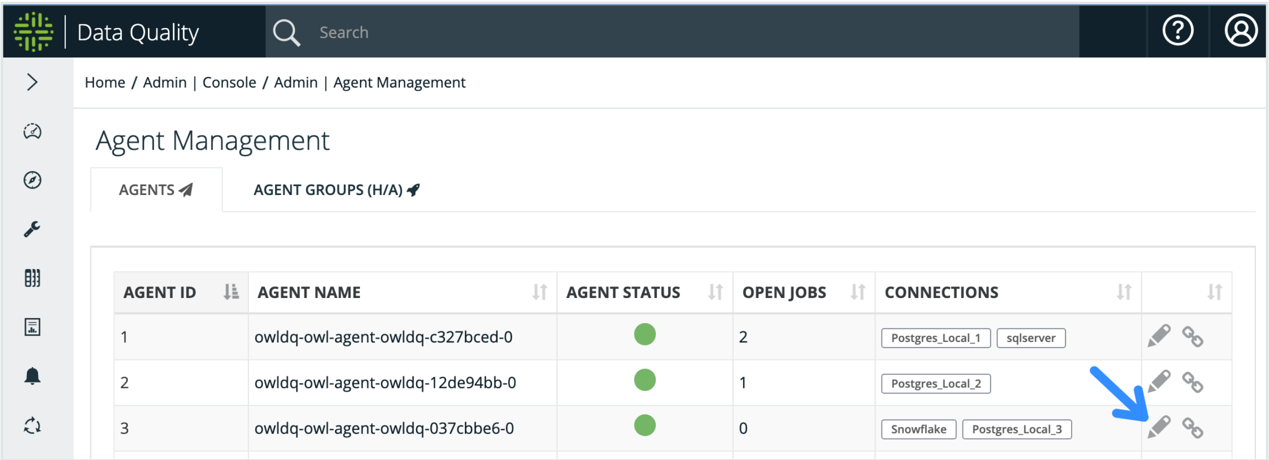
> **Warning** You should not delete an Edge using the UI, to avoid orphaned records.

4. Configure an Agent

Navigate to the Remote Agent panel in the admin console

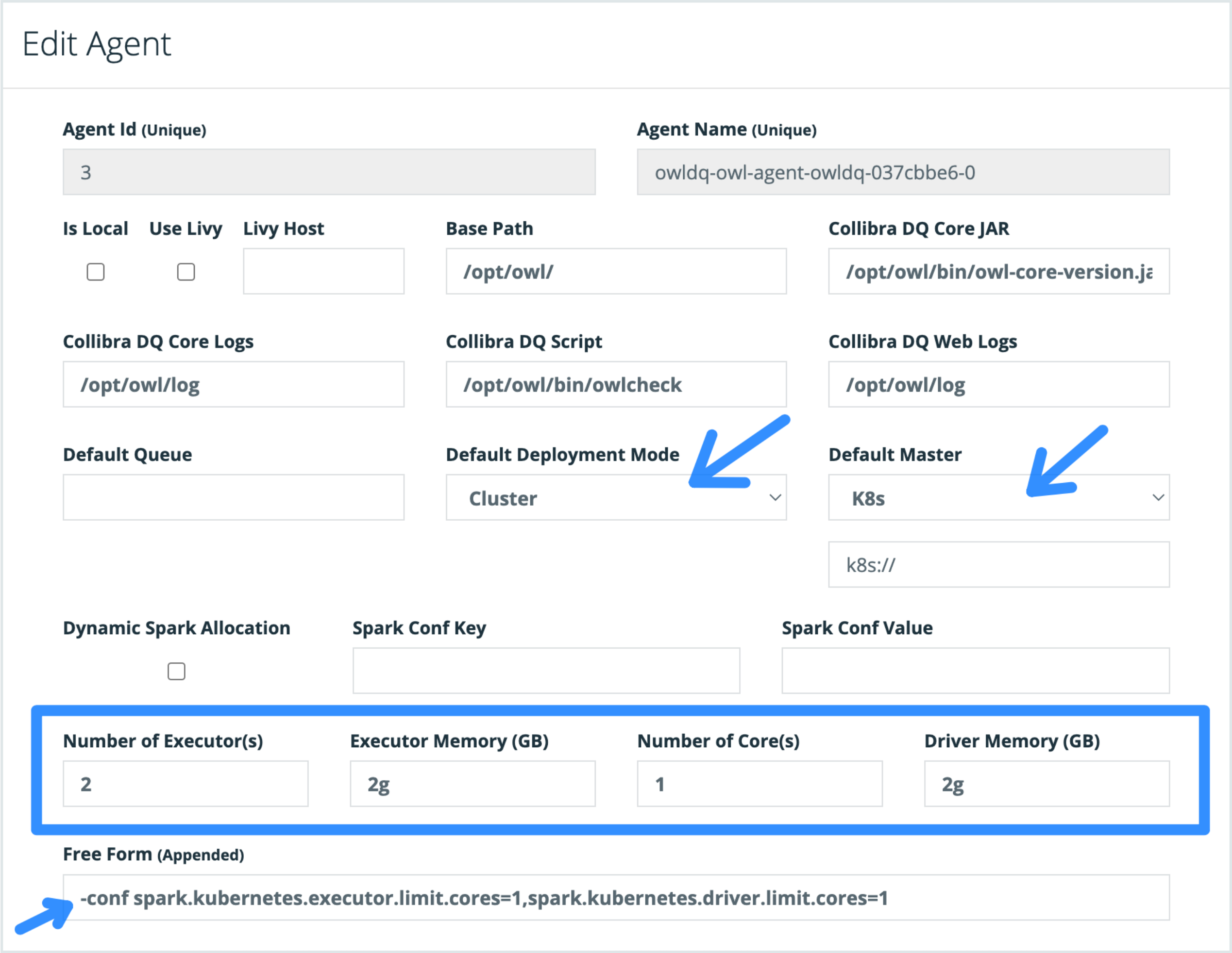


Upon completion of the Edge installation, you'll find an agent available from each respective Edge Site. Click the pencil icon to configure the agent.



AGENT ID	AGENT NAME	AGENT STATUS	OPEN JOBS	CONNECTIONS	
1	owldq-owl-agent-owldq-c327bced-0	●	2	Postgres_Local_1 sqlserver	
2	owldq-owl-agent-owldq-12de94bb-0	●	1	Postgres_Local_2	
3	owldq-owl-agent-owldq-037cbbe6-0	●	0	Snowflake Postgres_Local_3	

Change the Default Deploy Mode to Cluster, the Default Masters to K8s and input defaults for resource assignment. Also add freeform append Spark confs as shown here.



Edit Agent

Agent Id (Unique): 3

Agent Name (Unique): owldq-owl-agent-owldq-037cbbe6-0

Is Local □ Use Livy □ Livy Host:

Base Path: /opt/owl/

Collibra DQ Core JAR: /opt/owl/bin/owl-core-version.ja

Collibra DQ Core Logs: /opt/owl/log

Collibra DQ Script: /opt/owl/bin/owlcheck

Collibra DQ Web Logs: /opt/owl/log

Default Queue:

Default Deployment Mode: Cluster

Default Master: K8s

k8s://

Dynamic Spark Allocation □

Spark Conf Key:

Spark Conf Value:

Number of Executor(s): 2

Executor Memory (GB): 2g

Number of Core(s): 1

Driver Memory (GB): 2g

Free Form (Appended): -conf spark.kubernetes.executor.limit.cores=1,spark.kubernetes.driver.limit.cores=1

Use the spark confs in the code block below.

```
-conf spark.kuber-
netes.ex-
ecutor.limit.cores=1,spark.kubernetes.driver.limit.cores=1
```

> **Note** The DQ Job (Spark) compute will take place locally on Edge K3s. Increase the size of your VM to vertically scale for more resources (.e.g. 32 cores, RAM, etc.). This is the preferred option in beta. Hadoop compute is supported if customer chooses that path and uses their Dataproc or EMR cluster.

> **Note** Make note of the agent name that as created. In the following step you will create a connection and select (link) the agent to your connection.

> **Warning** Do not delete an Agent from the UI, to avoid any orphaned records.

5. Set Job Limits

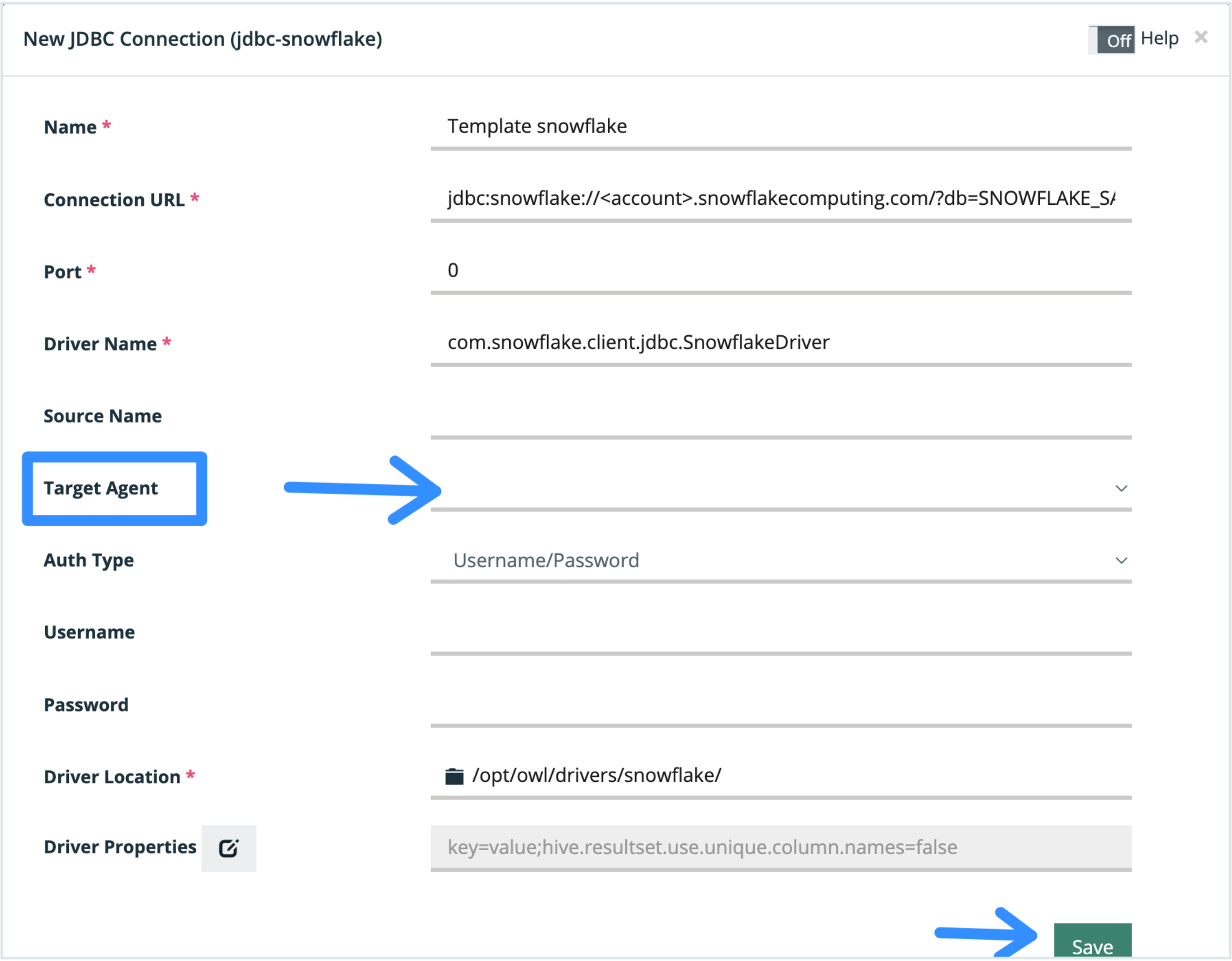
Set max cores to 1 in the job limit settings.

Refer to this link for configuring job limits.

6. Add a Connection

This is the same process of adding a connection found Adding Connectionswith one difference. You will map the connection to your agent upon establishing a connection. **This is different than mapping a connection and an agent in the self-hosted application.**

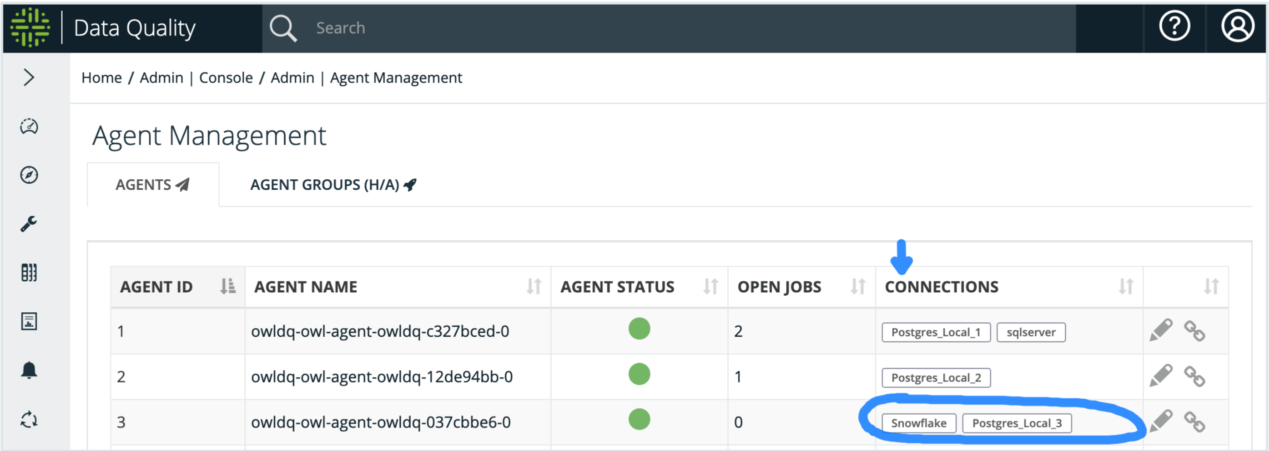
Select your target agent using the **Target Agent drop-down**. This drop-down will populate with existing agents. Here is where you will select the agent name from the previous step.



New JDBC Connection (jdbc-snowflake)

Name *	Template snowflake
Connection URL *	jdbc:snowflake://<account>.snowflakecomputing.com/?db=SNOWFLAKE_S/
Port *	0
Driver Name *	com.snowflake.client.jdbc.SnowflakeDriver
Source Name	
Target Agent	
Auth Type	Username/Password
Username	
Password	
Driver Location *	/opt/owl/drivers/snowflake/
Driver Properties	key=value;hive.resultset.use.unique.column.names=false

Afterwards, you do not need to assign the connection to the agent. It will be automatically mapped.



Home / Admin | Console / Admin | Agent Management

Agent Management

AGENT ID	AGENT NAME	AGENT STATUS	OPEN JOBS	CONNECTIONS	
1	owldq-owl-agent-owldq-c327bced-0	●	2	Postgres_Local_1 sqlserver	
2	owldq-owl-agent-owldq-12de94bb-0	●	1	Postgres_Local_2	
3	owldq-owl-agent-owldq-037cbbe6-0	●	0	Snowflake Postgres_Local_3	

> **Note** To map a connection to another agent, you need to re-save the connection and select another agent from the drop-down list.

7. Run a DQ Job

Run a DQ Job to validate the installation. Use the Explorer to onboard a table and check the Jobs page as normal to see the status.

> **Note** If the DQ Job does not succeed, please check your Agent settings and system prerequisites

Notes

Edge Capability Resource Requirements: If insufficient resources, your capabilities will not perform properly.

Installer: Please beware, downloading new installer will invalidate previous installer.

Volume: /var/lib/rancher/k3s path must have 50gb available

Root access: root access is needed, though future revisions will follow the least privileged user access policies.

The private beta is designed to let customers 1) complete the installation 2) confirm successful DQ jobs can be run and 3) validate their security requirements whereby no sensitive data is stored outside their custody.

Helpful Commands

```
# Get all pods running
sudo /usr/local/bin/kubectl get pods --all-namespaces

# Get shell access to pod
sudo /usr/local/bin/kubectl exec -it <dq-web-pod> -n collibra-
edge -- bash

# Get shell access to pod
sudo /usr/local/bin/kubectl exec -it collibra-edge-controller-
<pod-name> -n collibra-edge -- sh

# Check network connectivity to database
curl telnet://<rds-host>:<port>

# Delete jobs
sudo /usr/local/bin/kubectl delete pod <pod-name> -n collibra-
edge
```

FAQ

What network access is needed?

- The Edge Site and Postgres need to communicate with each other.
- Additionally, logging and heartbeat requires outbound access to several services. Please refer to Edge documentation for specific services that are used.

How can a user check the install?

- Time: The install should complete in around ~5 minutes; if not, there is likely an issue.
- Check that the pods
- `sudo /usr/local/bin/kubectl get pods --all-namespaces`

Is there a way to get more checks / more logs?

- `sudo /usr/local/bin kubectl describe`

How to verify successful install?

- In your Collibra DQ instance, navigate to the Edge Site Management panel in the Admin Console and confirm a HEALTHY status

- Support can confirm via Datadog, the edge site will send heartbeats

How to locate my Edge site in Datdog?

- Send your Edge Site ID to Support to check the health status.

Do customers have access to Datadog?

- Only Collibra has access to Datadog logging.

Can all my Collibra DQ and other capabilities run on the same Edge Site?

- There are not technical reasons preventing other capabilities and Collibra DQ from running on the same Edge Site.
- The guidance for the beta is to have DQ Edge separate from DGC Edge capabilities and simply use two Edge sites.

Are there any limitations with Collibra DQ Cloud in terms of features or functionality?

- While remote files are supported, local files and uploaded files are not supported due to security restrictions
- Specific drivers are not available in the beta, though the most common data sources are available.

What are the benefits of installing with Edge vs. a stand-alone, self-hosted application?

- The primary benefits are managed upgrades, maintenance, and reducing the ownership costs of an entirely self-hosted set of components.
- In addition, this design allows customers to take advantage of containers and cloud technologies without deep technical skillset requirements.
- This installation pattern was intentionally develop to not compromise any security requirements and give the customer complete custody of their data.
- Lastly, this aligns the Collibra architecture standards so support and services teams will benefit from normalized deployment models. In particular, when it comes to installation, configuration, and troubleshooting.

Agent

How to Install a New DQ Agent

Setting up a DQ Agent using `setup.sh` as part of DQ package

Use `setup.sh` script located in `/opt/owl/` (or other The installation folder path for DQ. All other paths in DQ Agent are relative to this installation path. that your installation used). See example code block for installing a DQ Agent with Postgres server running `localhost` on port `5432` with database postgres and Postgres username/password combo `postgres/password`.

```
# PATH TO DIR THAT CONTAINS THE INSTALL DIR
export BASE_PATH=/opt

# PATH TO AGENT INSTALL DIR
export INSTALL_PATH=/opt/owl

# DQ Metadata Postgres Storage settings
export METASTORE_HOST=localhost
export METASTORE_PORT=5432
export METASTORE_DB=postgres
export METASTORE_USER=postgres
export METASTORE_PASSWORD=password

cd $INSTALL_PATH

# Install DQ Agent only
./setup.sh \
    -owlbase=$BASE_PATH \
    -options=owlagent \
    -pguser=$METASTORE_USER \
    -pgpassword=$METASTORE_PASSWORD \
    -pgserver=${METASTORE_HOST}:${METASTORE_PORT}/${METASTORE_
DB}
```

The setup script will automatically generate the `/opt/owl/config/owl.properties` file and encrypt the provided password.

Setting up a DQ Agent manually

- Passwords to DQ Metadata Postgres Storage should be encrypted before being stored in `/opt/owl/config/owl.properties` file.

```
# PATH TO AGENT INSTALL DIR
export INSTALL_PATH=/opt/owl

cd $INSTALL_PATH

#Encrypt DQ Metadata Postgres Storage password
./owlmanage.sh encrypt=password
```

`owlmanage.sh` will generate an encrypted string for the plain text password input. The encrypted string can be used in the `/opt/owl/config/owl.properties` configuration file to avoid exposing the DQ Metadata Postgres Storage password.

- To complete Owl Agent configuration, edit the `/opt/owl/config/owl.properties` configuration file with basic agent values:

```
vi $INSTALL_PATH/config/owl.properties
```

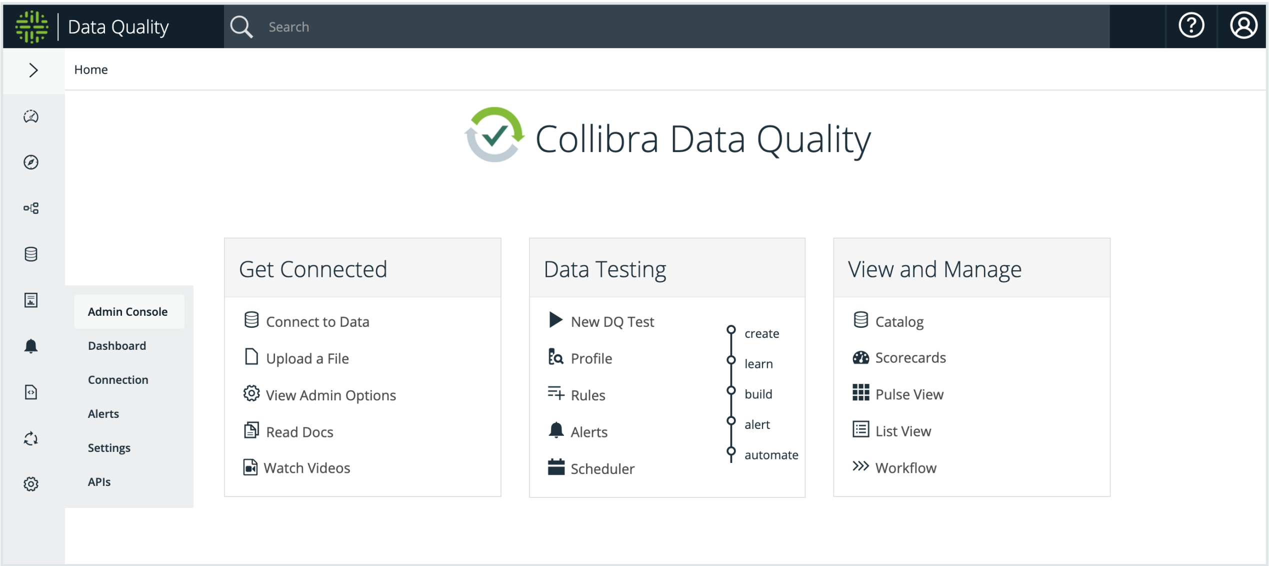
- and add the following properties:

```
spring.datasource.url=jdbc:postgresql://{DB_HOST}:{DB_PORT}/
{METASTORE_DB}
spring.datasource.username={METASTORE_USER}
spring.datasource.password={METASTORE_PASSWORD}
spring.datasource.driver-class-name-
e=com.owl.org.postgresql.Driver

spring.agent.datasource.url=jdbc:postgresql://{DB_HOST}:{DB_
PORT}/{METASTORE_DB}
spring.agent.datasource.username={METASTORE_USER}
spring.agent.datasource.password={METASTORE_PASSWORD}
spring.agent.datasource.driver-class-name=org.postgresql.Driver
```

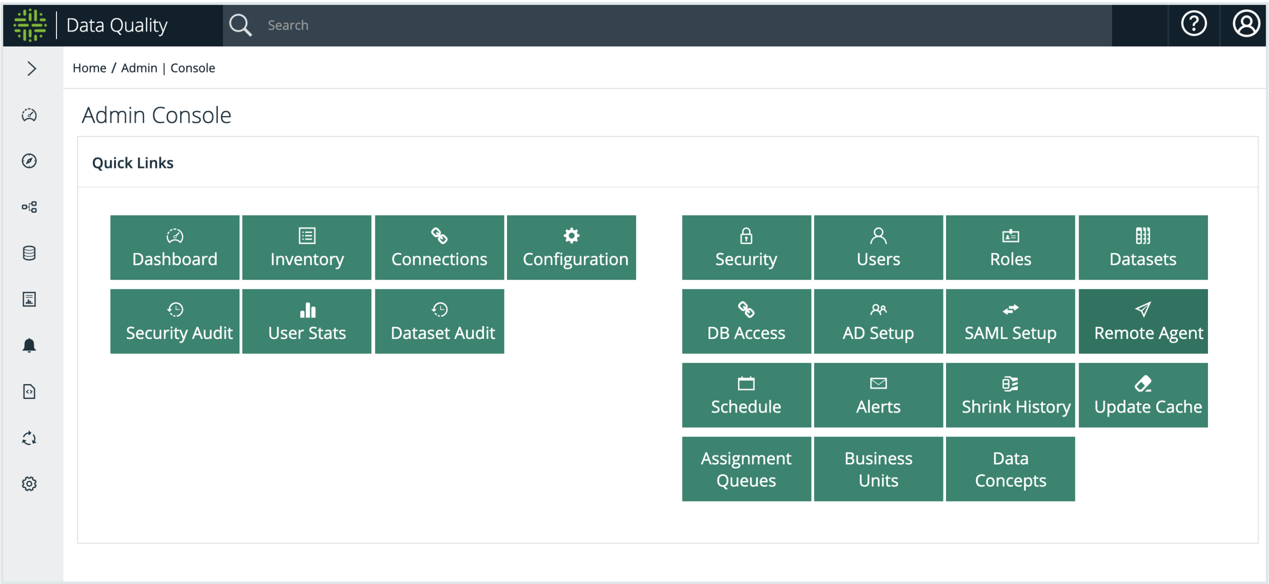
- Restart the web app.

How to Configure Agent via UI

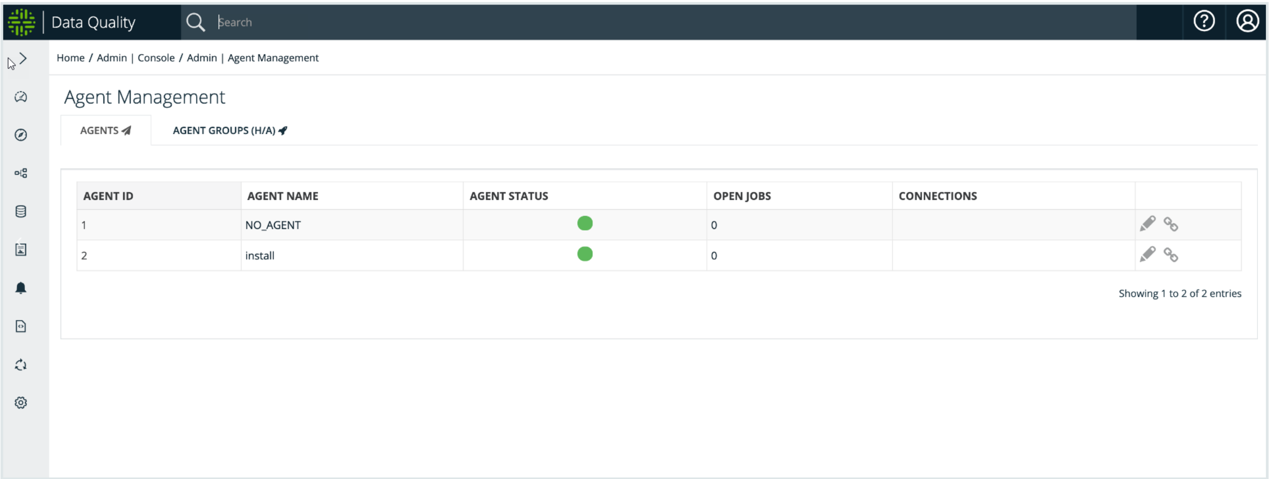
Login to DQ Web and navigate to Admin Console.



- From the Admin Console, click on the Remote Agent tile.



- Identify the row with the agent to edit.



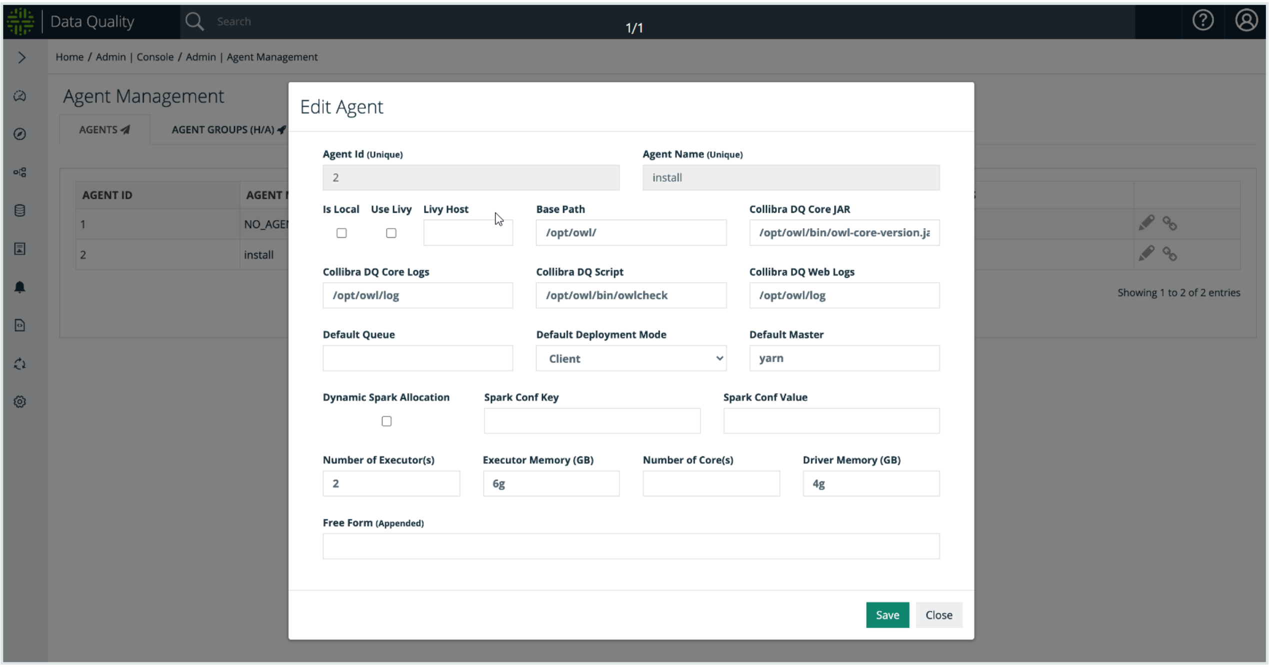
Agent Management

AGENTS | AGENT GROUPS (H/A)

AGENT ID	AGENT NAME	AGENT STATUS	OPEN JOBS	CONNECTIONS	
1	NO_AGENT	●	0		
2	install	●	0		

Showing 1 to 2 of 2 entries

- Click the pencil icon to edit.



Edit Agent

Agent Id (Unique): 2

Agent Name (Unique): install

Is Local □ Use Livy □ Livy Host

Base Path: /opt/owl/

Collibra DQ Core JAR: /opt/owl/bin/owl-core-version.ja

Collibra DQ Core Logs: /opt/owl/log

Collibra DQ Script: /opt/owl/bin/owlcheck

Collibra DQ Web Logs: /opt/owl/log

Default Queue

Default Deployment Mode: Client

Default Master: yarn

Dynamic Spark Allocation □

Spark Conf Key

Spark Conf Value

Number of Executor(s): 2

Executor Memory (GB): 6g

Number of Core(s)

Driver Memory (GB): 4g

Free Form (Appended)

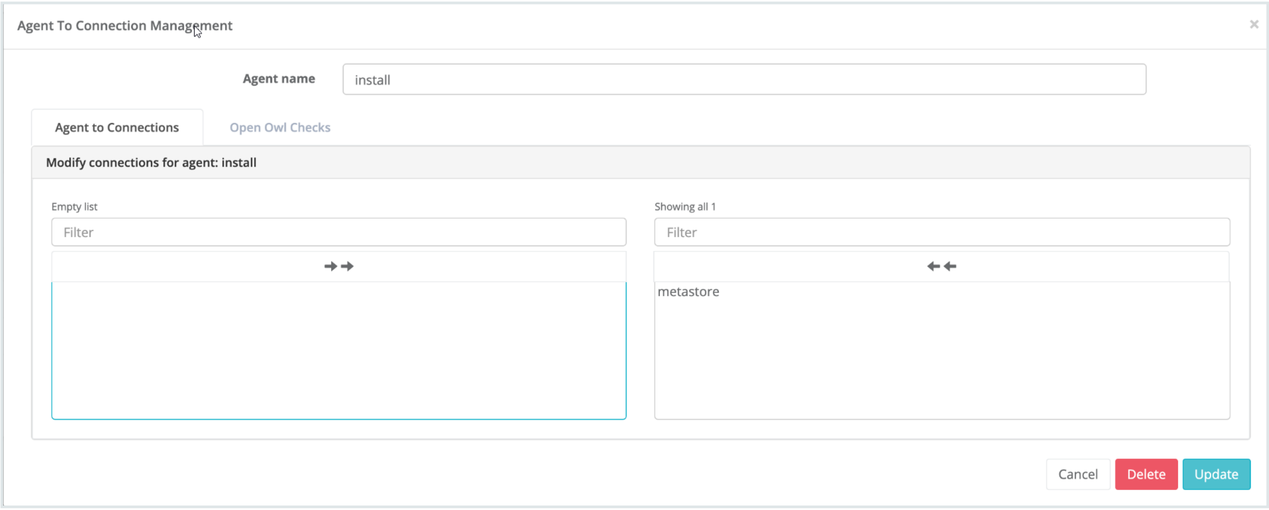
How to Link DB Connection to Agent via UI

When you add a new Adding Connections, the DQ Agent must be given the permission to run DQ Job via the specified agent.

From the Agent Management table, select the chain link icon next to the DQ Agent to establish link to DB Connection. A modal to give that agent permission to run DQ Jobs by DB Connection name displays (as shown in the screenshot above). The left-side panel is the list of

DB Connection names that have not been linked to the DQ Agent. The right-side panel is the list of DB Connection names that have the permission to run DQ Job.

Double click the DQ Connection name to move from left to right. In the following screenshot, DB Connection named "metastore" is added to DQ Agent. Click the "Update" button to save the new list of DB Connections.



Agent To Connection Management

Agent name: install

Modify connections for agent: install

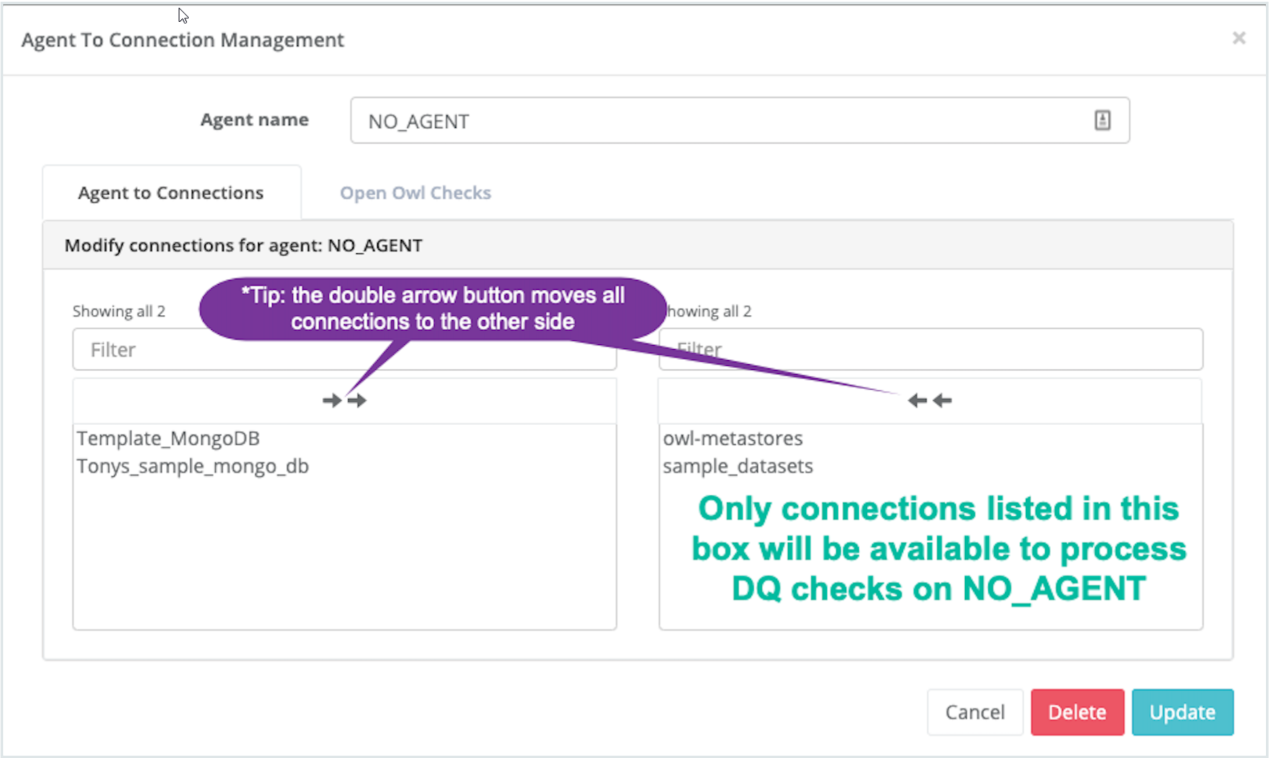
Empty list

Filter

Showing all 1

Filter

metastore



Agent To Connection Management

Agent name: NO_AGENT

Modify connections for agent: NO_AGENT

Showing all 2

Filter

Template_MongoDB
Tonys_sample_mongo_db

Showing all 2

Filter

owl-metastores
sample_datasets

*Tip: the double arrow button moves all connections to the other side

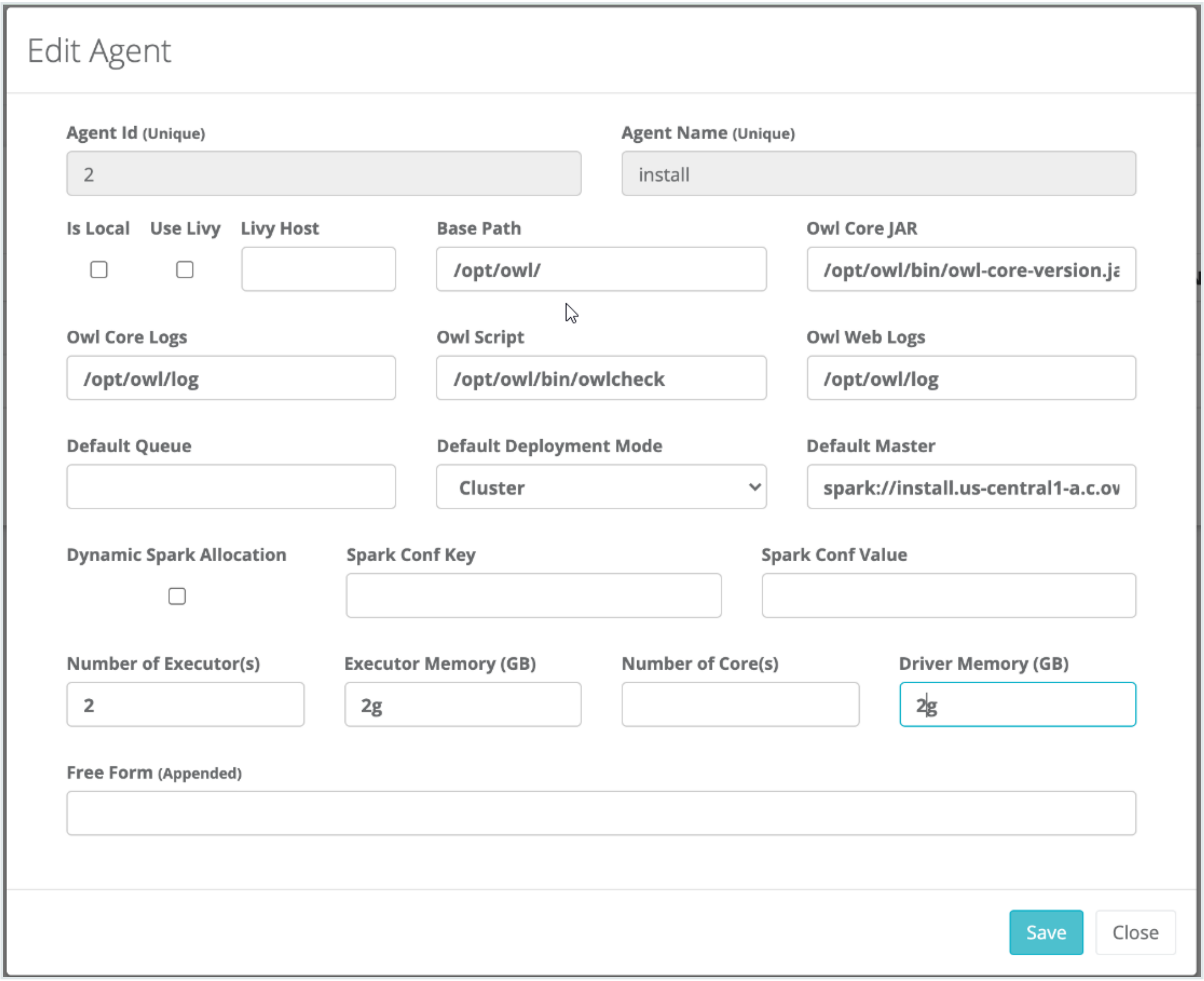
Only connections listed in this box will be available to process DQ checks on NO_AGENT

Adding a connection to a DQ Agent

Agent Configuration Parameters

Parameter	Description
Is Local	For Hadoop only
Is Livy	Deprecated. Not used.
Base Path	The installation folder path for DQ. All other paths in DQ Agent are relative to this installation path. This is the location that was set as `OWL_BASE` in Full Standalone Setup and other installation setups followed by `owl/` folder. For example, if setup command was `export OWL_BASE=/home/centos` then the **Base Path** in the Agent configuration should be set to `/home/centos/owl/`. Default: `/opt/owl/`.
Owl Core JAR	The file path to DQ Core jar file. Default `<Base Path>/owl/bin/`.
Owl Core Logs	The folder path where DQ Core logs are stored. Logs from DQ Jobs are stored in this folder. Default: `<Base Path>/owl/log`.
Owl Web Logs	The folder path where DQ Web logs are stored. Logs from DQ Web App is stored in this folder. Default: `<Base Path>/owl/log`.
Owl Script	The file path to DQ execution script `owlcheck.sh`. This script is used to run DQ Job via command line without using agent. Using`owlcheck.sh`for running DQ Jobs is superseded by DQ Agent execution model. Default: `<Base Path>/owl/bin/owlcheck`.
Deploy Deployment Mode	The Spark deployment mode that takes one of `Client` or `Cluster`.
Default Master	The Spark Master URL copied from the Spark cluster verification screen (`spark://...`).
Default Queue	The default resource queue for YARN.

Parameter	Description
Dynamic Spark Allocation	Deprecated. Not used.
Spark Conf Key	Deprecated. Not used.
Spark Conf Value	Deprecated. Not used.
Number of executor(s)	The default number of executors allocated per DQ Job when using this Agent to run DQ Scan.
Executer Memory (GB)	The default RAM per executors allocated per DQ Job when using this Agent to run DQ Scan.
Number of Core(s)	The default number of cores per executors allocated per DQ Job when using this Agent to run DQ Scan.
Driver Memory (GB)	The default driver RAM allocated per DQ Job when using this Agent to run DQ Scan.
Free Form (Appended)	Other `spark-submit` parameters to append to each DQ Job when using this Agent to run DQ Scan.



Edit Agent

Agent Id (Unique): 2

Agent Name (Unique): install

Is Local □

Use Livy □

Livy Host:

Base Path: /opt/owl/

Owl Core JAR: /opt/owl/bin/owl-core-version.ja

Owl Core Logs: /opt/owl/log

Owl Script: /opt/owl/bin/owlcheck

Owl Web Logs: /opt/owl/log

Default Queue:

Default Deployment Mode: Cluster

Default Master: spark://install.us-central1-a.c.ov

Dynamic Spark Allocation □

Spark Conf Key:

Spark Conf Value:

Number of Executor(s): 2

Executor Memory (GB): 2g

Number of Core(s):

Driver Memory (GB): 2g

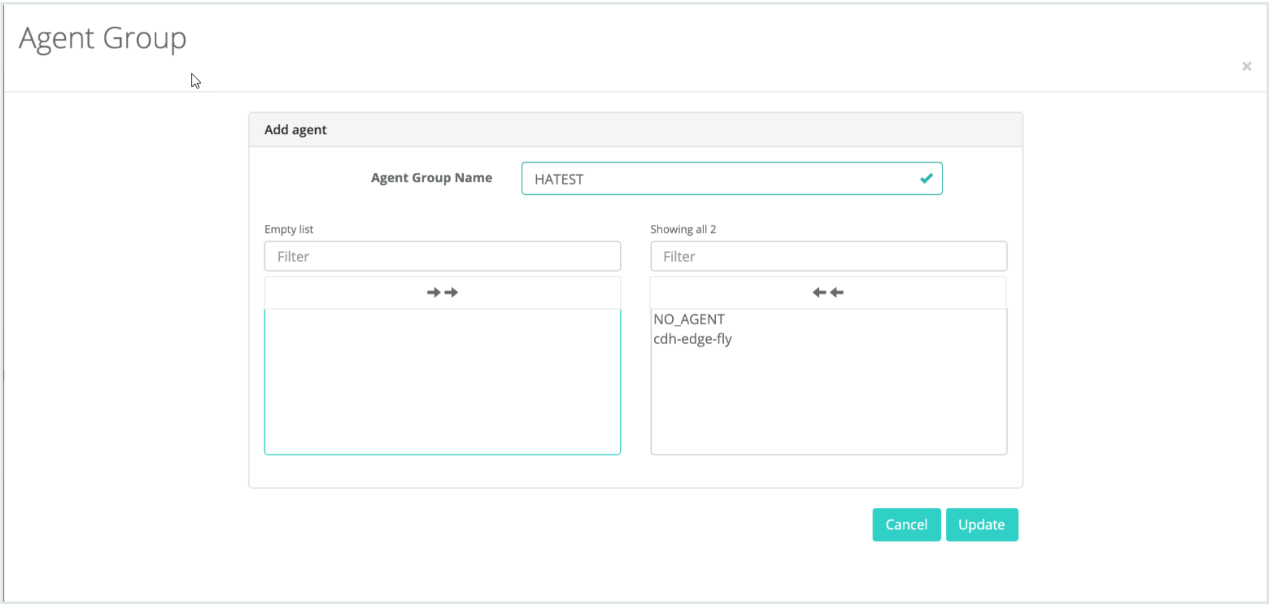
Free Form (Appended):

Setting up an HA Group

If you have multiple DQ Agents, then you can establish them as an HA Group. When doing so, make sure both DQ Agents have the same connections established to them.

- Click on the "AGENT GROUPS (H/A)" tab, name your HA Group, and add the Agents you'd like to participate as Group.

> **Note** HA GROUPS will execute jobs in a round robin fashion.

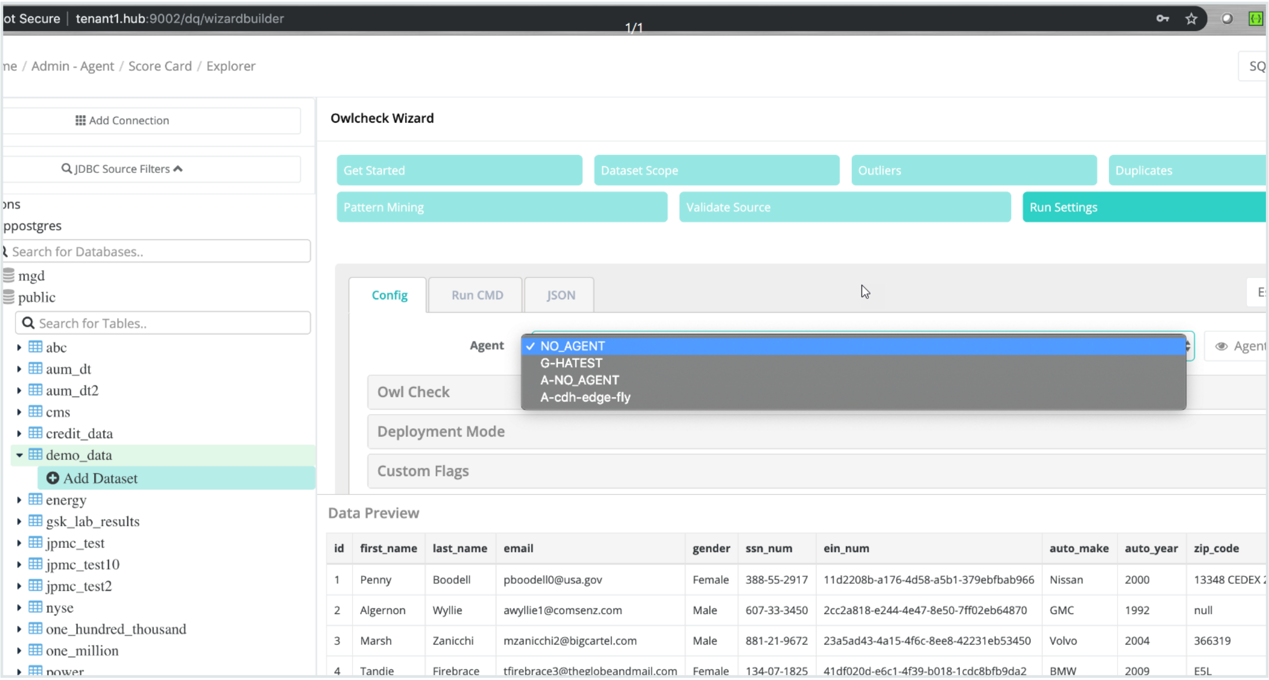


Agent Group

Add agent

Agent Group Name: HATEST

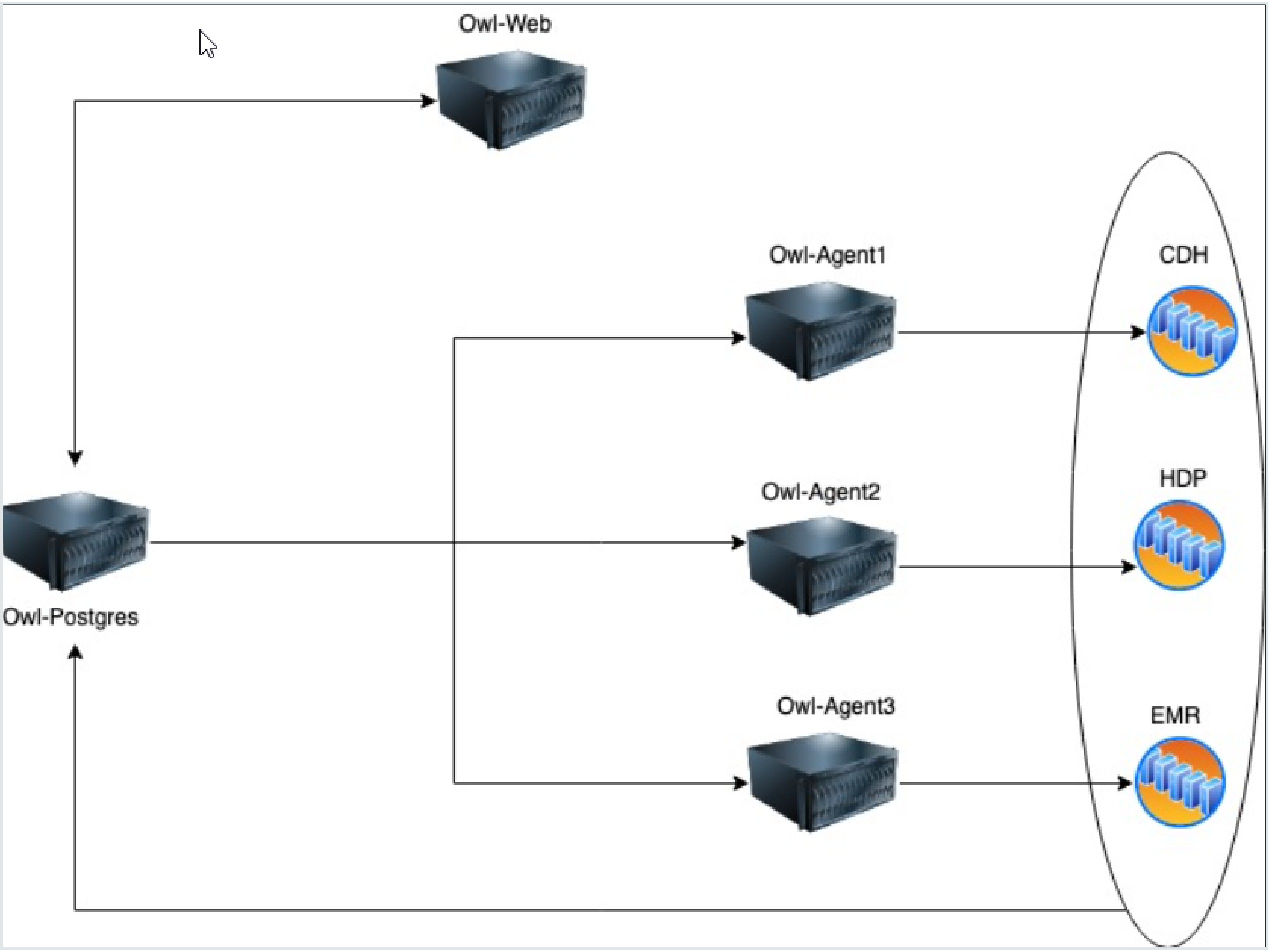
- When the Agents have been registered, associated with DB connections, users can now execute a job via the explorer page.



Data Preview

id	first_name	last_name	email	gender	ssn_num	ein_num	auto_make	auto_year	zip_code
1	Penny	Boodell	pboodell0@usa.gov	Female	388-55-2917	11d2208b-a176-4d58-a5b1-379ebfbab966	Nissan	2000	13348 CEDEX 2
2	Algernon	Wyllie	awyllie1@comsenz.com	Male	607-33-3450	2cc2a818-e244-4e47-8e50-7ff02eb64870	GMC	1992	null
3	Marsh	Zanicchi	mzanicchi2@bigcartel.com	Male	881-21-9672	23a5ad43-4a15-4f6c-8ee8-42231eb53450	Volvo	2004	366319
4	Tandie	Firebrace	tfirebrace3@theglobeandmail.com	Female	134-07-1825	41df020d-e6c1-4f39-b018-1cdc8bfb9da2	BMW	2009	E5L

Diagram



The image above provides a high-level depiction of how agents work within DQ. A job execution is driven by DQ Jobs that are written to an `agent_q` table inside the DQ Metadata Postgres Storagevia the Web UI or REST API endpoint. Each agent available and running queries the `Owl-Postgres` table every 5 seconds to execute the DQ Jobs the agent is responsible for. For example, the EMR agent `Owl-Agent3` only executes DQ Jobs scheduled to run on EMR.

When an agent picks up a DQ Job to execute, the agent will launch the job either locally on the agent node itself or on a cluster as a spark job (if the agent is setup as an edge node of a cluster). Depending on where the job launches, the results of the DQ Job will write back to the DQ Metadata Storage (`Owl-Postgres` database). The results are then displayed on the DQ Web UI, exposed as REST API, and available for direct SQL query against `Owl-Postgres` database.

Chapter 6

Collibra DQ Connections

Supported Connections

A list of supported data source connection types.

> **Note** To access our old Supported Connections page, please refer to 2022.03.

Production

The following is a list of drivers certified for production use.

Connections - Currently Supported

Connection	Certified	Tested	Packaged	Optionally Packaged	Pushdown	Estimate job	Filtergram	Analyze Data	Schedule	Spark Agent	Yarn Agent	Parallel JDBC	Session State	Kerberos Password	Kerberos Password Manager	Kerberos Keytab	Kerberos TGT	Standalone (non-Livy)	JDK8 Driver Compatibility	JDK11 Driver Compatibility
Athena	✓ Yes	✓ Yes	❗ No	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	❗ No	❗ No	❗ No	❗ No	❗ No	✓ Yes	✓ Yes	✓ Yes

Connection	Certified	Tested	Packaged	Optionally Packaged	Pushdown	Estimate job	Filtergram	Analyze Data	Schedule	Spark Agent	Yarn Agent	Parallel JDBC	Session State	Kerberos Password	Kerberos Password Manager	Kerberos Keytab	Kerberos TGT	Standalone (non-Live)	JDK8 Driver Compatibility	JDK11 Driver Compatibility
BigQuery	✓ Yes	✓ Yes	❗ No	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	❗ No	❗ No	❗ No	❗ No	❗ No	✓ Yes	✓ Yes	✓ Yes
Databricks JDBC	✓ Yes	✓ Yes	❗ No	✓ Yes	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	✓ Yes	✓ Yes
DB2	✓ Yes	✓ Yes	✓ Yes	❗ No	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	❗ No	❗ No	❗ No	❗ No	❗ No	✓ Yes	✓ Yes	✓ Yes
Dremio	✓ Yes	✓ Yes	✓ Yes	❗ No	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	❗ No	❗ No	❗ No	❗ No	❗ No	✓ Yes	✓ Yes	✓ Yes

Connection	Certified	Tested	Packaged	Optionally Packaged	Pushdown	Estimate job	Filtergram	Analyze Data	Schedule	Spark Agent	Yarn Agent	Parallel JDBC	Session State	Kerberos Password	Kerberos Password Manager	Kerberos Keytab	Kerberos TGT	Standalone (non-Live)	JDK8 Driver Compatibility	JDK11 Driver Compatibility
Hive	✓ Yes	✓ Yes	❗ No	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	❗ No	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes
Impala	✓ Yes	❗ No	❗ No	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	❗ No	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes
MS SQL	✓ Yes	✓ Yes	✓ Yes	❗ No	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	❗ No	❗ No	❗ No	❗ No	❗ No	✓ Yes	✓ Yes	❗ No
MYSQL	✓ Yes	✓ Yes	✓ Yes	❗ No	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	❗ No	❗ No	❗ No	❗ No	❗ No	✓ Yes	✓ Yes	✓ Yes

Connection	Certified	Tested	Packaged	Optionally Packaged	Pushdown	Estimate job	Filtergram	Analyze Data	Schedule	Spark Agent	Yarn Agent	Parallel JDBC	Session State	Kerberos Password	Kerberos Password Manager	Kerberos Keytab	Kerberos TGT	Standalone (non-Livy)	JDK8 Driver Compatibility	JDK11 Driver Compatibility
Oracle	✓ Yes	✓ Yes	✓ Yes	❗ No	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	❗ No	❗ No	❗ No	❗ No	❗ No	✓ Yes	✓ Yes	✓ Yes
Postgres	✓ Yes	✓ Yes	✓ Yes	❗ No	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	❗ No	❗ No	❗ No	❗ No	❗ No	✓ Yes	✓ Yes	✓ Yes
Presto	✓ Yes	❗ No	✓ Yes	❗ No	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	❗ No	❗ No	❗ No	❗ No	❗ No	✓ Yes	✓ Yes	✓ Yes
Redshift	✓ Yes	✓ Yes	✓ Yes	❗ No	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	❗ No	❗ No	❗ No	❗ No	❗ No	✓ Yes	✓ Yes	✓ Yes

Connection	Certified	Tested	Packaged	Optionally Packaged	Pushdown	Estimate job	Filtergram	Analyze Data	Schedule	Spark Agent	Yarn Agent	Parallel JDBC	Session State	Kerberos Password	Kerberos Password Manager	Kerberos Keytab	Kerberos TGT	Standalone (non-Livy)	JDK8 Driver Compatibility	JDK11 Driver Compatibility
Snowflake	✓ Yes	✓ Yes	✓ Yes	❗ No	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	❗ No	❗ No	❗ No	❗ No	❗ No	✓ Yes	✓ Yes	✓ Yes
Sybase	✓ Yes	✓ Yes	✓ Yes	❗ No	❗ No	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	✓ Yes	✓ Yes	✓ Yes
Teradata	✓ Yes	✓ Yes	✓ Yes	❗ No	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes	❗ No	❗ No	❗ No	❗ No	❗ No	✓ Yes	✓ Yes	✓ Yes

Note The Dremio connection is compatible with JDK11 if you add the following to owlmanage.sh as a JVM option for the web and Spark instance: `-Dcdjd.io.netty.tryReflectionSetAccessible=true`

Remote Connections - Currently Supported

Connection	Certified	Tested	Packaged	Optionally packaged	Pushdown	Estimate job	Filtergram	Analyze data	Spark agent	Yarn agent
Azure Data Lake (Gen2)	✓ Yes	✓ Yes	✓ Yes	❗ No	❗ No	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes
Google Cloud Storage	✓ Yes	✓ Yes	❗ No	✓ Yes	❗ No	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes
HDFS	✓ Yes	✓ Yes	✓ Yes	❗ No	❗ No	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes
S3	✓ Yes	✓ Yes	✓ Yes	❗ No	❗ No	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✓ Yes

Under Evaluation

The following is a list of drivers which are under evaluation (not certified yet for production usage). These connections are currently ineligible for escalated support services.

Connections - Tech Preview

Connection	Certified	Tested	Packaged	Optional packaging	Pushdown	Estimate job	Filtergram	Analyze data	Schedule	Spark agent	Yarn agent	Parallel JDBC	Session state	Kerberos state	Kerberos password manager	Kerberos keytab	Kerberos TGT	Standalone (non-Livy)
Cassandra	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No
MongoDB	❗ No	❗ No	❗ No	❗ No	❗ No	✓ Yes	❗ No	✓ Yes	✓ Yes	✓ Yes	✓ Yes	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	✓ Yes
SAP Hana	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No
Solr	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No

Streaming - Tech Preview

Connection	Certified	Tested	Packaged	Optional packaging	Pushdown	Estimate job	Filtergram	Analyze data	Schedule	Spark agent	Yarn agent	Parallel JDBC	Session state	Kerberos password	Kerberos password manager	Kerberos TGT	CRDB metastore	Standalone (non-Livy)
Kafka	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No	❗ No

Files

File type	Supported
CSV (and all delimiters)	✓ Yes
Parquet	✓ Yes
AVRO	✓ Yes
JSON	✓ Yes
DELTA	✓ Yes

Limitations

Authentication

- DQ Jobs that require Kerberos TGT are not yet supported on Spark Standalone or Local deployments
    - Recommended to submit jobs via Yarn or K8s

File Limitations

File Sizes

- Files with more than 250 columns supported in File Explorer, unless you have Livy enabled.
- Files larger than 5gb are not supported in File Explorer, unless you have Livy enabled.
- Smaller file sizes will allow for skip scanning and more efficient processing
- Advanced features like replay, scheduling, and historical lookbacks require a date signature in the folder of file path

S3

- Please ensure no spaces in S3 connection name
- Please remember to select 'Save Credentials' checkbox upon establishing connection
- Please point to **root** bucket, not sub folders

Local Files

- Local files can only be run using NO_AGENT default
- This is for quick testing, smaller files, and demonstration purposes.
- Local file scanning is not intended for large scale production use.

Livy

- Livy is only supported for K8s environments

Spark Engine Support

- MapR is EOL and MapR spark engine not supported to run Collibra DQ jobs.

Databricks

Please refer to this page for more details on Databricks support

The only supported Databricks spark submit option is to use a notebook to initiate the job (Scala and Pyspark options). This is intended for pipeline developers and users knowledgeable with Databricks and notebooks. This form factor is ideal for incorporating data quality within existing Spark ETL data flows. The results are still available for business users to consume. The configuration is not intended for business users to implement. There are three ways that Databricks users can run DQ jobs using Databricks cluster or JDBC connection. 1. **Notebook** Users can directly open a notebook, upload Collibra DQjars and run a DQ job on Databricks cluster. The full steps are explained in below page. Collibra DQsupports this flow in production.

https://dq-docs.collibra.com/apis-1/notebook/cdq-+-databricks

2. Spark-Submit

There are two ways to run a spark submit job on Databricks's cluster. The first approach is to run a DQ spark submit job using Databricks UI and the second approach is by invoking Databricks rest API. We have tested both approaches against different cluster versions of DataBricks (See below table). Below is the full documentation to demonstrate these paths. https://dq-docs.collibra.com/apis-1/notebook/cdq-+-databricks/dq-databricks-submit\

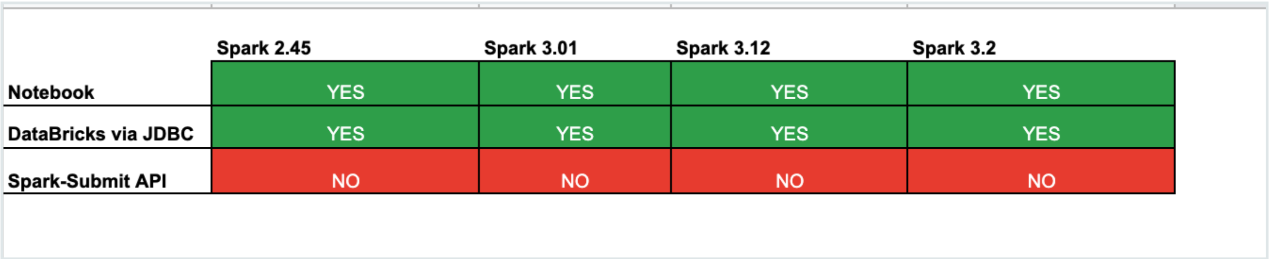
Please note that these are only examples to demonstrate how to achieve DQ spark submit to Databricks's cluster. These paths are **not** supported in production and the Collibra DQ team does **not** support any bug coverages or professional services or customer questions for these flows. \

3. JDBC

Collibra DQ users can create JDBC connections in CDQ UI and connect to their Databricks database. This is scheduled for 2022.05 release.

> **Warning** Delta Lake and JDBC connectivity has been validated against Spark 3.01 Collibra DQ package, Databricks 7.3 LTS and SparkJDBC41.jar. This is available as Preview. No other combinations have been certified at this time.

> **Warning** Spark submit using the Databricks spark master url is not supported.



	Spark 2.45	Spark 3.01	Spark 3.12	Spark 3.2
Notebook	YES	YES	YES	YES
DataBricks via JDBC	YES	YES	YES	YES
Spark-Submit API	NO	NO	NO	NO

Connectivity to Athena

Your host can connect to Athena with either an Athena public service endpoint or an Athena private endpoint. For more information on setting the endpoint, see Command line options and Boto3 documentation.

JDBC URL Example

jdbc:awsathena://AwsRegion=us-east-1;User=xxx;Password=xxx;S3OutputLocation=s3://data-bucket;**MetadataRetrievalMethod=Query**

- Athena uses port 443 to connect to the host.
- Athena's streaming API uses port 444 to stream the query results. When you use a JDBC/ODBC driver, Athena uses this port to stream the query results to the JDBC/ODBC driver installed on the client host. Therefore, unblock this port when you use a JDBC/ODBC driver to connect to Athena. If this port is blocked, your business intelligence tool might time out or fail to show query results when you run a query.
- Use the appropriate JDBC connection URLs in your business tool configuration according to your private DNS configuration for your endpoint.
  - Use the following connection string if you turned off the private DNS: jdbc:awsathena://vpce-.athena.us-east-1.vpce.amazonaws.com:443
  - Use the following connection string if you turned on the private DNS: jdbc:awsathena://athena.us-east-1.amazonaws.com:443
- Be sure that the security group attached to your VPC endpoint allows traffic from the host where you installed the JDBC/ODBC driver.
- Be sure that port 444 isn't blocked. If you use an AWS PrivateLink endpoint to connect to Athena, then be sure that the security group attached to the AWS PrivateLink endpoint is open to inbound traffic on port 444. Athena uses port 444 to stream query results. If port 444 is blocked, then the results aren't streamed back to your client host. In such

situations, you might receive an error message similar to "[Simba][AthenaJDBC](100123) An error has occurred. Exception during column initialization". This can also cause the business intelligence tool to stop responding and not display the query results.

```
telnet athena.us-east-1.amazonaws.com 443
telnet glue.us-east-1.amazonaws.com 443
```

Chapter 6

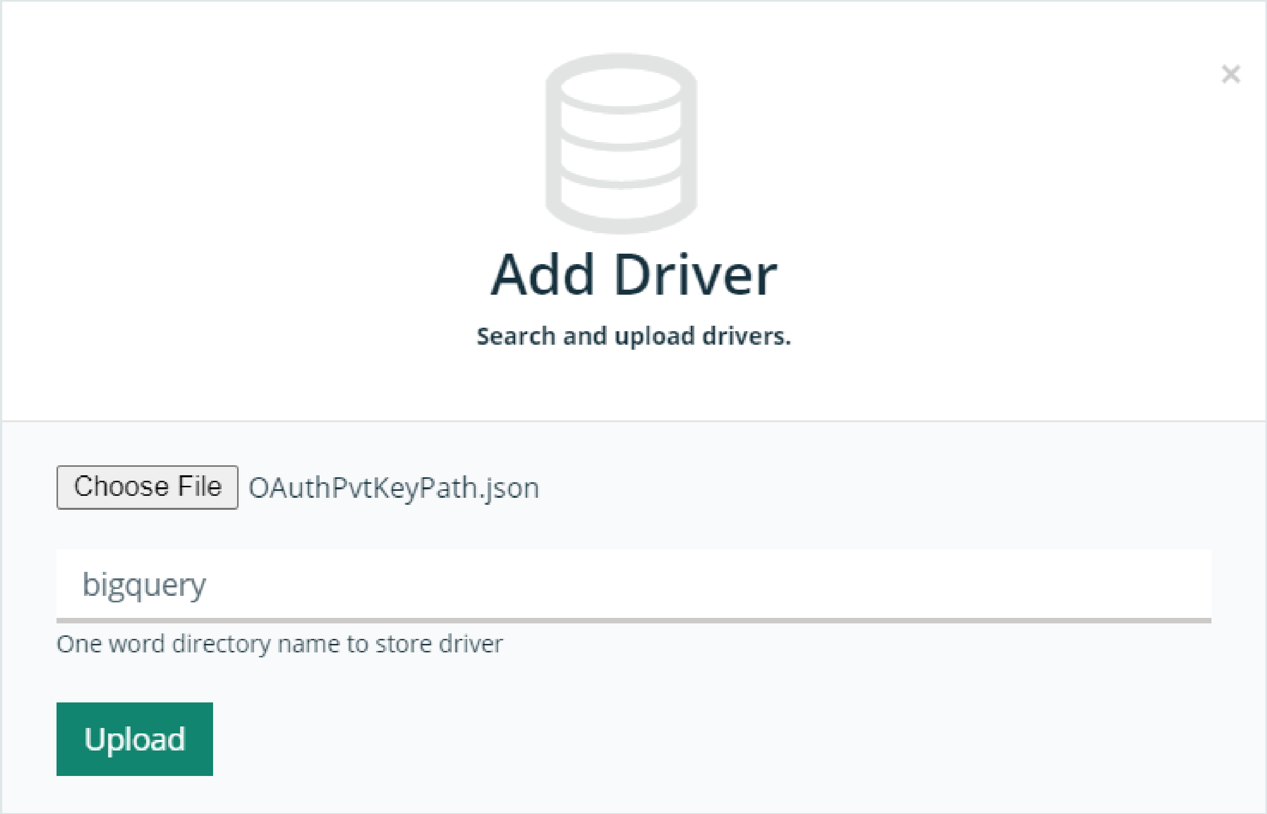
Minimum Permissions

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "VisualEditor0",
            "Effect": "Allow",
            "Action": [
                "athena:StartQueryExecution",
                "s3:ListBucketMultipartUploads",
                "athena:GetQueryResultsStream",
                "glue:GetTables",
                "glue:GetPartitions",
                "athena:GetQueryResults",
                "glue:BatchGetPartition",
                "s3:ListBucket",
                "glue:GetDatabases",
                "athena:ListQueryExecutions",
                "s3:ListMultipartUploadParts",
                "glue:GetTable",
                "glue:GetDatabase",
                "athena:GetWorkGroup",
                "s3:PutObject",
                "s3:GetObject",
                "glue:GetPartition",
                "glue:GetCatalogImportStatus",
                "athena:StopQueryExecution",
                "athena:GetQueryExecution",
                "s3:GetBucketLocation",
                "athena:BatchGetQueryExecution",
                "athena:DeletePreparedStatement",
                "athena:CreatePreparedStatement"
            ],
            "Resource": [
                "arn:aws:athena:*:<AWSAccountID>:workgroup/prima-
ry",
                "arn:aws:s3:::<S3 bucket name>/*",
                "arn:aws:s3:::<S3 bucket name>",
                "arn:aws:glue:*:<AWSAccountID>:catalog",
                "arn:aws:glue:*:<AWSAccountID>:database/<databas-
e name>",
                "arn:aws:glue:*:<AWSAccountID>:table/<database
name>/*"
            ]
        }
    ]
}
```

Connectivity to BigQuery

Steps for the BigQuery Connection

1. **Driver**: com.simba.googlebigquery.jdbc42.Driver
2. **Locate your service account owl-gcp.json** (your org auth key in JSON format)
3. **Create a JDBC connection** (for example only do not use this JDBC URL): jdbc:bigquery://https://www.googleapis.com/bigquery/v2:443;ProjectId=;OAuthType=0;OAuthServiceAcctEmail=<1234567890>-compute@developer.gserviceaccount.com;OAuthPvtKeyPath=/opt/ext/bq-gcp.json;Timeout=86400
4. **Requires a path to a JSON file** that contains the service account for authorization. That same file is provided to the Spark session to make a direct to storage connection for maximum parallelism once Core fires up."
   a. Helpful tip: This JSON file can be uploaded to your bigquery directory using the "add driver".



Add Driver

Search and upload drivers.

OAuthPvtKeyPath.json

bigquery

One word directory name to store driver

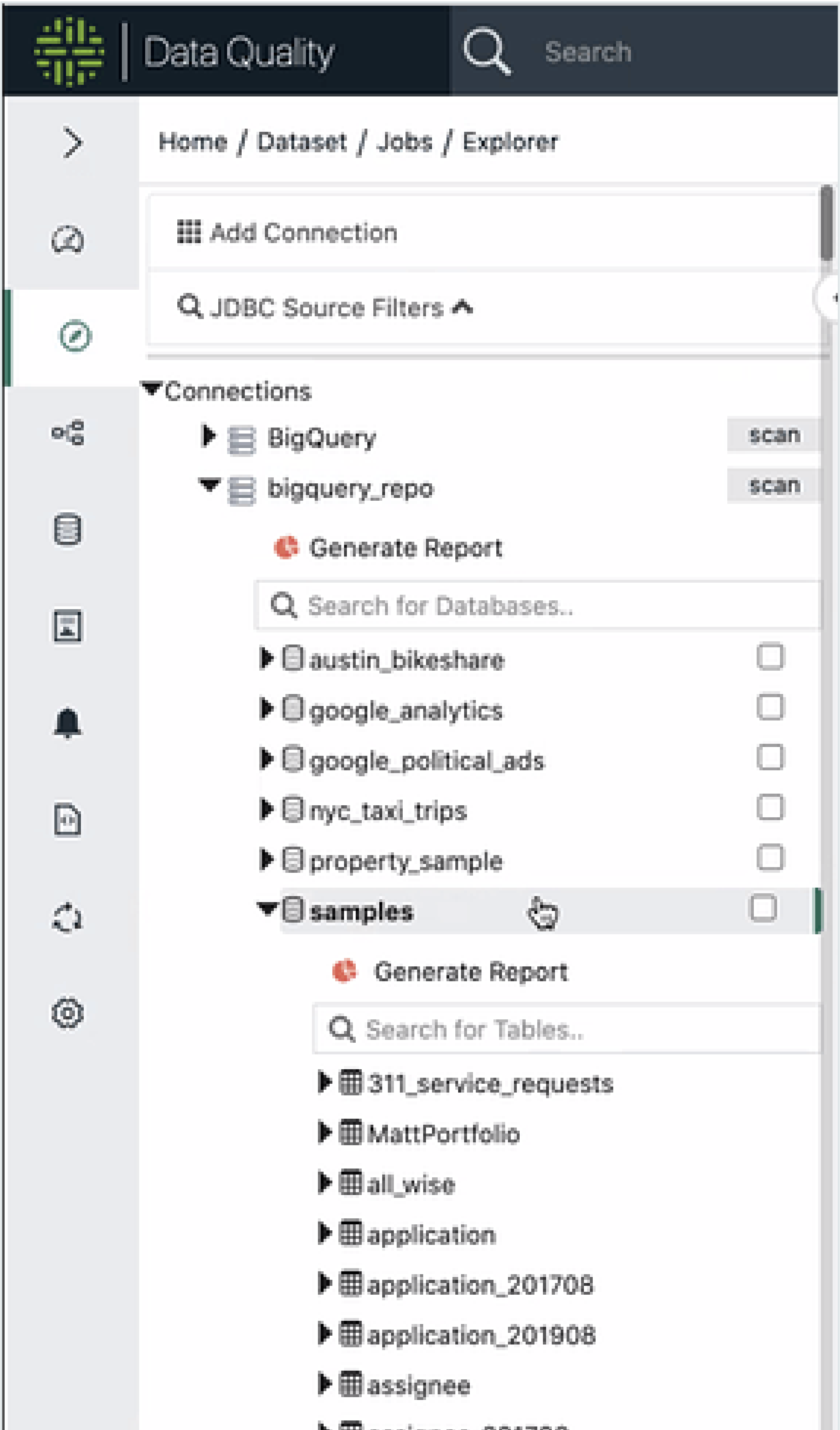
To succeed with the connection, you must follow these steps:

1. **Password for the BigQuery Connector form in Collibra DQ must be a base64 encoded string created from the json file (see step 3. above)** and input as password. For example: `base64 your_json.json -w 0` or `cat your_json.json | base64 -w 0`
2. **Check that this JAR exists and is on the path of the Collibra DQ Web UI server** (eg. <INSTALL_PATH>/owl/drivers/bigquery/core). Look at your driver directory location which contains this BigQuery JAR: spark-bigquery_2.12-0.18.1.jar
3. **Make sure these JARs present in <INSTALL_PATH>/owl/drivers/bigquery/:** ****animal-sniffer-annotations-1.19.jargoogle-api-services-bigquery-v2-rev20201030-1.30.10.jargrpc-google-cloud-bigquerystorage-v1beta1-0.106.4.jarlistenablefuture-9999.0-empty-to-avoid-conflict-with-guava.jarannotations-4.1.1.4.jargoogle-auth-library-credentials-0.22.0.-jargrpc-google-cloud-bigquerystorage-v1beta2-0.106.4.jaropencensus-api-0.24.0.jarapi-common-1.10.1.jargoogle-auth-library-oauth2-http-0.22.0.jargrpc-grpclb-1.33.1.jaropen-census-contrib-http-util-0.24.0.jarauto-value-annotations-1.7.4.jarGoogleBigQueryJDBC42.jargrpc-netty-shaded-1.33.1.jarperfmark-api-0.19.0.jaravro-1.10.0.jargoogle-cloud-bigquery-1.125.0.jargrpc-protobuf-1.33.1.jarprotobuf-

java-3.13.0.jarchecker-compat-qual-2.5.5.jargoogle-cloud-bigquerystorage-1.6.4.jargrpc-protobuf-lite-1.33.1.jarprotobuf-java-util-3.13.0.jarcommons-codec-1.11.jargoogle-cloud-core-1.93.10.jargrpc-stub-1.33.1.jarproto-google-cloud-bigquerystorage-v1-1.6.4.jarcommons-compress-1.20.jargoogle-cloud-core-http-1.93.10.jargson-2.8.6.jarproto-google-cloud-bigquerystorage-v1alpha2-0.106.4.jarcommons-lang3-3.5.jargoogle-http-client-1.38.0.jarguava-23.0.jarproto-google-cloud-bigquerystorage-v1beta1-0.106.4.jarcommons-logging-1.2.jargoogle-http-client-apache-v2-1.38.0.jarhttpclient-4.5.13.jarproto-google-cloud-bigquerystorage-v1beta2-0.106.4.jarconscrypt-openjdk-uber-2.5.1.jargoogle-http-client-appengine-1.38.0.jarhttpcore-4.4.13.jarproto-google-common-protos-2.0.1.jarcoregoogle-http-client-jackson2-1.38.0.jarj2objc-annotations-1.3.jarproto-google-iam-v1-1.0.3.jarerror_prone_annotations-2.4.0.jargoogle-oauth-client-1.31.1.jarjackson-annotations-2.11.0.jargrpc-alts-1.33.1.jarjackson-core-2.11.3.jarslf4j-api-1.7.30.jarfailureaccess-1.0.1.jargrpc-api-1.33.1.jarjackson-databind-2.11.0.jargax-1.60.0.jargrpc-auth-1.33.1.jarjavax.annotation-api-1.3.2.jarthreetenbp-1.5.0.jargax-grpc-1.60.0.jargrpc-context-1.33.1.jarjoda-time-2.10.1.jargax-httpjson-0.77.0.jargrpc-core-1.33.1.jarjson-20200518.jargoogle-api-client-1.31.1.jargrpc-google-cloud-bigquerystorage-v1-1.6.4.jarjsr305-3.0.2.jar

4. You may get a CLASSPATH conflict regarding the JAR files.

5. Make sure the BigQuery connector Scala version matches your Spark Scala version.



Data Quality

Search

Home / Dataset / Jobs / Explorer

Add Connection

JDBC Source Filters

Connections
- BigQuery — scan
- bigquery_repo — scan
  - Generate Report
  - Search for Databases..
  - austin_bikeshare □
  - google_analytics □
  - google_political_ads □
  - nyc_taxi_trips □
  - property_sample □
  - samples □
    - Generate Report
    - Search for Tables..
    - 311_service_requests
    - MattPortfolio
    - all_wise
    - application
    - application_201708
    - application_201908
    - assignee

Networking

Please account for these urls from a networking and firewall perspective.

logging.googleapis.com

oauth2.googleapis.com

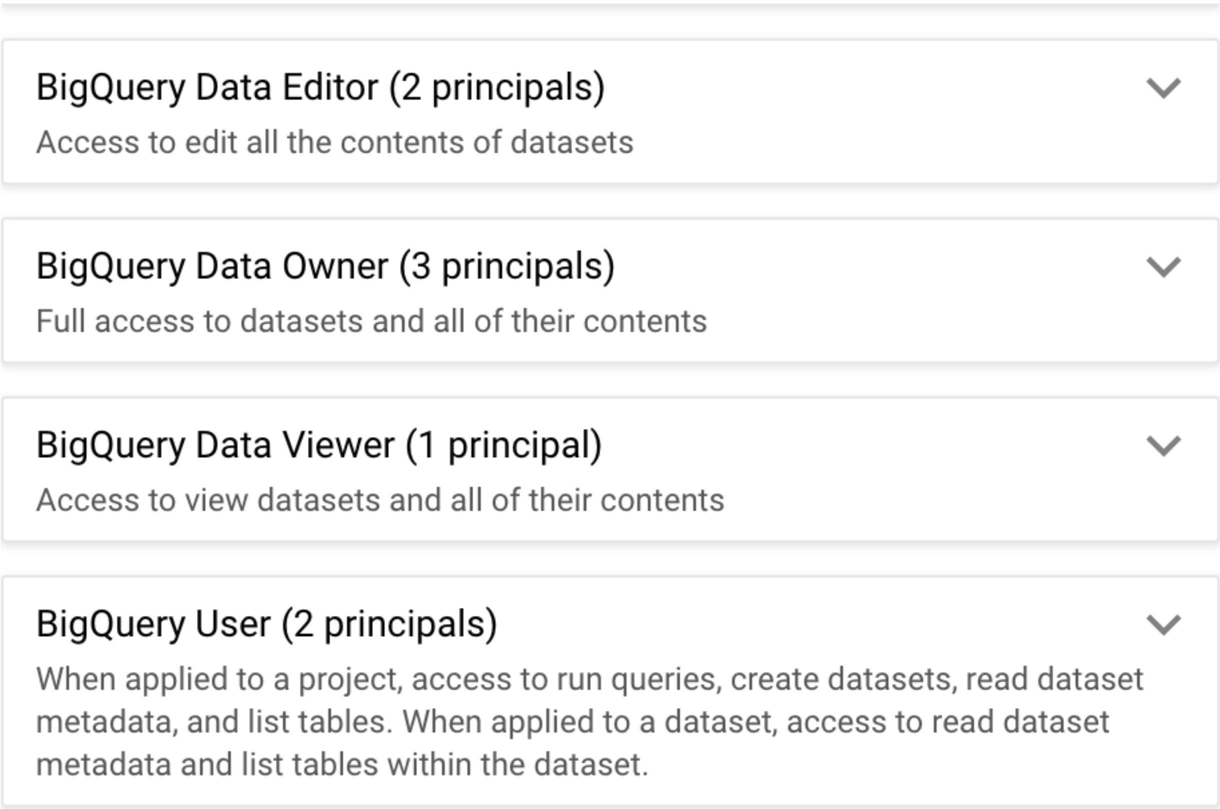
googleapis.com

bigquerystorage.googleapis.com

bigquery.googleapis.com

Permissions

Make sure the project and account have appropriate permissions. These are common permissions to provide to the account.



BigQuery Data Editor (2 principals)

Access to edit all the contents of datasets

BigQuery Data Owner (3 principals)

Full access to datasets and all of their contents

BigQuery Data Viewer (1 principal)

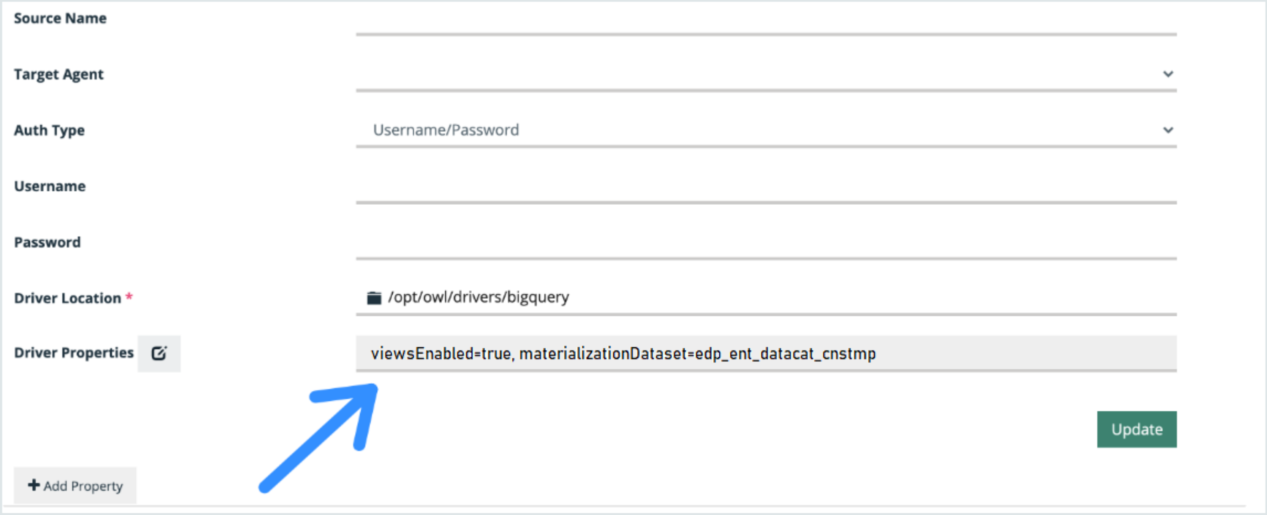
Access to view datasets and all of their contents

BigQuery User (2 principals)

When applied to a project, access to run queries, create datasets, read dataset metadata, and list tables. When applied to a dataset, access to read dataset metadata and list tables within the dataset.

Views

Support for BigQuery views is available from the 2021.11 release onward. There are BigQuery limitations on creating views from different data sets (collections). Optionally, you can add the `viewsEnabled=true` parameter to the connection property when defining the connection.



Source Name	
Target Agent	
Auth Type	Username/Password
Username	
Password	
Driver Location *	/opt/owl/drivers/bigquery
Driver Properties	viewsEnabled=true, materializationDataset=edp_ent_datacat_cnstmp

> **Note** For read/write access to BigQuery, you can use the Spark BigQuery connector. To use this connector, ensure that the following configurations are set:
>
> `viewsEnabled` is set to true.
> `materializationDataset` is set to a data set where the GCP user has table creation permission.
> `materializationProject` is optional.

Spark Version 2

> **Warning** Be sure to use the Spark BigQuery connector that is compatible with your version of Spark.
>
> Also, when using Spark <3 and Scala 2.11, add the following props to the connection properties:

```
dq.bq.legacy=true,viewsEnabled=true
```

Connectivity to Databricks

There are three ways to utilize Databricks infrastructure with Collibra Data Quality:

- JDBC (Supported)
- Notebook/SDK (Supported)
- Spark Submit (Not Supported)

JDBC (Supported)

> **Note** Certification, support and optional packaging is available from 2022.05.

URL

```
jdbc:databricks:// <your-account-here>.
.cloud.databricks.com:443/default;transportMode=http;ssl=1;httpPath=sql/protocolv1/o/363
3393438801721/0915-195703-sh82m595;AuthMech=3;UID=token;PWD=<your-token-
here>
```

Driver

com.databricks.client.jdbc.Driver

Credentials

```
user:token
password: <your-user-generated-token>
```

Jar

https://databricks-bi-artifacts.s3.us-east-2.amazonaws.com/simbaspark-drivers/jdbc/2.6.27/DatabricksJDBC42-2.6.27.1048.zip
`Version:` 2.6.27

Link to Databricks download.

Link to older versions of Databricks JDBC.

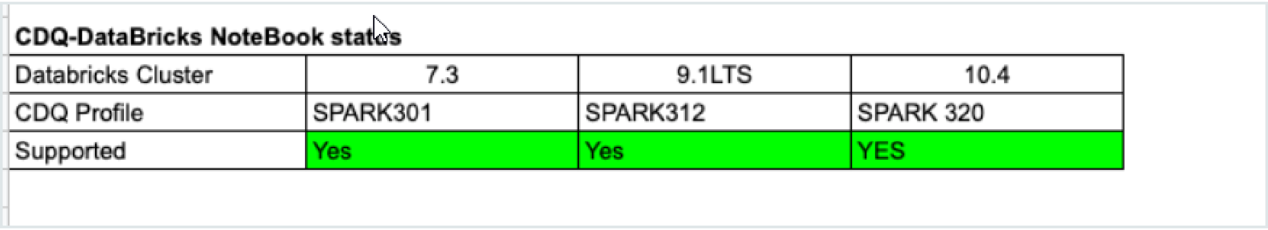
Notebook (Supported)

- Pyspark SDK
- Scala SDK
- CDQ + Databricks

Databricks no longer supports Run time 6.5 and 10.3. Therefore, CDQ Profile 2.45 is not runnable on Databricks.

https://docs.databricks.com/release-notes/runtime/10.3ml.html

The following table shows the latest supported versions of CDQ Profiles and their matching Databricks Run times. (last updated: September 2022).



CDQ-DataBricks NoteBook status

Databricks Cluster	7.3	9.1LTS	10.4
CDQ Profile	SPARK301	SPARK312	SPARK 320
Supported	Yes	Yes	YES

Spark Submit (Not Supported)

- Spark Master URL
- Databricks Jobs API
  - Rest

   - UI
   - DQ-Databricks Submit

> **Note** While these are not officially supported, there is a reference to architecture and implementation pattern for how to do a Databricks Job submission.

CDQ Connection to Databricks via JDBC

Make a Collibra DQ Connection to Databricks

Make a Collibra DQ connection to Databricks by performing the following steps.

> **Note** The Databricks Driver is packaged with the installation and can be found in the Driver folder.

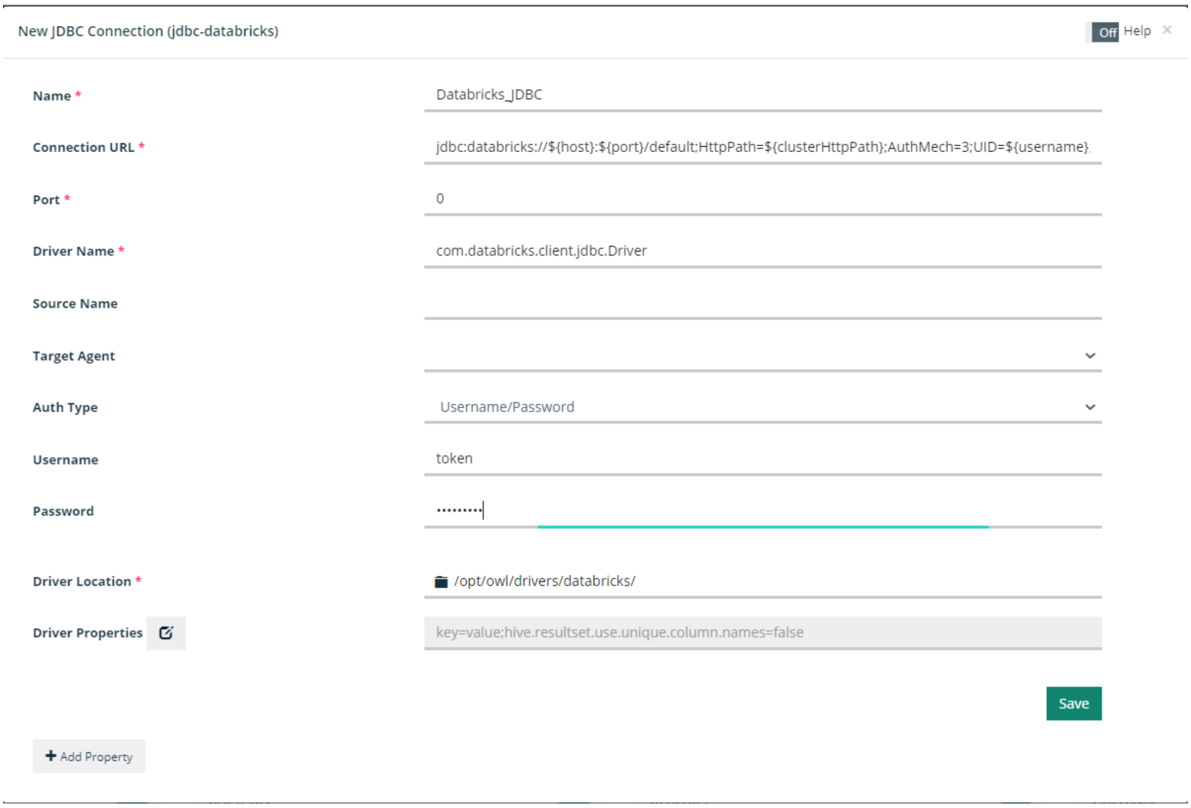
Steps

1. Login to your Collibra DQ instance.
2. Click the ⚙ icon, then click **Connection**.
3. Locate the DATABRICKS driver DatabricksJDBC42.
4. Click **Add**.
5. Complete the following fields:
   - **Name** - Add a name for the connection (e.g., Databricks_JDBC).
   - **Connection URL** - Enter the URL for the connection: jdbc:databricks://<your-account-here>..cloud.databricks.com:443/default;transportMode=http;ssl=1;httpPath=sql/protocolv1/o/3633393438801721/0915-195703-sh82m595;AuthMech=3;UID=token;PWD=<your-token-here>
   - **Port** - Enter the port for the connection.
   - **Driver Name** - Enter the name for the driver (e.g., com.databricks.client.jdbc.Driver)
   - **Auth Type** - Select the type of authorization from the drop-down list (e.g., Username/Password).

- **Username** - Username is **token**.
- **Password** - The token you entered in the Connection URL.

○ **Driver Location** - Enter the location where the driver resides.

Your connection should look similar to the following screenshot:

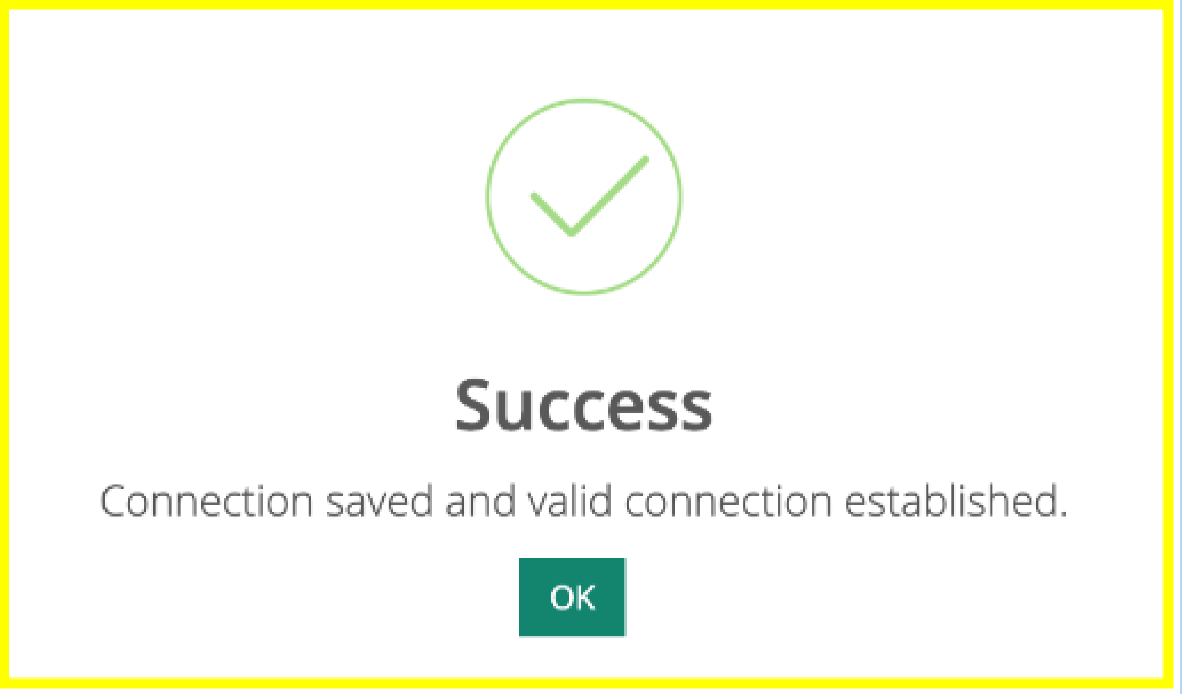


New JDBC Connection (jdbc-databricks)

Name *	Databricks_JDBC
Connection URL *	jdbc:databricks://${host}:${port}/default;HttpPath=${clusterHttpPath};AuthMech=3;UID=${username};
Port *	0
Driver Name *	com.databricks.client.jdbc.Driver
Source Name	
Target Agent	
Auth Type	Username/Password
Username	token
Password	•••••••••
Driver Location *	/opt/owl/drivers/databricks/
Driver Properties	key=value;hive.resultset.use.unique.column.names=false

6. Click **Save**.

If your connection information is valid, you receive the following message:

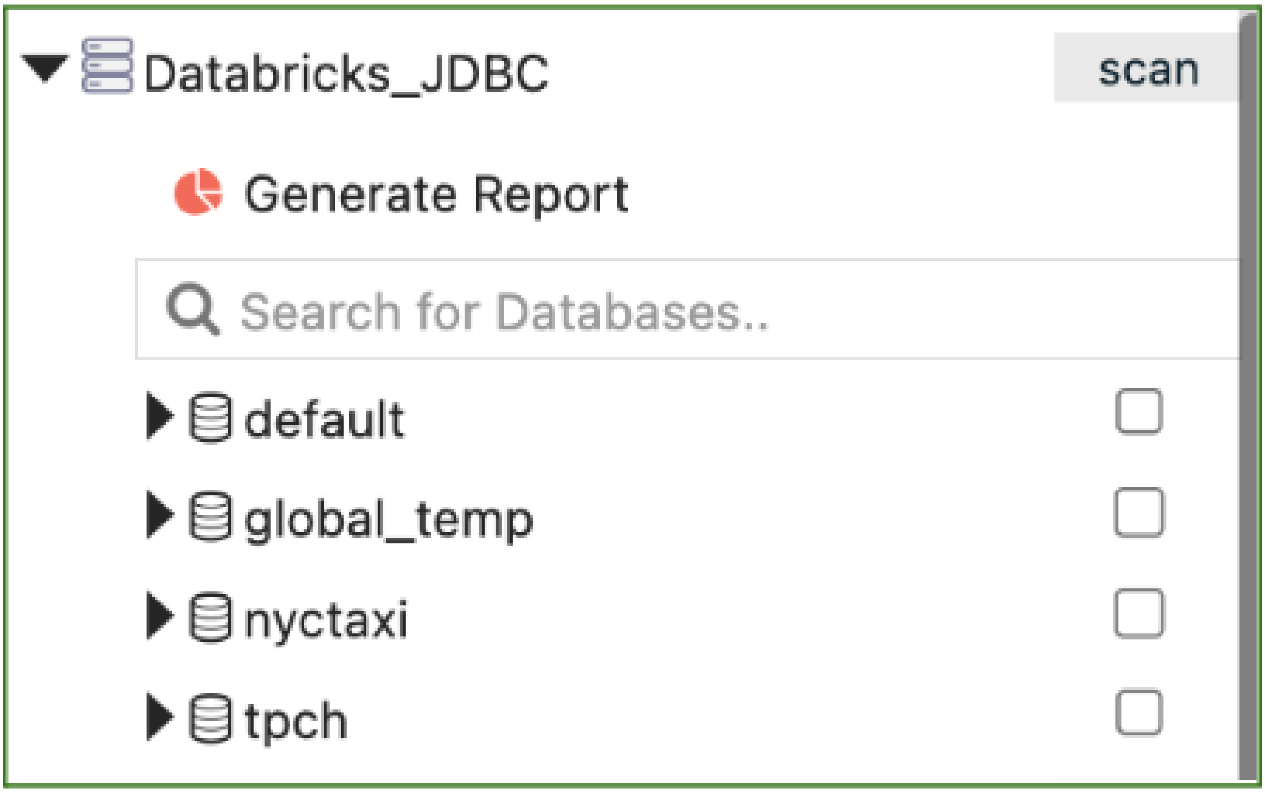


Success

Connection saved and valid connection established.

You have now successfully made a CDQ connection to Databricks via JDBC.

> **Tip** To view the connection, you can navigate to the CDQ Explorer page and click Databricks JDBC connection.
> Choose your dataset and continue to create your CDQ Job.



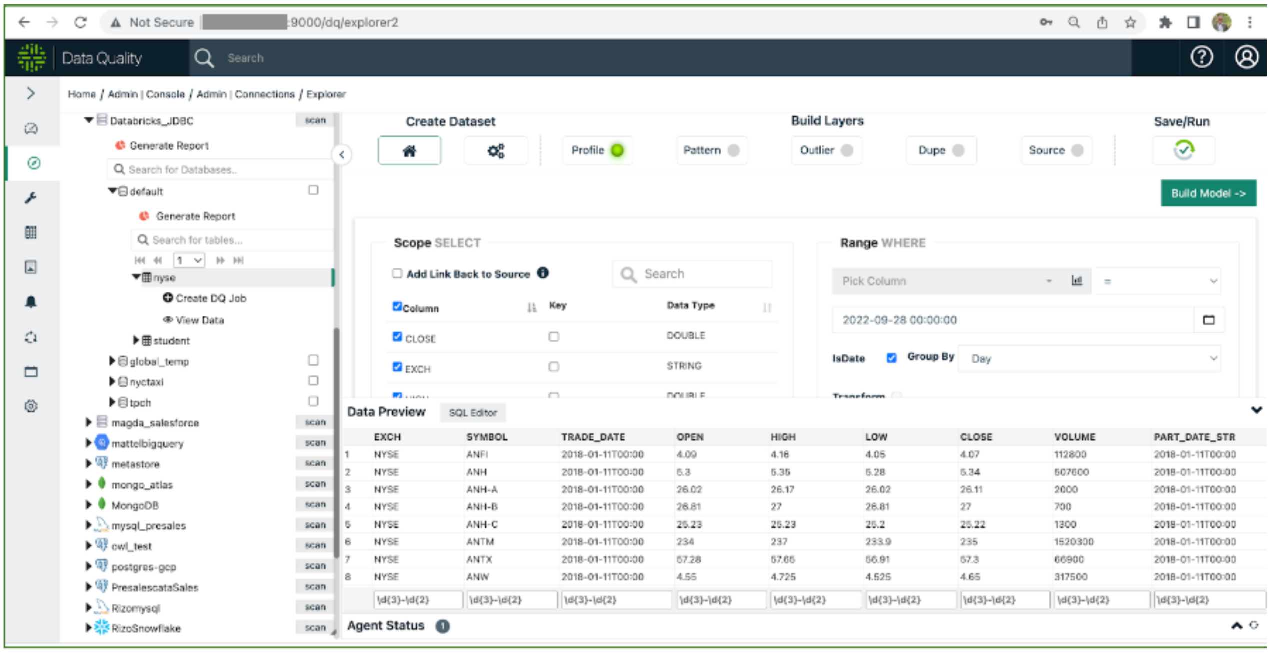
Databricks_JDBC scan

Generate Report

Search for Databases..

- default □
- global_temp □
- nyctaxi □
- tpch □

The following screenshot is an example of the **default > nyse** database.



Not Secure [redacted]:9000/dq/explorer2

Data Quality Search

Home / Admin | Console / Admin | Connections / Explorer

- Databricks_JDBC scan
  - Generate Report
  - Search for Databases..
  - default □
    - Generate Report
    - Search for tables...
    - nyse
      - Create DQ Job
      - View Data
    - student
  - global_temp □
  - nyctaxi □
  - tpch □
- magda_salesforce scan
- mattelbigquery scan
- metastore scan
- mongo_atlas scan
- MongoDB scan
- mysql_presales scan
- owl_test scan
- postgres-gcp scan
- PresalescataSales scan
- Rizomysql scan
- RizoSnowflake scan

Create Dataset

Build Layers: Profile, Pattern, Outlier, Dupe, Source

Save/Run

Build Model ->

Scope SELECT

□ Add Link Back to Source

☑ Column	Key	Data Type
☑ CLOSE	□	DOUBLE
☑ EXCH	□	STRING

Range WHERE

Pick Column =

2022-09-28 00:00:00

IsDate ☑ Group By Day

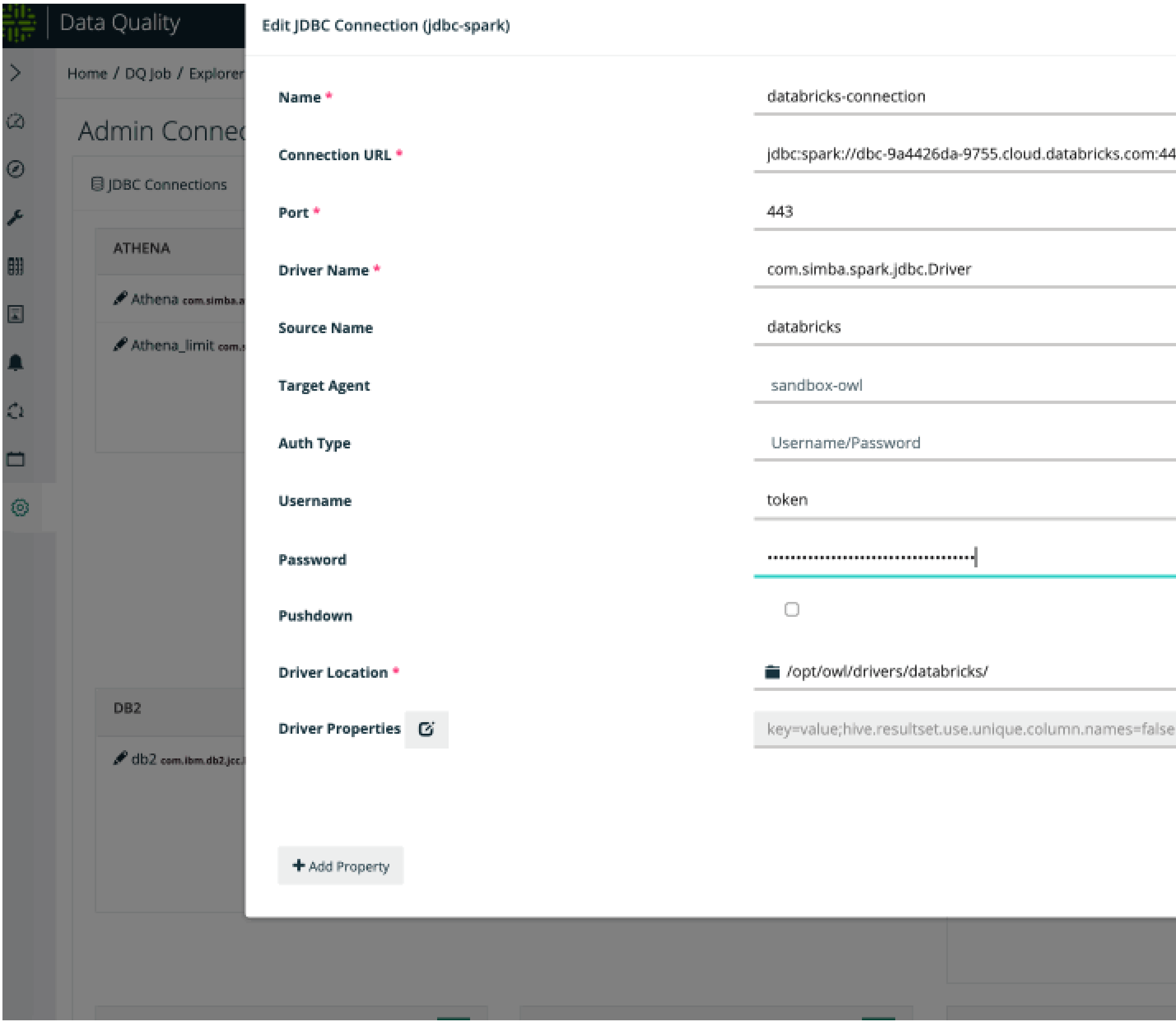
Data Preview SQL Editor

	EXCH	SYMBOL	TRADE_DATE	OPEN	HIGH	LOW	CLOSE	VOLUME	PART_DATE_STR
1	NYSE	ANFI	2018-01-11T00:00	4.09	4.16	4.05	4.07	112800	2018-01-11T00:00
2	NYSE	ANH	2018-01-11T00:00	5.3	5.35	5.28	5.34	507600	2018-01-11T00:00
3	NYSE	ANH-A	2018-01-11T00:00	26.02	26.17	26.02	26.11	2000	2018-01-11T00:00
4	NYSE	ANH-B	2018-01-11T00:00	26.81	27	26.81	27	700	2018-01-11T00:00
5	NYSE	ANH-C	2018-01-11T00:00	25.23	25.23	25.2	25.22	1300	2018-01-11T00:00
6	NYSE	ANTM	2018-01-11T00:00	234	237	233.9	235	1520300	2018-01-11T00:00
7	NYSE	ANTX	2018-01-11T00:00	57.28	57.65	56.91	57.3	66900	2018-01-11T00:00
8	NYSE	ANW	2018-01-11T00:00	4.55	4.725	4.525	4.65	317500	2018-01-11T00:00
	\d{3}-\d{2}	\d{3}-\d{2}	\d{3}-\d{2}	\d{3}-\d{2}	\d{3}-\d{2}	\d{3}-\d{2}	\d{3}-\d{2}	\d{3}-\d{2}	\d{3}-\d{2}

Agent Status 1

Recap

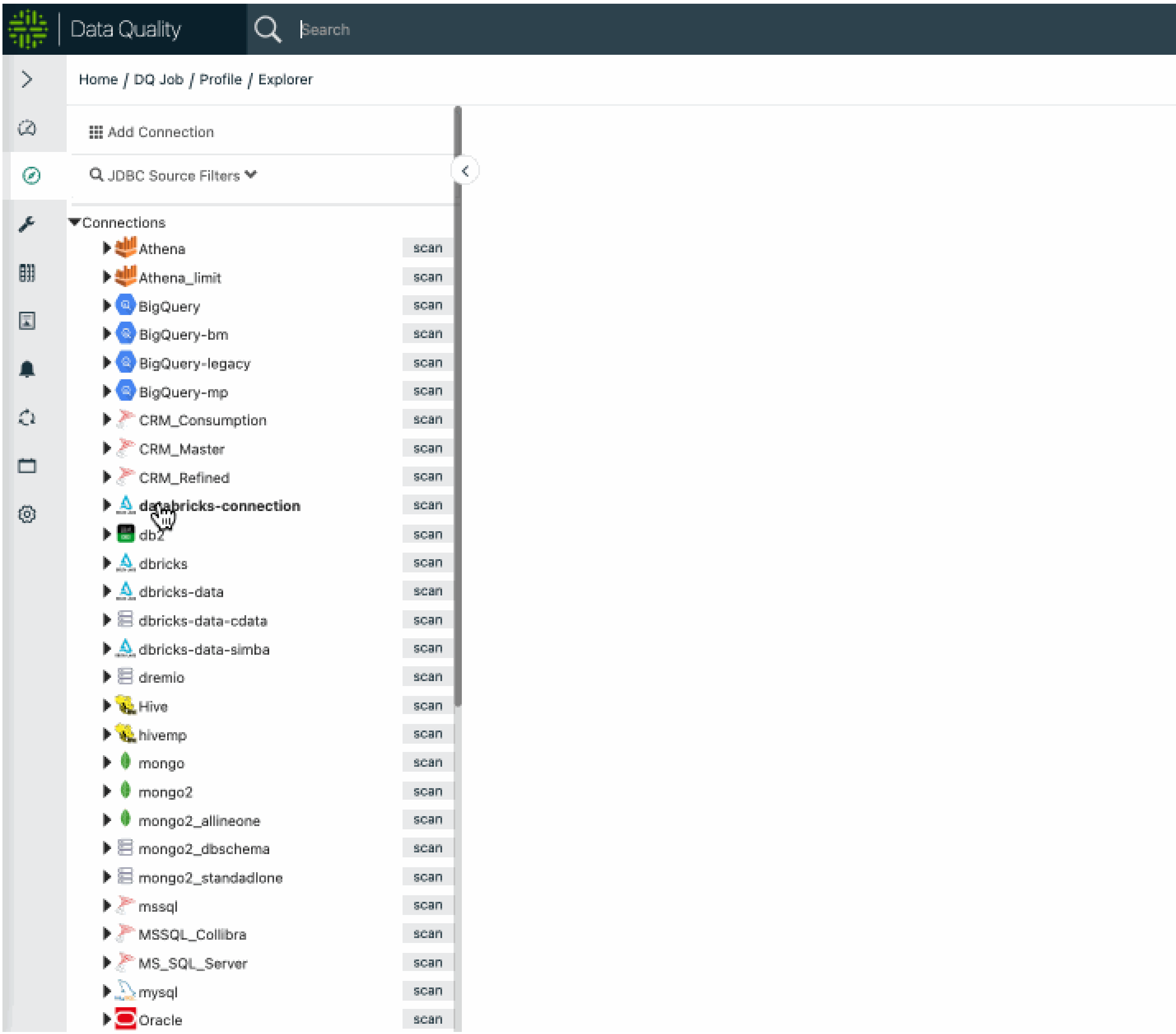
Input JDBC credentials:



Edit JDBC Connection (jdbc-spark)

Name *	databricks-connection
Connection URL *	jdbc:spark://dbc-9a4426da-9755.cloud.databricks.com:44
Port *	443
Driver Name *	com.simba.spark.jdbc.Driver
Source Name	databricks
Target Agent	sandbox-owl
Auth Type	Username/Password
Username	token
Password	••••••••••••••••••••••••••••••••••••••
Pushdown	□
Driver Location *	/opt/owl/drivers/databricks/
Driver Properties	key=value;hive.resultset.use.unique.column.names=false

Browse connection:

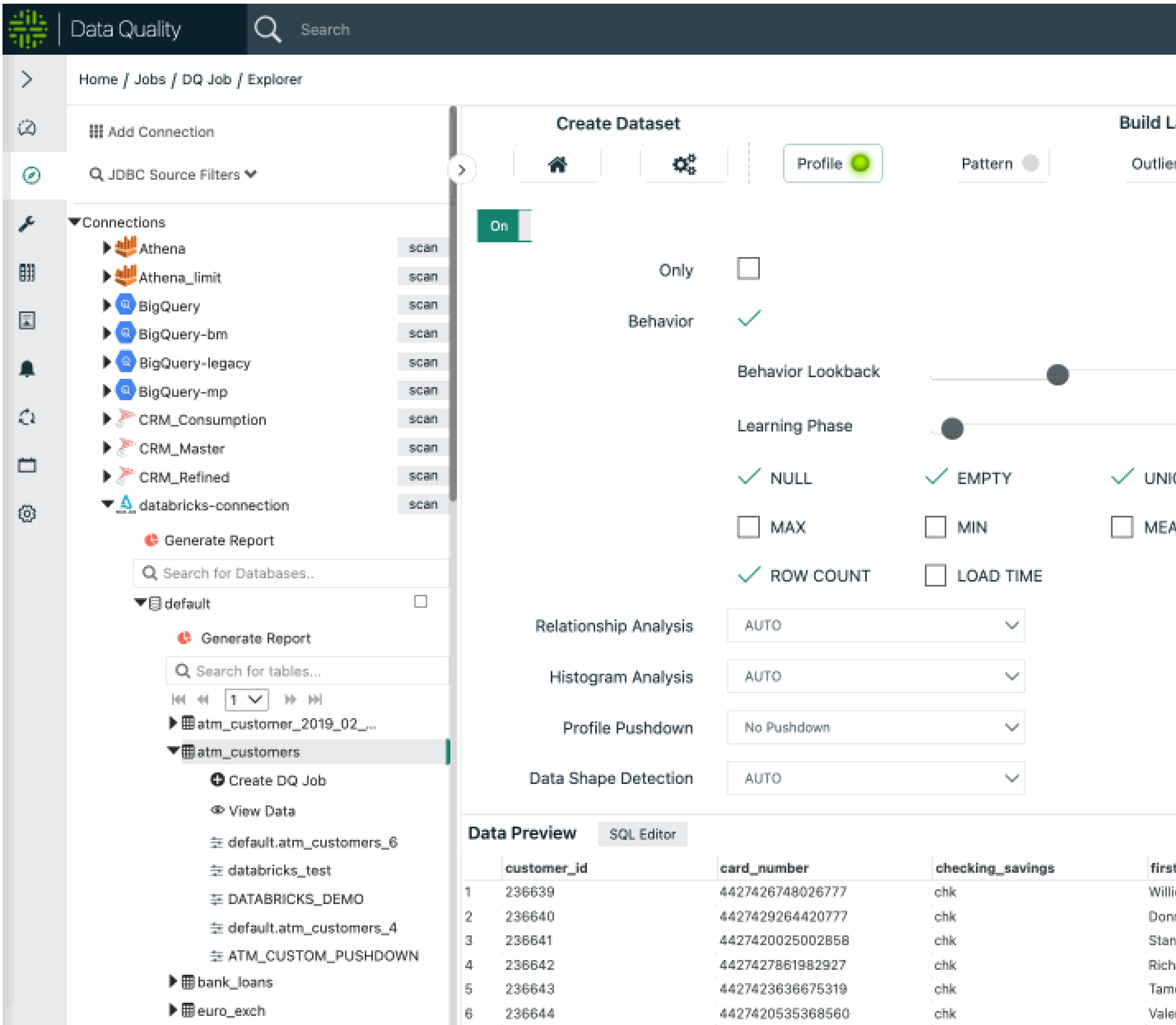


Home / DQ Job / Profile / Explorer

Connections

Athena	scan
Athena_limit	scan
BigQuery	scan
BigQuery-bm	scan
BigQuery-legacy	scan
BigQuery-mp	scan
CRM_Consumption	scan
CRM_Master	scan
CRM_Refined	scan
databricks-connection	scan
db2	scan
dbricks	scan
dbricks-data	scan
dbricks-data-cdata	scan
dbricks-data-simba	scan
dremio	scan
Hive	scan
hivemp	scan
mongo	scan
mongo2	scan
mongo2_allineone	scan
mongo2_dbschema	scan
mongo2_standadlone	scan
mssql	scan
MSSQL_Collibra	scan
MS_SQL_Server	scan
mysql	scan
Oracle	scan

Run Job:



Only □

Behavior ✓

Behavior Lookback

Learning Phase

✓ NULL ✓ EMPTY ✓ UNI

□ MAX □ MIN □ MEA

✓ ROW COUNT □ LOAD TIME

Relationship Analysis: AUTO

Histogram Analysis: AUTO

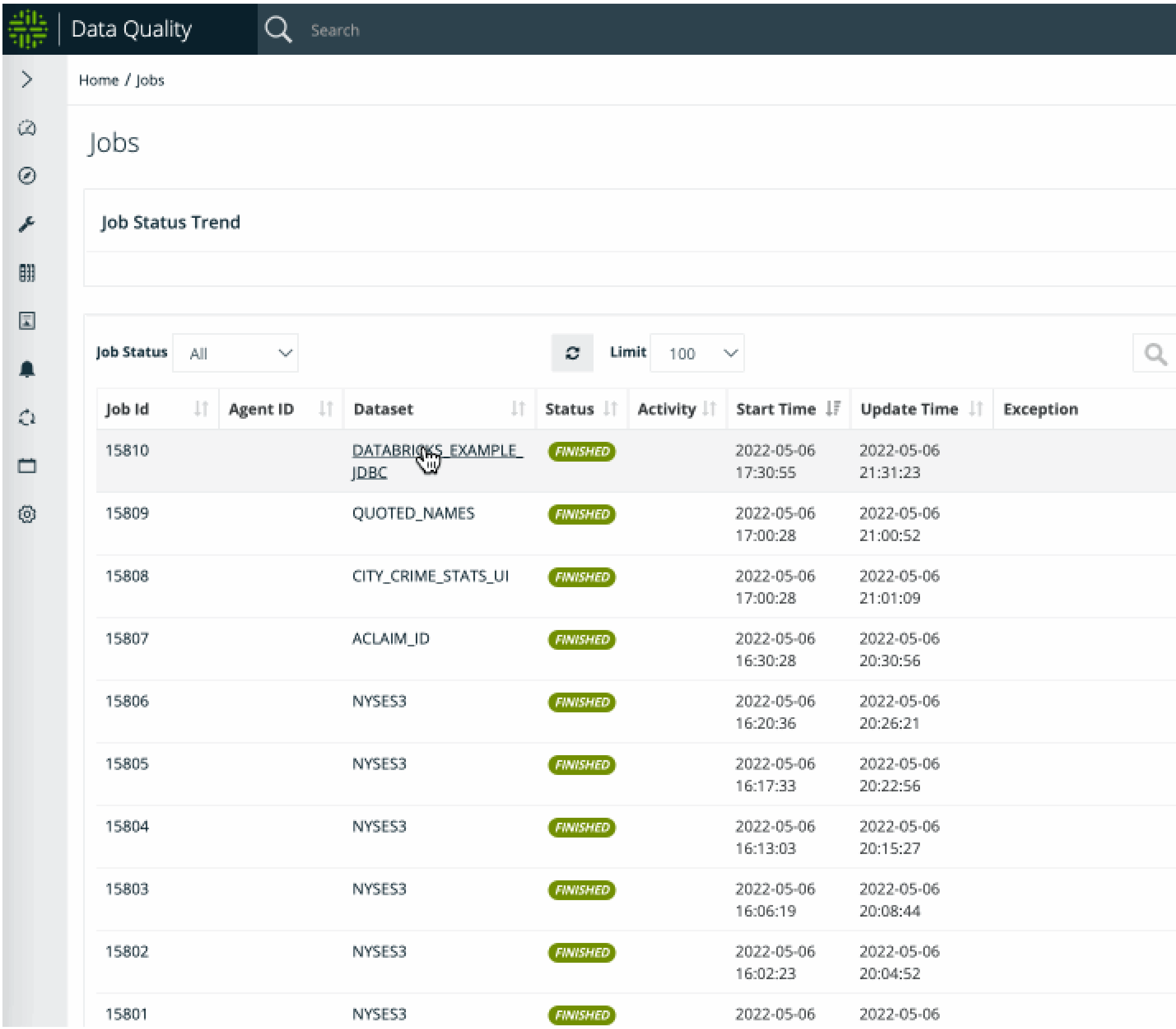
Profile Pushdown: No Pushdown

Data Shape Detection: AUTO

Data Preview SQL Editor

	customer_id	card_number	checking_savings	first
1	236639	4427426748026777	chk	Willi
2	236640	4427429264420777	chk	Don
3	236641	4427420025002858	chk	Stan
4	236642	4427427861982927	chk	Rich
5	236643	4427423636675319	chk	Tam
6	236644	4427420535368560	chk	Vale

See results:



Jobs

Job Status Trend

Job Id	Agent ID	Dataset	Status	Activity	Start Time	Update Time	Exception
15810		DATABRICKS_EXAMPLE_JDBC	FINISHED		2022-05-06 17:30:55	2022-05-06 21:31:23	
15809		QUOTED_NAMES	FINISHED		2022-05-06 17:00:28	2022-05-06 21:00:52	
15808		CITY_CRIME_STATS_UI	FINISHED		2022-05-06 17:00:28	2022-05-06 21:01:09	
15807		ACLAIM_ID	FINISHED		2022-05-06 16:30:28	2022-05-06 20:30:56	
15806		NYSES3	FINISHED		2022-05-06 16:20:36	2022-05-06 20:26:21	
15805		NYSES3	FINISHED		2022-05-06 16:17:33	2022-05-06 20:22:56	
15804		NYSES3	FINISHED		2022-05-06 16:13:03	2022-05-06 20:15:27	
15803		NYSES3	FINISHED		2022-05-06 16:06:19	2022-05-06 20:08:44	
15802		NYSES3	FINISHED		2022-05-06 16:02:23	2022-05-06 20:04:52	
15801		NYSES3	FINISHED		2022-05-06	2022-05-06	

Connectivity to Hive

Example URL

```
jdbc:hive2://cdh-instance1.us-east1-b.c.owl-hadoop-cdh.internal:10000/default;AuthMech=1;KrbHostFQDN=cdh-instance1.us-east1-b.c.owl-hadoop-cdh.internal;KrbRealm=CW.COM;KrbServiceName=hive;SSL=1;SSLKeyStore=/opt/cloudera/security/pki/cdh-instance1.us-east1-b.c.owl-hadoop-cdh.internal-server.jks;AllowSelfSignedCerts=1;SSLKeyStorePwd=password;principal=hive/cdh-instance1.us-east1-b.c.owl-hadoop-cdh.internal@CW.COM
```

Driver Name

```
com.simba.hive.jdbc41.HS2Driver
```

Driver Properties

```
hive.resultset.use.unique.column.names=false
```

What Does each option mean

Base connection string = jdbc:hive2://cdh-instance1.us-east1-b.c.owl-hadoop-cdh.internal:10000/default

Authentication identifier = AuthMech=1 (which states Kerberos)

Kerberos Hive Server FQDN = KrbHostFQDN=cdh-instance1.us-east1-b.c.owl-hadoop-cdh.internal

Kerberos Realm used = KrbRealm=CW.COM *(Not necessarily needed)*

Kerberos Service name = KrbServiceName=hive

Enabling SSL = SSL=1

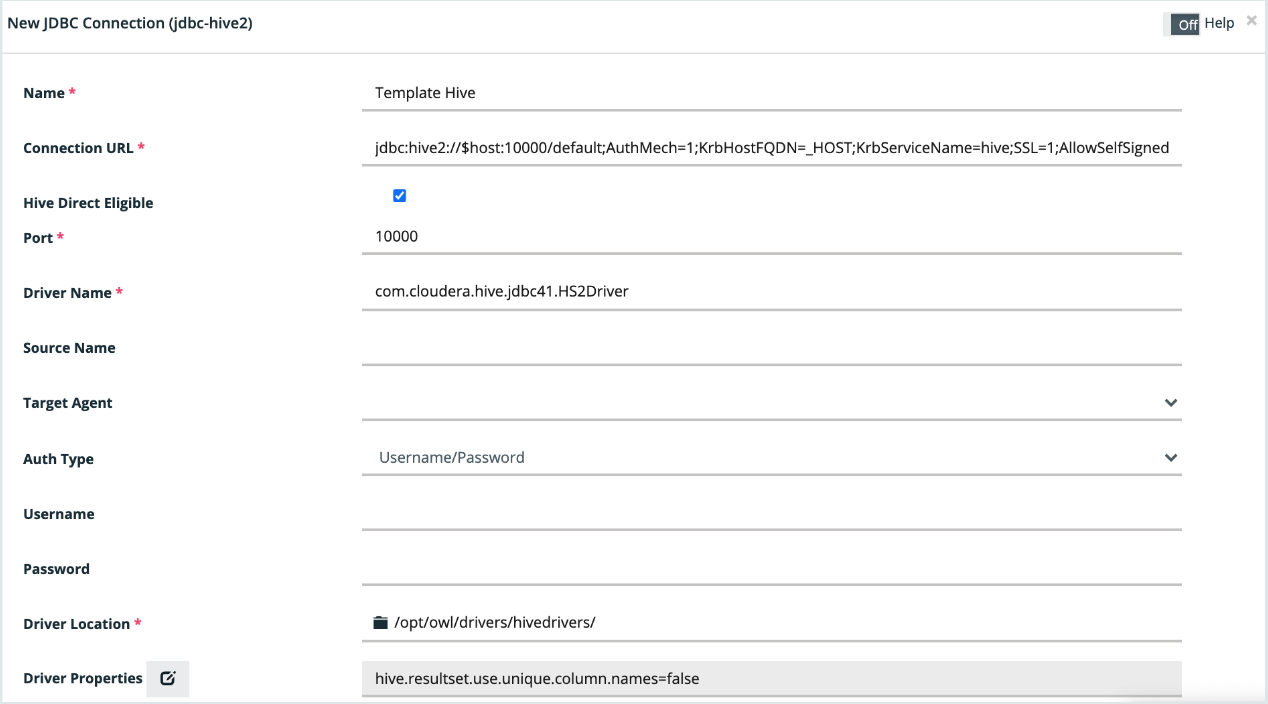
The SSL KeyStore to be used to = SSLKeyStore=/opt/cloudera/security/pki/cdh-instance1.us-east1-b.c.owl-hadoop-cdh.internal-server.jks *(Could use SSL TrustStore also)*

Allow for Self Signed certifications to be OK = AllowSelfSignedCerts=1 *(our environment used self signed certs)*

Password to the KeyStore = SSLKeyStorePwd=password *(Not necessarily needed)*

Kerberos Principal to use to Authenticate with = principal=hive/cdh-instance1.us-east1-b.c.owl-hadoop-cdh.internal@CW.COM

Example Connection



New JDBC Connection (jdbc-hive2)

Name *	Template Hive
Connection URL *	jdbc:hive2://$host:10000/default;AuthMech=1;KrbHostFQDN=_HOST;KrbServiceName=hive;SSL=1;AllowSelfSigned
Hive Direct Eligible	☑
Port *	10000
Driver Name *	com.cloudera.hive.jdbc41.HS2Driver
Source Name	
Target Agent	
Auth Type	Username/Password
Username	
Password	
Driver Location *	/opt/owl/drivers/hivedrivers/
Driver Properties	hive.resultset.use.unique.column.names=false

FAQ

It is very common to require this connection property when not using the default schema. Remember to add this to the connection properties when defining the connection.

```
hive.resultset.use.unique.column.names=false
```

Connecting to CDH 5.16 Hive SSL/TLS/Kerberos Setup

The Cloudera Hive JDBC drivers used
https://www.cloudera.com/downloads/connectors/hive/jdbc/2-5-16.html

JDBC Connection String used

jdbc:hive2://cdh-instance1.us-east1-b.c.owl-hadoop-cdh.internal:10000/default;AuthMech=1;KrbHostFQDN=cdh-instance1.us-east1-b.c.owl-hadoop-cdh.internal;KrbRealm=CW.COM;KrbServiceName=hive;SSL=1;SSLKeyStore=/opt/cloudera/security/pki/cdh-instance1.us-east1-b.c.owl-hadoop-cdh.internal-server.jks;AllowSelfSignedCerts=1;SSLKeyStorePwd=password;principal=hive/cdh-instance1.us-east1-b.c.owl-hadoop-cdh.internal@CW.COM

What Does each option mean

Base connection string = jdbc:hive2://cdh-instance1.us-east1-b.c.owl-hadoop-cdh.internal:10000/default

Authentication identifier = AuthMech=1 (which states Kerberos)

Kerberos Hive Server FQDN = KrbHostFQDN=cdh-instance1.us-east1-b.c.owl-hadoop-cdh.internal

Kerberos Realm used = KrbRealm=CW.COM *(Not necessarily needed)*

Kerberos Service name = KrbServiceName=hive

Enabling SSL = SSL=1

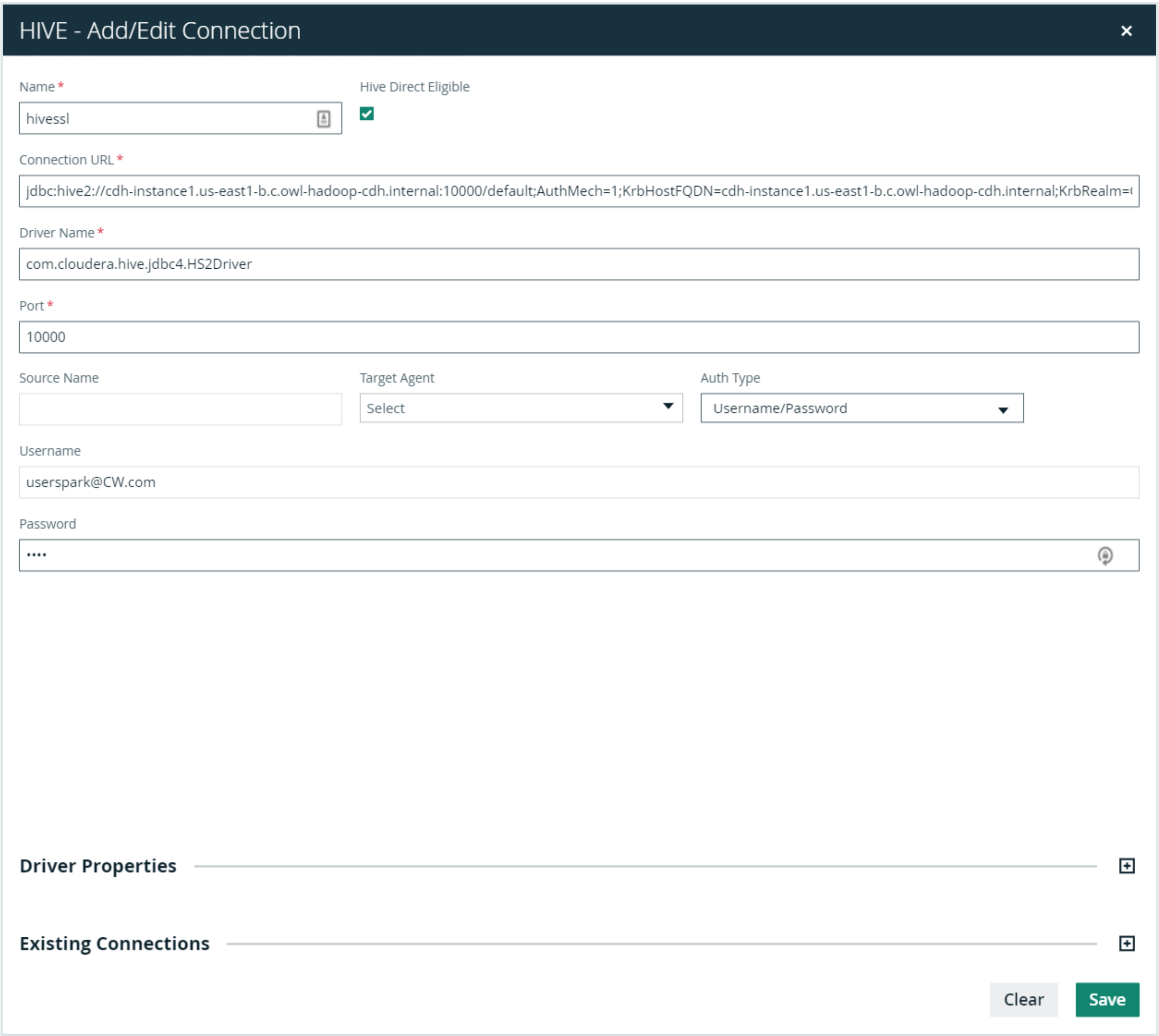
The SSL KeyStore to be used to = SSLKeyStore=/opt/cloudera/security/pki/cdh-instance1.us-east1-b.c.owl-hadoop-cdh.internal-server.jks *(Could use SSL TrustStore also)*

Allow for Self Signed certifications to be OK = AllowSelfSignedCerts=1 *(our environment used self signed certs)*

Password to the KeyStore = SSLKeyStorePwd=password *(Not necessarily needed)*

Kerberos Principal to use to Authenticate with = principal=hive/cdh-instance1.us-east1-b.c.owl-hadoop-cdh.internal@CW.COM

Within the Collibra DQ Web UI you have to specify the following (See ScreenShot below)



HIVE - Add/Edit Connection

Name * hivessl

Hive Direct Eligible ☑

Connection URL * jdbc:hive2://cdh-instance1.us-east1-b.c.owl-hadoop-cdh.internal:10000/default;AuthMech=1;KrbHostFQDN=cdh-instance1.us-east1-b.c.owl-hadoop-cdh.internal;KrbRealm=

Driver Name * com.cloudera.hive.jdbc4.HS2Driver

Port * 10000

Source Name

Target Agent Select

Auth Type Username/Password

Username userspark@CW.com

Password ••••

Name = hivessl

Connection URL = jdbc:hive2://cdh-instance1.us-east1-b.c.owl-hadoop-cdh.internal:10000/default;AuthMech=1;KrbHostFQDN=cdh-instance1.us-east1-b.c.owl-hadoop-cdh.internal;KrbRealm=CW.COM;KrbServiceName=hive;SSL=1;SSLKeyStore=/opt/cloudera/security/pki/cdh-instance1.us-east1-b.c.owl-hadoop-cdh.internal-server.jks;AllowSelfSignedCerts=1;SSLKeyStorePwd=password;principal=hive/cdh-instance1.us-east1-b.c.owl-hadoop-cdh.internal@CW.COM

Port = 10000

Driver Name = com.cloudera.hive.jdbc4.HS2Driver

Username = userspark@CW.COM

Password = password

Connectivity to Oracle

Example URL

```
jdbc:oracle:thin:@10.589.0.31:1521:DEV
```

Driver Name

```
oracle.jdbc.OracleDriver
```

Connection Properties Recognized by Oracle JDBC Drivers

Name	Short Name	Type	Description
user	n/a	String	the user name for logging into the database
password	n/a	String	the password for logging into the database

Name	Short Name	Type	Description
database	server	String	the connect string for the database
internal_logon	n/a	String	a role, such as `sysdba` or `sysoper`, that allows you to log on as `sys`
defaultRowPrefetch	prefetch	String (containing integer value)	the default number of rows to prefetch from the server (default value is "10")
remarksReporting	remarks	String (containing boolean value)	"true" if getTables() and getColumns() should report TABLE_REMARKS; equivalent to using setRemarksReporting() (default value is "false")
defaultBatchValue	batchvalue	String (containing integer value)	the default batch value that triggers an execution request (default value is "10")
includeSynonyms	synonyms	String (containing boolean value)	"true" to include column information from predefined "synonym" SQL entities when you execute a `DataBaseMetaData getColumns()` call; equivalent to connection `setIncludeSynonyms()` call (default value is "false")

Name	Short Name	Type	Description
processEscapes	n/a	String (containing boolean value)	"false" to disable escape processing for statements (Statement or PreparedStatement) created from this connection. Set this to "false" if you want to avoid many calls to `Statement.setEscapeProcessing(false);`. This is espcially usefull for PreparedStatement where a call to `setEscapeProcessing (false)` would have no effect. The default is "true".
defaultNChar	n/a	String (containing boolean value)	"false" is the default. If set to "true", the default behavior for handling character datatypes is changed so that NCHAR/NVARCHAR2 become the default. This means that setFormOfUse() won't be needed anymore when using NCHAR/NVARCHAR2. This can also be set as a java property :`java -Doracle.jdbc.defaultNChar=true myApplication`
useFetchSizeWithLongColumn	n/a	String (containing boolean value)	"false" is the default. **THIS IS A THIN ONLY PROPERTY. IT SHOULD NOT BE USED WITH ANY OTHER DRIVERS.**If set to "true", the performance when retrieving data in a 'SELECT' will be improved but the default behavior for handling LONG columns will be changed to fetch multiple rows (prefetch size). It means that enough memory will be allocated to read this data. So if you want to use this property, make sure that the LONG columns you are retrieving are not too big or you may run out of memory. This property can also be set as a java property : `java -Doracle.jdbc.useFetchSizeWithLongColumn=true myApplication`

Name	Short Name	Type	Description
SetFloatAndDoubleUseBinary	n/a	String (containing boolean value)	"false" is the default. If set to "true", causes the java.sql.PreparedStatment setFloat and setDouble API's to use internal binary format as for BINARY_FLOAT and BINARY_DOUBLE parameters. See oracle.jdbc.OraclePreparedStatement setBinaryFloat and setBinaryDouble

https://docs.oracle.com/cd/E11882_01/appdev.112/e13995/oracle/jdbc/OracleDriver.html

Connectivity to Presto

Example URL

```
jdbc:presto://xyz.presto.svc.cluster.local:8080/database
```

Driver Name

```
com.facebook.presto.jdbc.PrestoDriver
```

Connection Properties

These methods may be mixed; some parameters may be specified in the URL while others are specified using properties. However, the same parameter may not be specified using both methods.

Parameter Reference

Name	Description
`user`	Username to use for authentication and authorization.

Name	Description
`password`	Password to use for LDAP authentication.
`socksProxy`	SOCKS proxy host and port. Example: `localhost:1080`
`httpProxy`	HTTP proxy host and port. Example: `localhost:8888`
`protocols`	Comma delineated list of HTTP protocols to use. Example: `protocols=http11`. Acceptable values: `http11,http10,http2`
`applicationNamePrefix`	Prefix to append to any specified `ApplicationName` client info property, which is used to set the source name for the Presto query. If neither this property nor `ApplicationName` are set, the source for the query will be `presto-jdbc`.
`accessToken`	Access token for token based authentication.
`SSL`	Use HTTPS for connections
`SSLKeyStorePath`	The location of the Java KeyStore file that contains the certificate and private key to use for authentication.
`SSLKeyStorePassword`	The password for the KeyStore.
`SSLTrustStorePath`	The location of the Java TrustStore file that will be used to validate HTTPS server certificates.
`SSLTrustStorePassword`	The password for the TrustStore.
`KerberosRemoteServiceName`	Presto coordinator Kerberos service name. This parameter is required for Kerberos authentication.
`KerberosPrincipal`	The principal to use when authenticating to the Presto coordinator.

Name	Description
`KerberosUseCanonicalHostname`	Use the canonical hostname of the Presto coordinator for the Kerberos service principal by first resolving the hostname to an IP address and then doing a reverse DNS lookup for that IP address. This is enabled by default.
`KerberosConfigPath`	Kerberos configuration file.
`KerberosKeytabPath`	Kerberos keytab file.
`KerberosCredentialCachePath`	Kerberos credential cache.
`extraCredentials`	Extra credentials for connecting to external services. The extraCredentials is a list of key-value pairs. Example: `foo:bar;abc:xyz` will create credentials `abc=xyz` and `foo=bar`
`customHeaders`	Custom headers to inject through JDBC driver. The customHeaders is a list of key-value pairs. Example: `testHeaderKey:testHeaderValue` will inject the header `testHeaderKey` with value `testHeaderValue`. Values should be percent encoded.

Connectivity to Redshift

Example URL

```
jdbc:redshift://redshift-cluster-name.kdkcis9g8.us-east-1.red-
shift.amazonaws.com:5439/dev
```

Driver Name

```
com.amazon.redshift.jdbc.Driver
```

Amazon Redshift offers drivers for tools that are compatible with the JDBC 4.2 API. For information about the functionality supported by these drivers, see the Amazon Redshift JDBC driver release notes.

For detailed information about how to install the JDBC driver version 1.0, reference the JDBC driver libraries, and register the driver class, see Amazon Redshift JDBC driver installation and configuration guide.

For each computer where you use the Amazon Redshift JDBC driver, make sure that Java Runtime Environment (JRE) 8.0 is installed.

If you use the Amazon Redshift JDBC driver for database authentication, make sure that you have AWS SDK for Java 1.11.118 or later in your Java class path. If you don't have AWS SDK for Java installed, download the ZIP file with JDBC 4.2–compatible driver (without the AWS SDK) and driver dependent libraries for the AWS SDK:

- JDBC 4.2–compatible driver (without the AWS SDK) and driver dependent libraries for AWS SDK files version 1.2.55.

  The class name for this driver is `com.amazon.redshift.jdbc42.Driver`.

  This ZIP file contains the JDBC4.2–compatible driver (without the AWS SDK) and its dependent library files. Unzip the dependent jar files to the same location as the JDBC driver. Only the JDBC driver needs to be in the CLASSPATH because the driver manifest file contains all dependent library file names which are located in the same directory as the JDBC driver. For more information about how to install the JDBC driver, see Amazon Redshift JDBC driver installation and configuration guide.

  Use this Amazon Redshift JDBC driver with the AWS SDK that is required for IAM database authentication.

- JDBC 4.2–compatible driver (without the AWS SDK) version 1.2.55.

  The class name for this driver is `com.amazon.redshift.jdbc42.Driver`.

  Be sure to use ANTLR version 4.8.1. The antlr4-runtime-4.8-1.jar is included in the ZIP download link above with the JDBC 4.2–compatible driver (without the AWS SDK) and driver dependent libraries for the AWS SDK.

For more information about previous driver versions, see Use previous JDBC driver versions with the AWS SDK for Java.

Then download and review the Amazon Redshift ODBC and JDBC driver license agreement.

If your tool requires a specific previous version of a driver, see Use previous JDBC driver version 1.0 driver versions in certain cases.

Getting the JDBC URL

Before you can connect to your Amazon Redshift cluster from a SQL client tool, you need to know the JDBC URL of your cluster. The JDBC URL has the following format: `jdbc:redshift://endpoint:port/database`.Note

A JDBC URL specified with the former format of `jdbc:postgresql://endpoint:port/database` still works.

The fields of the format shown preceding have the following values.

Field	Value
`jdbc`	The protocol for the connection.
`redshift`	The subprotocol that specifies to use the Amazon Redshift driver to connect to the database.
`endpoint`	The endpoint of the Amazon Redshift cluster.
`port`	The port number that you specified when you launched the cluster. If you have a firewall, make sure that this port is open for you to use.
`database`	The database that you created for your cluster.

The following is an example JDBC URL:

```
jdbc:redshift://examplecluster.abc123xyz789.us-west-
2.redshift.amazonaws.com:5439/dev
```

For information about how to get your JDBC connection, see Finding your cluster connection string.

If the client computer fails to connect to the database, you can troubleshoot possible issues. For more information, see Troubleshooting connection issues in Amazon Redshift.\

https://docs.aws.amazon.com/redshift/latest/mgmt/configure-jdbc-connection.html

Connectivity to Snowflake

Example URL

JDBC Driver Connection String

```
jdbc:snowflake://accountname.us-east-2.aws.s-
nowflakecomputing.com?db=cdq&warehouse=cdqw
```

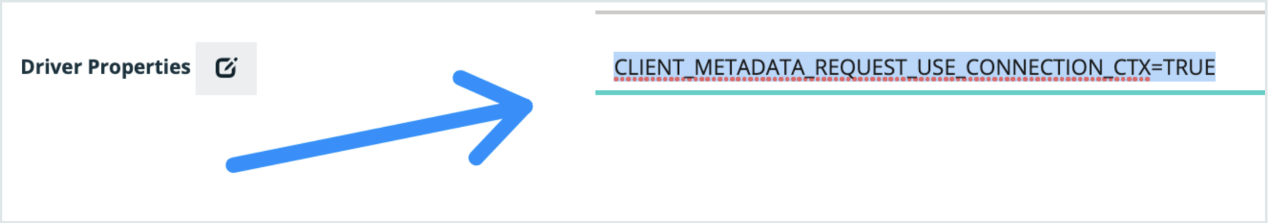
Driver Name

```
net.snowflake.client.jdbc.SnowflakeDriver
```

The previous driver class, `com.snowflake.client.jdbc.SnowflakeDriver`, is still supported but is deprecated (i.e. it will be removed in a future release, TBD).

Limit Databases Displayed

Add this connection property to limit the databases and tables displayed in the Explorer view. This will reduce the entries in the Explorer window to only those tables that the user can access.



CLIENT_METADATA_REQUEST_USE_CONNECTION_CTX=TRUE

```
CLIENT_METADATA_REQUEST_USE_CONNECTION_CTX=TRUE
```

Connection Parameters

For documentation on individual connection parameters, see the JDBC Driver Connection Parameter Reference.`<account_identifier>`

Specifies the account identifier for your Snowflake account. For details, see Account Identifiers. For examples of the account identifier used in a JDBC connection string, see Examples.`<connection_params>`

Specifies a series of one or more parameters, in the form of `<param>=<value>`, with each parameter separated by the ampersand character (`&`), and no spaces anywhere in the connection string.

For documentation on individual connection parameters, see the JDBC Driver Connection Parameter Reference.

Other Parameters

Any session parameter can be included in the connection string. For example:

> `CLIENT_SESSION_KEEP_ALIVE=<Boolean>`
>
> Specifies whether to keep the current session active after a period of inactivity, or to force the user to login again. If the value is `true`, Snowflake keeps the session active indefinitely, even if there is no activity from the user. If the value is `false`, the user must log in again after four hours of inactivity.
>
> Default is `false`.

For descriptions of all the session parameters, see Parameters.

Examples

The following is an example of the connection string that uses an account identifier that specifies the account `myaccount` in the organization `myorganization`.

```
jdbc:snowflake://myorganization-myac-
coun-
t.s-
now-
flake-
com-
put-
ing.-
com/?user=peter&warehouse=mywh&db=mydb&schema=public
```

The following is an example of a connection string that uses the account locator `xy12345` as the account identifier:

```
jdb-
c:s-
now-
flake://xy12345.s-
now-
flake-
com-
put-
ing.-
com/?user=peter&warehouse=mywh&db=mydb&schema=public
```

Note that this example uses an account in the AWS US West (Oregon) region. If the account is in a different region or if the account uses a different cloud provider, you need to specify additional segments after the account locator.

Configuring the JDBC Driver -- Snowflake Documentation

Private Link

Please let us know if you are using private link for Snowflake. Setup can vary depending on the endpoint that is created. In most cases, use the private endpoint as a normal JDBC connection.

Snowflake Community

Advanced Private Link and Proxy

Here is an example JDBC string connection we used that take into account the following setup:

- <ACCOUNT_NAME> is the full link to the Snowflake instance with the private link.
- DQ installed on-prem in a private IaaS and DQ is behind a proxy.
- If the Snowflake instance is using a private link, whitelist the private link URL to bypass the proxy.
- In addition to connectivity to the Snowflake instance, the JDBC driver tries to access Snowflake Blob storage by connecting directly to some S3 buckets managed by Snowflake.
- Those need to be whitelisted as well.

Example URL

jdbc:snowflake://<ACCOUNT_NAME>/?tracing=all&useProxy=true&proxyHost=10.142.22.37&proxyPort=8080&proxyUser=xyz&proxyPassword=xyz&nonProxyHosts=*.privatelink.snowflakecomputing.com%7Csfc-eu-ds1-customer-stage.s3.eu-central-1.amazonaws.com

Pushdown

> **Note** As of 2022.08, Snowflake Pushdown is only available as a public beta offering for participating customers.

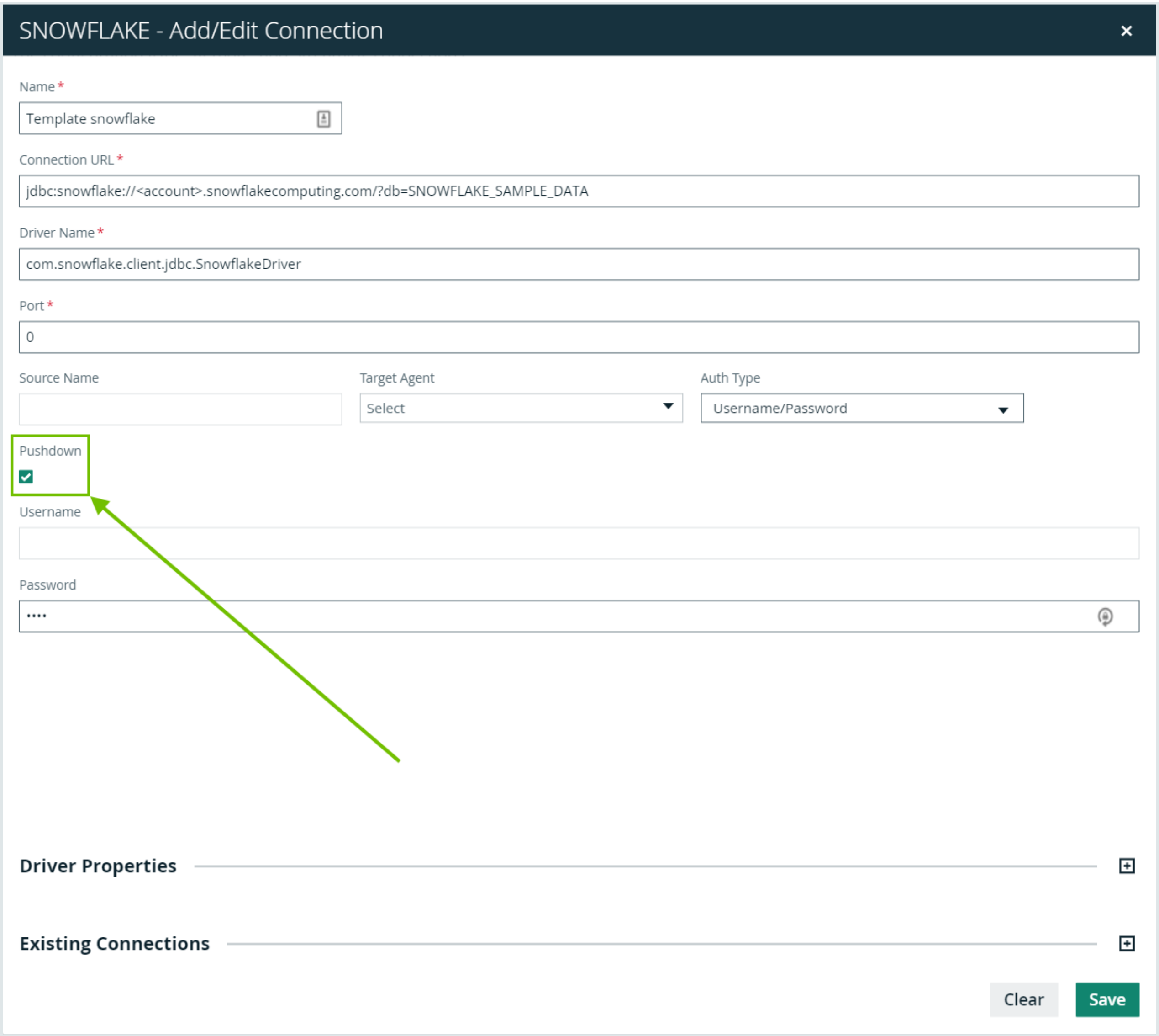
To get started with Snowflake Pushdown, a user with Admin access must run the following script to set up users, roles, and the Collibra DQ virtual warehouse.

```
-- Update the following session variables
set dq_username='SERVICE_ACCOUNT_USER';
-- Use only uppercase for password
set dq_password='SERVICE_ACCOUNT_PASSWORD';
set dq_warehouse_name='COLLIBRA_DQ_WH';
set dq_warehouse_size='XSMALL';
set user_database='TARGET_DB';

-- Do not update, variables for Collibra DQ
set dq_role_name='COLLIBRA_DQ_ROLE';

-- Run as admin user
USE ROLE ACCOUNTADMIN;

-- User and Role for Collibra DQ
CREATE ROLE IF NOT EXISTS identifier($dq_role_name);
CREATE USER IF NOT EXISTS identifier($dq_username) PASSWORD=$dq_
password DEFAULT_ROLE=$dq_role_name;
GRANT ROLE identifier($dq_role_name) TO USER identifier($dq_user-
name);

-- Warehouse to run Collibra DQ
CREATE WAREHOUSE IF NOT EXISTS identifier($dq_warehouse_name)
WAREHOUSE_SIZE=$dq_warehouse_size INITIALLY_SUSPENDED=TRUE
AUTO_SUSPEND = 5 AUTO_RESUME = TRUE;

-- Assign privileges to Collibra DQ warehouse
GRANT OPERATE, USAGE, MONITOR ON WAREHOUSE identifier($dq_ware-
house_name) TO ROLE identifier($dq_role_name);

-- Assign metadata access to Collibra DQ role
GRANT USAGE,MONITOR on DATABASE identifier($user_database) to
identifier($dq_role_name);
GRANT USAGE,MONITOR ON ALL SCHEMAS IN DATABASE identifier($user_
database) to identifier($dq_role_name);

-- Update session variable user_database, run this portion for
each target database you wish to run DQ checks
-- Grant read access to objects in user database
USE DATABASE identifier($user_database);
GRANT SELECT ON ALL TABLES IN DATABASE identifier($user_data-
base) TO ROLE identifier($dq_role_name);
GRANT SELECT ON ALL VIEWS IN DATABASE identifier($user_database)
TO ROLE identifier($dq_role_name);
GRANT SELECT ON ALL EXTERNAL TABLES IN DATABASE identifier
($user_database) TO ROLE identifier($dq_role_name);
GRANT SELECT ON ALL STREAMS IN DATABASE identifier($user_data-
base) TO ROLE identifier($dq_role_name);
```

```
GRANT SELECT ON FUTURE TABLES IN DATABASE identifier($user_data-
base) TO ROLE identifier($dq_role_name);
GRANT SELECT ON FUTURE VIEWS IN DATABASE identifier($user_data-
base) TO ROLE identifier($dq_role_name);
GRANT SELECT ON FUTURE EXTERNAL TABLES IN DATABASE identifier
($user_database) TO ROLE identifier($dq_role_name);
GRANT SELECT ON FUTURE STREAMS IN DATABASE identifier($user_data-
base) TO ROLE identifier($dq_role_name);
```

Warning Please ensure the SQL variables are updated in the above script before proceeding.

To run a Snowflake Pushdown job, you must opt in when setting up your Snowflake connection. To toggle Pushdown capabilities on, ensure that the Pushdown checkbox in the Snowflake connection modal is checked.



SNOWFLAKE - Add/Edit Connection

Name *
Template snowflake

Connection URL *
jdbc:snowflake://<account>.snowflakecomputing.com/?db=SNOWFLAKE_SAMPLE_DATA

Driver Name *
com.snowflake.client.jdbc.SnowflakeDriver

Port *
0

Source Name

Target Agent
Select

Auth Type
Username/Password

Pushdown
☑

Username

Password
····

Connectivity to SQL Server

Example URL

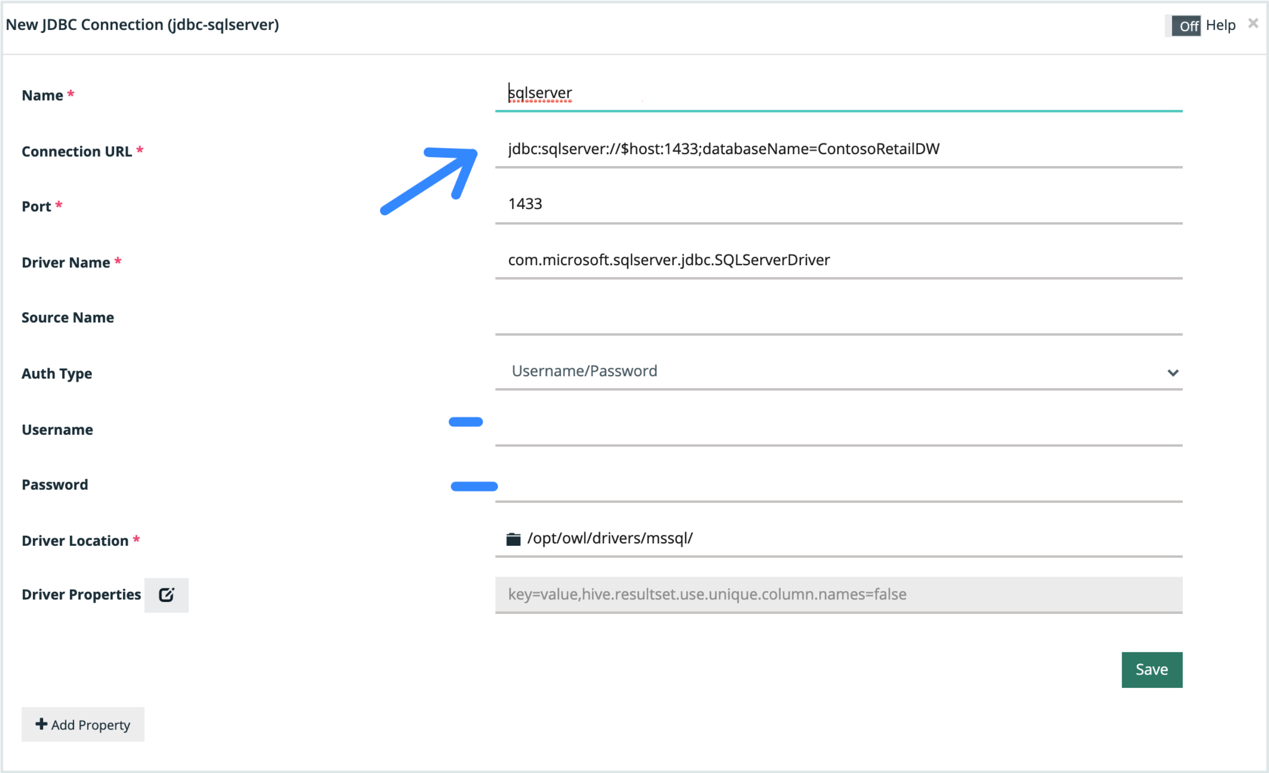
```
jdbc:sqlserver://$host:1433;databaseName=ContosoRetailDW
```

Driver Name

```
com.microsoft.sqlserver.jdbc.SQLServerDriver
```

Setup

1. Navigate to the connections page
2. Locate the SQL Server template
3. Fill in the required JDBC details
4. Click save to validate the connection



New JDBC Connection (jdbc-sqlserver)

Name *	sqlserver
Connection URL *	jdbc:sqlserver://$host:1433;databaseName=ContosoRetailDW
Port *	1433
Driver Name *	com.microsoft.sqlserver.jdbc.SQLServerDriver
Source Name	
Auth Type	Username/Password
Username	
Password	
Driver Location *	/opt/owl/drivers/mssql/
Driver Properties	key=value,hive.resultset.use.unique.column.names=false

Microsoft JDBC Driver for SQL Server - JDBC Driver for SQL Server

Troubleshooting

The Microsoft JDBC Driver for SQL Server requires that TCP/IP be installed and running to communicate with your SQL Server database. You can use the SQL Server Configuration Manager to verify which network library protocols are installed.

A database connection attempt might fail for many reasons. These can include the following:

- TCP/IP is not enabled for SQL Server, or the server or port number specified is incorrect. Verify that SQL Server is listening with TCP/IP on the specified server and port. This might be reported with an exception similar to: "The login has failed. The TCP/IP connection to the host has failed." This indicates one of the following:
    - SQL Server is installed but TCP/IP has not been installed as a network protocol for SQL Server by using the SQL Server Network Utility for SQL Server 2000 (8.x), or the SQL Server Configuration Manager for SQL Server 2005 (9.x) and later.
    - TCP/IP is installed as a SQL Server protocol, but it is not listening on the port specified in the JDBC connection URL. The default port is 1433, but SQL Server can be configured at product installation to listen on any port. Make sure that SQL Server is listening on port 1433. Or, if the port has been changed, make sure that the port specified in the JDBC connection URL matches the changed port. For more information about JDBC connection URLs, see Building the connection URL.
    - The address of the computer that is specified in the JDBC connection URL does not refer to a server where SQL Server is installed and started.
    - The networking operation of TCP/IP between the client and server running SQL Server is not operable. You can check TCP/IP connectivity to SQL Server by using telnet. For example, at the command prompt, type `telnet 192.168.0.0 1433` where 192.168.0.0 is the address of the computer that is running SQL Server and 1433 is the port it is listening on. If you receive a message that states "Telnet cannot connect," TCP/IP is not listening on that port for SQL Server connections. Use the SQL Server Network Utility for SQL Server 2000 (8.x), or the SQL Server Configuration Manager for SQL Server 2005 (9.x) and later to make sure that SQL Server is configured to use TCP/IP on port 1433.
    - The port that is used by the server has not been opened in the firewall. This includes the port that is used by the server or optionally, the port associated with a named instance of the server.
- The specified database name is incorrect. Make sure that you are logging on to an existing SQL Server database.
- The user name or password is incorrect. Make sure that you have the correct values.
- When you use SQL Server Authentication, the JDBC driver requires that SQL Server is installed with SQL Server Authentication, which is not the default. Make sure that this option is included when you install or configure your instance of SQL Server.

See also

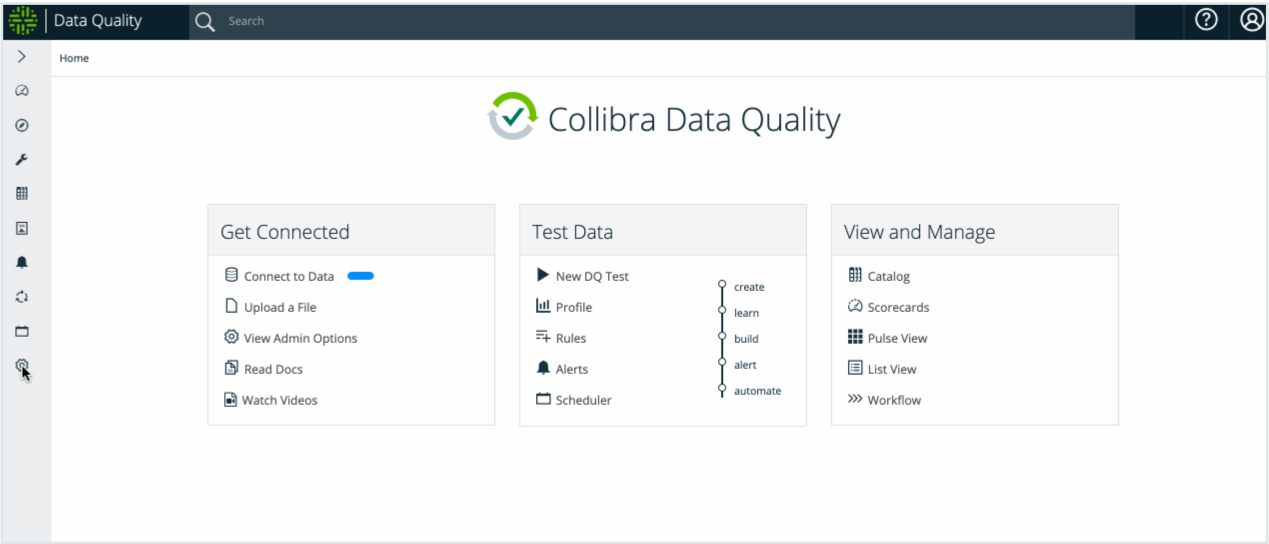
Diagnosing problems with the JDBC driver

Connecting to SQL Server with the JDBC driver

FAQ

SQL Server represents RDS, Azure SQL, and traditional SQL Server installations

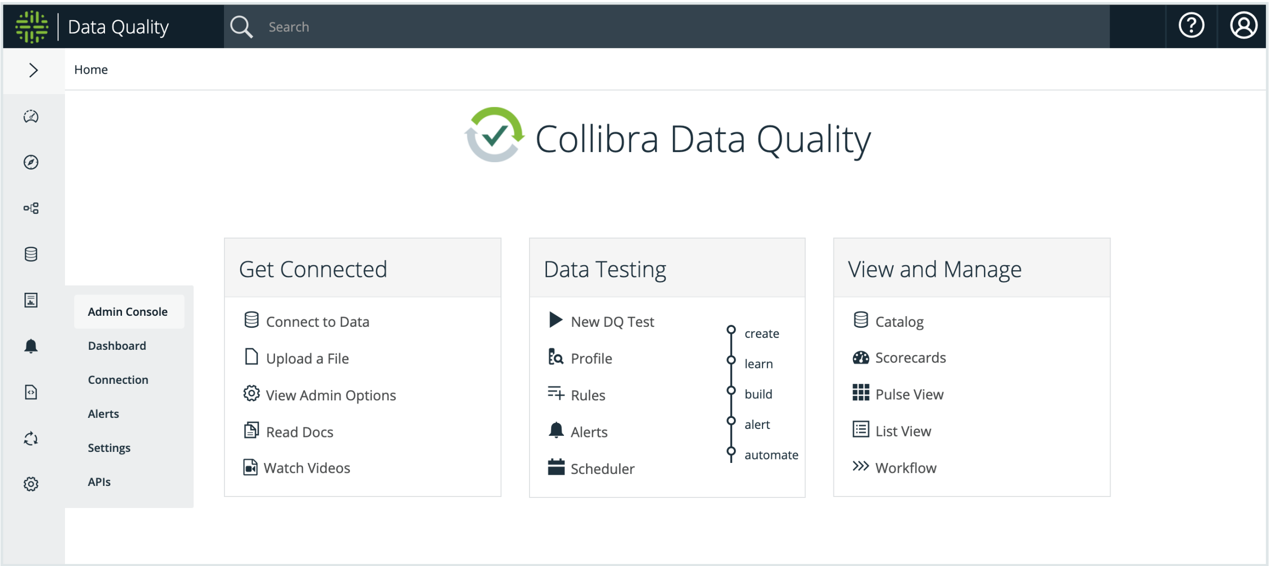
Adding Connections



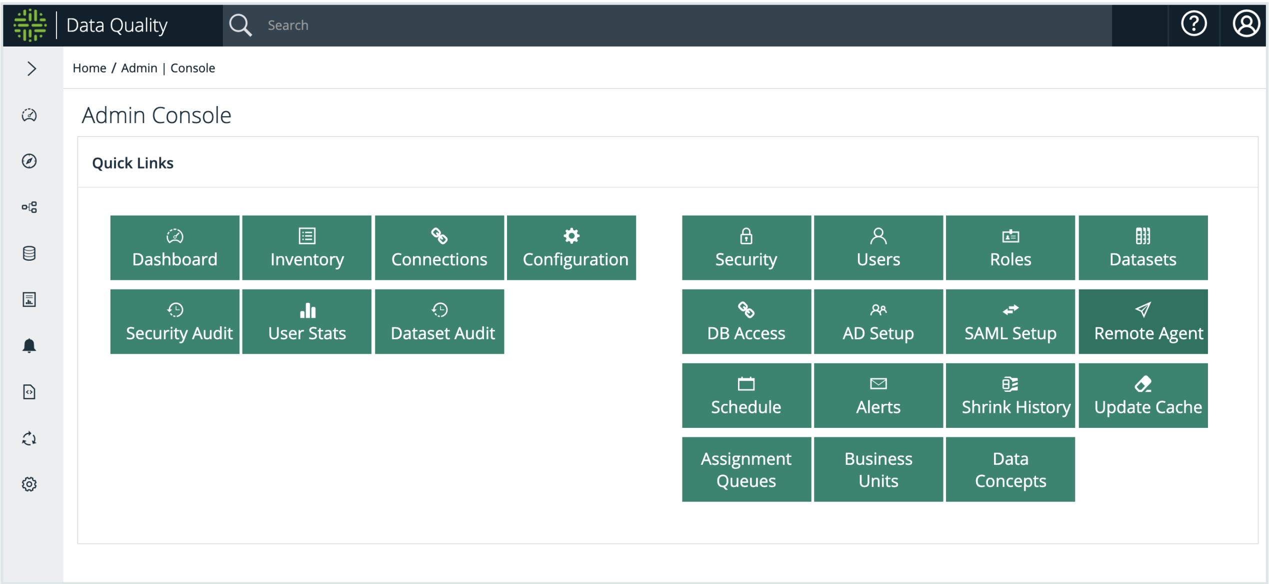
How to Add DB Connection via UI

We will add a connection named `metastore` that connects to local Postgres server (`localhost:5432/postgres`)

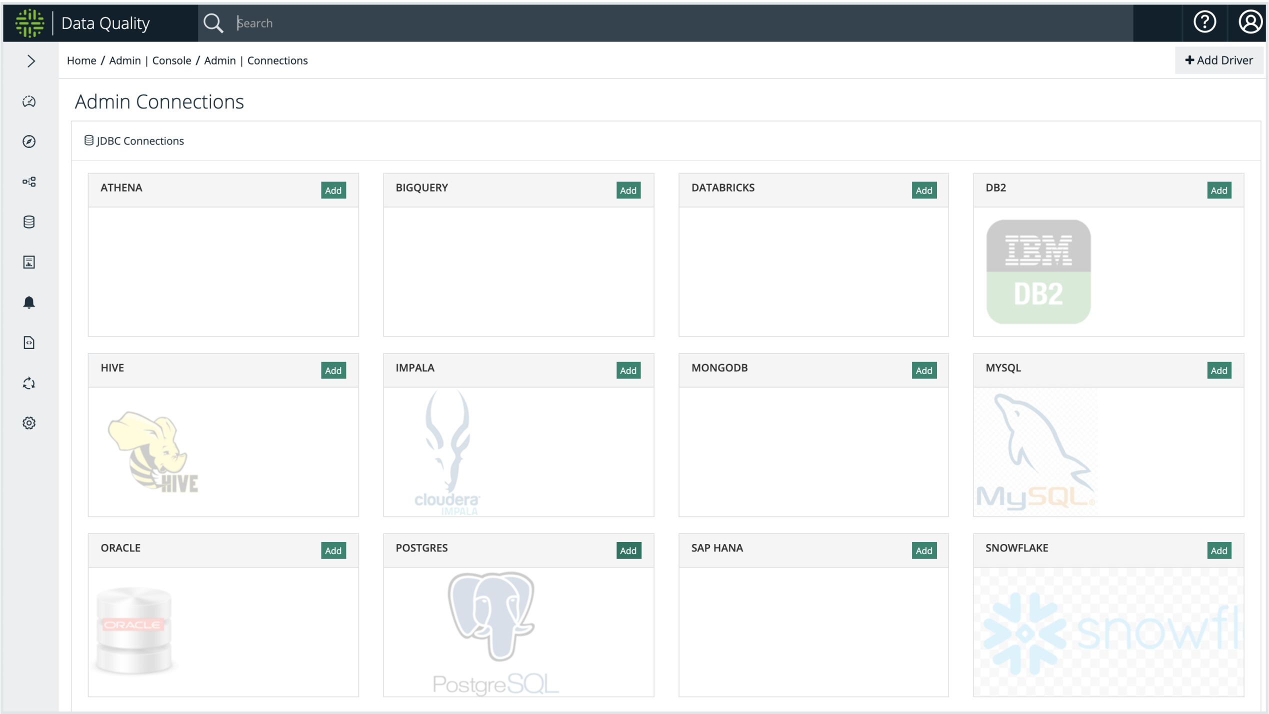
- Login to DQ Web and navigate to Admin Console.



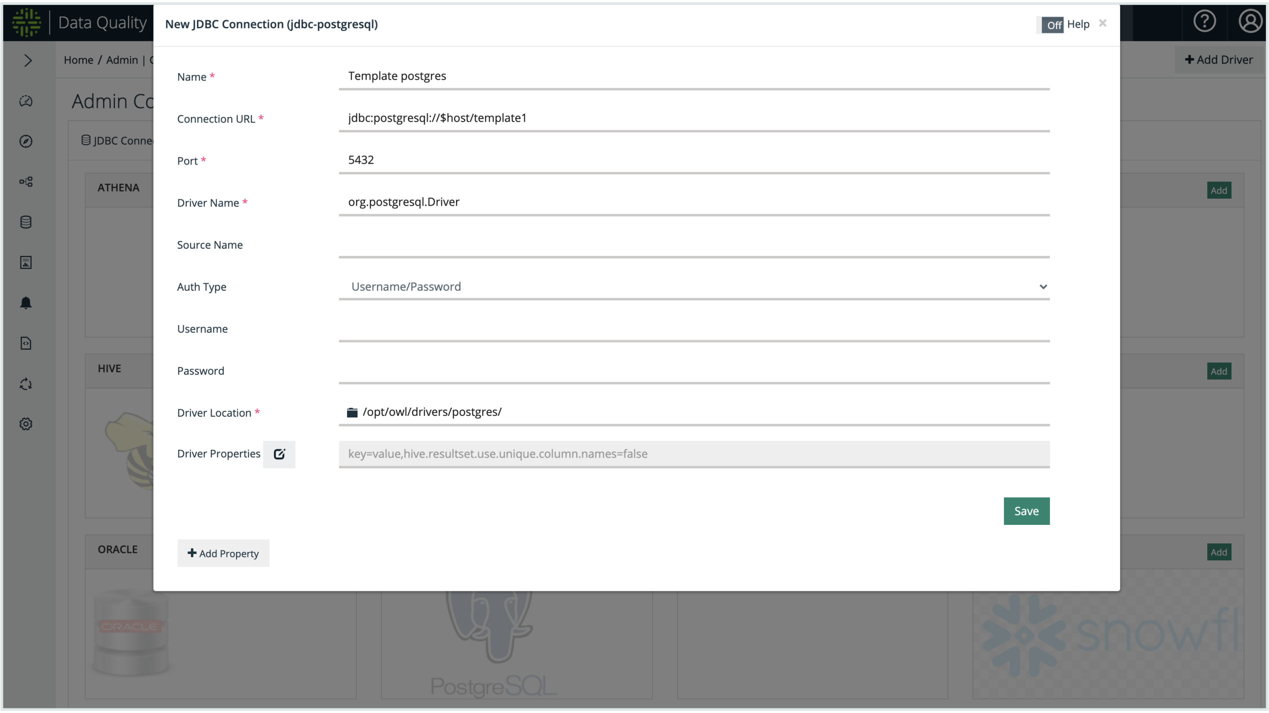
- From the Admin Console, click on the Connections tile.



- Click on Add button in Postgres box to add a Postgres connection.



Default Postgres JDBC template connection is shown. This modal is populated with basic values what Postgres connection setting should look like.



New JDBC Connection (jdbc-postgresql)

Name * Template postgres

Connection URL * jdbc:postgresql://$host/template1

Port * 5432

Driver Name * org.postgresql.Driver

Source Name

Auth Type Username/Password

Username

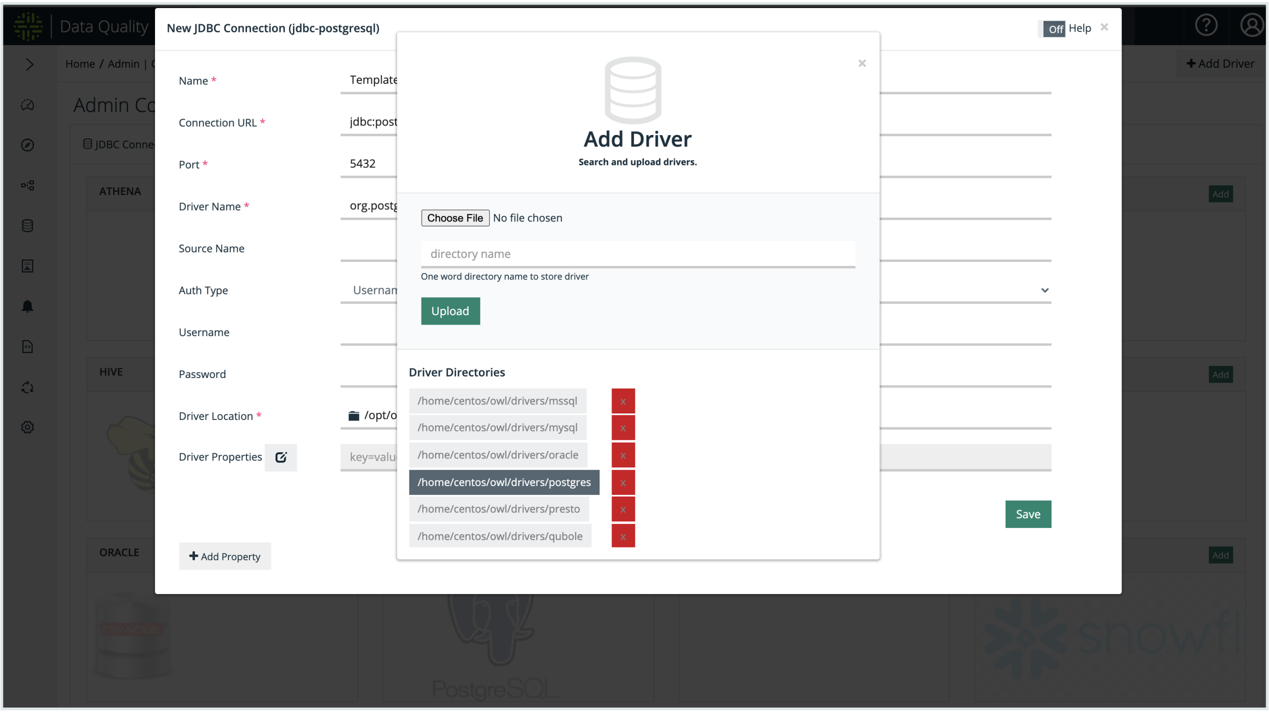
Password

Driver Location * /opt/owl/drivers/postgres/

Driver Properties key=value,hive.resultset.use.unique.column.names=false

Replace the Connection URL to point to the Postgres server you want to run DQ Jobs against. In this example, `jdbc:postgresql://localhost:5432/postgres`

Also change Driver Location to the JDBC Driver for Postgres in your installation. Click on the folder icon and click on Postgres driver path. These Driver Directories are default JDBC Drivers provided by DQ installation (usually in `$OWL_BASE/owl/drivers/*`)



New JDBC Connection (jdbc-postgresql)

Name * Template

Connection URL * jdbc:post

Port * 5432

Driver Name * org.postg

Source Name

Auth Type Usernam

Username

Password

Driver Location * /opt/o

Driver Properties key=valu

Add Driver

Search and upload drivers.

Choose File No file chosen

directory name

One word directory name to store driver

Upload

Driver Directories

/home/centos/owl/drivers/mssql

/home/centos/owl/drivers/mysql

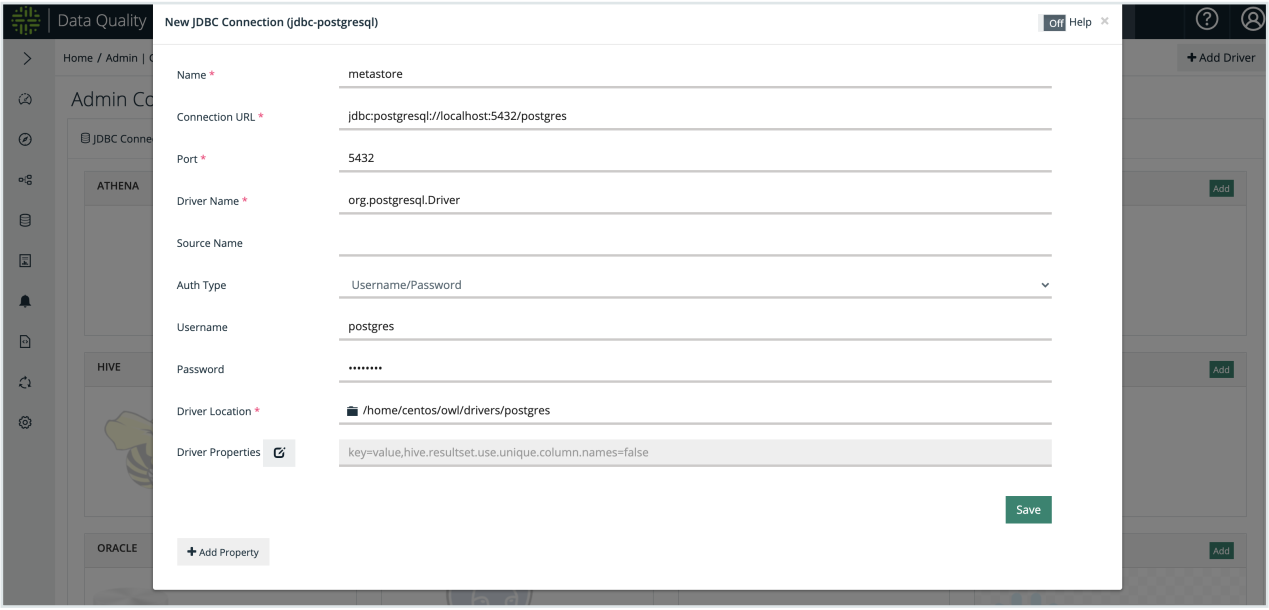
/home/centos/owl/drivers/oracle

/home/centos/owl/drivers/postgres

/home/centos/owl/drivers/presto

/home/centos/owl/drivers/qubole

The following screenshot shows what the new connection setting should look like. Make sure to provide the correct Postgres Username and Password (if using Username/Password for authentication). Press Save to continue. ***This action will attempt to establish a connection.***



New JDBC Connection (jdbc-postgresql)

Name * metastore

Connection URL * jdbc:postgresql://localhost:5432/postgres

Port * 5432

Driver Name * org.postgresql.Driver

Source Name

Auth Type Username/Password

Username postgres

Password ••••••••

Driver Location * /home/centos/owl/drivers/postgres

Driver Properties key=value,hive.resultset.use.unique.column.names=false

Link Connection to Agent

> **Note** Make sure to Agent to a DQ Agent, if required.

Remote file connections

About remote file connections

This section is an overview of the supported data file formats and the limitations of connecting to a remote file.

Supported file types

File formats differ in structure, so you might need to prepare your data before establishing a connection.

Type	File structure	Notes
Delimited (CSV, TSV, etc.)	Structured	The default delimiter is comma (for example, CSV).
Parquet	Structured	
Avro	Structured	
JSON	Semi-structured	
ORC	Semi-structured	
XML	Semi-structured	
Delta	Semi-structured	

Supported delimiters

The following table is a list of supported delimiters available in the Delimiter dropdown menu.

<table>
<tr><th>Type</th><th>Format</th><th>Description</th></tr>
<tr><td>Comma</td><td>CSV</td><td><code>,</code> is used to separate values in the file.
This is the default delimiter for files.</td></tr>
<tr><td>Tab</td><td>TSV</td><td><code>tab</code> is used to separate values in the file.</td></tr>
<tr><td>Semicolon</td><td>CSV</td><td><code>;</code> is used to separate values in the file.</td></tr>
<tr><td>Double Quote</td><td>CSV</td><td><code>"</code> is used to separate values in the file.</td></tr>
<tr><td>Single Quote</td><td>CSV</td><td><code>'</code> is used to separate values in the file.</td></tr>
<tr><td>Pipe</td><td>TXT</td><td><code>\|</code> is used to separate values in the text file.</td></tr>
<tr><td>SOH</td><td>TXT</td><td>A Unicode character 'START OF HEADING' (U+0001) is an invisible control character.</td></tr>
<tr><td>Custom</td><td>N/A</td><td>Add a custom delimiter. Support for custom delimiters may vary.</td></tr>
</table>

Connecting to Hadoop Distributed File System (HDFS)

Prerequisites

To configure the HDFS connector, you need:

- Admin privileges in your Collibra Data Quality instance.
- Access to an HDFS cluster.

Steps

1. In the main menu, hover over the gear icon and click **Connection**.
   The Connections page opens.
2. Scroll down to the HDFS card.

3. Click the Add button to add a new HDFS connection.
   The New Remote File Connection (HDFS) modal opens.

4. Enter the values for each property.

Property	Description
Name	The unique name of your HDFS connector.
Connection URL	The HDFS URL used for your connection.
Target Agent	The target agent lets you select an agent for your connection.
Auth Type	The method used to authorize your connection. **Note**: If you use an Unsecured Auth Type, no other authorization fields are required. This is not recommended.
Principal	The service principal used to let Collibra Data Quality access your connection.
Keytab	The keytab used to authorize your connection. **Note**: Only applicable when you select Keytab as the Auth Type.
TGT	The Ticket Granting Ticket used to authorize your connection. **Note**: Only applicable when you select TGT Cache as the Auth Type.
Driver Properties	The configurable driver properties for your connection. **Note**: This is an optional configuration.

5. Click **Save** to establish your connection.

What's next?

Once you save your HDFS connection:

- A confirmation message tells you that your connection is saved and valid.
- You can immediately access your HDFS connection Explorer (no-code).
- Begin Profile (automatic).

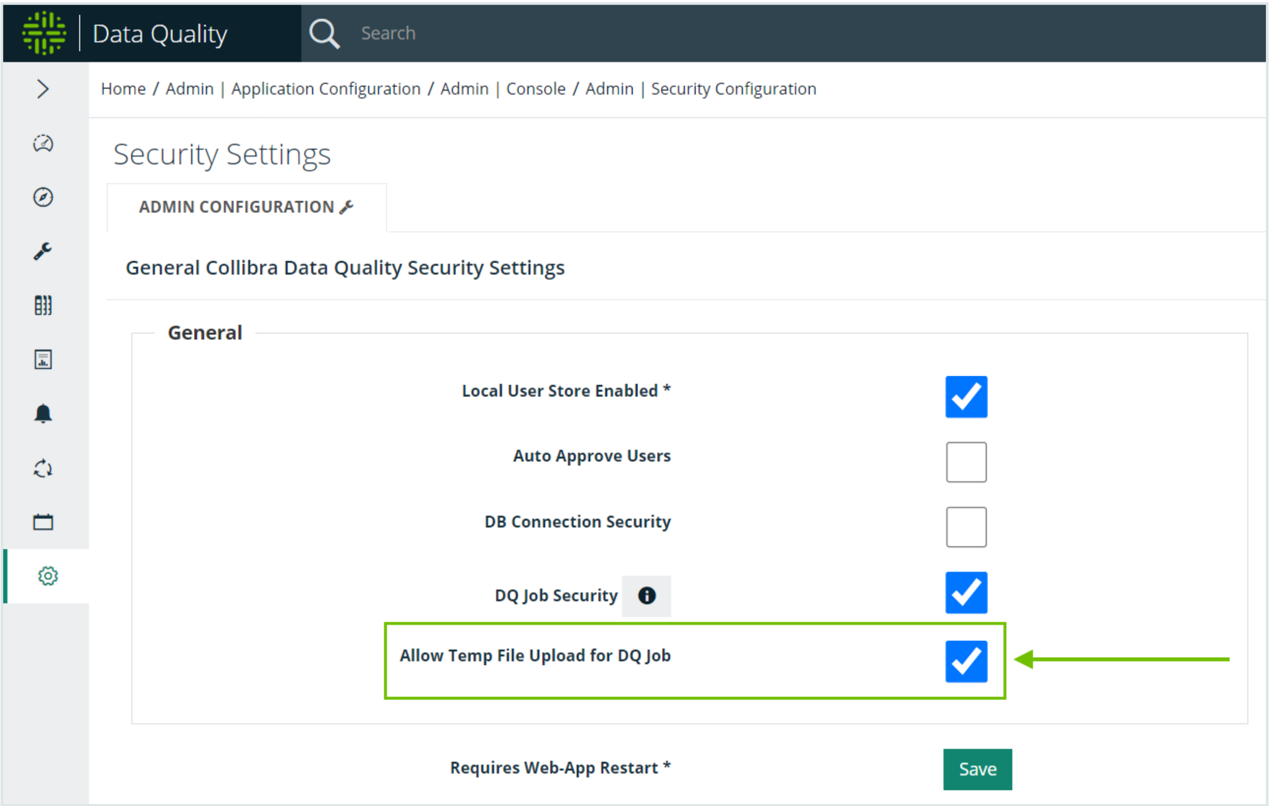
Connecting to Temp Files

Temp files allow you to upload and run a DQ job on files directly from your local machine. This is not a recommended connection for more advanced users but can be useful when you first get started in Collibra Data Quality.

Prerequisites

To connect to a temp file, you need:

- A file in a supported file format saved on your local drive.
- To verify that the Allow Temp File Upload for DQ Job checkbox under Admin Console > Security Configuration is checked.



Home / Admin | Application Configuration / Admin | Console / Admin | Security Configuration

Security Settings

ADMIN CONFIGURATION

General Collibra Data Quality Security Settings

General

Local User Store Enabled *	☑
Auto Approve Users	□
DB Connection Security	□
DQ Job Security	☑
Allow Temp File Upload for DQ Job	☑

Requires Web-App Restart *

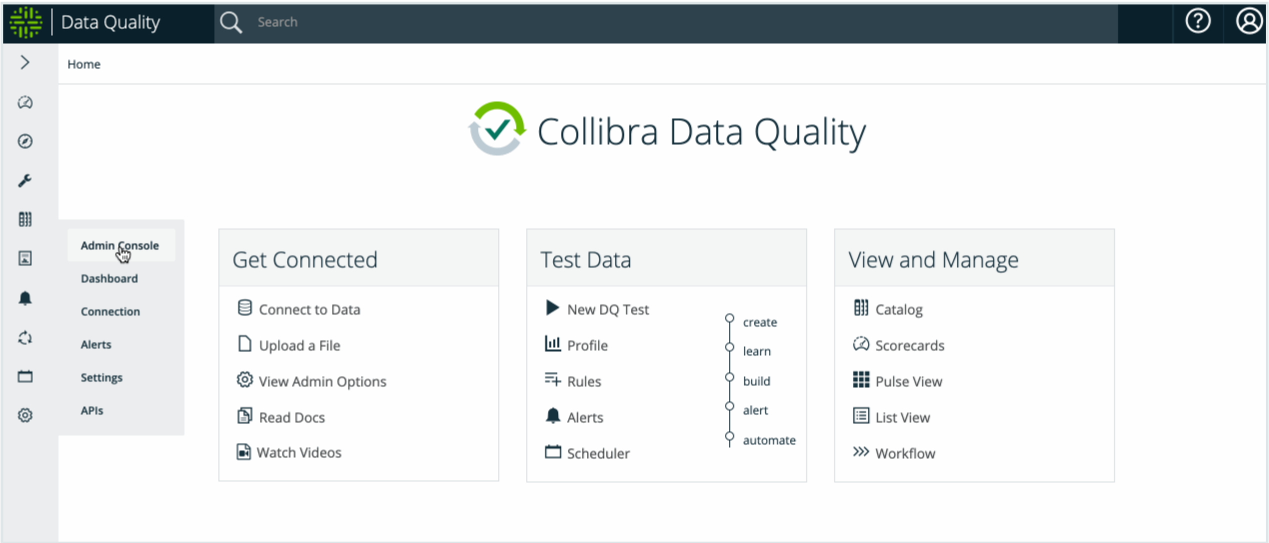
Steps

1. In the main menu, click the **Explorer** button. >> Explorer opens.
2. Click **Temp Files**. >> Temp Files expands.

3. Click **Add Temp File**. >> Upload Temp File alert opens.
4. Click **Choose File**.
5. Select a file from your local drive.
6. Click **Open**. >> Your file loads into the Temp Files folder.
7. In the Temp Files folder in the application, select your file.
8. Click **Create DQ Job**.
9. Verify your file information and enter the required information.
10. Click **Load File**. >> The application automatically reads your file and opens Scope & Range.
11. Select your DQ layers. >> You can also leave the defaults set.
12. Click **Save & Run**.
13. Enter a unique name and any additional information. >> Note: Temp files differ from other remote file connections in that they do not require an agent to run successfully. This is a legacy component.
14. Click the **Run CMD** tab. >> This is a bypass step for temp files.
15. Click **Run**. >> Your job is sent to the Jobs queue.

> **Warning** All temp files are only temporarily stored in the application. At 11:59 PM EST, all temp files uploaded on a given day are automatically removed.

Adding a connection to a DQ Agent

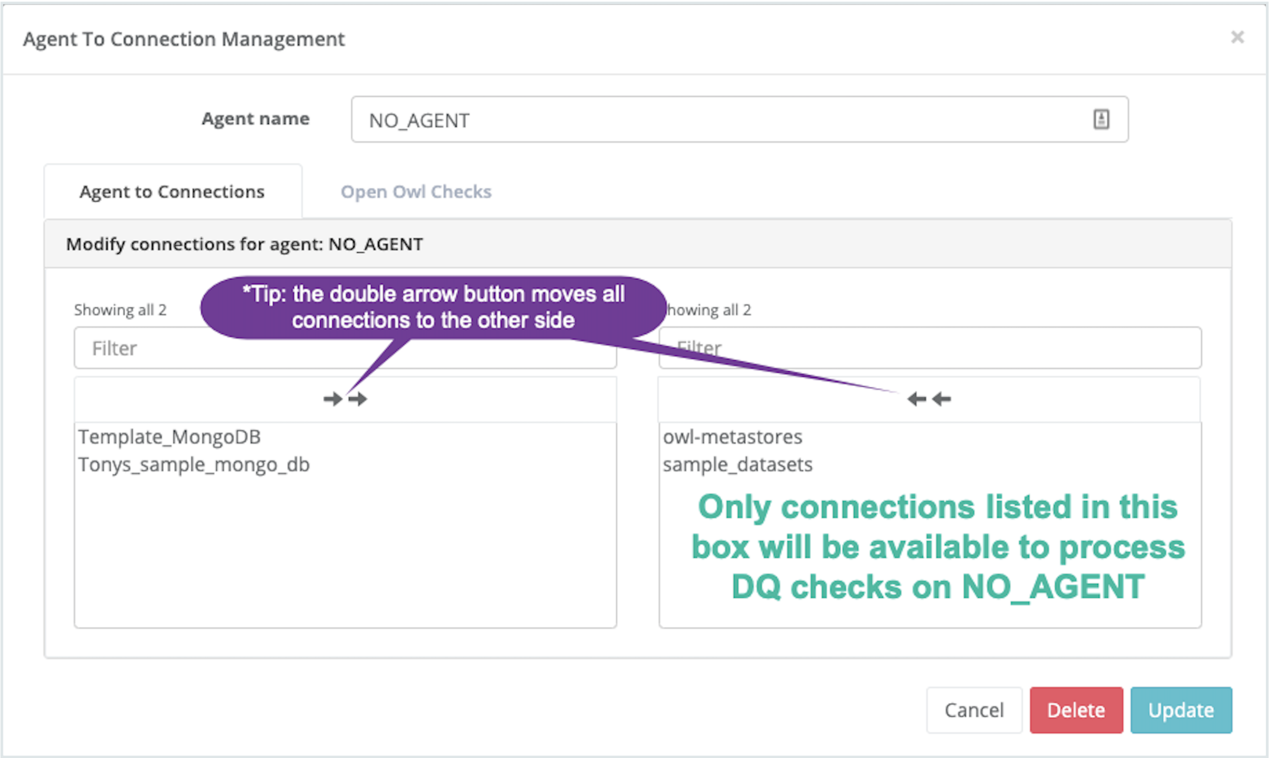


How To Link DB Connection to Agent via UI

When you add a new Database Connection, the DQ Agent must be given the permission to run DQ Job via the specified agent.

From Fig 3, select the chain link icon next to the DQ Agent to establish link to DB Connection. A modal to add give that agent permission to run DQ Jobs by DB Connection name will show (Fig 5). The left-side panel is the list DB Connection names that has not been linked to the DQ Agent. The right-side panel is the list of DB Connection names that has the permission to run DQ Job.

Double click the DQ Connection name to move from left to right. In Fig 5, DB Connection named "metastore" is being added to DQ Agent. Click the "Update" button to save the new list of DB Connections.Fig 5: Adding DB Connection named "metastore" to the DQ AgentFig 6: How to add all connections to the selected DQ Agent



Agent To Connection Management

Agent name: NO_AGENT

Modify connections for agent: NO_AGENT

Showing all 2

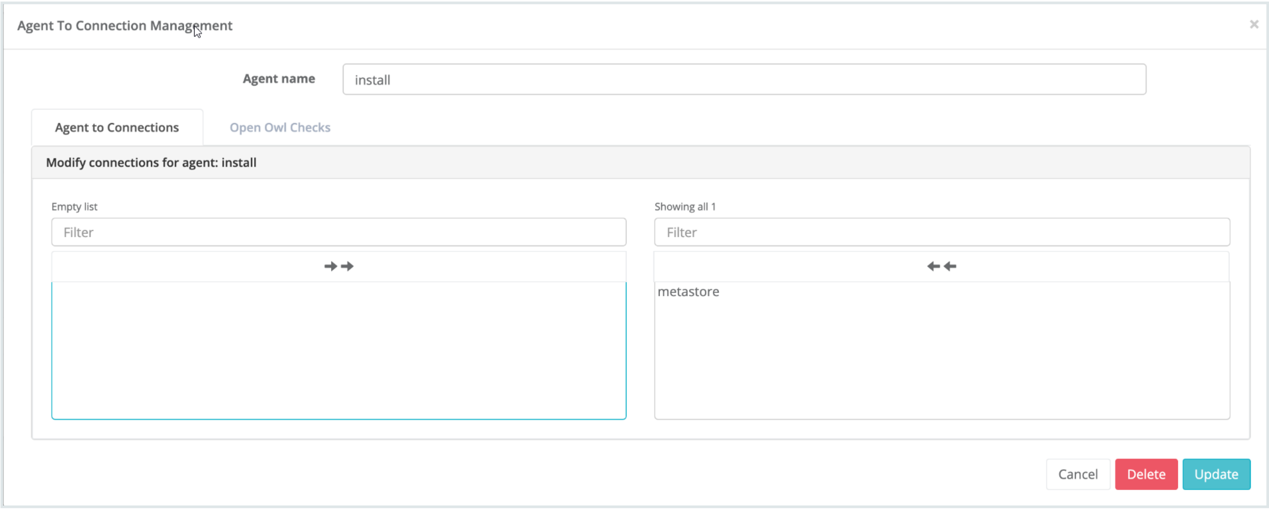
Template_MongoDB
Tonys_sample_mongo_db

howing all 2

owl-metastores
sample_datasets

*Tip: the double arrow button moves all connections to the other side

Only connections listed in this box will be available to process DQ checks on NO_AGENT



Agent To Connection Management

Agent name: install

Modify connections for agent: install

Empty list

Filter

Showing all 1

Filter

metastore

Collibra DQ Features

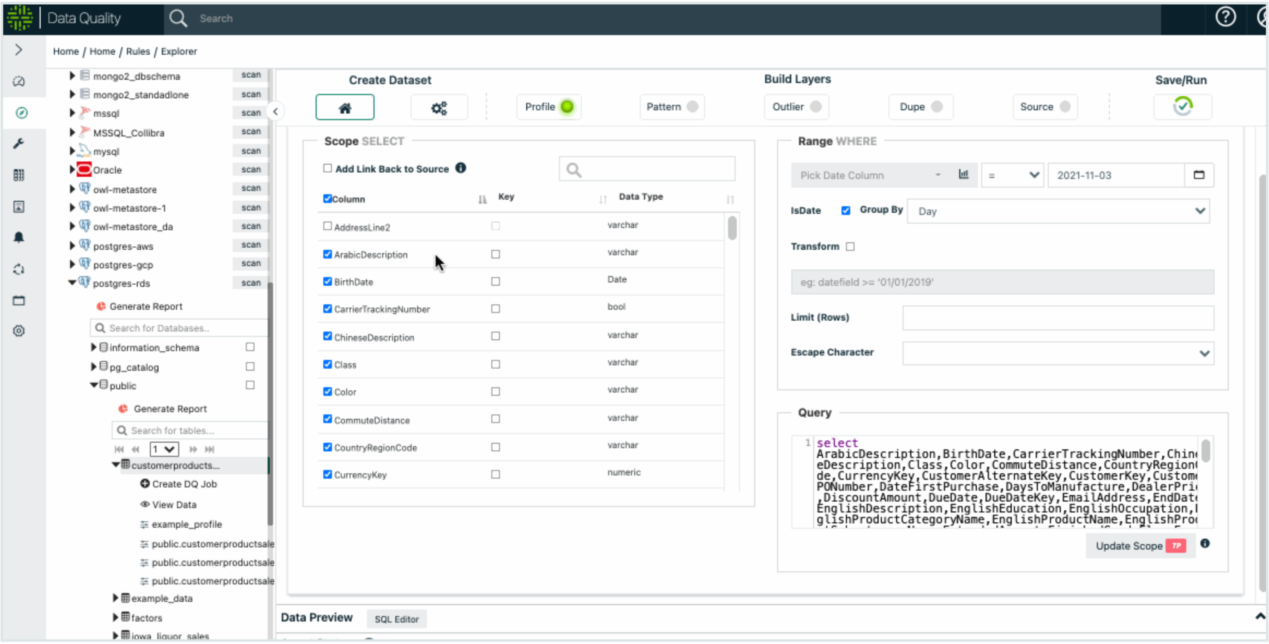
Profile (automatic)

Create profiles based on a table, view, or file.

> **Note** Users have the option to scan the entire dataset or users can apply custom filtering to select the depth (row filtering) and width (columns).

Select the Scope

You can find detailed instructions about selecting the scope in the Explorer section. You can run limits, by time, or full table scans if you have enough resources.



Scope SELECT

☐ Add Link Back to Source

☑ Column	Key	Data Type
☐ AddressLine2	☐	varchar
☑ ArabicDescription	☐	varchar
☑ BirthDate	☐	Date
☑ CarrierTrackingNumber	☐	bool
☑ ChineseDescription	☐	varchar
☑ Class	☐	varchar
☑ Color	☐	varchar
☑ CommuteDistance	☐	varchar
☑ CountryRegionCode	☐	varchar
☑ CurrencyKey	☐	numeric

Range WHERE

Pick Date Column = 2021-11-03

IsDate ☑ Group By Day

Transform ☐

eg: datefield >= '01/01/2019'

Limit (Rows)

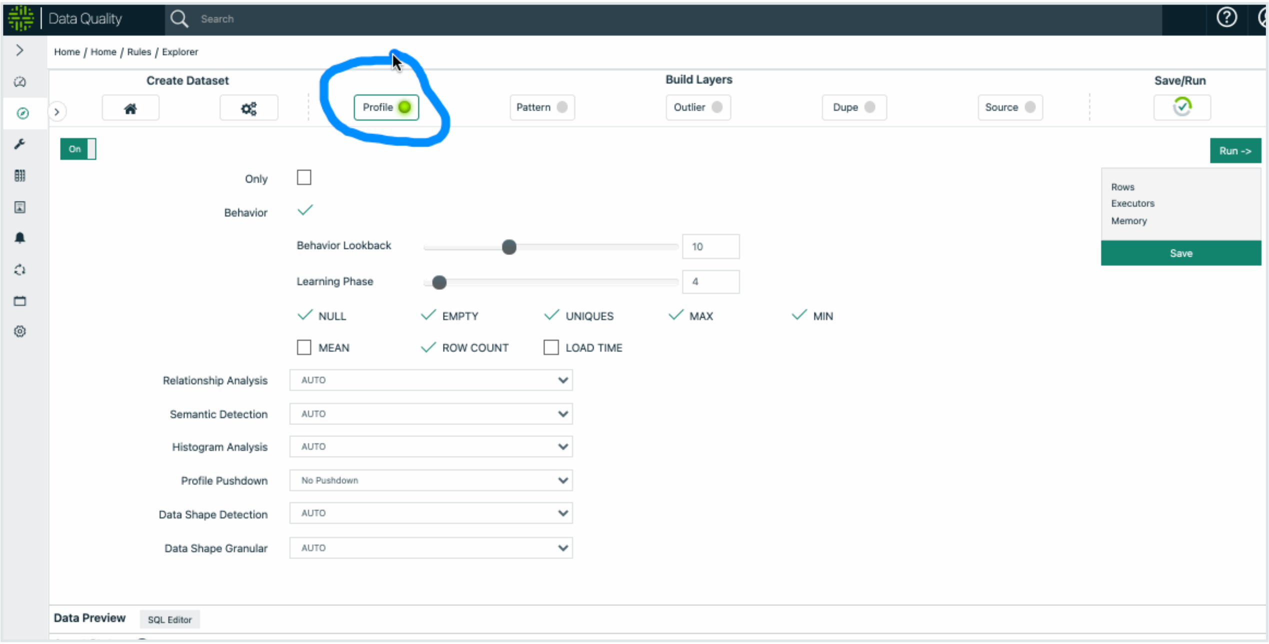
Escape Character

Query

```
select
ArabicDescription,BirthDate,CarrierTrackingNumber,Chin
eDescription,Class,Color,CommuteDistance,CountryRegion
de,CurrencyKey,CustomerAlternateKey,CustomerKey,Custom
PONumber,DateFirstPurchase,DaysToManufacture,DealerPri
,DiscountAmount,DueDate,DueDateKey,EmailAddress,EndDat
EnglishDescription,EnglishEducation,EnglishOccupation,
glishProductCategoryName,EnglishProductName,EnglishPro
```

Update Scope TP

Select Options (or leave defaults)



Only □

Behavior ✓

Behavior Lookback 10

Learning Phase 4

✓ NULL ✓ EMPTY ✓ UNIQUES ✓ MAX ✓ MIN

□ MEAN ✓ ROW COUNT □ LOAD TIME

Relationship Analysis: AUTO

Semantic Detection: AUTO

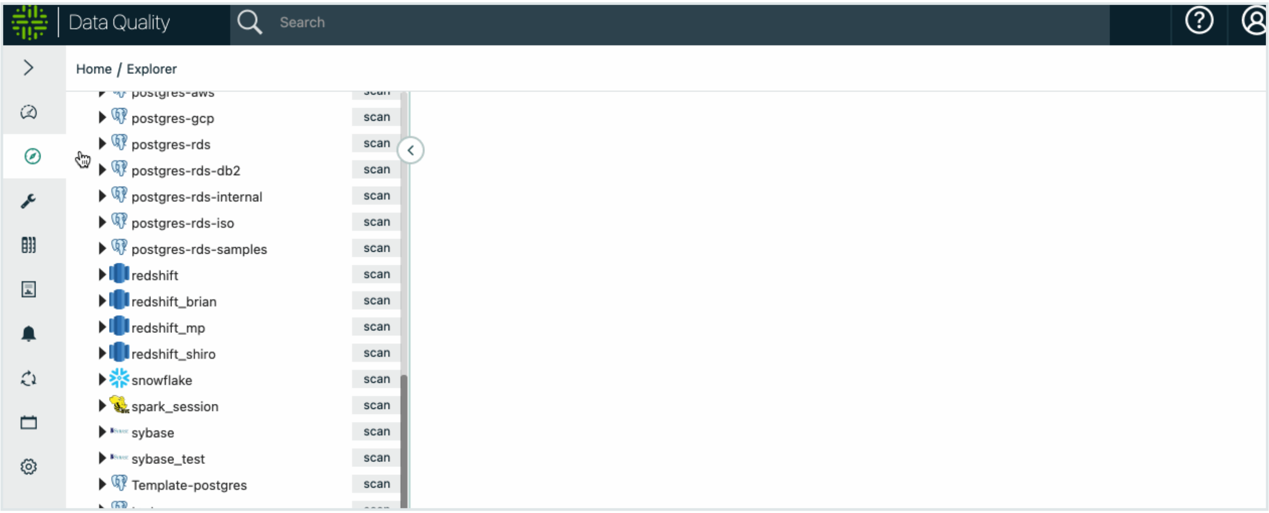
Histogram Analysis: AUTO

Profile Pushdown: No Pushdown

Data Shape Detection: AUTO

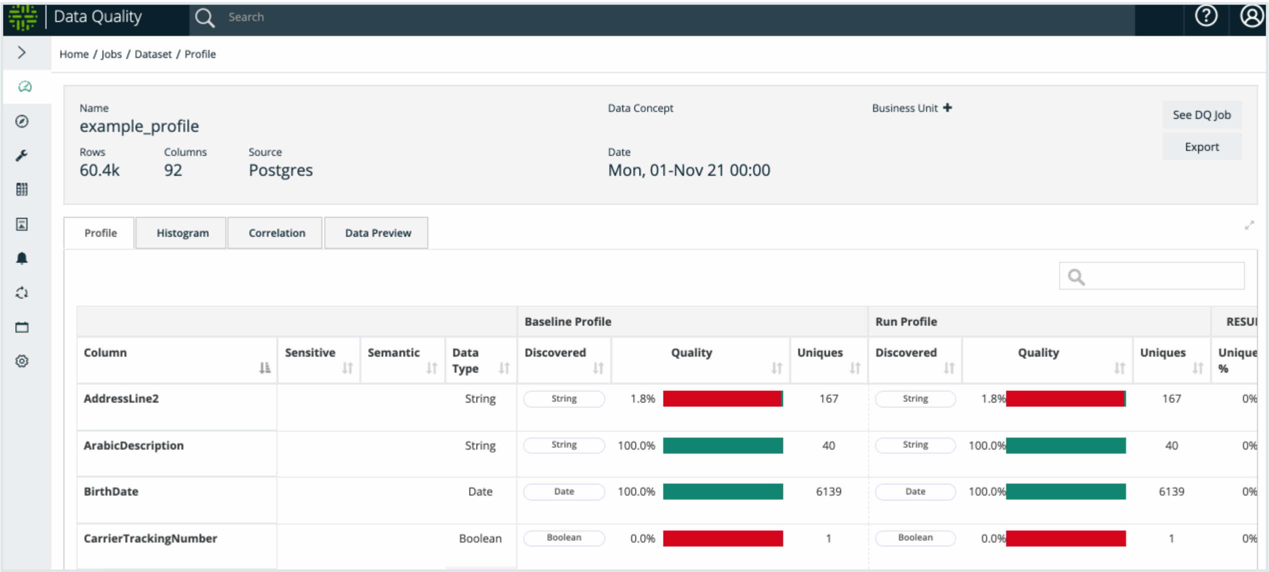
Data Shape Granular: AUTO

Save / Run



postgres-aws scan
postgres-gcp scan
postgres-rds scan
postgres-rds-db2 scan
postgres-rds-internal scan
postgres-rds-iso scan
postgres-rds-samples scan
redshift scan
redshift_brian scan
redshift_mp scan
redshift_shiro scan
snowflake scan
spark_session scan
sybase scan
sybase_test scan
Template-postgres scan

View the Results



Name: example_profile

Data Concept

Business Unit +

Rows: 60.4k

Columns: 92

Source: Postgres

Date: Mon, 01-Nov 21 00:00

				Baseline Profile			Run Profile			RESUI
Column	Sensitive	Semantic	Data Type	Discovered	Quality	Uniques	Discovered	Quality	Uniques	Unique %
AddressLine2			String	String	1.8% 🟥	167	String	1.8% 🟥	167	0%
ArabicDescription			String	String	100.0% 🟩	40	String	100.0% 🟩	40	0%
BirthDate			Date	Date	100.0% 🟩	6139	Date	100.0% 🟩	6139	0%
CarrierTrackingNumber			Boolean	Boolean	0.0% 🟥	1	Boolean	0.0% 🟥	1	0%

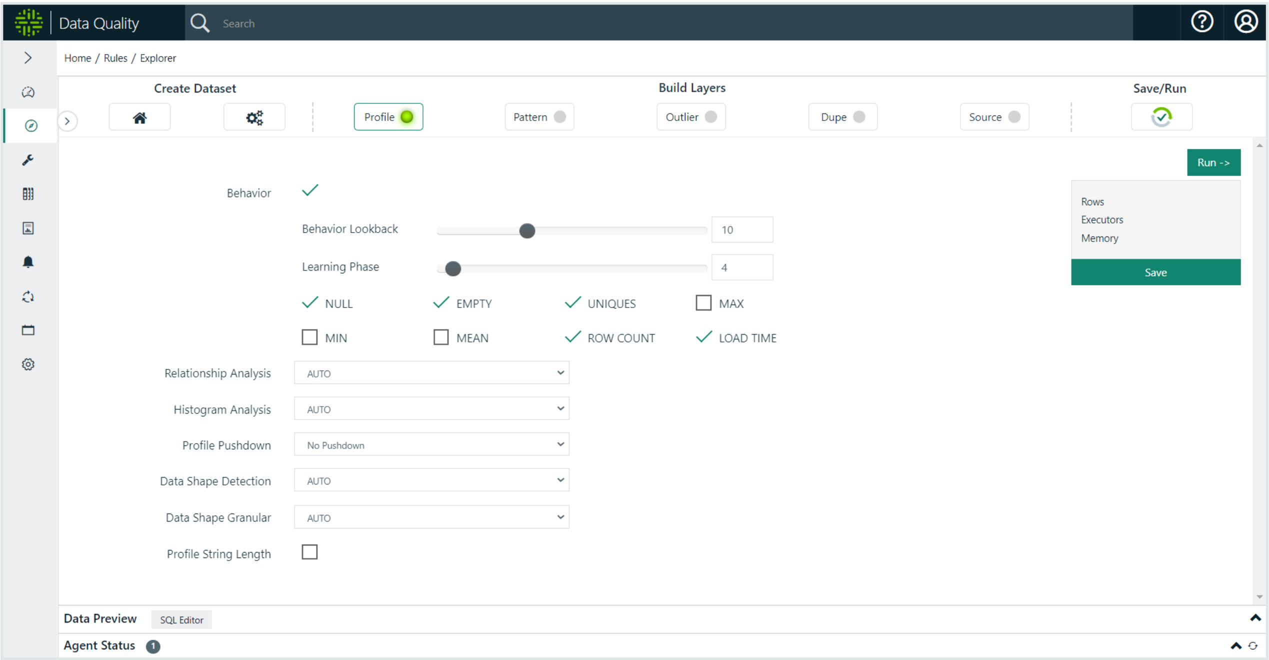
Automatically Profile

Collibra DQ automatically profiles data sets over time to enable drill-ins for detailed insights and automated data quality. A profile is just the first step towards an amazing amount of auto discovery. Visualize segments of the data set and how the data set changes over time.

Collibra DQ offers click or code options to run profiling.

Data Set Profile

Collibra DQ creates a detailed profile of each dataset under management. This profile will later be used to both provide insight and automatically identify data quality issues.



Behavior ✓

Behavior Lookback 10

Learning Phase 4

✓ NULL ✓ EMPTY ✓ UNIQUES □ MAX

□ MIN □ MEAN ✓ ROW COUNT ✓ LOAD TIME

Relationship Analysis: AUTO

Histogram Analysis: AUTO

Profile Pushdown: No Pushdown

Data Shape Detection: AUTO

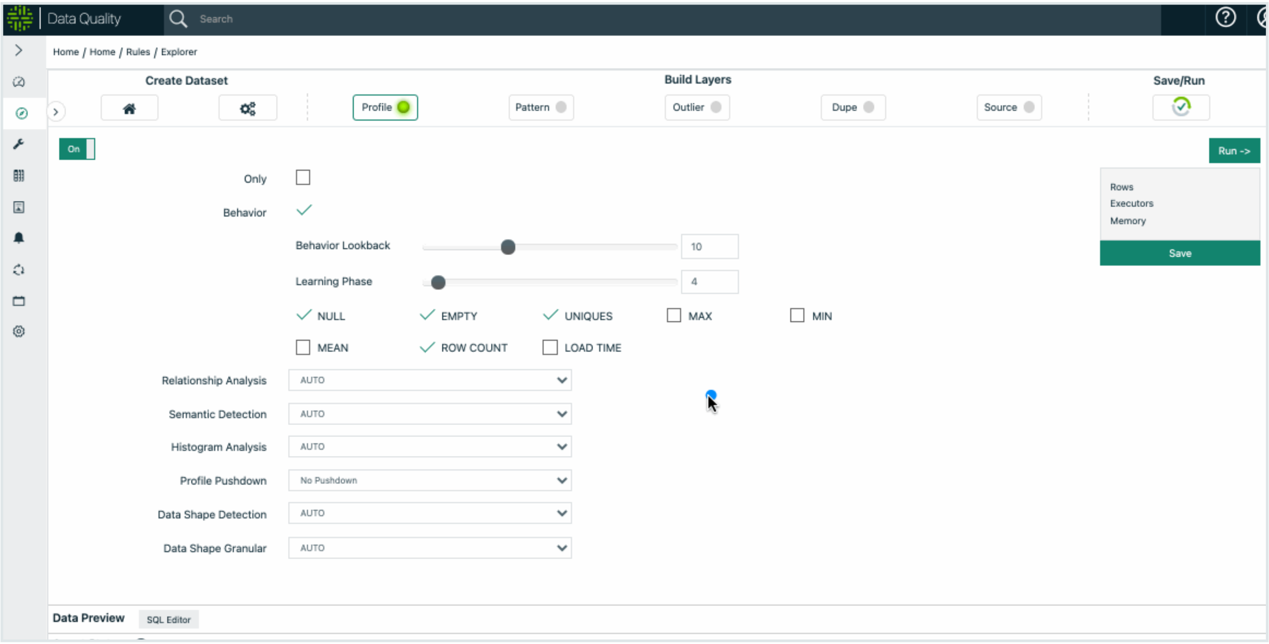
Data Shape Granular: AUTO

Profile String Length □

Pushdown Profiling

Collibra DQ can compute the Profile of a data set either via Spark (default) or a Data Warehouse (Profile Pushdown) where the data lives as the engine. When the Profile is computed using the datasource DBMS the user can choose two levels of pushdown:

- Full Profile - Perform full profile calculation except for TopN
- Count - Only perform row and column counts



Only □

Behavior ✓

Behavior Lookback 10

Learning Phase 4

✓ NULL ✓ EMPTY ✓ UNIQUES □ MAX □ MIN

□ MEAN ✓ ROW COUNT □ LOAD TIME

Relationship Analysis AUTO

Semantic Detection AUTO

Histogram Analysis AUTO

Profile Pushdown No Pushdown

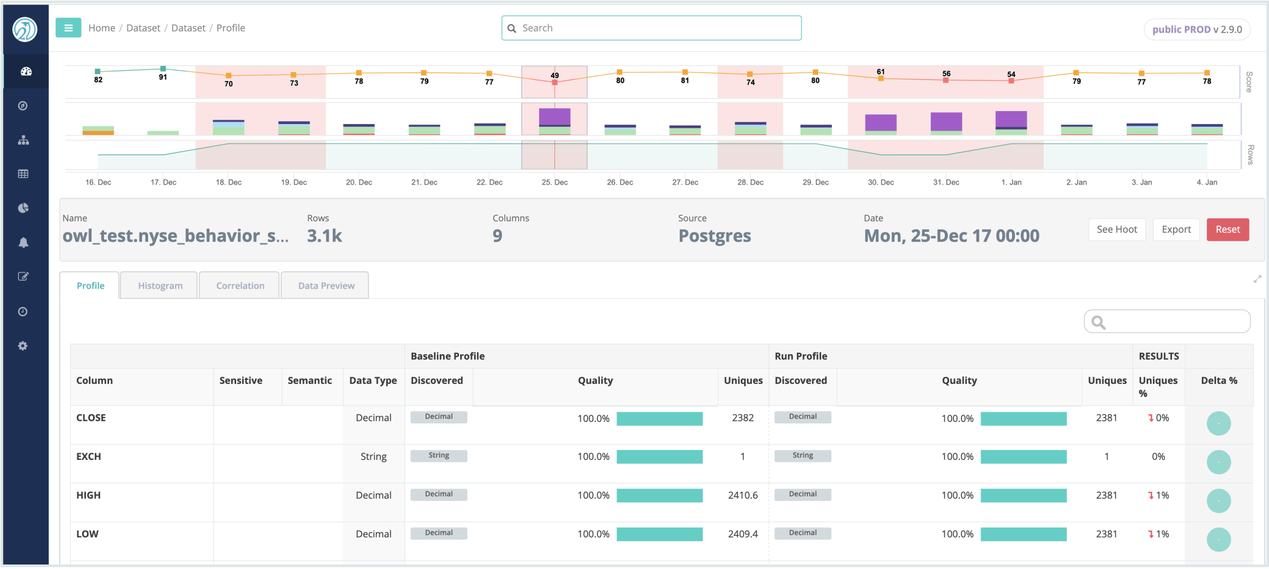
Data Shape Detection AUTO

Data Shape Granular AUTO

Note The following DBMS systems are supported for "Profile Pushdown":

- Impala
- Hive
- Snowflake
- Presto
- Teradata
- SQL Server
- PostgreSQL
- Redshift
- MySQL
- Oracle
- DB2

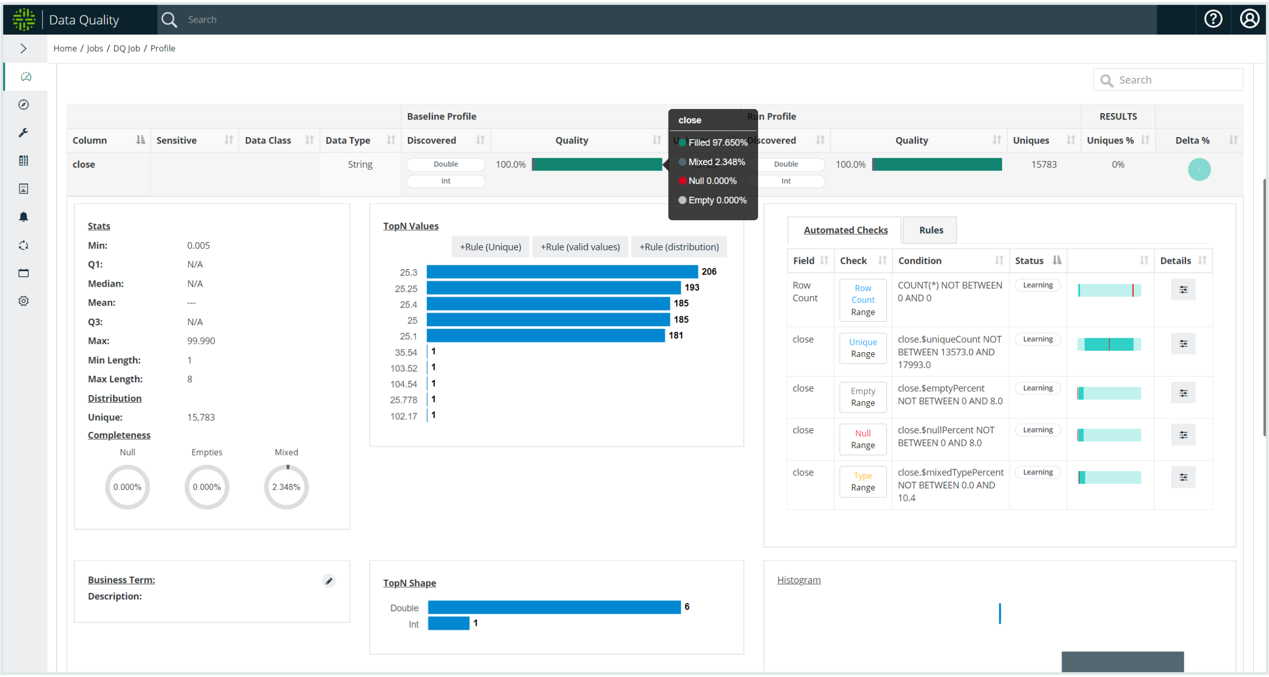
Warning Pushdown and parallel JDBC cannot be used together. If you are using pushdown, do not select the parallel JDBC option.



Name: owl_test.nyse_behavior_s...
Rows: 3.1k
Columns: 9
Source: Postgres
Date: Mon, 25-Dec 17 00:00

				Baseline Profile			Run Profile			RESULTS	
Column	Sensitive	Semantic	Data Type	Discovered	Quality	Uniques	Discovered	Quality	Uniques	Uniques %	Delta %
CLOSE			Decimal	Decimal	100.0%	2382	Decimal	100.0%	2381	↓0%	●
EXCH			String	String	100.0%	1	String	100.0%	1	0%	●
HIGH			Decimal	Decimal	100.0%	2410.6	Decimal	100.0%	2381	↓1%	●
LOW			Decimal	Decimal	100.0%	2409.4	Decimal	100.0%	2381	↓1%	●

Profile Insights



				Baseline Profile			Run Profile			RESULTS	
Column	Sensitive	Data Class	Data Type	Discovered	Quality	Uniques	Discovered	Quality	Uniques	Uniques %	Delta %
close			String	Double Int	100.0%		Double Int	100.0%	15783	0%	●

close
- Filled 97.650%
- Mixed 2.348%
- Null 0.000%
- Empty 0.000%

Stats

Min:	0.005
Q1:	N/A
Median:	N/A
Mean:	---
Q3:	N/A
Max:	99.990
Min Length:	1
Max Length:	8

Distribution

Unique:	15,783

Completeness

Null	Empties	Mixed
0.000%	0.000%	2.348%

TopN Values

Automated Checks | Rules

Field	Check	Condition	Status		Details
Row Count	Row Count Range	COUNT(*) NOT BETWEEN 0 AND 0	Learning		
close	Unique Range	close.$uniqueCount NOT BETWEEN 13573.0 AND 17993.0	Learning		
close	Empty Range	close.$emptyPercent NOT BETWEEN 0 AND 8.0	Learning		
close	Null Range	close.$nullPercent NOT BETWEEN 0 AND 8.0	Learning		
close	Type Range	close.$mixedTypePercent NOT BETWEEN 0.0 AND 10.4	Learning		

Business Term:
Description:

TopN Shape

By gathering a variety of different statistics, Collibra DQ's profile can provide a great deal of insight about a data set.

To see the difference between baseline (historical) and current values, Collibra DQ provides a **Delta %** change column. In the Delta % change column, data is represented in a pie chart for quick visualization of the changes.

To elaborate on the quality metrics:

The profile can discover attributes then helps delineate the relative metrics around numeric v. non-numeric discovered.

- Filled - [1] Integer - The percentage of data that is numeric (or non-numeric) in a numeric (or non-numeric) discovered column.
- Mixed - [String] Integer - The percentage of data that is non-numeric (or numeric) in a numeric (or non-numeric) discovered column.
- Null - [] - The percentage of data that has no value at all.
- Empty - [""] - The percentage of data that has a string instance of zero length.

> **Note** Profile includes a range of statistics:

- Actual Datatype
- Discovered Datatypes
- Percent Null
- Percent Empty
- Percent Mixed Types
- Cardinality
- Minimum
- Maximum
- Mean
- TopN / BottomN
- Value Quartiles
- Minimum (String) Length
- Maximum (String) Length

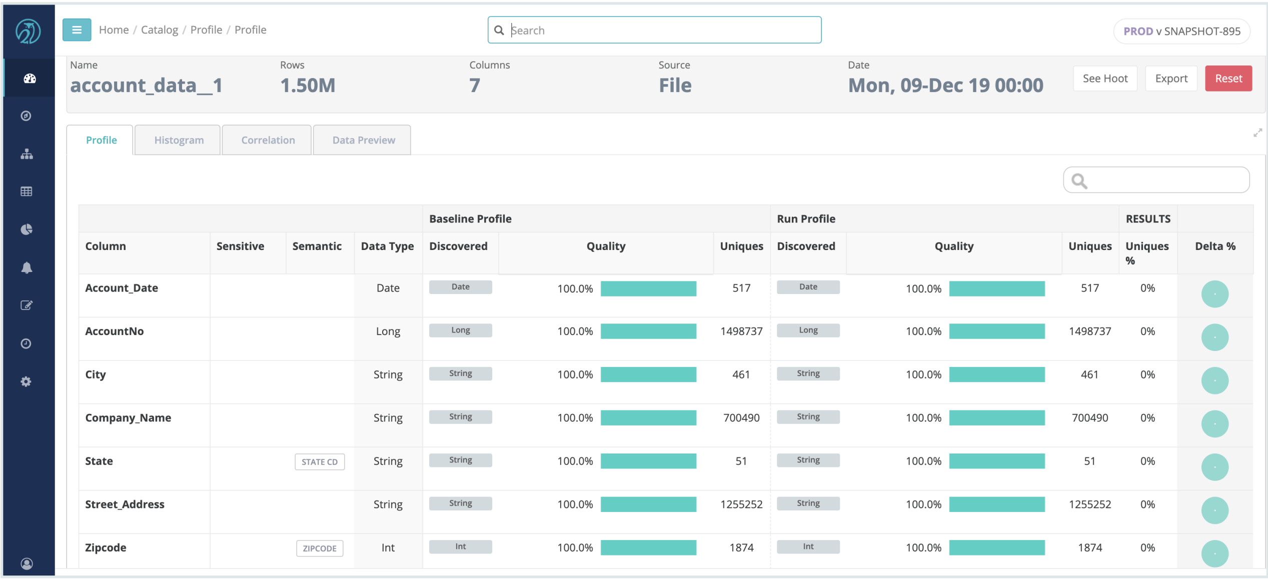
Sensitive Data Detection (Semantic)

Collibra DQ can automatically identify any type of common PII columns.

> **Note** Collibra DQ is able to detect the following types of PII:

- EMAIL
- PHONE
- ZIP CODE

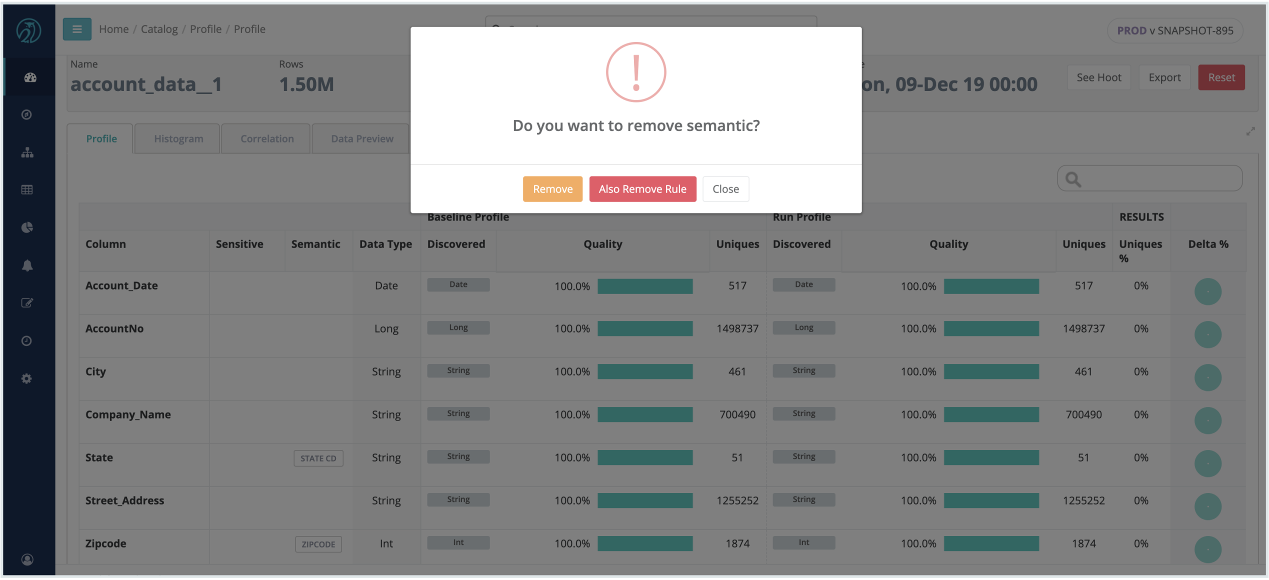
- STATE CD
- CREDIT CARD
- GENDER
- SSN
- IP ADDRESS
- EIN



Name: account_data__1
Rows: 1.50M
Columns: 7
Source: File
Date: Mon, 09-Dec 19 00:00

				Baseline Profile			Run Profile			RESULTS	
Column	Sensitive	Semantic	Data Type	Discovered	Quality	Uniques	Discovered	Quality	Uniques	Uniques %	Delta %
Account_Date			Date	Date	100.0%	517	Date	100.0%	517	0%	
AccountNo			Long	Long	100.0%	1498737	Long	100.0%	1498737	0%	
City			String	String	100.0%	461	String	100.0%	461	0%	
Company_Name			String	String	100.0%	700490	String	100.0%	700490	0%	
State		STATE CD	String	String	100.0%	51	String	100.0%	51	0%	
Street_Address			String	String	100.0%	1255252	String	100.0%	1255252	0%	
Zipcode		ZIPCODE	Int	Int	100.0%	1874	Int	100.0%	1874	0%	

Once detected, Collibra DQ tags the column in the Profile as the discovered type and automatically applies a rule. You can choose to decline any discovered tag by clicking on it and confirming the delete action. This action also removes the rule associated with the tag.



Do you want to remove semantic?

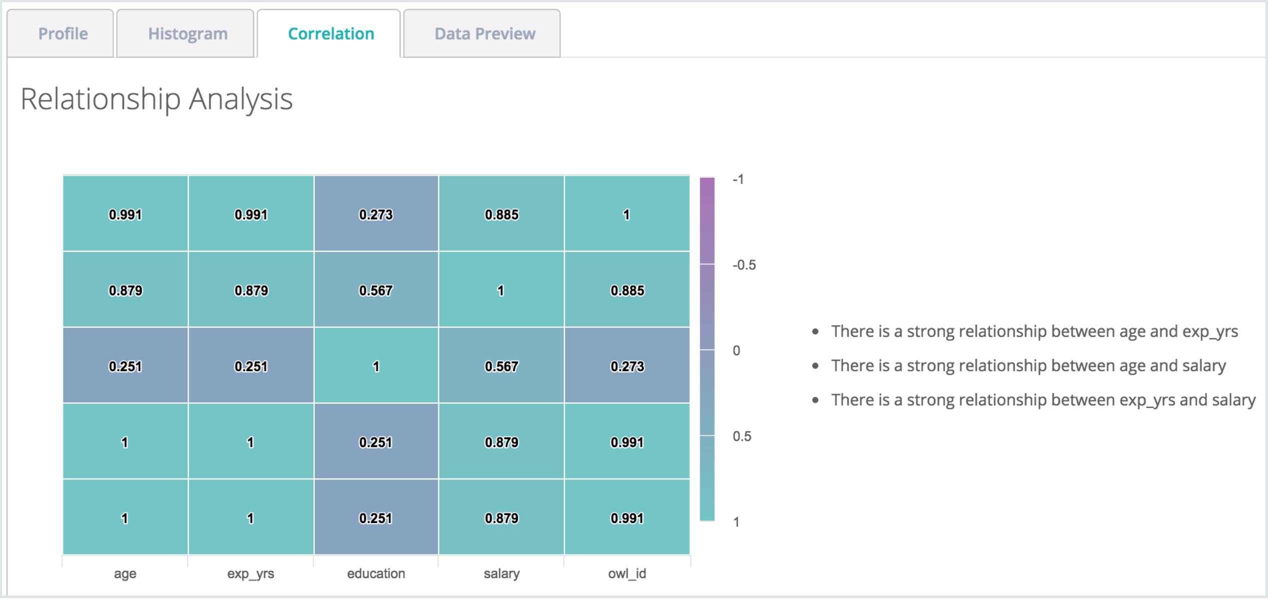
Remove | Also Remove Rule | Close

Name: account_data__1
Rows: 1.50M
Date: ...on, 09-Dec 19 00:00

				Baseline Profile			Run Profile			RESULTS	
Column	Sensitive	Semantic	Data Type	Discovered	Quality	Uniques	Discovered	Quality	Uniques	Uniques %	Delta %
Account_Date			Date	Date	100.0%	517	Date	100.0%	517	0%	
AccountNo			Long	Long	100.0%	1498737	Long	100.0%	1498737	0%	
City			String	String	100.0%	461	String	100.0%	461	0%	
Company_Name			String	String	100.0%	700490	String	100.0%	700490	0%	
State		STATE CD	String	String	100.0%	51	String	100.0%	51	0%	
Street_Address			String	String	100.0%	1255252	String	100.0%	1255252	0%	
Zipcode		ZIPCODE	Int	Int	100.0%	1874	Int	100.0%	1874	0%	

Correlation Matrix (Relationship)

Discover hidden relationships and measure the strength of those relationships.



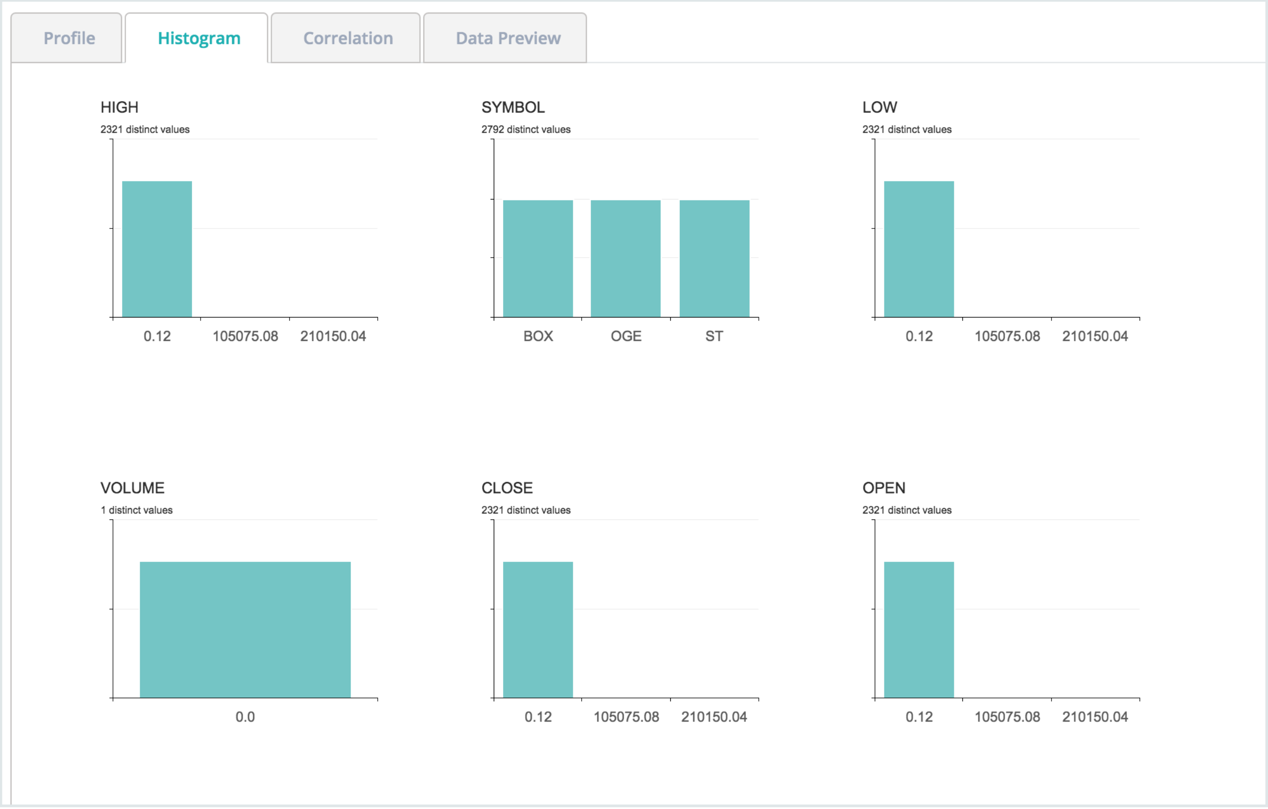
Relationship Analysis

age	exp_yrs	education	salary	owl_id
0.991	0.991	0.273	0.885	1
0.879	0.879	0.567	1	0.885
0.251	0.251	1	0.567	0.273
1	1	0.251	0.879	0.991
1	1	0.251	0.879	0.991

- There is a strong relationship between age and exp_yrs
- There is a strong relationship between age and salary
- There is a strong relationship between exp_yrs and salary

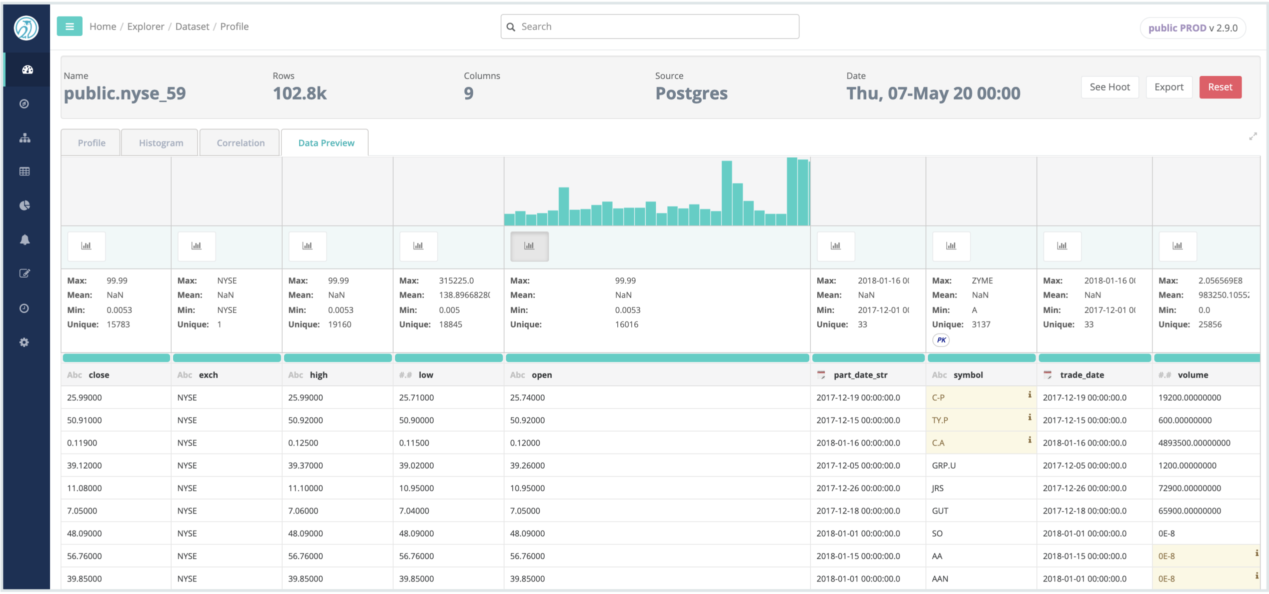
Histograms

Often the first step in a data science project is to segment the data. Collibra DQ automatically does this using histograms.



Data Preview

After profiling the data, for those users with appropriate rights, Collibra DQ provides a glimpse of the dataset. The Data preview tab also provides a some basic insights such as highlights of Data Shape issues and Outliers (if enabled), and Column Filtergram visualization.



Name	Rows	Columns	Source	Date
public.nyse_59	102.8k	9	Postgres	Thu, 07-May 20 00:00

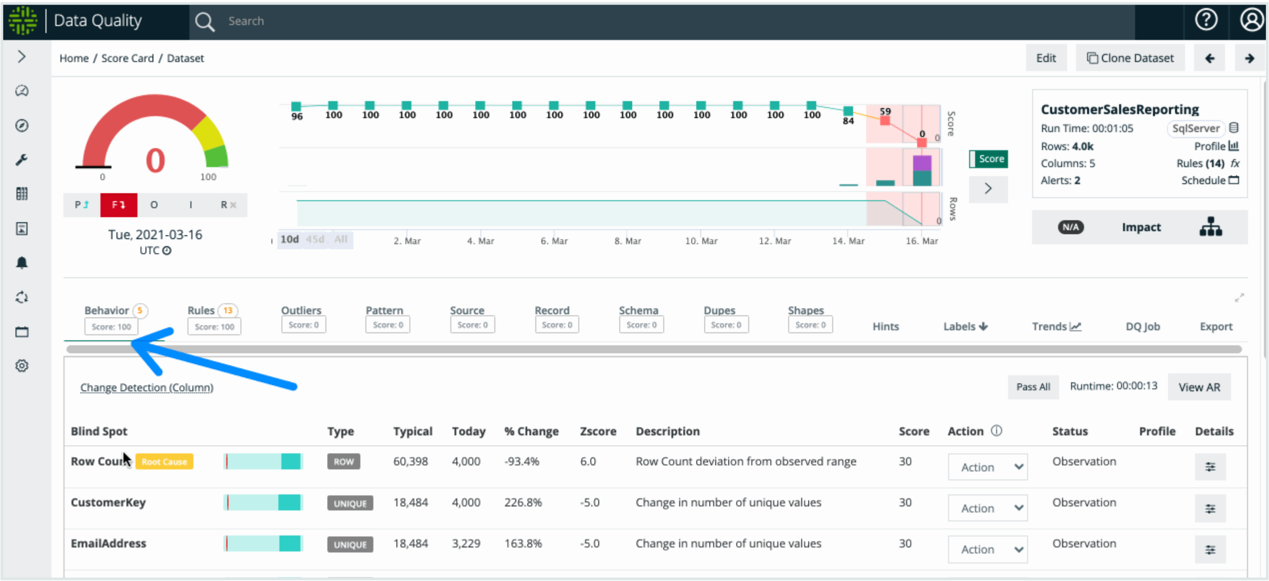
	close	exch	high	low	open	part_date_str	symbol	trade_date	volume
Max:	99.99	NYSE	99.99	315225.0	99.99	2018-01-16 0(	ZYME	2018-01-16 0(	2.056569E8
Mean:	NaN	NaN	NaN	138.8966828(	NaN	NaN	NaN	NaN	983250.1055:
Min:	0.0053	NYSE	0.0053	0.005	0.0053	2017-12-01 0(	A	2017-12-01 0(	0.0
Unique:	15783	1	19160	18845	16016	33	3137 PK	33	25856

Abc close	Abc exch	Abc high	#.# low	Abc open	part_date_str	Abc symbol	trade_date	#.# volume
25.99000	NYSE	25.99000	25.71000	25.74000	2017-12-19 00:00:00.0	C-P i	2017-12-19 00:00:00.0	19200.00000000
50.91000	NYSE	50.92000	50.90000	50.92000	2017-12-15 00:00:00.0	TY.P i	2017-12-15 00:00:00.0	600.00000000
0.11900	NYSE	0.12500	0.11500	0.12000	2018-01-16 00:00:00.0	C.A i	2018-01-16 00:00:00.0	4893500.00000000
39.12000	NYSE	39.37000	39.02000	39.26000	2017-12-05 00:00:00.0	GRP.U	2017-12-05 00:00:00.0	1200.00000000
11.08000	NYSE	11.10000	10.95000	10.95000	2017-12-26 00:00:00.0	JRS	2017-12-26 00:00:00.0	72900.00000000
7.05000	NYSE	7.06000	7.04000	7.05000	2017-12-18 00:00:00.0	GUT	2017-12-18 00:00:00.0	65900.00000000
48.09000	NYSE	48.09000	48.09000	48.09000	2018-01-01 00:00:00.0	SO	2018-01-01 00:00:00.0	0E-8
56.76000	NYSE	56.76000	56.76000	56.76000	2018-01-15 00:00:00.0	AA	2018-01-15 00:00:00.0	0E-8 i
39.85000	NYSE	39.85000	39.85000	39.85000	2018-01-01 00:00:00.0	AAN	2018-01-01 00:00:00.0	0E-8 i

Behavior (automatic)

This is commonly referred to as statistical change detection or data observability.

> **Note** Results are found under the Behavior tab (short for behavioral analytics). This tracks changes in the heuristics of the underlying data profiling metrics. The adaptive rules (AR) modal displays a complete list of monitoring types and criteria.

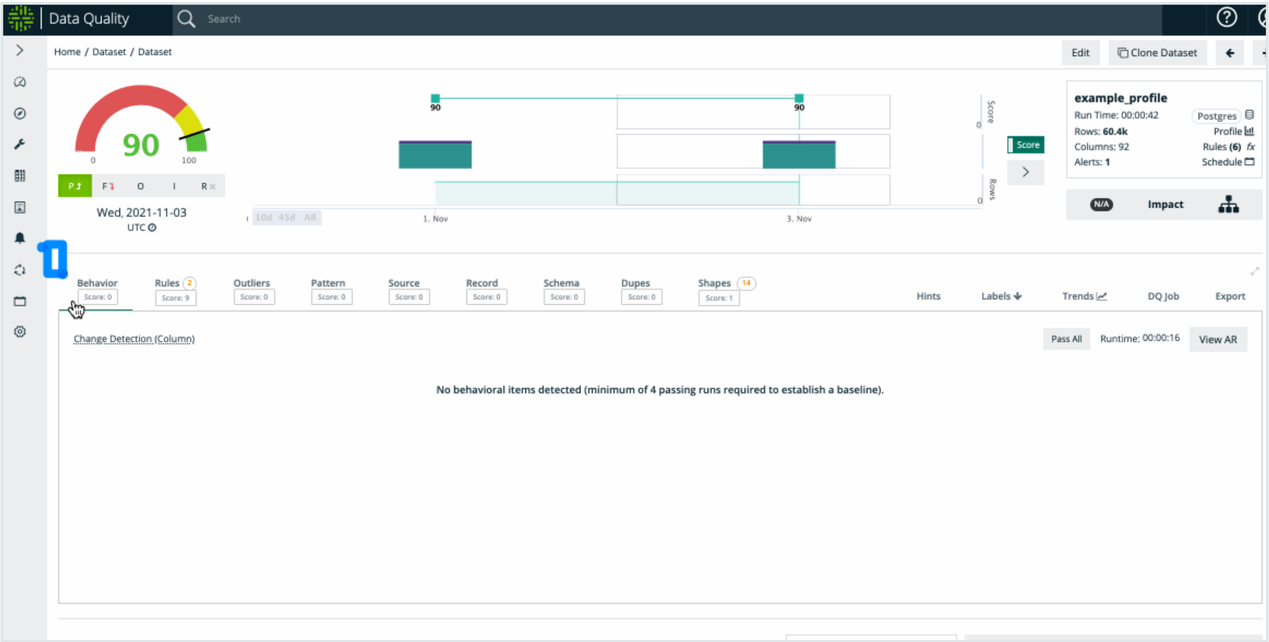


Blind Spot		Type	Typical	Today	% Change	Zscore	Description	Score	Action ⓘ	Status	Profile	Details
Row Cour Root Cause		ROW	60,398	4,000	-93.4%	6.0	Row Count deviation from observed range	30	Action	Observation		
CustomerKey		UNIQUE	18,484	4,000	226.8%	-5.0	Change in number of unique values	30	Action	Observation		
EmailAddress		UNIQUE	18,484	3,229	163.8%	-5.0	Change in number of unique values	30	Action	Observation		

Evolution of Rule based Data Quality

The main goal of Collibra Data Quality is to provide enterprise data quality insight while greatly reducing the volume of Rules that need to be written manually. When a data set is brought under management, Collibra profiles the data and builds a model for each data set. This allows Collibra to learn what "normal" means within the context of each data set. As the data changes, the definition of "normal" also changes. Instead of requiring you to adjust rule settings, Collibra continues to adjust its model. This approach enables Collibra to provide automated, enterprise-grade data quality coverage that removes the need to write dozens or even hundreds of rules per data set.

> **Note** Behaviors is turned on by default. Monitoring will calibrate and detect DQ observations, based on the profiling activity.



example_profile
Run Time: 00:00:42
Rows: 60.4k
Columns: 92
Alerts: 1
Postgres
Profile
Rules (6)
Schedule

Runtime: 00:00:16

No behavioral items detected (minimum of 4 passing runs required to establish a baseline).

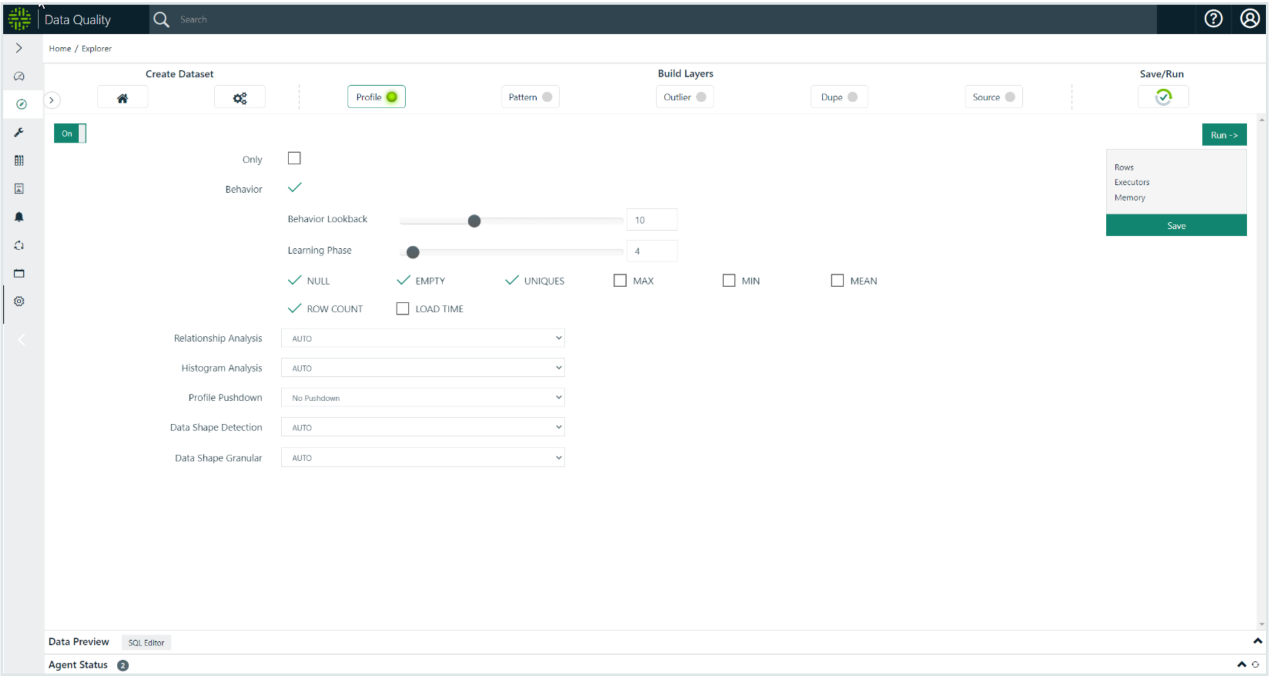
Using Behavioral Analytics (Change Detection)

Typically, data quality checks are scheduled to run on a given data set daily. Behavior data quality, or change detection, is built on top of data calculated by the Profile activity. The default settings will often work just fine, however, Collibra lets you specify two key parameters:

Parameter	Description
Behavior Lookback	The number of DQ checks that the model encompasses. For example: A lookback of 10 means that the model is based on the combined statistics from the last 10 DQ checks of a data set.
Learning Phase	The minimum number of DQ checks that are required before behavioral scoring is applied. Collibra DQ does not attempt to apply Behavioral scoring to a data set until at least this many DQ checks are run on it.

Applicable Behavioral Factors

You can choose to forego the application of any of the above factors to the scoring of the model. For example, you can instruct Collibra Data Quality to not track MIN and MAX ranges of values in columns by unchecking the MIN and MAX checkbox. This prevents Collibra from detecting any extreme values in any column of the dataset using the Behavioral model.



On

Only ☐

Behavior ✓

Behavior Lookback 10

Learning Phase 4

✓ NULL ✓ EMPTY ✓ UNIQUES ☐ MAX ☐ MIN ☐ MEAN

✓ ROW COUNT ☐ LOAD TIME

Relationship Analysis: AUTO

Histogram Analysis: AUTO

Profile Pushdown: No Pushdown

Data Shape Detection: AUTO

Data Shape Granular: AUTO

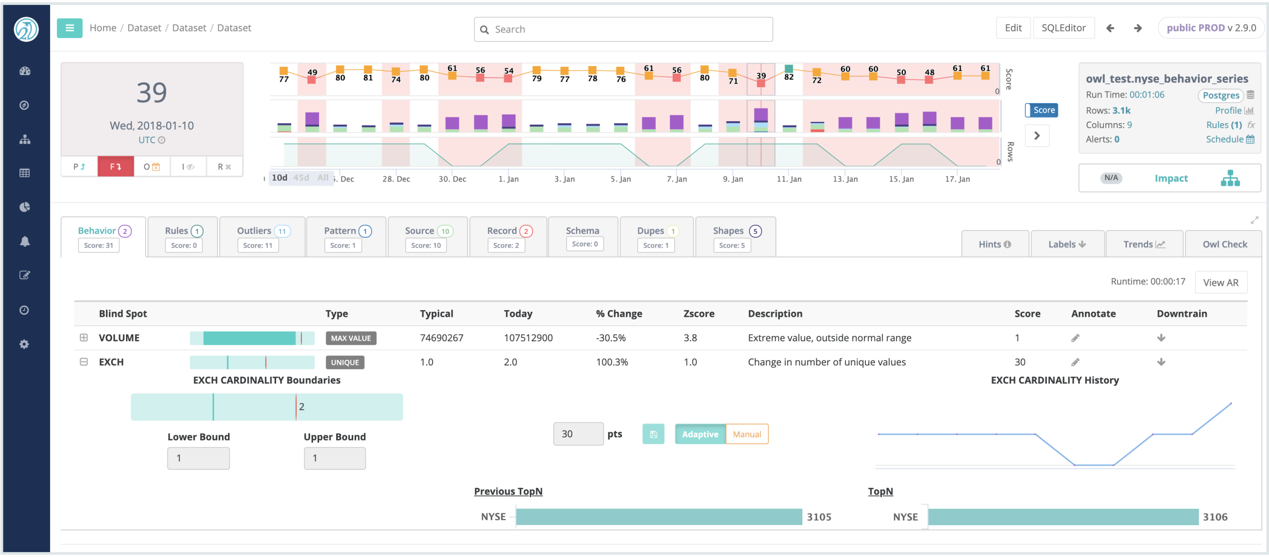
Rows
Executors
Memory

With each run, Collibra Data Quality profiles the data set at the column level and begins to establish a model for the data set. Initially, there is no need for any manual intervention, just keep the data coming. Within a few runs, the model becomes sufficiently robust to begin detecting data quality issues that are otherwise covered by manual rules. For example, Collibra may detect that a particular column experienced a spike in the number of NULL values (typically a manually defined rule).

> **Note** Collibra Data Quality's behavioral model consists of the following factors:
>
> - NULL values
> - Empty values
> - Cardinality
> - Datatype shifting
> - Row counts
> - Load time
> - Minimum value
> - Maximum value
> - Mean value

Over time, the definition of normal for any given column within the dataset can change. The data may legitimately become more sparse or decrease in volume. Collibra Data Quality continues to learn and adjust the model throughout the life of the data set. However, if there is a drastic (but legitimate) change in the data, this could still mean several days of unnecessary alerts while the model is adjusting. To accelerate model adjustment, Collibra DQ provides the ability to adjust the acceptable range for a given behavioral finding.

For example, Collibra DQ learned that a particular column typically has between 10% and 20% Empty values. Today, the column is 80% Empty values. Collibra raises a data quality issue and subtracts a proportional amount of points from the quality score of today's DQ run. You may review the finding and realize that there is a legitimate business reason for why that column has more empty values. With a few clicks, you can adjust the acceptable range for that finding. Collibra incorporates the user-defined inputs into the model and adjusts the current day's quality score. Collibra Data Quality would have eventually arrived at the correct range without any input, but without user input, it may have taken a few runs to get there.



owl_test.nyse_behavior_series
Run Time: 00:01:06
Rows: 3.1k
Columns: 9
Alerts: 0
Postgres
Profile
Rules (1)
Schedule

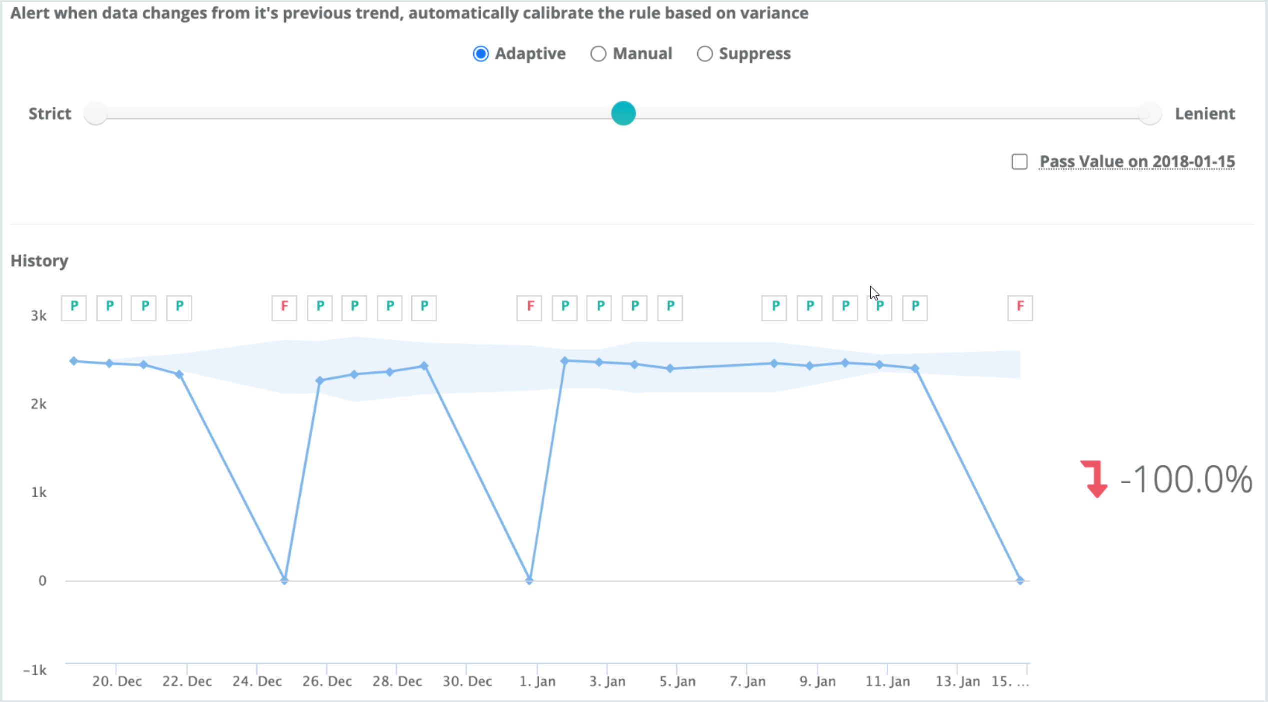
Runtime: 00:00:17

Blind Spot	Type	Typical	Today	% Change	Zscore	Description	Score	Annotate	Downtrain
⊞ VOLUME	MAX VALUE	74690267	107512900	-30.5%	3.8	Extreme value, outside normal range	1	✎	↓
⊟ EXCH	UNIQUE	1.0	2.0	100.3%	1.0	Change in number of unique values	30	✎	↓

Lower Bound: 1
Upper Bound: 1
30 pts

Drill-in to see the predicted range of valid values

Automatic flagging of break records with erroneous data.



Alert when data changes from it's previous trend, automatically calibrate the rule based on variance

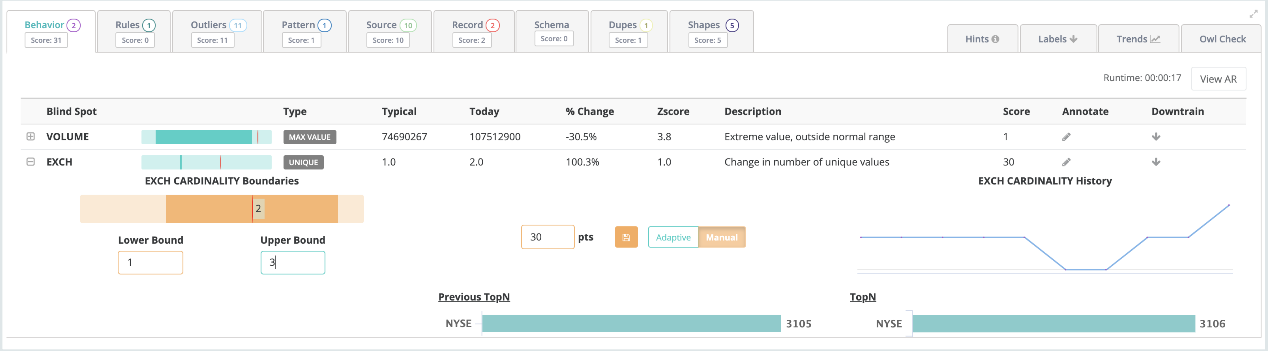
● Adaptive ○ Manual ○ Suppress

Strict — Lenient

☐ Pass Value on 2018-01-15

History

The screenshot above shows some of the controls and visualizations that can be used to tune the Behavioral model. In this specific example, Collibra has detected that the cardinality of the EXCH field has doubled from 1 to 2 unique values. However, you can instruct Collibra to disregard this finding and adjust the model by manually specifying the range of values acceptable in this column. To assist the user, Collibra provides a line chart and a historical topN visualization of this column's cardinality.



Runtime: 00:00:17

Blind Spot	Type	Typical	Today	% Change	Zscore	Description	Score	Annotate	Downtrain
VOLUME	MAX VALUE	74690267	107512900	-30.5%	3.8	Extreme value, outside normal range	1	✎	↓
EXCH	UNIQUE	1.0	2.0	100.3%	1.0	Change in number of unique values	30	✎	↓

EXCH CARDINALITY Boundaries

Lower Bound: 1

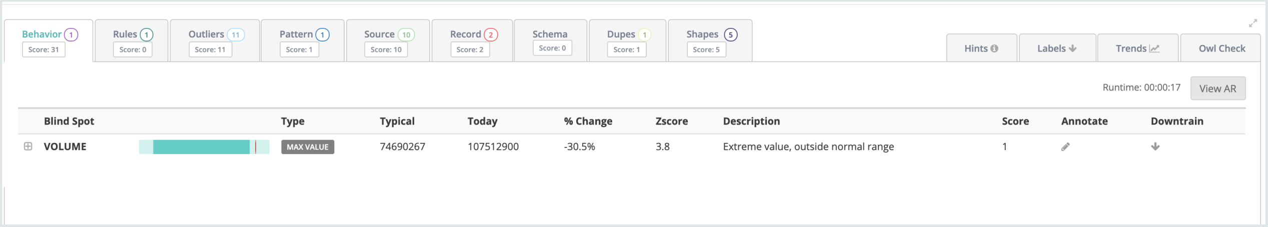
Upper Bound: 3

30 pts

Adaptive [✓ Manual]

EXCH CARDINALITY History

If you want to instruct Collibra that there can be as many as 3 valid values in the EXCH column, click the "Manual" button and adjust the upper bound from 1 to 3, then click the save button.



Blind Spot	Type	Typical	Today	% Change	Zscore	Description	Score	Annotate	Downtrain
VOLUME	MAX VALUE	74690267	107512900	-30.5%	3.8	Extreme value, outside normal range	1		

Collibra adjusts the Behavioral model's baseline, removes the finding, and adjusts the quality score. From that point on, Collibra knows the acceptable range for unique values in the EXCH column is between 1 and 3.

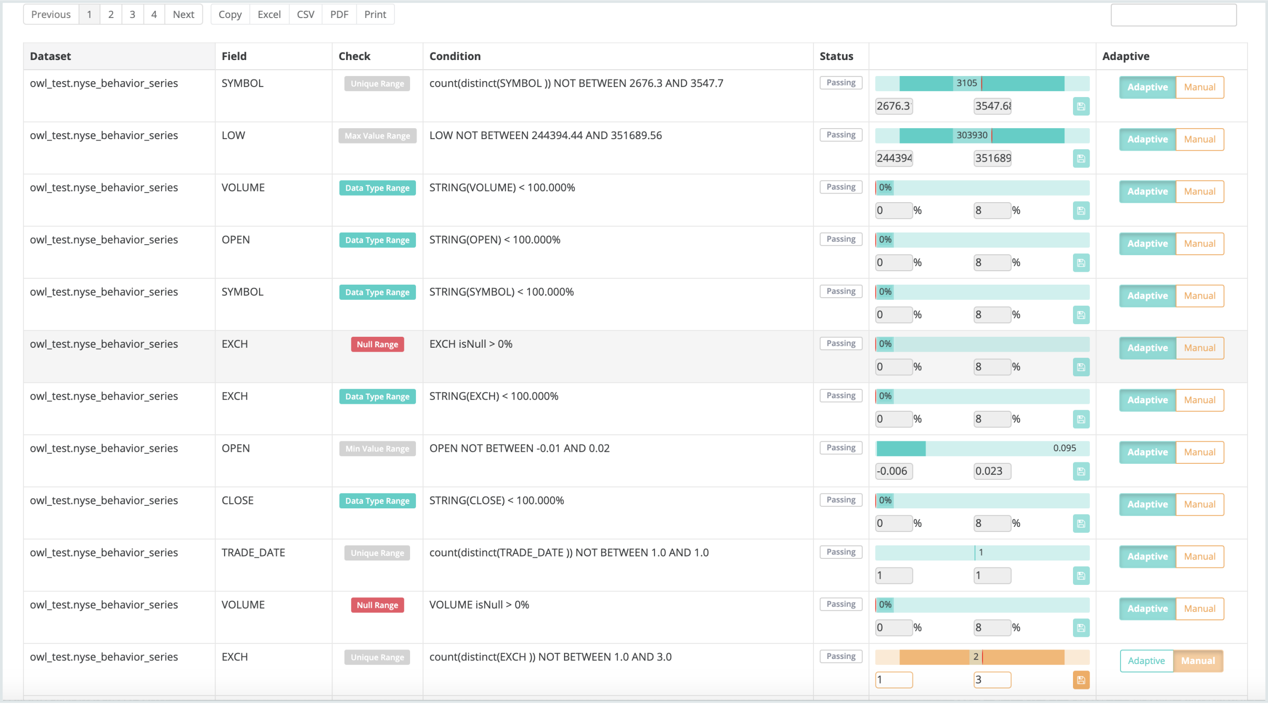
Item	Description
Blind Spot	The name of the column with a possible change detected during a DQ check.
Type	The type of DQ check performed on a given column. For example, Unique (Range) is the number of unique values that fall outside a given range.
Baseline	The baseline value is the mean of the preceding number of scans determined by the value selected for Behavior Lookback in the Profile section of the Explorer page.
Today	
% Change	The percent change from the value of one row to another. $x = \frac{V_2 - V_1}{\lvert V_1 \rvert} * 100$
Δ % Change	The delta percent change from the value of one row to another.
Zscore	The number of standard deviations away from the expected baseline value.
Description	The description of the type of DQ check performed on a given column.
Score	The value subtracted from your overall DQ score. The distance from the expected ranges set by the variance and boundaries of the baseline value. Expected ranges are also visible in the AR panel with graphs available in the Details panel for each line item.
Action	The item labels you can apply to an observation that let you train the behavioral model on future runs. Available options are Validate, Invalidate, and Resolve.
Status	The status of a DQ item, for example, Observation.

Item	Description
Profile	
Details	By clicking the Details button, a line graph lets you drill into changes over time.

Adaptive Rules

As Collibra Data Quality builds and evolves the behavioral model, it exposes all of the "Adaptive Rules" that it learns about. The above example demonstrates how Collibra learns and automatically applies rules. You have control but if left alone, Collibra learns what "Normal" means for a given data set and scores the data set accordingly. This results in a large set of rules that are automatically applied and adapted as the data set changes over time.

To view or modify Adaptive Rules, navigate to the Behavior tab on the findings page for the desired data set and click the "View AR" button on the right side of the screen. This brings up a full list of Adaptive Rules.

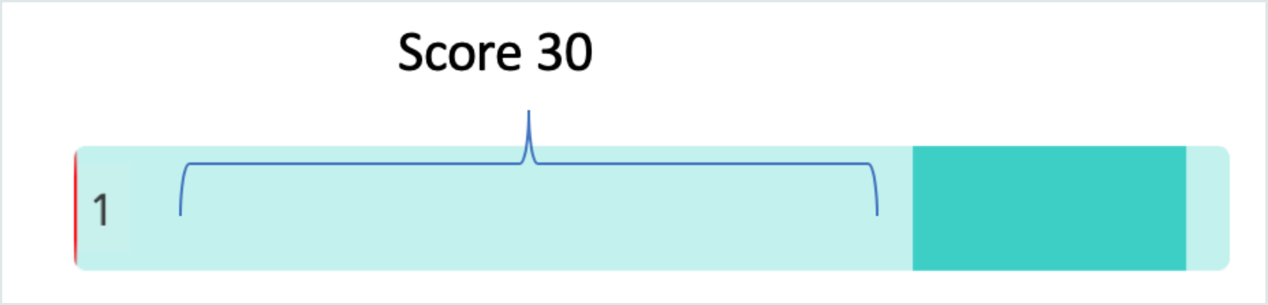


Dataset	Field	Check	Condition	Status		Adaptive
owl_test.nyse_behavior_series	SYMBOL	Unique Range	count(distinct(SYMBOL)) NOT BETWEEN 2676.3 AND 3547.7	Passing	3105 2676.3 3547.6	Adaptive Manual
owl_test.nyse_behavior_series	LOW	Max Value Range	LOW NOT BETWEEN 244394.44 AND 351689.56	Passing	303930 244394 351689	Adaptive Manual
owl_test.nyse_behavior_series	VOLUME	Data Type Range	STRING(VOLUME) < 100.000%	Passing	0% 0 % 8 %	Adaptive Manual
owl_test.nyse_behavior_series	OPEN	Data Type Range	STRING(OPEN) < 100.000%	Passing	0% 0 % 8 %	Adaptive Manual
owl_test.nyse_behavior_series	SYMBOL	Data Type Range	STRING(SYMBOL) < 100.000%	Passing	0% 0 % 8 %	Adaptive Manual
owl_test.nyse_behavior_series	EXCH	Null Range	EXCH isNull > 0%	Passing	0% 0 % 8 %	Adaptive Manual
owl_test.nyse_behavior_series	EXCH	Data Type Range	STRING(EXCH) < 100.000%	Passing	0% 0 % 8 %	Adaptive Manual
owl_test.nyse_behavior_series	OPEN	Min Value Range	OPEN NOT BETWEEN -0.01 AND 0.02	Passing	0.095 -0.006 0.023	Adaptive Manual
owl_test.nyse_behavior_series	CLOSE	Data Type Range	STRING(CLOSE) < 100.000%	Passing	0% 0 % 8 %	Adaptive Manual
owl_test.nyse_behavior_series	TRADE_DATE	Unique Range	count(distinct(TRADE_DATE)) NOT BETWEEN 1.0 AND 1.0	Passing	1 1 1	Adaptive Manual
owl_test.nyse_behavior_series	VOLUME	Null Range	VOLUME isNull > 0%	Passing	0% 0 % 8 %	Adaptive Manual
owl_test.nyse_behavior_series	EXCH	Unique Range	count(distinct(EXCH)) NOT BETWEEN 1.0 AND 3.0	Passing	2 1 3	Adaptive Manual

The Adaptive Rules also provide you with the ability to adjust ranges derived from the behavior model. You can manually adjust the tolerance range and score of any Adaptive Rule. While this may at times be convenient, it is also just fine to let Collibra Data Quality handle the model tuning through its own learning process.

Scoring

In adaptive mode Collibra Data Quality automatically generates a DQ item score based on the egregiousness of the line item. This measurement is directly proportional to the distance from the green range to the red line. Example below.



The score can range from 0-30. This ties to the percent change and Z-Score. In cases when the Z-Score ranges from 0.0 - 6.0.

FAQ

Q: Which Collibra DQ API contains all behavioral checks (passing and breaking)?

- /v2/getdqchecksdetails.

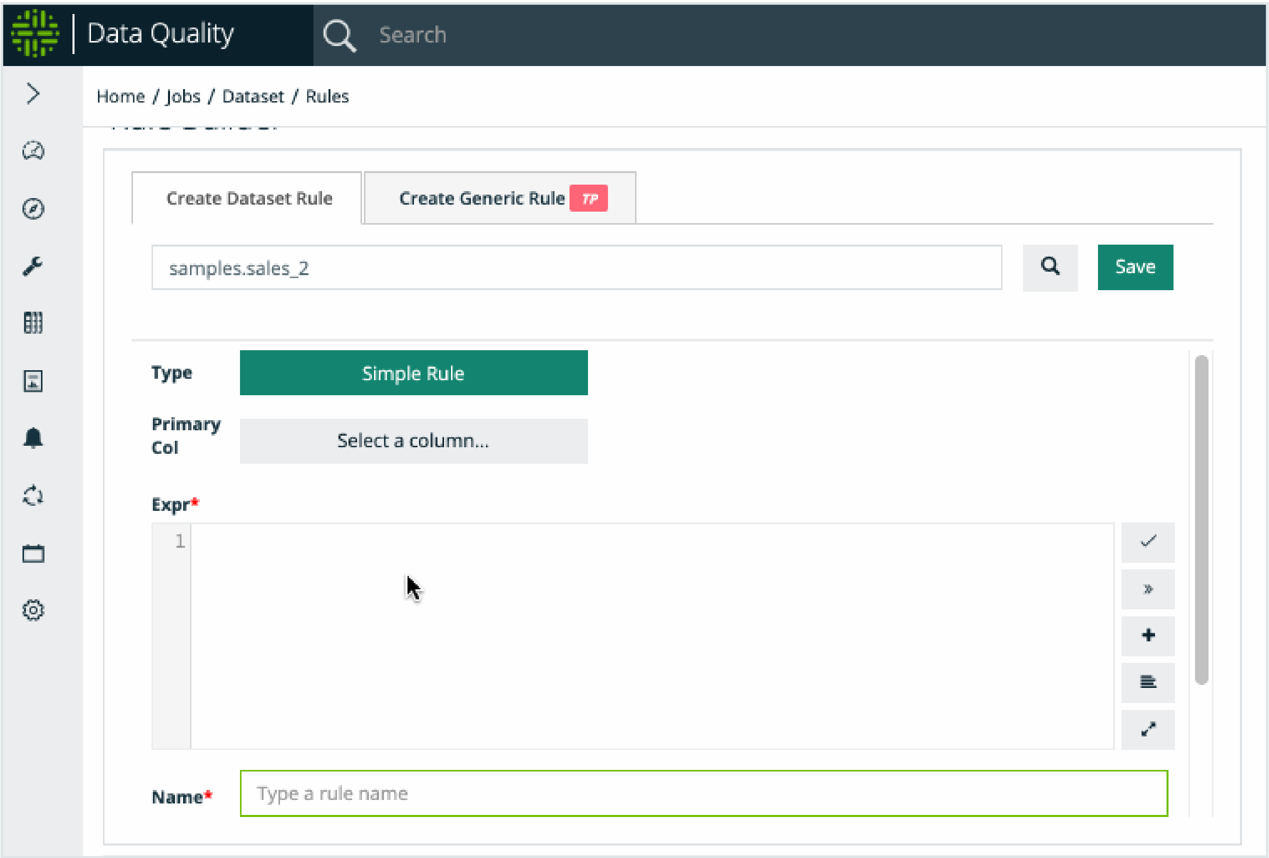
Q: How is 'Mean' defined in the Behavioral Modal chart?

- Mean represents the average of behavioral lookback window e.g. if today is the 11th of the month, and the bhlb is set at 10, the mean will be the average of the 1st to the 10th, and the statistic on the 11th day will represent the change to that mean.
- Also of note: the mean only includes passing rules, not failed runs.

Rules (user-defined)

Apply custom monitoring with SQL.

SQL Rule Engine



samples.sales_2

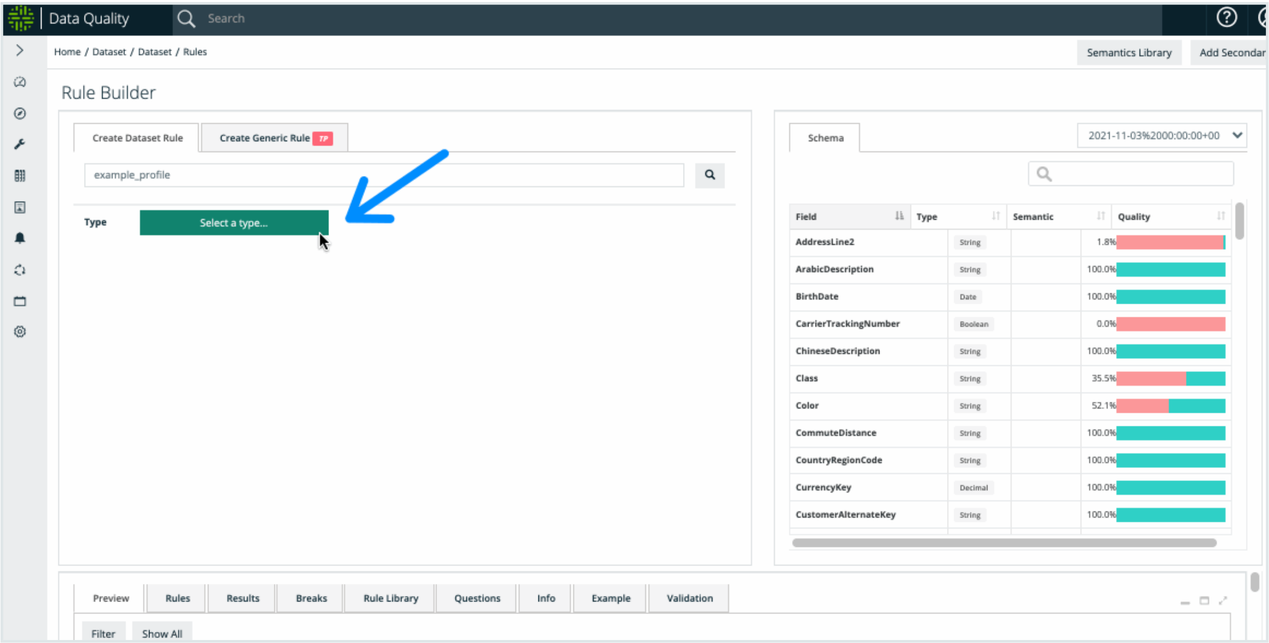
Type: Simple Rule

Primary Col: Select a column...

Name*: Type a rule name

Introduction

Collibra Data Quality takes a strong stance that data should first be profiled, auto-discovered and learned before applying basic rules. This methodology commonly removes thousands of rules that will never need to be written and evolve naturally overtime. However there are still many cases to add a simple rule, complex rule or domain specific rule. Simply search for any dataset and add a rule. You can use the optional Column Name/Category/Description to add meta-data to your rules for future reporting.

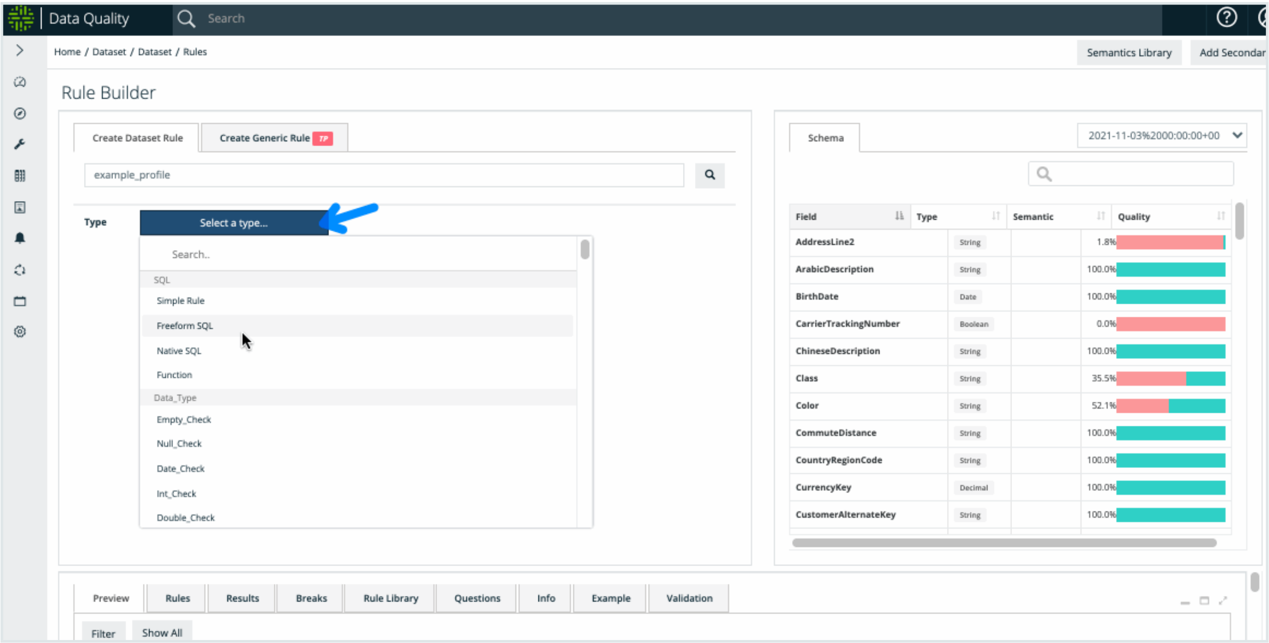


Field	Type	Semantic	Quality
AddressLine2	String		1.8%
ArabicDescription	String		100.0%
BirthDate	Date		100.0%
CarrierTrackingNumber	Boolean		0.0%
ChineseDescription	String		100.0%
Class	String		35.5%
Color	String		52.1%
CommuteDistance	String		100.0%
CountryRegionCode	String		100.0%
CurrencyKey	Decimal		100.0%
CustomerAlternateKey	String		100.0%

Note Customized discovery routines can be run using the Rule Library together with Rule Discovery.

Query Builder

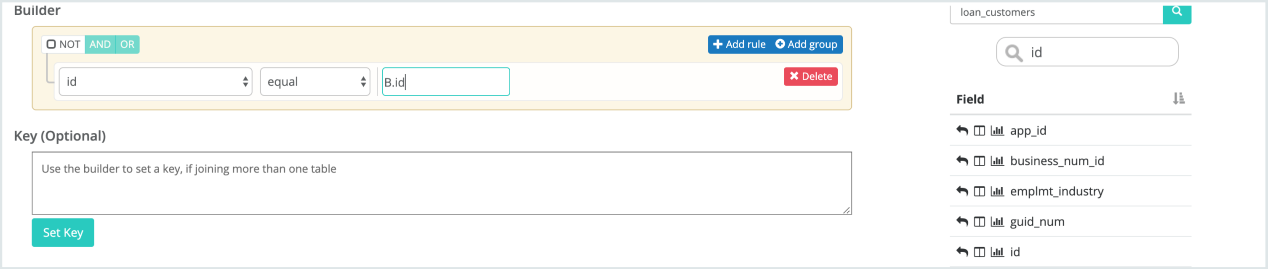
Query builder will help generate SQL for more complex rules. You can apply to one or two tables (Table A on left and Table B on right). The query builder can help build up multi-part conditions.



example_profile

2021-11-03%2000:00:00+00

Field	Type	Semantic	Quality
AddressLine2	String		1.8%
ArabicDescription	String		100.0%
BirthDate	Date		100.0%
CarrierTrackingNumber	Boolean		0.0%
ChineseDescription	String		100.0%
Class	String		35.5%
Color	String		52.1%
CommuteDistance	String		100.0%
CountryRegionCode	String		100.0%
CurrencyKey	Decimal		100.0%
CustomerAlternateKey	String		100.0%



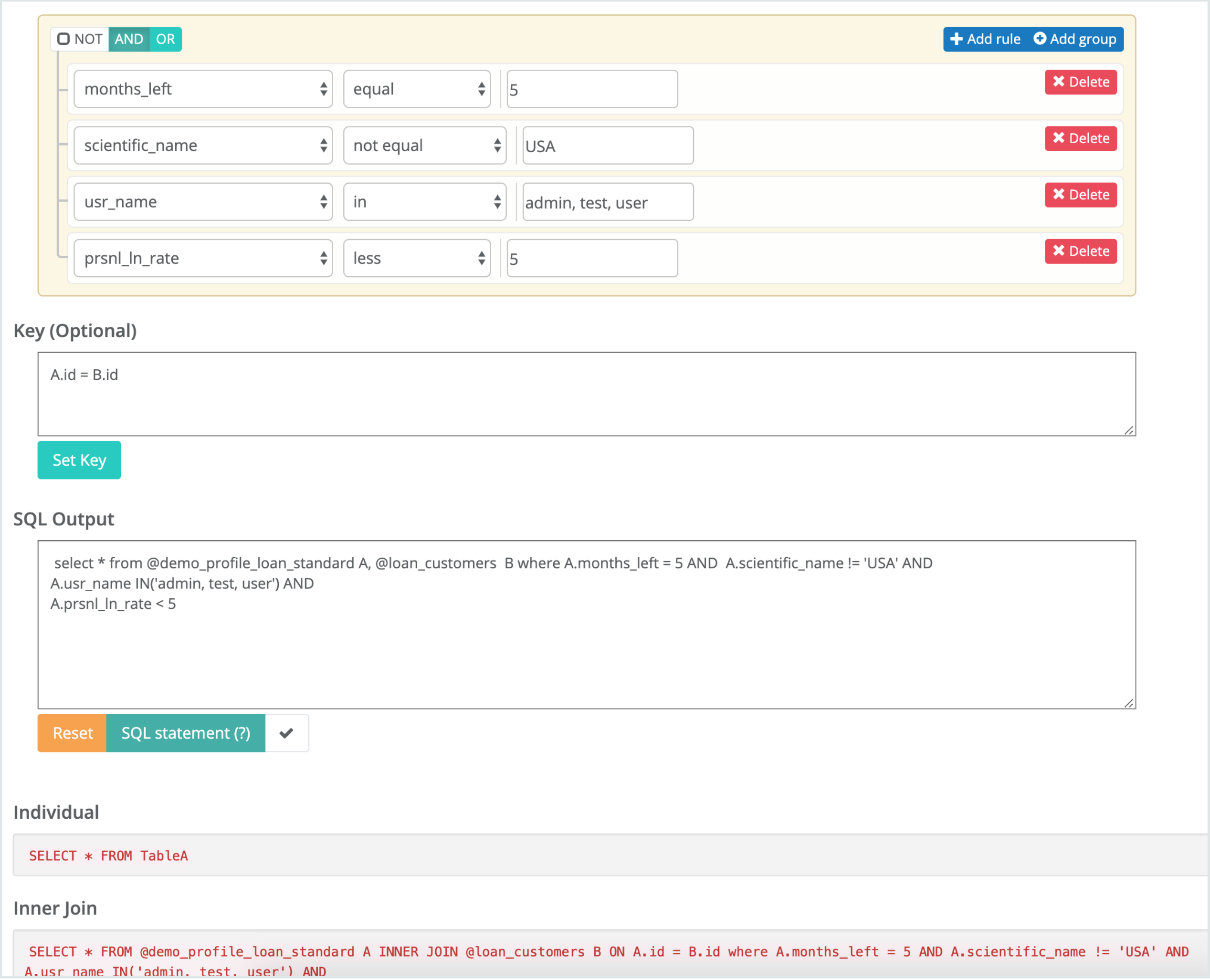
id equal B.id

Use the builder to set a key, if joining more than one table

loan_customers

id

- app_id
- business_num_id
- emplmt_industry
- guid_num
- id



months_left	equal	5
scientific_name	not equal	USA
usr_name	in	admin, test, user
prsnl_ln_rate	less	5

Key (Optional)

```
A.id = B.id
```

SQL Output

```
 select * from @demo_profile_loan_standard A, @loan_customers  B where A.months_left = 5 AND  A.scientific_name != 'USA' AND
A.usr_name IN('admin, test, user') AND
A.prsnl_ln_rate < 5
```

Individual

```
SELECT * FROM TableA
```

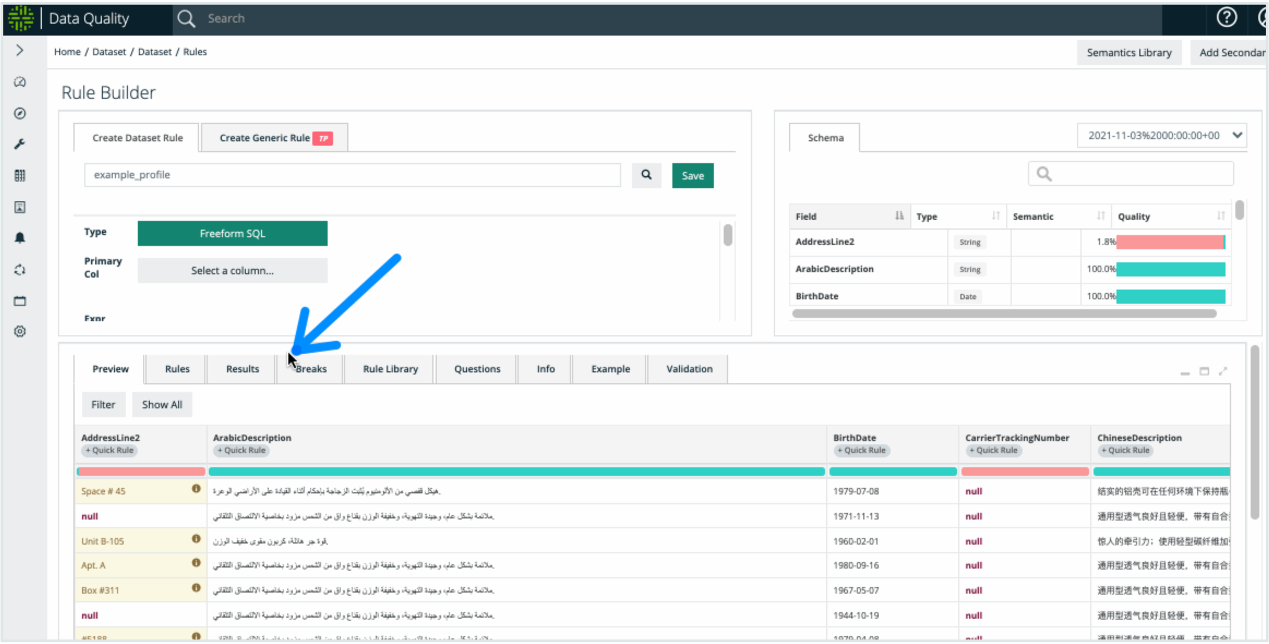
Inner Join

```
SELECT * FROM @demo_profile_loan_standard A INNER JOIN @loan_customers B ON A.id = B.id where A.months_left = 5 AND A.scientific_name != 'USA' AND
A.usr_name IN('admin, test, user') AND
```

> **Note** As with any SQL generator, there are limitations for more complex scenarios.

Break Records

Storing break records is only available for Freefrom and Simple rule types. Rule library rules uses one of these types as well.



Home / Dataset / Dataset / Rules

example_profile

Type: Freeform SQL

Primary Col: Select a column...

Expr

2021-11-03%2000:00:00+00

Field	Type	Semantic	Quality
AddressLine2	String		1.8%
ArabicDescription	String		100.0%
BirthDate	Date		100.0%

AddressLine2 + Quick Rule	ArabicDescription + Quick Rule	BirthDate + Quick Rule	CarrierTrackingNumber + Quick Rule	ChineseDescription + Quick Rule
Space # 45	هيكل قفصي من الألومنيوم يثبت الزجاجة بإحكام أثناء القيادة على الأراضي الوعرة.	1979-07-08	null	结实的铝壳可在任何环境下保持瓶
null	ملائمة بشكل عام، وجيدة التهوية، وخفيفة الوزن بقناع واق من الشمس مزود بخاصية الالتصاق التلقائي.	1971-11-13	null	通用型透气良好且轻便，带有自合
Unit B-105	قوة جر هائلة، كربون مقوى خفيف الوزن.	1960-02-01	null	惊人的牵引力；使用轻型碳纤维加
Apt. A	ملائمة بشكل عام، وجيدة التهوية، وخفيفة الوزن بقناع واق من الشمس مزود بخاصية الالتصاق التلقائي.	1980-09-16	null	通用型透气良好且轻便，带有自合
Box #311	ملائمة بشكل عام، وجيدة التهوية، وخفيفة الوزن بقناع واق من الشمس مزود بخاصية الالتصاق التلقائي.	1967-05-07	null	通用型透气良好且轻便，带有自合
null	ملائمة بشكل عام، وجيدة التهوية، وخفيفة الوزن بقناع واق من الشمس مزود بخاصية الالتصاق التلقائي.	1944-10-19	null	通用型透气良好且轻便，带有自合
#5188	[illegible]	1979-04-08	null	通用型透气良好且轻便，带有自合

Enable additional storage with the -linkid flag. This allows you to store complete sets of break records. See the DQ Job LinkID for more details.

> **Note** Stat, Native, and Data Type (global) rules are not eligible for storing exception records.

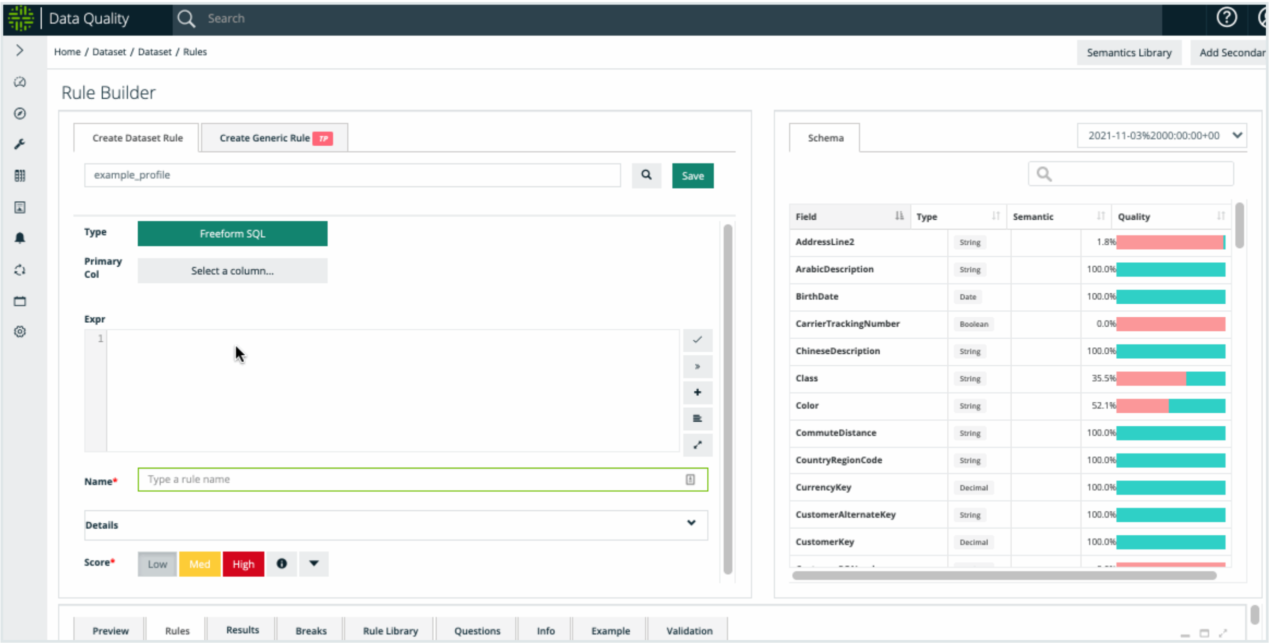
Quick Tips

If joining more than one data source, make sure both sets of drivers are in the -lib. Or separately supply a -libsrc pointing to the appropriate directory/jar file location. Versions later than 2021.11 use the -addlib for additional directories to add to the classpath.

Native SQL uses your native DB syntax. The score is total break records / rows from the scope (query / -q) of the defined DQ job.

Spark SQL

This is a complete list of Spark SQL operators and functions available. https://spark.apache.org/docs/latest/api/sql/index.html



example_profile

Type: Freeform SQL

Primary Col

Expr

Name*

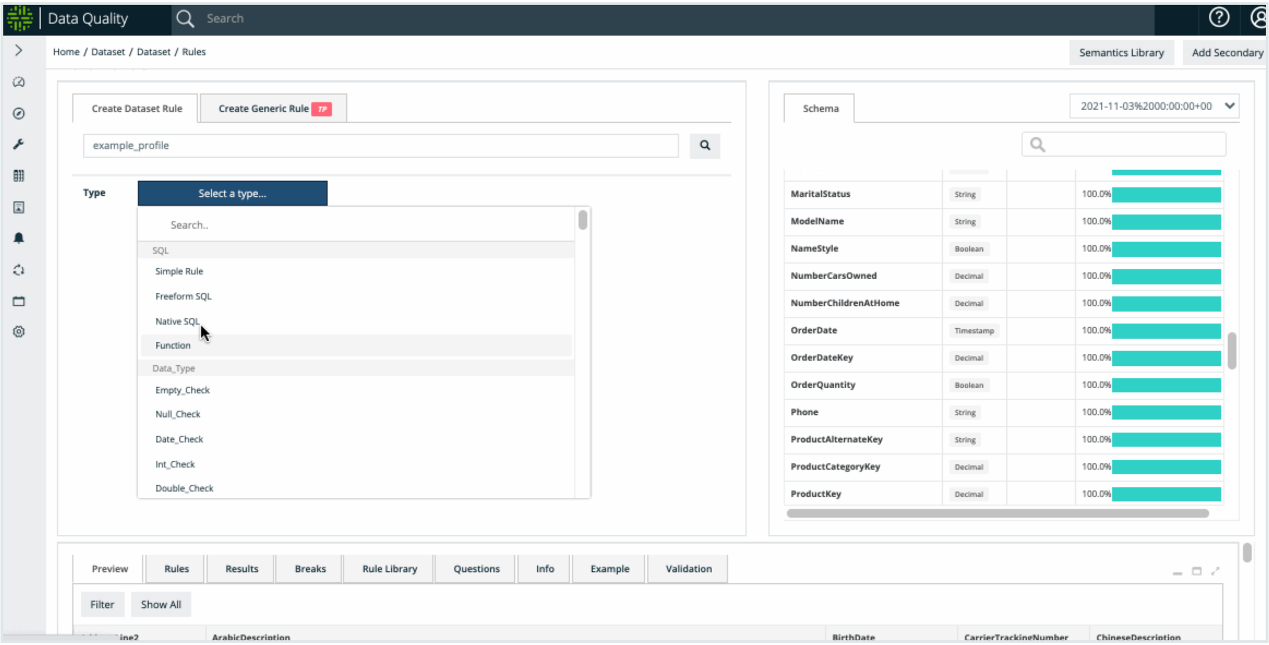
Details

Score*

2021-11-03%2000:00:00+00

Field	Type	Semantic	Quality
AddressLine2	String		1.8%
ArabicDescription	String		100.0%
BirthDate	Date		100.0%
CarrierTrackingNumber	Boolean		0.0%
ChineseDescription	String		100.0%
Class	String		35.5%
Color	String		52.1%
CommuteDistance	String		100.0%
CountryRegionCode	String		100.0%
CurrencyKey	Decimal		100.0%
CustomerAlternateKey	String		100.0%
CustomerKey	Decimal		100.0%

Adding a Rule



example_profile

Type

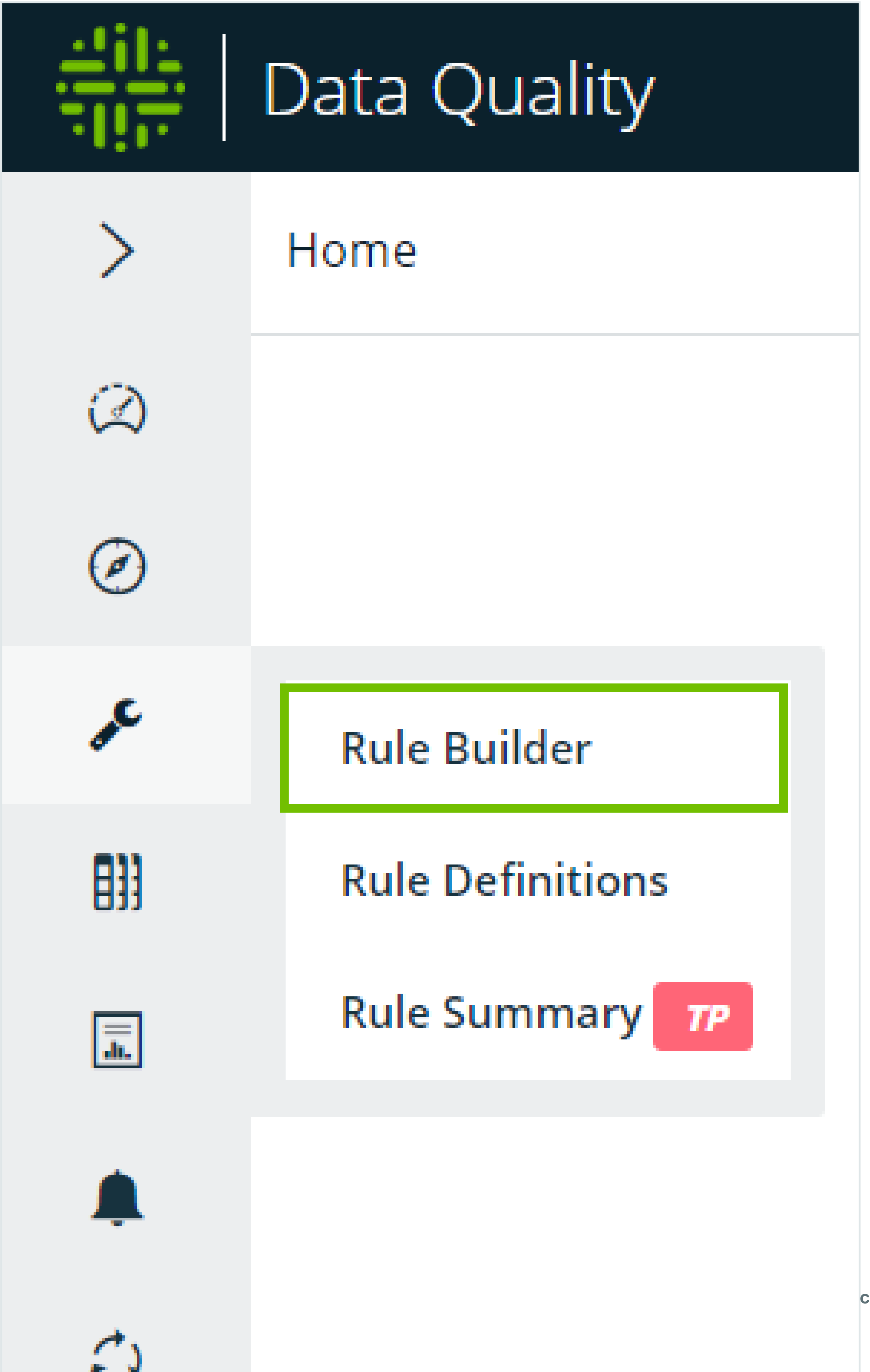
2021-11-03%2000:00:00+00

Field	Type	Semantic	Quality
MaritalStatus	String		100.0%
ModelName	String		100.0%
NameStyle	Boolean		100.0%
NumberCarsOwned	Decimal		100.0%
NumberChildrenAtHome	Decimal		100.0%
OrderDate	Timestamp		100.0%
OrderDateKey	Decimal		100.0%
OrderQuantity	Boolean		100.0%
Phone	String		100.0%
ProductAlternateKey	String		100.0%
ProductCategoryKey	Decimal		100.0%
ProductKey	Decimal		100.0%

To add a rule, go to the Rules page. There are two ways to access the Rules page in Collibra DQ:

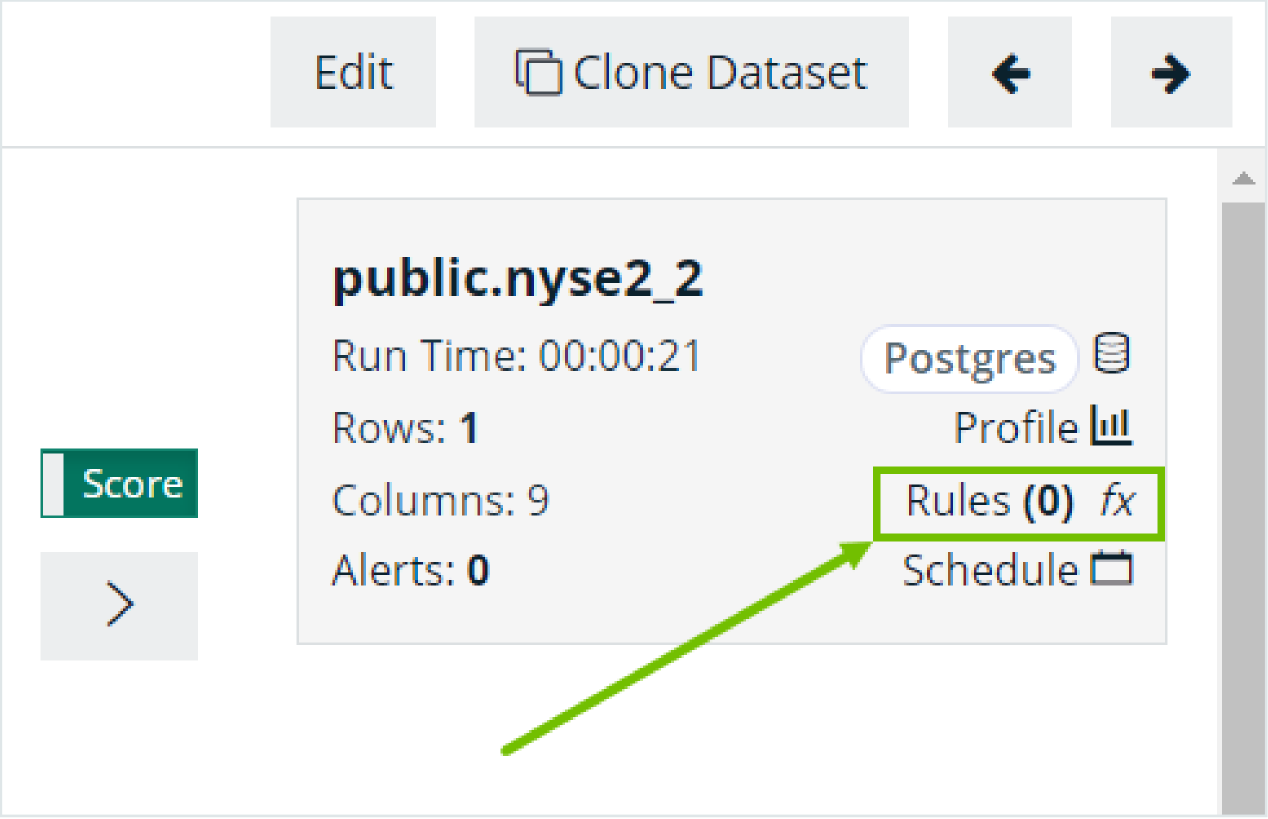
- From the **left navigation bar**.
- From the **findings page**.

To access the Rules page from the left navigation bar, click the wrench icon and then **Rule Builder**. From the Rule Builder page, select a data set and a rule type.



Data Quality
Home
Rule Builder
Rule Definitions
Rule Summary
TP

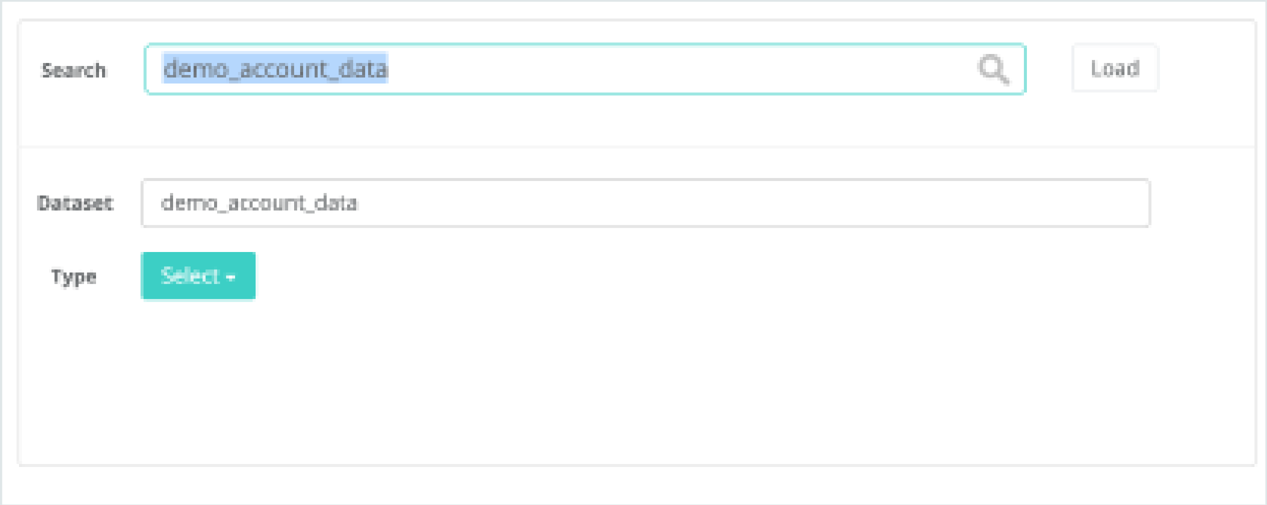
To access the Rules page from the findings page, open a DQ Job to display the findings page. From the findings page, click **Rules** in the metadata box in the upper right of the page. The Rule Builder opens. Since you're navigating to the Rule Builder from the findings page directly, you do not have to select a data set. In this case, select a rule type to get started.



Instructions

1. Search for a data set or navigate to the Rule Builder page in the left navigation panel.
    - Rules can only be applied to data sets once a DQ job runs once
2. Click Load.
    - The schema and any previously saved rules populate.
3. Select a rule type with the dropdown next to the Type label
4. Select a rule name
    - If applying a preset rule, the rule name will be auto populated
5. Input a rule condition
    - Only if applying a simple, freeform sql, stat, or native rule type.
    - Provide a value in the condition/sql/function input field.
    - Keystroke Ctrl+Space provides IntelliSense.

6. Select Low, Medium or High for scoring severity (optional).
7. Add any custom DQ dimensions for reporting (optional).
8. Click submit to save the rule.



Search demo_account_data

Dataset demo_account_data

Type Select

The rule is measured on the next DQ job run for that particular data set.

Rule Types

Rule type	Description	Example
Simple rules	Simple rules are used when you want to filter a condition on a single column in a single table.	City = 'Baltimore'
Freeform SQL rules	Freeform SQL rules are used when you want to apply a condition across multiple tables/columns and generally when more flexibility or customization is desired.	select * from dataset where name = 'Collibra'
Preset rules	Preset rules are used for quickly adding strict condition checks. Commonly used conditions are available to add to any data set columns.	

All built-in Spark functions are available to use. Visit https://spark.apache.org/docs/2.3.0/api/sql/ for simple and freeform sql rules.

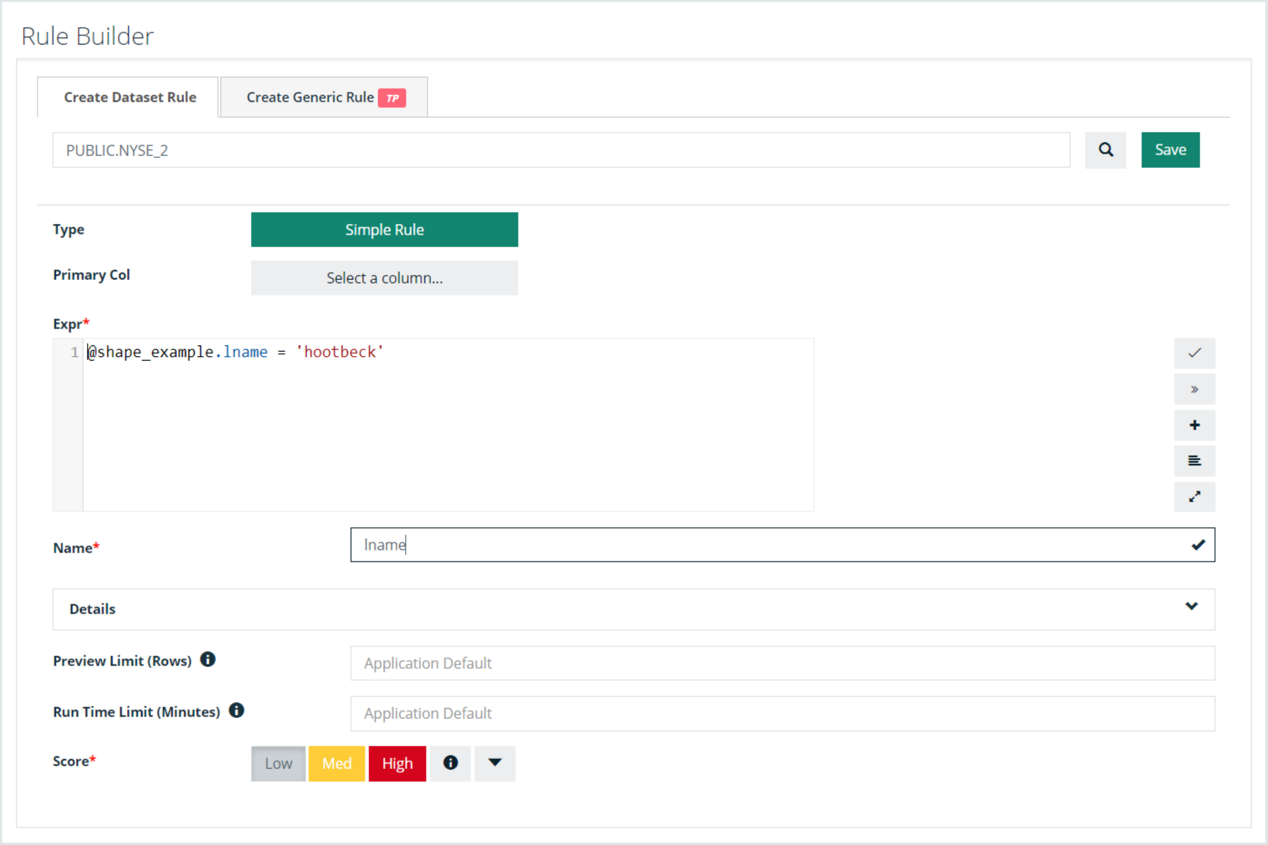
Points and Percentage

For every percentage the *x* condition occurs, deduct *y* points from the data quality score. If a rule was triggered 10 times out of 100 rows, break records occurred 10% of the time. If you input 1 point for every 1 percent, 10 points would be deducted from the overall score.

Creating Your First Rule

Let's create a simple rule using the below information. The data set name.

1. Search for "shape_example" and click "Load"
2. Select "Simple Rule"
3. Rule Name = lnametest
4. @shape_example.lname = "hootbeck" (should hit one time day over day).
5. Points = 1
6. Percentage = 1
7. Click "Submit"



PUBLIC.NYSE_2

Type: Simple Rule

Primary Col: Select a column...

Expr*

```
@shape_example.lname = 'hootbeck'
```

Name*: lname

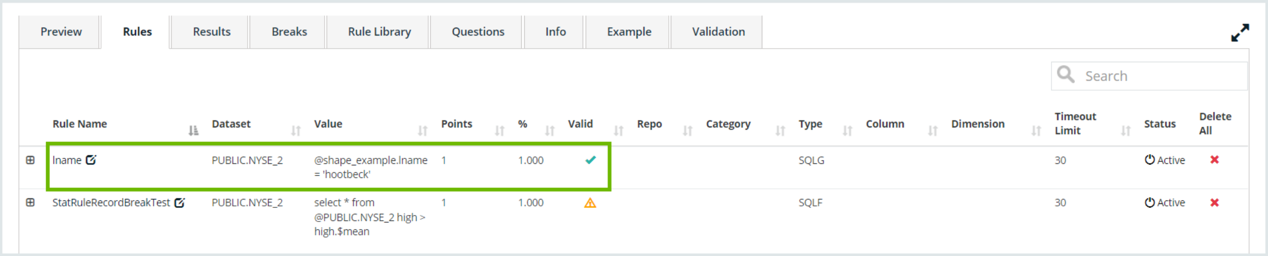
Preview Limit (Rows): Application Default

Run Time Limit (Minutes): Application Default

Score*: Low Med High

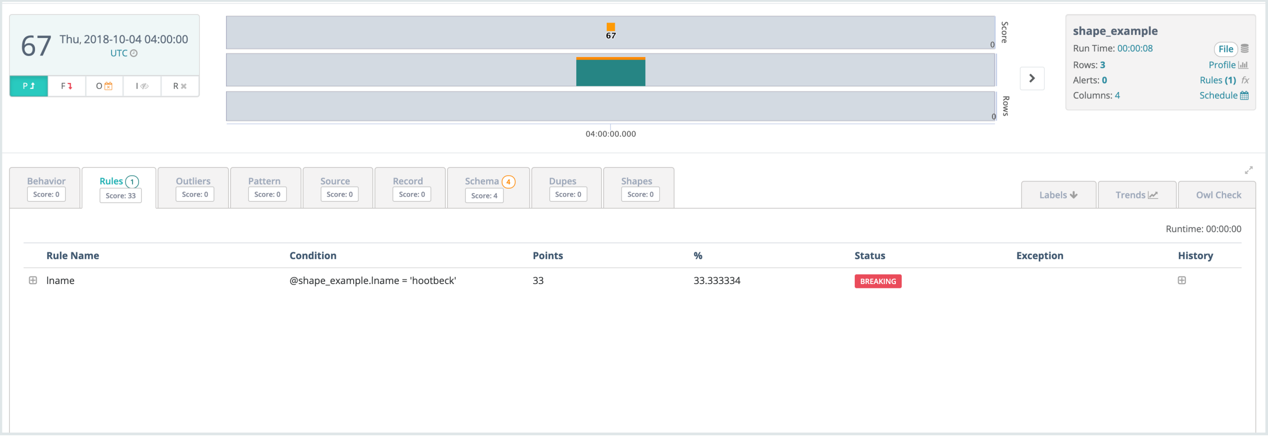
Once the rule has been submitted please find the below list of rules with the new rule we just defined as shown below.

Seeing Your First Rule Get Triggered



	Rule Name	Dataset	Value	Points	%	Valid	Repo	Category	Type	Column	Dimension	Timeout Limit	Status	Delete All
⊞	lname	PUBLIC.NYSE_2	@shape_example.lname = 'hootbeck'	1	1.000	✓			SQLG			30	Active	✖
⊞	StatRuleRecordBreakTest	PUBLIC.NYSE_2	select * from @PUBLIC.NYSE_2 high > high.$mean	1	1.000	⚠			SQLF			30	Active	✖

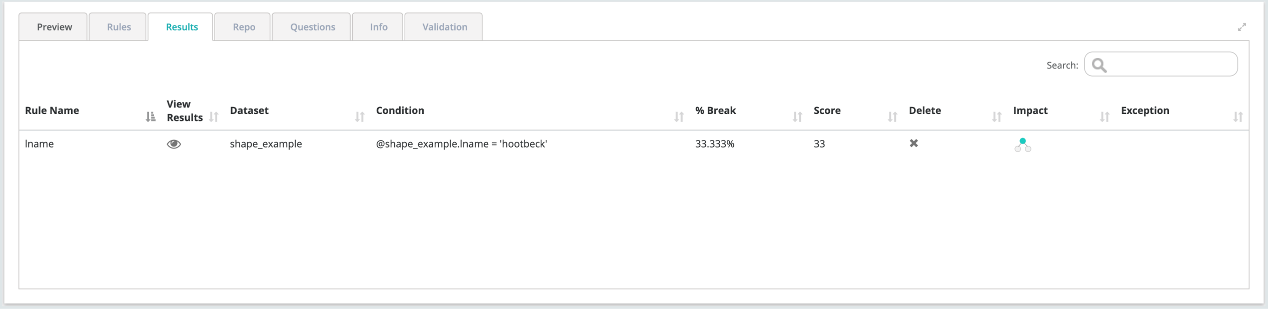
Rule scores will appear under the Rules tab on the findings page. You can also see more details in the bottom panel of the Rules page under the Rules and Results tabs.



shape_example
Run Time: 00:00:08
Rows: 3
Alerts: 0
Columns: 4

Runtime: 00:00:00

	Rule Name	Condition	Points	%	Status	Exception	History
⊞	lname	@shape_example.lname = 'hootbeck'	33	33.333334	BREAKING		⊞

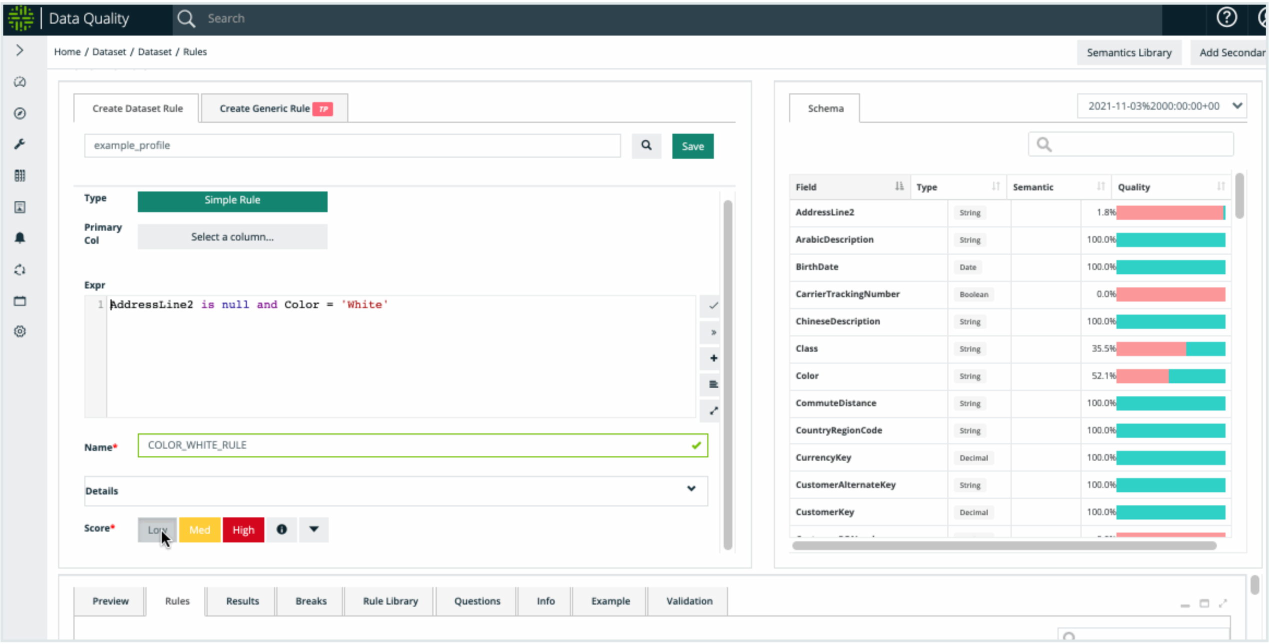


Search:

Rule Name	View Results	Dataset	Condition	% Break	Score	Delete	Impact	Exception
lname	👁	shape_example	@shape_example.lname = 'hootbeck'	33.333%	33	✖		

Scores

Each rule definition has a specific score. Depending on the severity, rules can be hard or soft, and can contribute a different weight that affects your overall DQ score.



example_profile

Type: Simple Rule

Primary Col: Select a column...

Expr

```
AddressLine2 is null and Color = 'White'
```

Name*: COLOR_WHITE_RULE

Details

Score*: Low Med High

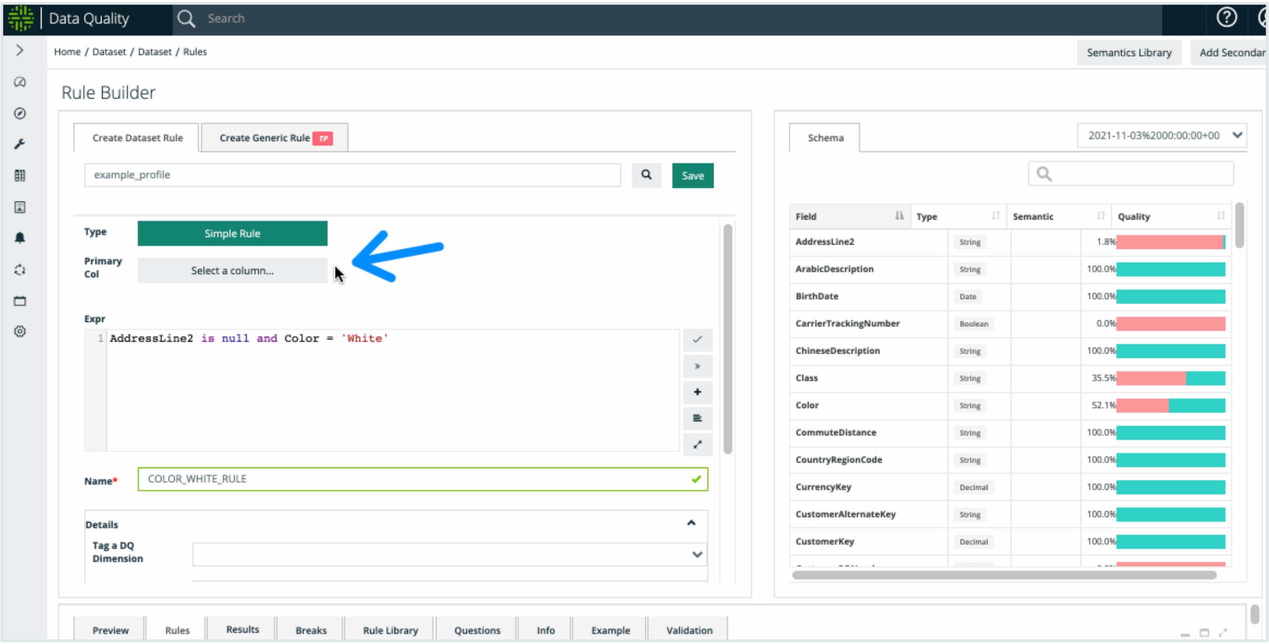
2021-11-03%2000:00:00+00

Field	Type	Semantic	Quality
AddressLine2	String		1.8%
ArabicDescription	String		100.0%
BirthDate	Date		100.0%
CarrierTrackingNumber	Boolean		0.0%
ChineseDescription	String		100.0%
Class	String		35.5%
Color	String		52.1%
CommuteDistance	String		100.0%
CountryRegionCode	String		100.0%
CurrencyKey	Decimal		100.0%
CustomerAlternateKey	String		100.0%
CustomerKey	Decimal		100.0%

Note This is calculated by points per threshold. The ratio is calculated from the total rows of the associated DQ job scan.

Dimensions

Each rule can be associated with a dimension. You can also apply metadata like primary column and description. While not mandatory, these can be particularly useful when using the DQ Connector and Custom.



example_profile

Type: Simple Rule

Primary Col: Select a column...

Expr

```
AddressLine2 is null and Color = 'White'
```

Name*: COLOR_WHITE_RULE

Details

Tag a DQ Dimension

2021-11-03%2000:00:00+00

Field	Type	Semantic	Quality
AddressLine2	String		1.8%
ArabicDescription	String		100.0%
BirthDate	Date		100.0%
CarrierTrackingNumber	Boolean		0.0%
ChineseDescription	String		100.0%
Class	String		35.5%
Color	String		52.1%
CommuteDistance	String		100.0%
CountryRegionCode	String		100.0%
CurrencyKey	Decimal		100.0%
CustomerAlternateKey	String		100.0%
CustomerKey	Decimal		100.0%

Rule Types

SQL-Based Rules

Depending on the complexity, you can choose from short-form or long-form rules.

Simple

Just the condition (short-form). For example, using the column email_address. This runs against the dataframe and uses Spark SQL syntax. Simple rules can be thought of as everything after the where clause.

```
email_address is not null and email_address != ''
```

Freeform

Where 'Simple' rules just use the condition, 'Freeform' rules use the complete SQL statement. When more complex SQL is required, you can express more with Freeform including joins, CTE's and window statements.

```
select * from @DATASET_NAME where
email_address is not null and email_address != ''
```

> **Note** All built-in spark functions are available to use. (https://spark.apache.org/docs/2.3.0/api/sql/) for simple and freeform sql rules.

Native

Native rules use the SQL dialect of the underlying connection and database. Files are not eligible for native SQL rules. This is ideal if you want to use pushdown profiling and you want to use existing SQL logic. When coupled with pushdown profiling, you can achieve a very minimal infrastructure footprint.

See the Native section for more details.

Stat rules

Write rules against meta data and profiling stats. Complex counts and ratios can be referenced with simple syntax.

See the Stat Rules section for more details.

Data Type

- **Empty check**
    - Rule type: EMPTYCHECK
    - Description: Checking whether the target column has empty values or not
- **Null check**
    - Rule type: NULLCHECK
    - Description: Checking whether the target column has *NULL* values or not
- **Date check**
    - Rule type: DATECHECK
    - Description: Checking whether the target column has only DATE values or not

- **Integer check**
    - Rule type: INTCHECK
    - Description: Checking whether the target column has only INTEGER values or not
- **Double check**
    - Rule type: DOUBLECHECK
    - Description: Checking whether the target column has only DOUBLE values or not
- **String check**
    - Rule type: STRINGCHECK
    - Description: Checking whether the target column has only STRING values or not.
- **Mixed datatype check**
    - Rule type: DATATYPECHECK
    - **Description: ---**

SQL Based Rules

Collibra Data Quality uses ANSI-compliant SQL and offers pushdown rules that leverage specific database syntax.

Simple

This is the condition after the "where" clause.

Depending on the complexity, users can choose from short form or long form rules.

Simple

Just the condition (short form). For example, using the column email_address. This runs against the dataframe and uses Spark SQL syntax. Simple rules can be thought of as everything after the where clause.

```
email_address is not null and email_address != ''
```

> **Note** All built-in spark functions are available to use. (https://spark.apache.org/docs/2.3.0/api/sql/) for simple and freeform sql rules.

Freeform

Fully defined SQL for more detailed checks.

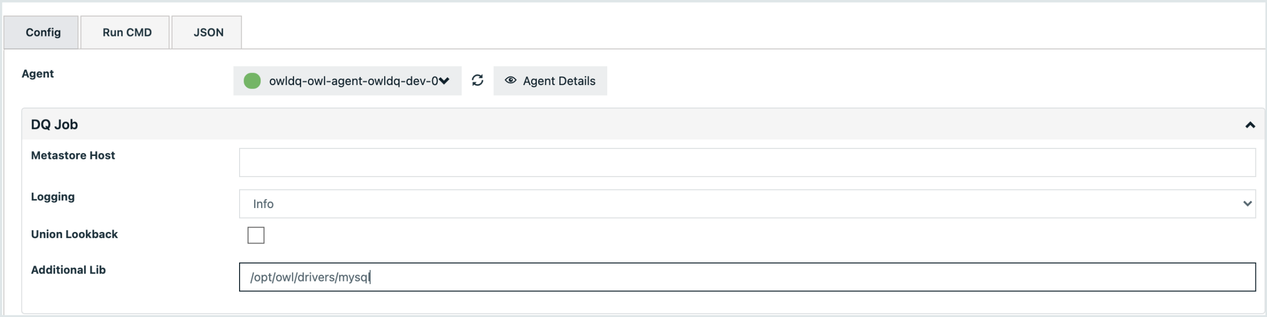
Where 'Simple' rules just use the condition, 'Freeform' rules use the complete SQL statement. When more complex SQL is required, you can express more with Freeform including joins, CTE's and window statements.

```
select * from @DATASET_NAME where
email_address is not null and email_address != ''
```

Warning Freeform rules should include a semi-colon at the end of the rule value.

Note All built-in Spark functions for non-Pushdown connections are available for use. See (https://spark.apache.org/docs/2.3.0/api/sql/) for Simple and Freeform SQL rules.

Cross-Connection Libraries



Agent: owldq-owl-agent-owldq-dev-0

Metastore Host:

Logging: Info

Union Lookback: □

Additional Lib: /opt/owl/drivers/mysql

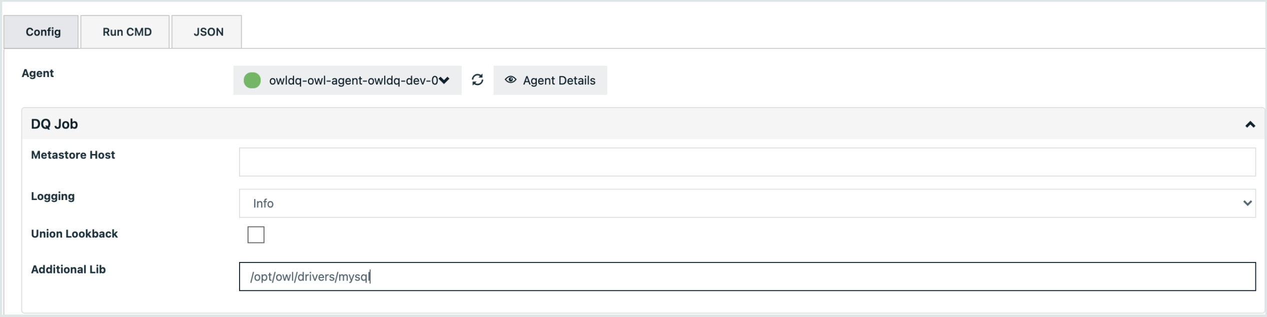
Note When applying cross-connection rules please use the -addlib to submit the job with the appropriate jar files. In this example, a secondary set of jars is added through the Explorer. These files are located in the /opt/owl/drivers/mysql directory. The path should not contain double quotes or single quotes. It should point to a directory without spaces in the path.

Cross-Data Set Rules

Warning Best practice for cross-table joins is to define a view and scan the view. Only in circumstances when a view cannot be created should you define cross-table joins with 2 separate data sets (DQ Jobs) and express the join in the rule.

If you're doing multiple lookups, this will improve long-term performance and consolidate maintenance.

Note Cross-dataset rules require -libsrc (prior to 2021.11) or -addlib (post 2022.01)



Agent: owldq-owl-agent-owldq-dev-0

Metastore Host:

Logging: Info

Union Lookback: □

Additional Lib: /opt/owl/drivers/mysql

In-Clause (Single Column)

```
select * from @table1 where id
not in ( select id from @table2 )
```

Except (Multi-Column)

```
select id, app_id, email, guid_num from @table1
EXCEPT
select id, app_id, email, guid_num from @table2
```

Referencing secondary data sets

When you create a Freeform SQL rule with secondary data sets, there are three important points to consider in order to avoid missing data set exceptions.

- Ensure that the name of your first data set matches the name of the main data set on which your rule is created.
- The column names in your table must be exact matches with the syntax of your query. >> If the column name uses CAPS, then your query must also use CAPS.
- Ensure that any data set referenced in your rule maintains a score of greater than or equal to (>=) a passing score of 75.

> **Note** These three points apply to all rules, not just Freeform Rules.

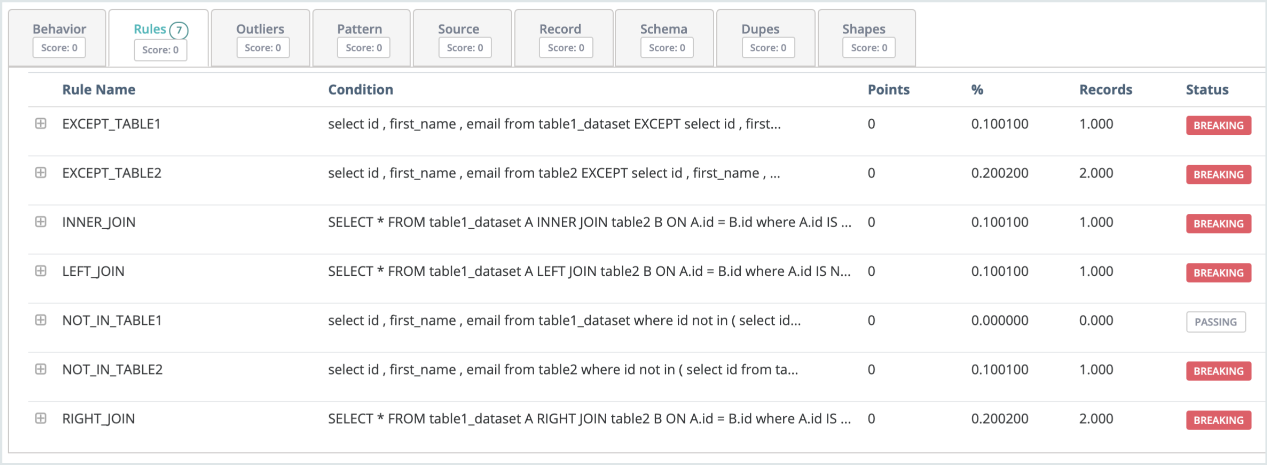
Joins

A **join** lets you reference two or more data sets in one rule. Joins are useful when you want to compare the values of a data set from a previous, or when you want to verify that all values are valid across your data sets.

Join example

```
SELECT
    *
FROM
    @table1 A
    LEFT JOIN @table2 B ON A.id = B.id
where
    B.id is null OR (A.email != B.email)
```

Sample Results



	Rule Name	Condition	Points	%	Records	Status
⊞	EXCEPT_TABLE1	select id , first_name , email from table1_dataset EXCEPT select id , first...	0	0.100100	1.000	BREAKING
⊞	EXCEPT_TABLE2	select id , first_name , email from table2 EXCEPT select id , first_name , ...	0	0.200200	2.000	BREAKING
⊞	INNER_JOIN	SELECT * FROM table1_dataset A INNER JOIN table2 B ON A.id = B.id where A.id IS ...	0	0.100100	1.000	BREAKING
⊞	LEFT_JOIN	SELECT * FROM table1_dataset A LEFT JOIN table2 B ON A.id = B.id where A.id IS N...	0	0.100100	1.000	BREAKING
⊞	NOT_IN_TABLE1	select id , first_name , email from table1_dataset where id not in (select id...	0	0.000000	0.000	PASSING
⊞	NOT_IN_TABLE2	select id , first_name , email from table2 where id not in (select id from ta...	0	0.100100	1.000	BREAKING
⊞	RIGHT_JOIN	SELECT * FROM table1_dataset A RIGHT JOIN table2 B ON A.id = B.id where A.id IS ...	0	0.200200	2.000	BREAKING

Cross-Table (Guided). Use our wizard to do ad-hoc analysis and visual setup.

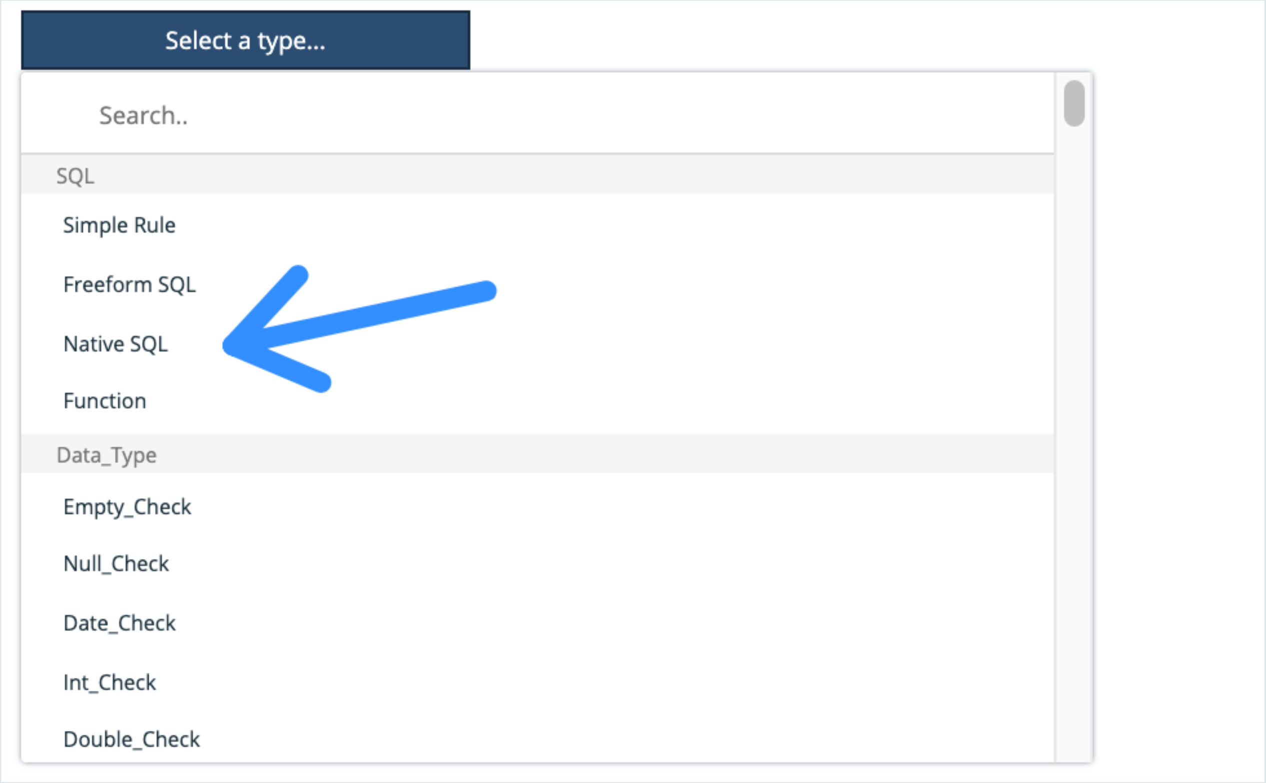
Join Example Example (vs. cross-table guided seen above).

Multi-part condition rules with the rule builder. Combines profiling metrics & builder in one screen.

Native

With Native SQL expressions we provide capability to use your existing validation statements, even if they use database-specific (Postgres/DB2/Oracle/MSSQL/etc.) functions or expressions.

This is commonly used when using pushdown profiling and/or pre-existing SQL validations exist in a specific syntax. Native rules are often referred to as pushdown rules.



If you have rules already written in Oracle, Sybase, or DB2 syntax - Copy/Paste the rule directly into the Native SQL section.

When creating a Native SQL rule, keep the following in mind:

- The SQL query must be a valid expression that can be run as a subquery. To avoid pulling large amounts of data into memory, Collibra Data Quality will wrap your expression so it only fetches the number of rows returned. Rules should be written such that the query returns the anomalous rows.
- The SQL query must take less than 30 minutes to run. It is recommended to use partitioned columns for efficiency.
- When testing the SQL query from the app, it is helpful if it takes less than 30 seconds to run. You can add a limit to reduce query time, or test the query in your SQL Editor.

> **Note** Testing native rules can be done quickly by limiting the results or using an external SQL IDE as well.

> **Warning** This rule type is not eligible to store break records, just the score itself! Additionally the rule will apply the logic directly to the JDBC connection. Native rules will run on the entire population of the data, regardless of any scope set for the DQ job (-q flag defined in the scope section of Explorer). Any filter or predicate clause entered in the -q flag should be added to the logic of the Native rule as well.

Stat Rules

One really powerful technique is to access the profile statistics in your rules. These are typically sub-second operations that do not require scanning or iterating. There are several cases where SQL struggles to support rules, such as: isNull but not "null count" or nullRatio or nullPercent. Or having access to types without doing crazy cast() operations. These are simplified below, i.e. fname.$type == 'String'

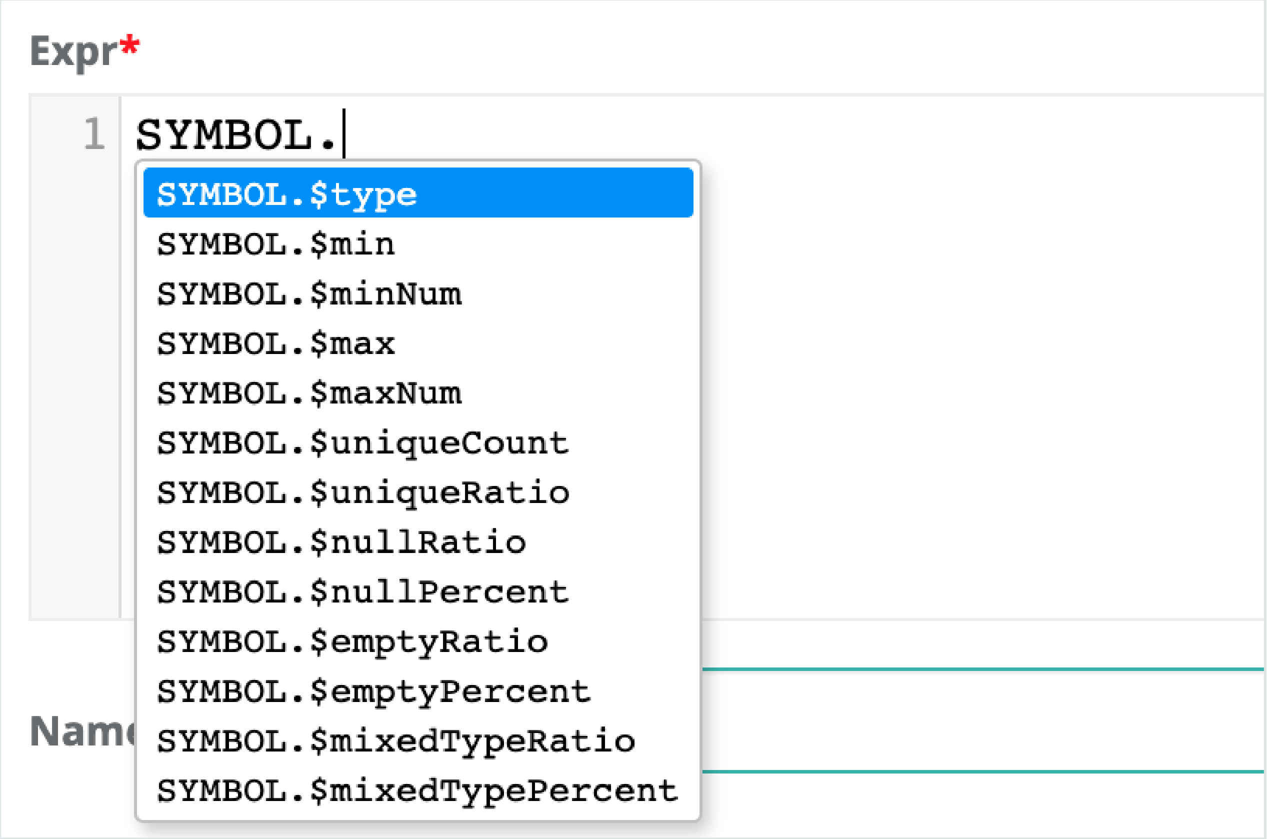
```
select * from @dataset where
fname.$type != 'String' AND $rowCount < 800
```

Dataset Level Stat	Rule Example	Description
$totalTimeInSeconds	$totalTimeInSeconds > 25	Alert when DQ job runs longer than 25 seconds.
$totalTimeInMinutes	$totalTimeInMinutes > 5	Alert when DQ job runs longer than 5 minutes.
$totalTimeInHours	$totalTimeInHours > 1	Alert when DQ job runs longer than 1 hour.
$rowCount	$rowCount < 9000	Alert when row count less than 9,000.
$runDate	$runDate='2020-01-24'	Use the ${rd} variable in rules.
$daysWithoutData	$daysWithoutData > 4	Alert when a dataset has missing or no rows for 5 days.

Dataset Level Stat	Rule Example	Description
$runsWithoutData	$runsWithoutData > 4	Alert when a dataset runs but has missing or no rows for 5 days.
$daysSinceLastRun	$daysSinceLastRun > 4	Alert when a dataset has not run for 5 days.

Column Level Stat	Rule Example	Description
.$type	fname.$type != 'String'	Alert when fname is not a string.
.$min	fname.$min > 'apple'	Lexicographical sort works for strings and numbers.
.$minNum	age.$minNum > 13	Type casted to a numeric for simple number checks.
.$mean	row_id.$mean > '4.500'	Alert when the mean is greater than a given value.
.$max	fname.$max > 'apple'	Alert when the max is greater than a given value.
.$maxNum	age.$maxNum > 13	Alert when the numeric value falls outside an acceptable range.
.$uniqueCount	id.$uniqueCount != $rowCount	Alert when the uniqueCount of a field doesn't match the rowCount.
.$uniqueRatio	gender.$uniqueRatio between .4 and .6	Alert when the ratio of uniqueCounts of a given field doesn't match the rowCount.
.$nullRatio	lname.$nullRatio not between .4 and .6	Alert when the ratio of nulls no longer falls within acceptable range.
.$nullPercent	lname.$nullPercent not between 40 and 60	Alert when the percent of nulls no longer falls within acceptable range
.$nullCount	lname.$nullCount >= 1	Test for a single null.

Column Level Stat	Rule Example	Description
.$emptyRatio	nc.$emptyRatio > 0.2	Alert when the ratio of empties no longer falls within acceptable range.
.$emptyPercent	nc.$emptyPercent > 20	Alert when the percent of empties no longer falls within an acceptable range.
.$emptyCount		Alert when the emptyCounts of a field no longer fall within an acceptable range.
.$mixedTypeRatio	nc.$mixedTypeRatio > 0.2	Alert when the ratio of mixed data types no longer falls within an acceptable range. For example, Strings and Ints in the same field.
.$mixedTypePercent	nc.$mixedTypeRatio > 20	Alert when the percent of mixed data types no longer falls within an acceptable range. For example, Strings and Ints in the same field.
.$mixedTypeCount	id.$mixedTypeCount >= 1	Alerts when the mixed data typeCount no longer falls within an acceptable range. For example, Strings and Ints in the same field.



```
SYMBOL.
```

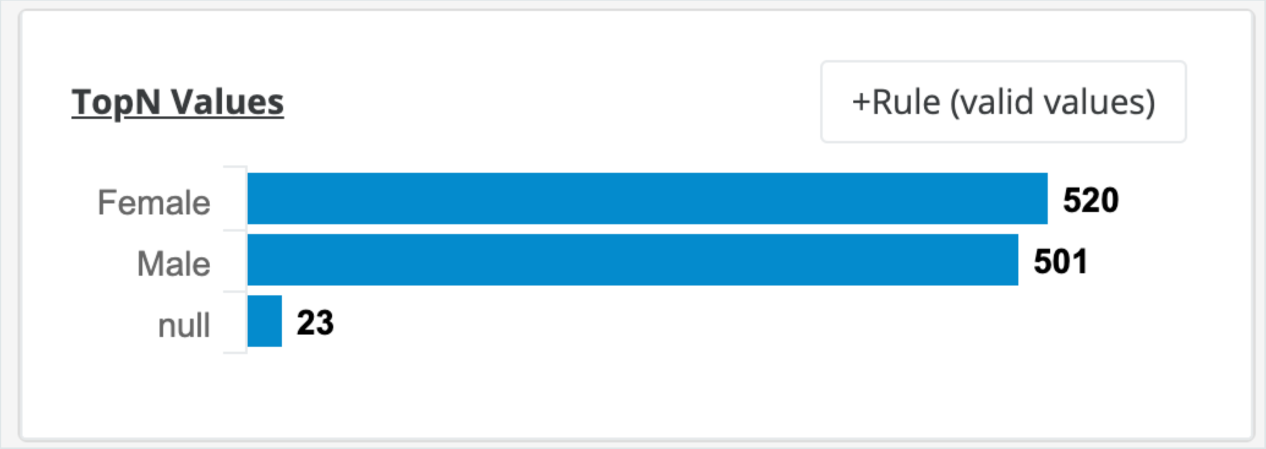
Known limitation. Cannot combine stat rules or distribution rules with regex rules in the same rule. Example car*_vin rlike '$[asdf][0-9]' and car_vin.$uniqueCount*

Distribution Rule

There is a common case in DQ where you want to know the distribution of a column's value. Consider gender. It can be expected that a column named gender consists of roughly 40-60% males and roughly 40-60% females if the data set is large and represents the population. This can be difficult to express in plain SQL, but it is very easy with the below syntax.

```
gender['Male'].$uniquePercent between 40 and 60
```

Column Value Level	Rule
.$uniqueCount	credit_rating['FAIR'].$uniqueCount > 7
.$uniquePercent	credit_rating['GOOD'].uniquePercent between 40 and 60



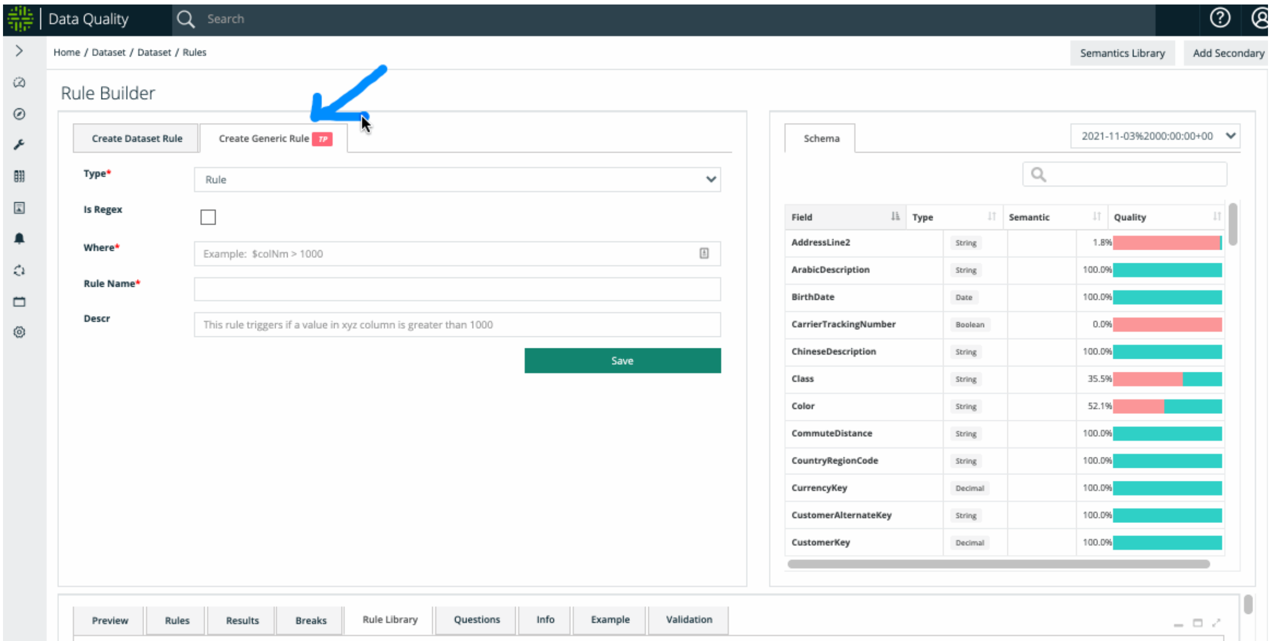
Data Type Rules

Data Type

Rule	Rule type	Description
Empty check	EMPTYCHECK	Checks whether the target column has empty values or not.
Null check	NULLCHECK	Checks whether the target column has *NULL* values or not.
Date check	DATECHECK	Checks whether the target column has **only** DATE values or not.
Integer check	INTCHECK	Checks whether the target column has **only** integer values or not.
Double check	DOUBLECHECK	Checks whether the target column has **only** DOUBLE values or not.
String check	STRINGCHECK	Checks whether the target column has **only** STRING values or not.
Mixed datatype check	DATATYPECHECK	Checks the dataType of the field.

Rule Templates

Ideal for rules that apply to more than one data set. Write once, apply many.



Type* Rule

Is Regex □

Where* Example: $colNm > 1000

Rule Name*

Descr This rule triggers if a value in xyz column is greater than 1000

2021-11-03%2000:00:00+00

Field	Type	Semantic	Quality
AddressLine2	String		1.8%
ArabicDescription	String		100.0%
BirthDate	Date		100.0%
CarrierTrackingNumber	Boolean		0.0%
ChineseDescription	String		100.0%
Class	String		35.5%
Color	String		52.1%
CommuteDistance	String		100.0%
CountryRegionCode	String		100.0%
CurrencyKey	Decimal		100.0%
CustomerAlternateKey	String		100.0%
CustomerKey	Decimal		100.0%

Templates are great for regex, format, and compliance checks.

A template rule substitutes the data set and column at runtime. This can save hundreds of redundant rules that do the same thing but on different column names.

Template rules are located in the **Type** dropdown as well as the **Quick Rules** dropdown. The complete list of template rules is located in the Rule Library section. These meant for global rules that are ideal for code sets, compliance checks, and regex checks. These are ideal for checks that apply to many tables.

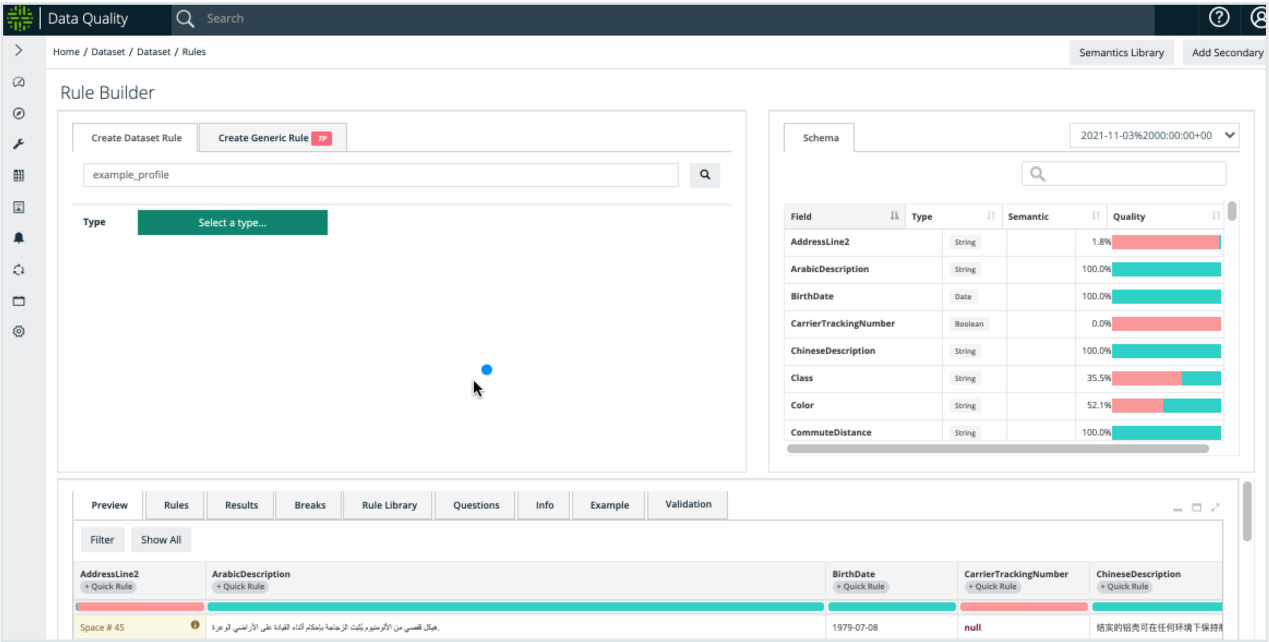
Rule templates use SQLG (simple) and occasionally SQLF (Freeform) types under the hood. Rule templates appear in the Rule Library once they are created.

See the Rule Library section for more details.

> **Note** Customized discovery routines can be run using the Rule Library together with Rule Discovery.

Rule Library

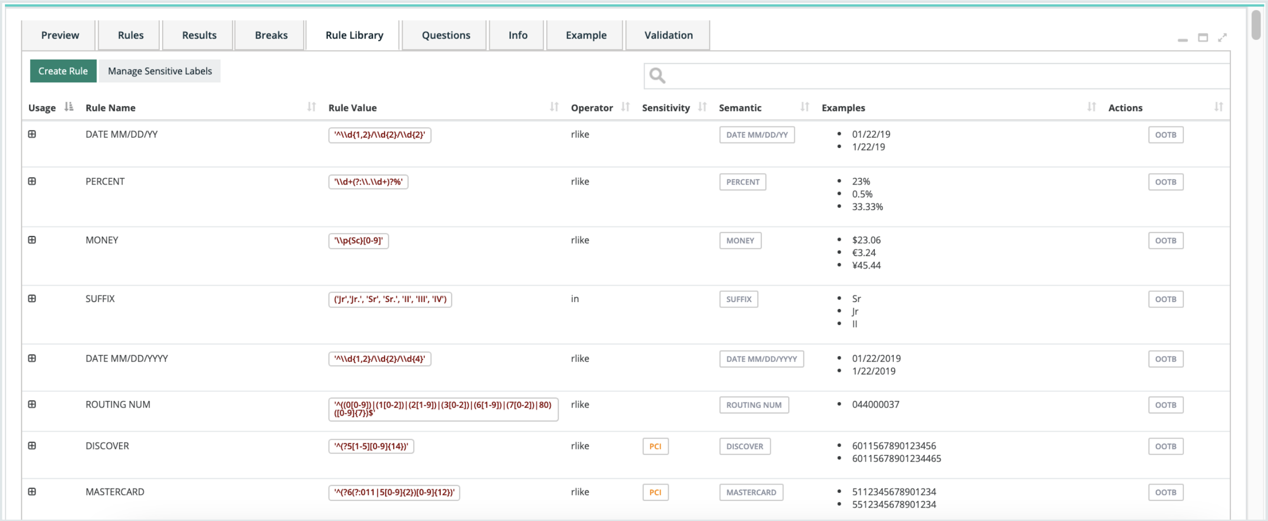
An organized repository of all your rule templates.



Field	Type	Semantic	Quality
AddressLine2	String		1.8%
ArabicDescription	String		100.0%
BirthDate	Date		100.0%
CarrierTrackingNumber	Boolean		0.0%
ChineseDescription	String		100.0%
Class	String		35.5%
Color	String		52.1%
CommuteDistance	String		100.0%

AddressLine2 + Quick Rule	ArabicDescription + Quick Rule	BirthDate + Quick Rule	CarrierTrackingNumber + Quick Rule	ChineseDescription + Quick Rule
Space # 45	هيكل قفصي من الألومنيوم يثبت الزجاجة بإحكام أثناء القيادة على الأراضي الوعرة.	1979-07-08	null	结实的铝壳可在任何环境下保持

The rule library contains both OOTB and custom-built rule templates.



Usage	Rule Name	Rule Value	Operator	Sensitivity	Semantic	Examples	Actions
⊞	DATE MM/DD/YY	'^\\d{1,2}/\\d{2}/\\d{2}'	rlike		DATE MM/DD/YY	• 01/22/19 • 1/22/19	OOTB
⊞	PERCENT	'\\d+(?:\\.\\d+)?%'	rlike		PERCENT	• 23% • 0.5% • 33.33%	OOTB
⊞	MONEY	'\\p{Sc}[0-9]'	rlike		MONEY	• $23.06 • €3.24 • ¥45.44	OOTB
⊞	SUFFIX	('Jr','Jr.', 'Sr', 'Sr.', 'II', 'III', 'IV')	in		SUFFIX	• Sr • Jr • II	OOTB
⊞	DATE MM/DD/YYYY	'^\\d{1,2}/\\d{2}/\\d{4}'	rlike		DATE MM/DD/YYYY	• 01/22/2019 • 1/22/2019	OOTB
⊞	ROUTING NUM	'^((0[0-9])|(1[0-2])|(2[1-9])|(3[0-2])|(6[1-9])|(7[0-2])|80)([0-9]{7})$'	rlike		ROUTING NUM	• 044000037	OOTB
⊞	DISCOVER	'^(?5[1-5][0-9]{14})'	rlike	PCI	DISCOVER	• 6011567890123456 • 60115678901234465	OOTB
⊞	MASTERCARD	'^(?6(?:011|5[0-9]{2})[0-9]{12})'	rlike	PCI	MASTERCARD	• 5112345678901234 • 5512345678901234	OOTB

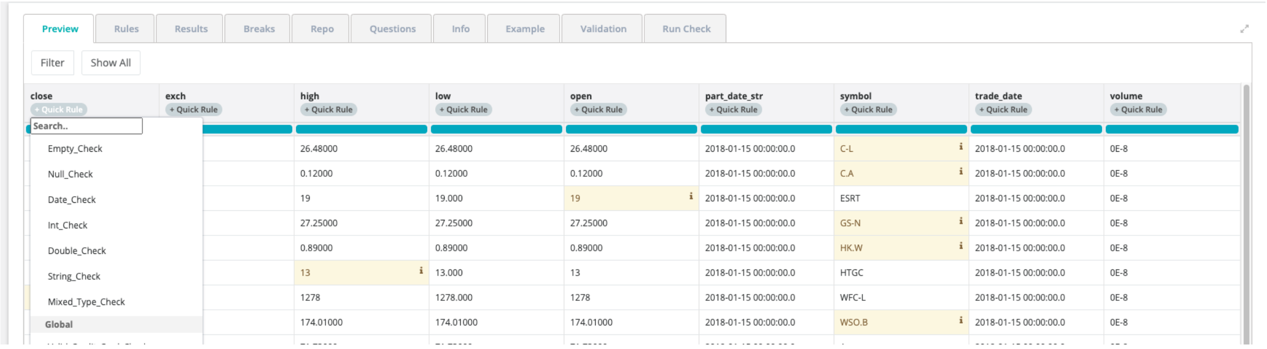
OOTB Rules

Collibra DQ shares all of its out-of-the-box rules with each user/tenant. This makes it easy to get started quickly and lets the team add common rules for specific use cases.

Below is a list of one-click rules that can be added to any data set. It is important to note that Collibra DQ often self-identifies these columns and automatically provides the proper protection.

- Email
- Zip
- Credit Card
- SSN
- EIN
- State Code
- Phone
- Gender
- IP Address
- Date
- Int
- Double

You can also apply common Data Type and Global rules from the Quick Rule dropdown under the Preview tab.



close	exch	high	low	open	part_date_str	symbol	trade_date	volume
		26.48000	26.48000	26.48000	2018-01-15 00:00:00.0	C-L	2018-01-15 00:00:00.0	0E-8
		0.12000	0.12000	0.12000	2018-01-15 00:00:00.0	C.A	2018-01-15 00:00:00.0	0E-8
		19	19.000	19	2018-01-15 00:00:00.0	ESRT	2018-01-15 00:00:00.0	0E-8
		27.25000	27.25000	27.25000	2018-01-15 00:00:00.0	GS-N	2018-01-15 00:00:00.0	0E-8
		0.89000	0.89000	0.89000	2018-01-15 00:00:00.0	HK.W	2018-01-15 00:00:00.0	0E-8
		13	13.000	13	2018-01-15 00:00:00.0	HTGC	2018-01-15 00:00:00.0	0E-8
		1278	1278.000	1278	2018-01-15 00:00:00.0	WFC-L	2018-01-15 00:00:00.0	0E-8
		174.01000	174.01000	174.01000	2018-01-15 00:00:00.0	WSO.B	2018-01-15 00:00:00.0	0E-8

Customized Rules

Add to the Rule Library

Create a rule once using the Create Generic Rule builder and re-use the rule across any column on any data set. This is called a global rule, or a rule in the Rule Library that you can use for global use across many data sets. Collibra Data Quality substitutes the data set and column to which the rule applies at runtime. This commonly saves hundreds of redundant rules that do the same thing but on different column names.

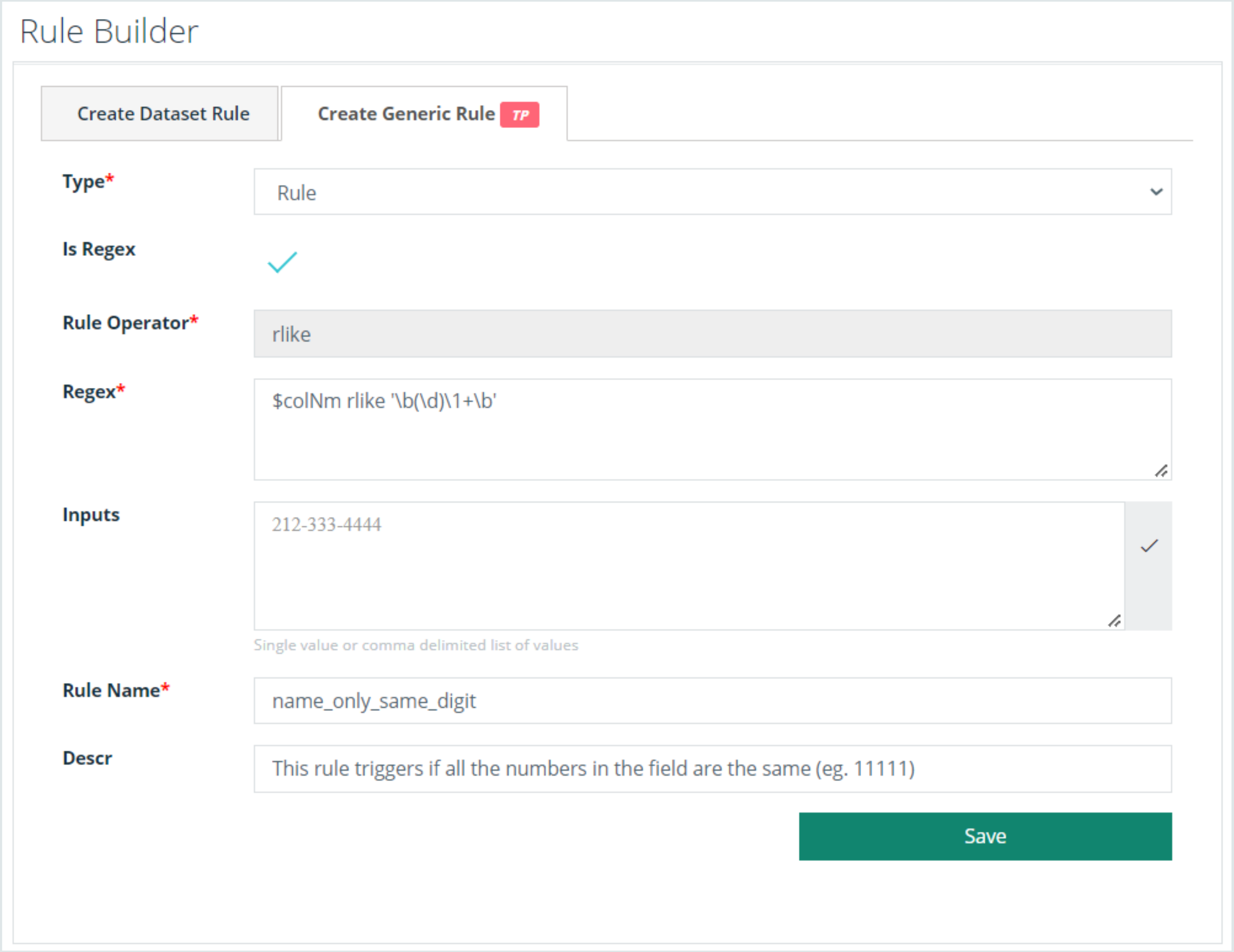
To add a rule to the Rule Library:

1. Select a data set from the search bar on the Rule Builder page.
2. Click the **Create Generic Rule** tab.
3. Enter the required information.

Option	Description
Type	The type of rule being created.
Is Regex	Select Is Regex if your rule is a Regex rule.
Rule Operator	rlike is the default operator.
Where	Enter your query. Only available for non-Regex rules.
Regex	Enter your Regex query. Only available for Regex rules.
Input	Enter your Regex input values as single values or a comma-delimited list of values. Optional field only available for Regex rules.
Rule name	Enter a unique name for your rule. This is stored in the Rule Library once the rule is saved. Required field for both Regex and non-Regex rules.
Descr	Enter a description for your rule. Optional field for both Regex and non-Regex rules.

4. Click **Save**.

The Rule Library hosts out of the box and custom global rules. See data concepts and semantics for advanced use of global rules.



Rule Builder

Type*: Rule

Is Regex: ✓

Rule Operator*: rlike

Regex*: $colNm rlike '\b(\d)\1+\b'

Inputs: 212-333-4444

Single value or comma delimited list of values

Rule Name*: name_only_same_digit

Descr: This rule triggers if all the numbers in the field are the same (eg. 11111)

The Rule Library hosts out-of-the-box and custom global rules. See Rule Discovery for advanced use of global rules.

Rule Discovery

Rule Preview

Set a Preview Limit

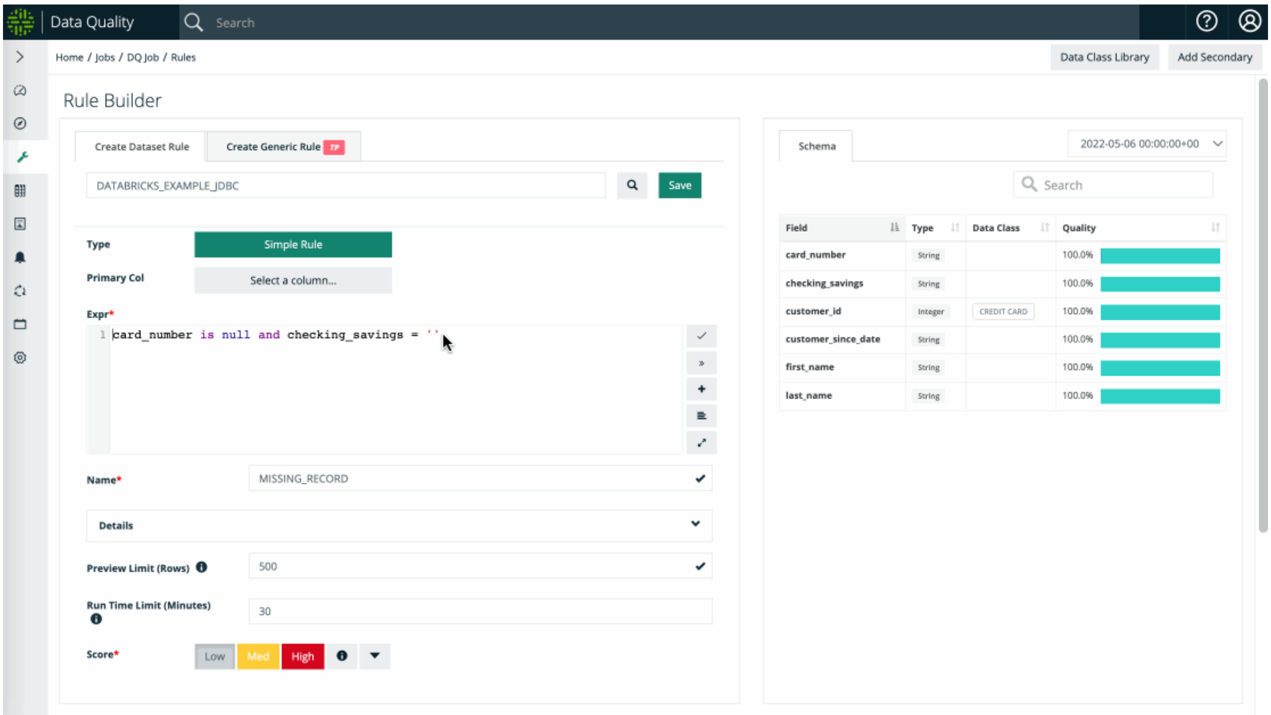
Rule Previews allow you to set Preview Limits by the row, enabling you to drill in to your data even further. Limits can be set to any positive number. 6 is default.

> **Note** Best practice is to apply a limit of 1000 or less. Increasing the limit above 1000 should only be done if your Postgres has sufficient CPU and memory.

Set a preview limit

1. Create a new **DQ Job** and navigate to the **Rule Builder** page.
2. Select your dataset and click the **Search** button.
3. Select a rule type from the **Select a type** button.
4. Create your SQL rule in the **Expr** field and enter a unique name for your rule in the **Name** field.
5. Enter an even number in **Preview Limit (Rows)**.
6. Click **Save**.
7. Run the **DQ Job** to execute the rules assigned to the dataset.

> **Note** Freeform and Simple rule are the only two rule types supported at this time.



DATABRICKS_EXAMPLE_JDBC

Type: Simple Rule

Primary Col: Select a column...

Expr*

```
card_number is null and checking_savings = ''
```

Name*: MISSING_RECORD

Details

Preview Limit (Rows): 500

Run Time Limit (Minutes): 30

Score*: Low Med High

2022-05-06 00:00:00+00

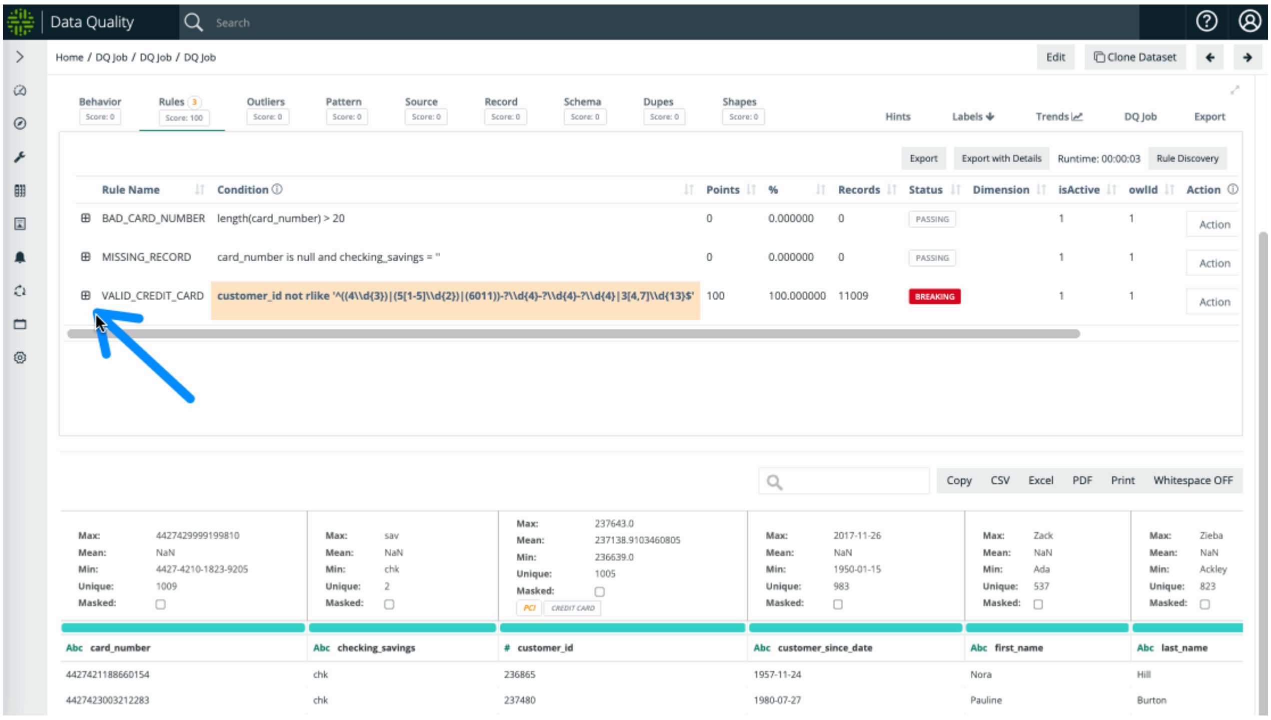
Field	Type	Data Class	Quality
card_number	String		100.0%
checking_savings	String		100.0%
customer_id	Integer	CREDIT CARD	100.0%
customer_since_date	String		100.0%
first_name	String		100.0%
last_name	String		100.0%

View and Export Results

Another key feature of Rule Previews is that you have the ability to easily export the details of your drill-in.

View and export your results

1. Click the + icon in the **Rule Name** column to expand the table to view your results.
2. Click **Export with Details** to download the break records to your local machine.



Rule Name	Condition	Points	%	Records	Status	Dimension	isActive	owlId	Action
⊞ BAD_CARD_NUMBER	length(card_number) > 20	0	0.000000	0	PASSING		1	1	Action
⊞ MISSING_RECORD	card_number is null and checking_savings = ''	0	0.000000	0	PASSING		1	1	Action
⊞ VALID_CREDIT_CARD	customer_id not rlike '^((4\\d{3})|(5[1-5]\\d{2})|(6011))-?\\d{4}-?\\d{4}-?\\d{4}|3[4,7]\\d{13}$'	100	100.000000	11009	BREAKING		1	1	Action

	Abc card_number	Abc checking_savings	# customer_id	Abc customer_since_date	Abc first_name	Abc last_name
Max:	4427429999199810	sav	237643.0	2017-11-26	Zack	Zieba
Mean:	NaN	NaN	237138.9103460805	NaN	NaN	NaN
Min:	4427-4210-1823-9205	chk	236639.0	1950-01-15	Ada	Ackley
Unique:	1009	2	1005	983	537	823
Masked:	□	□	□ PCI CREDIT CARD	□	□	□
	4427421188660154	chk	236865	1957-11-24	Nora	Hill
	4427423003212283	chk	237480	1980-07-27	Pauline	Burton

Note Rule preview is currently available for Freeform and Simple rules.

Rule Discovery

Custom data discovery and enforcement using rule templates (data concepts and semantics).

Data Categories

A data category is the category or family of a data set, for example, stock data, interest rate data, etc. By giving data categories, or classifying data sets, we can transfer (apply) common understanding, rules, and ML to data sets. This allows data stewards to set up concepts once and enables organizations to unify and standardize common rules and terms, solving many metadata scale challenges.

> **Note** Data set level
> **Security reference data** - Bloomberg financial data - **home loan data** - mortgage application data.

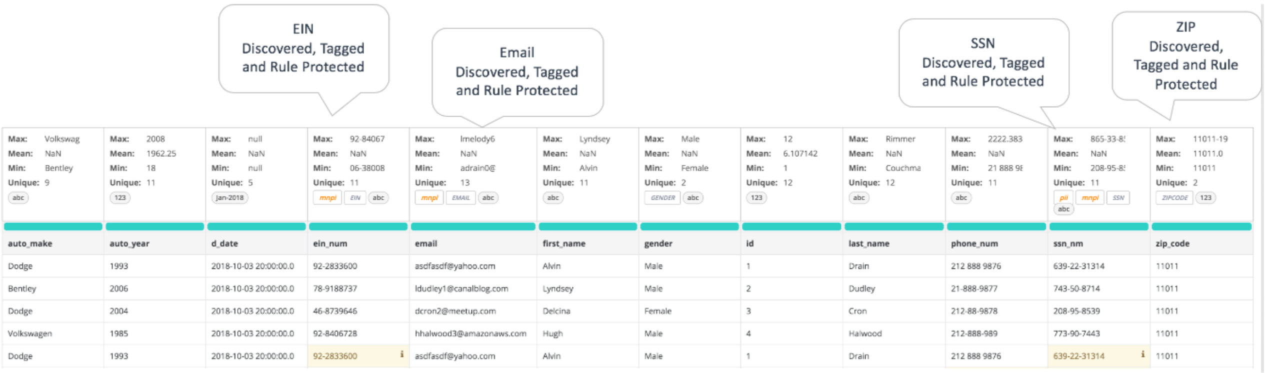
Data Classes

> **Note** Column Level
> EMAIL, ZIP CODE, SSN, CUSIP, GENDER, ADDRESS, CURRENCY CD, SKU, EIN, IP ADDRESS, PHONE, LICENSE, VIN, CREDIT CARD

A data class is the semantic type of a column or attribute of a data set, for example email, zip code, and so on. All columns have a physical type, such as String, Int, and Date, but the semantic understanding of what type of String is in the column can be very important. Data classes allow Collibra Data Quality to enforce DQ validation rules out of the box.

Collibra Data Quality's semantic scanning self-identifies standard columns and automatically provides the proper protection. This makes it easy to get started adding common rules for specific use cases.

Collibra Data Quality offers out of the box rules for 1-click rule creation


EIN
Discovered, Tagged and Rule Protected
Email
Discovered, Tagged and Rule Protected
SSN
Discovered, Tagged and Rule Protected
ZIP
Discovered, Tagged and Rule Protected

Max: Volkswag Mean: NaN Min: Bentley Unique: 9 abc	Max: 2008 Mean: 1962.25 Min: 18 Unique: 11 123	Max: null Mean: NaN Min: null Unique: 5 Jan-2018	Max: 92-84067 Mean: NaN Min: 06-38008 Unique: 11 mnpi EIN abc	Max: lmelody6 Mean: NaN Min: adrain0@ Unique: 13 mnpi EMAIL abc	Max: Lyndsey Mean: NaN Min: Alvin Unique: 11 abc	Max: Male Mean: NaN Min: Female Unique: 2 GENDER abc	Max: 12 Mean: 6.107142 Min: 1 Unique: 12 123	Max: Rimmer Mean: NaN Min: Couchma Unique: 12 abc	Max: 2222.383 Mean: NaN Min: 21 888 9ł Unique: 11 abc	Max: 865-33-8! Mean: NaN Min: 208-95-8! Unique: 11 pii mnpi SSN abc	Max: 11011-19 Mean: 11011.0 Min: 11011 Unique: 2 ZIPCODE 123
auto_make	**auto_year**	**d_date**	**ein_num**	**email**	**first_name**	**gender**	**id**	**last_name**	**phone_num**	**ssn_nm**	**zip_code**
Dodge	1993	2018-10-03 20:00:00.0	92-2833600	asdfasdf@yahoo.com	Alvin	Male	1	Drain	212 888 9876	639-22-31314	11011
Bentley	2006	2018-10-03 20:00:00.0	78-9188737	ldudley1@canalblog.com	Lyndsey	Male	2	Dudley	21-888-9877	743-50-8714	11011
Dodge	2004	2018-10-03 20:00:00.0	46-8739646	dcron2@meetup.com	Delcina	Female	3	Cron	212-88-9878	208-95-8539	11011
Volkswagen	1985	2018-10-03 20:00:00.0	92-8406728	hhalwood3@amazonaws.com	Hugh	Male	4	Halwood	212-888-989	773-90-7443	11011
Dodge	1993	2018-10-03 20:00:00.0	92-2833600 ℹ	asdfasdf@yahoo.com	Alvin	Male	1	Drain	212 888 9876	639-22-31314 ℹ	11011

Run Discovery

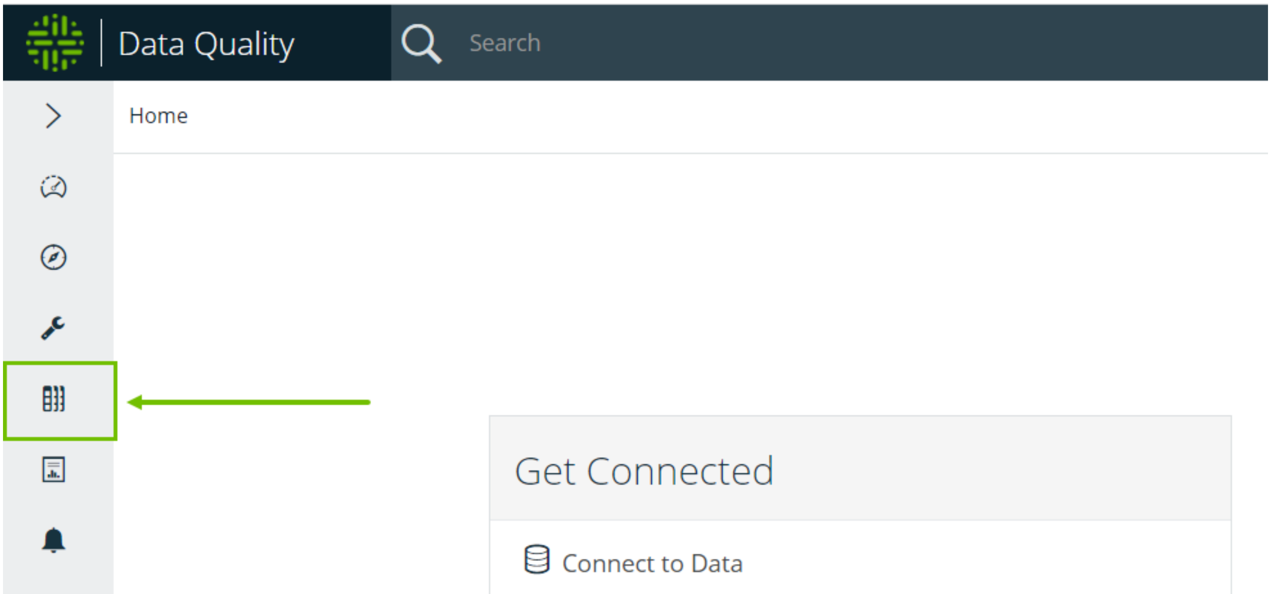
With the **Run Discovery** modal, you can run a **DQ Scan** to detect for the semantics assigned to a selected data concept. The Run Discovery algorithm automatically selects the best match if a column matches two or more data classes. Data class match criteria are determined by percent match and name distance.

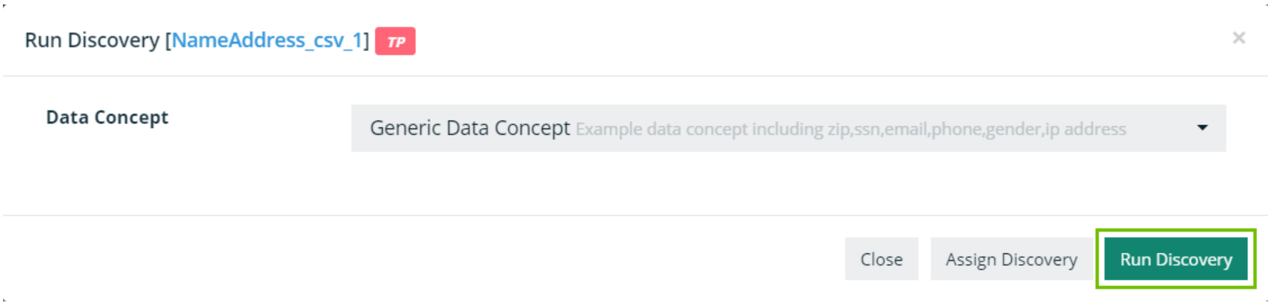
You can access the Run Discovery feature via:

- **Catalog**
- **DQ Job**

Via Catalog

1. In **Catalog**, select your dataset.
2. In the **Actions** dropdown menu, click **Data Concept**.
3. Select an option from the **Data Concept** dropdown and click **Run Discovery**.

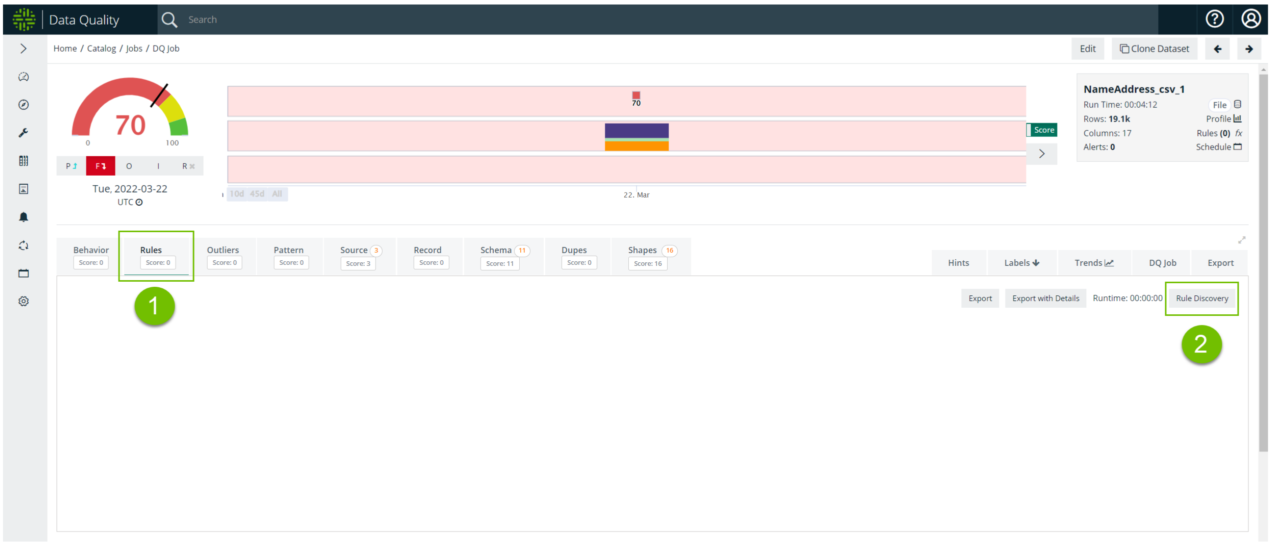


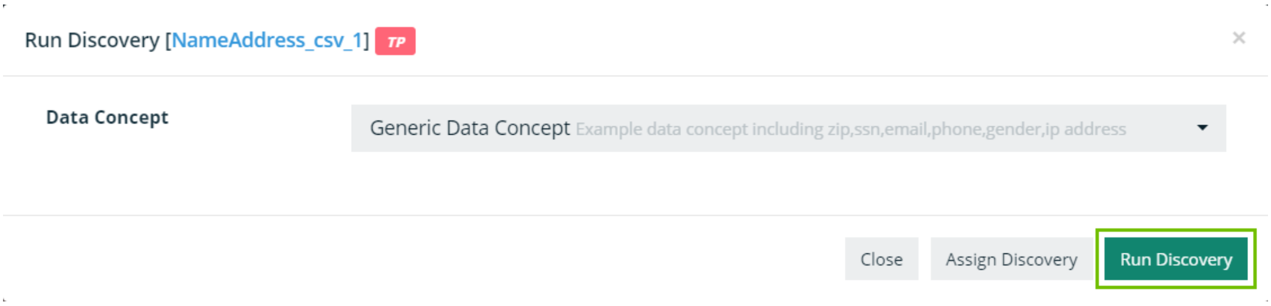


Data Concept: Generic Data Concept Example data concept including zip,ssn,email,phone,gender,ip address

Via DQ Job

1. From the **DQ Job** page, select your DQ Job.
2. Click the **Rules** tab in your DQ Job.
3. Click the **Rule Discovery** button.
4. In the **Data Concept** window, select your Data Concept.
5. Click **Run Discovery**.




Run Discovery [NameAddress_csv_1] TP

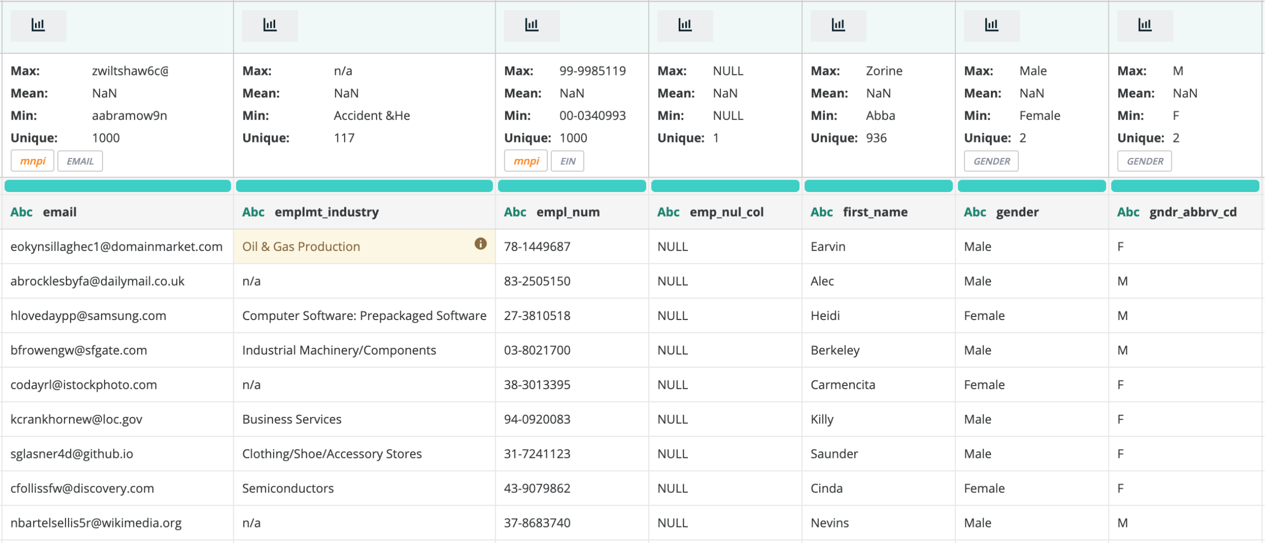
Data Concept: Generic Data Concept Example data concept including zip,ssn,email,phone,gender,ip address

Sensitive Data

> **Note** Column Level
>
> **PII** - personally identifiable information **MNPI** - materially non public information **PCI** - credit information like a credit card number **PHI** - HIPAA medical information

Data Discovery: The Power of Combining All Three into One Domain

Now imagine if you could classify your datasets as concepts, then automatically have all the columns be recognized semantically(with validation rules in place) as well as have the columns labeled with sensitivity tags. It might look something like the following screenshot.

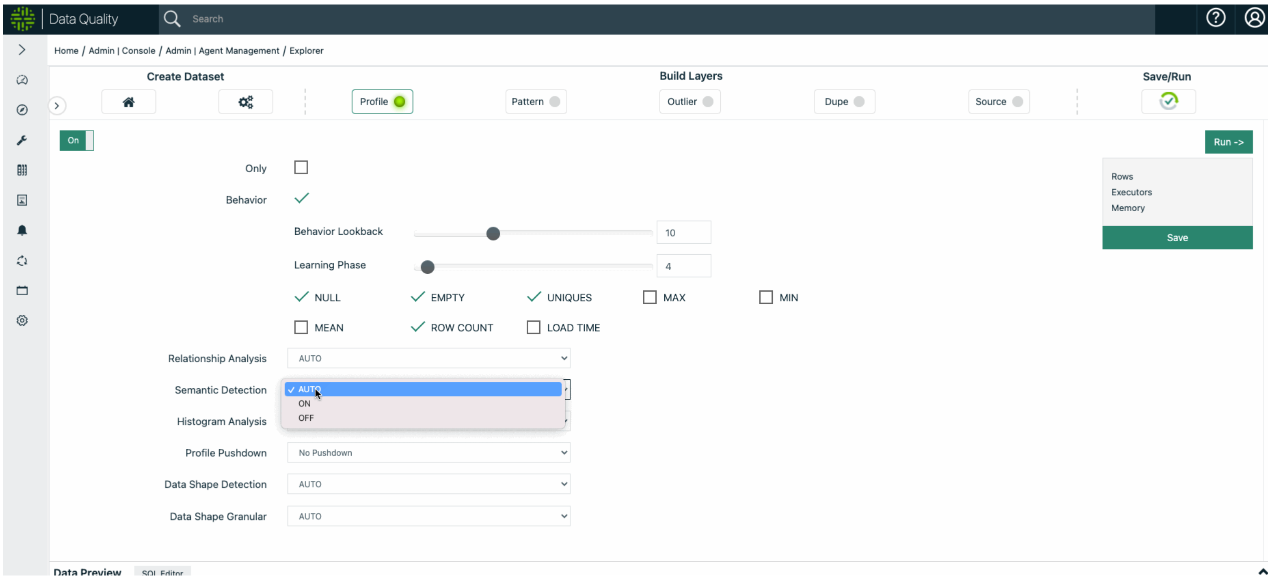


Max: zwiltshaw6c@ **Mean:** NaN **Min:** aabramow9n **Unique:** 1000 mnpi EMAIL	**Max:** n/a **Mean:** NaN **Min:** Accident &He **Unique:** 117	**Max:** 99-9985119 **Mean:** NaN **Min:** 00-0340993 **Unique:** 1000 mnpi EIN	**Max:** NULL **Mean:** NaN **Min:** NULL **Unique:** 1	**Max:** Zorine **Mean:** NaN **Min:** Abba **Unique:** 936	**Max:** Male **Mean:** NaN **Min:** Female **Unique:** 2 GENDER	**Max:** M **Mean:** NaN **Min:** F **Unique:** 2 GENDER
Abc **email**	Abc **emplmt_industry**	Abc **empl_num**	Abc **emp_nul_col**	Abc **first_name**	Abc **gender**	Abc **gndr_abbrv_cd**
eokynsillaghec1@domainmarket.com	Oil & Gas Production	78-1449687	NULL	Earvin	Male	F
abrocklesbyfa@dailymail.co.uk	n/a	83-2505150	NULL	Alec	Male	M
hlovedaypp@samsung.com	Computer Software: Prepackaged Software	27-3810518	NULL	Heidi	Female	M
bfrowengw@sfgate.com	Industrial Machinery/Components	03-8021700	NULL	Berkeley	Male	M
codayrl@istockphoto.com	n/a	38-3013395	NULL	Carmencita	Female	F
kcrankhornew@loc.gov	Business Services	94-0920083	NULL	Killy	Male	F
sglasner4d@github.io	Clothing/Shoe/Accessory Stores	31-7241123	NULL	Saunder	Male	F
cfollissfw@discovery.com	Semiconductors	43-9079862	NULL	Cinda	Female	F
nbartelsellis5r@wikimedia.org	n/a	37-8683740	NULL	Nevins	Male	M

Steps

Step 1: Create a DQ Job with Semantic Detection turned on.

From the Profile options page, create a new DQ Job and select ON from the Semantic Detection dropdown.



Only ☐

Behavior ✓

Behavior Lookback 10

Learning Phase 4

✓ NULL ✓ EMPTY ✓ UNIQUES ☐ MAX ☐ MIN

☐ MEAN ✓ ROW COUNT ☐ LOAD TIME

Relationship Analysis AUTO

Semantic Detection ✓ AUTO / ON / OFF

Histogram Analysis

Profile Pushdown No Pushdown

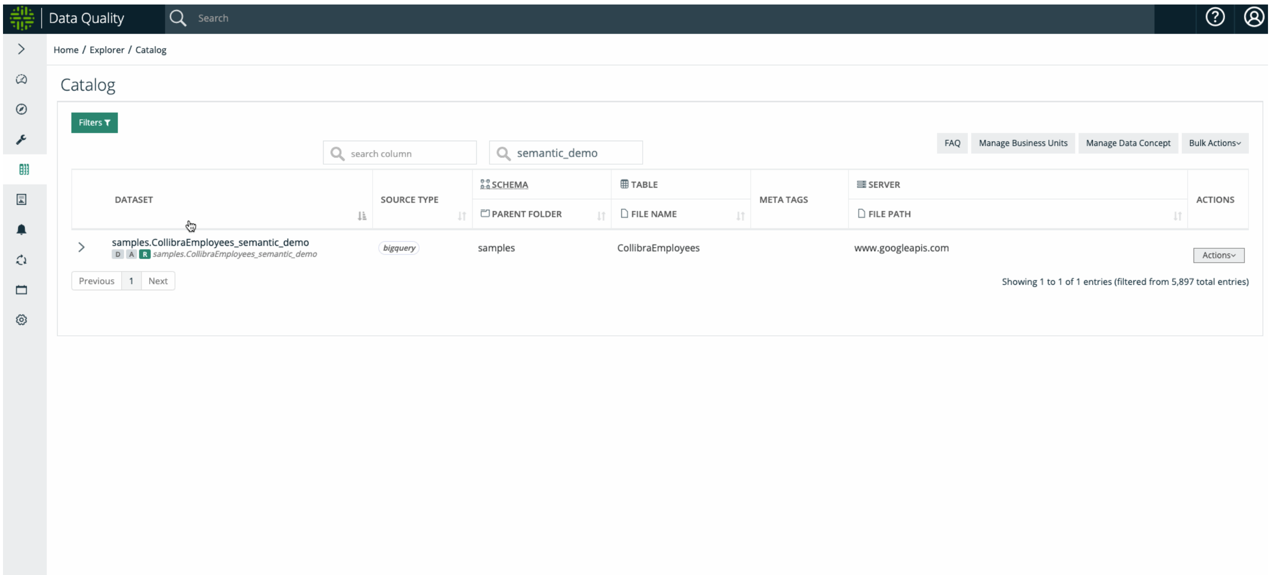
Data Shape Detection AUTO

Data Shape Granular AUTO

Step 2: In Catalog, select and apply your Data Concept.

Navigate to your dataset in **Catalog** and select the Data Concept you would like to apply with the **Actions** dropdown menu.

See below sections on how to **Administer Data Concepts** as well as how to **Create and Manage Semantics**.

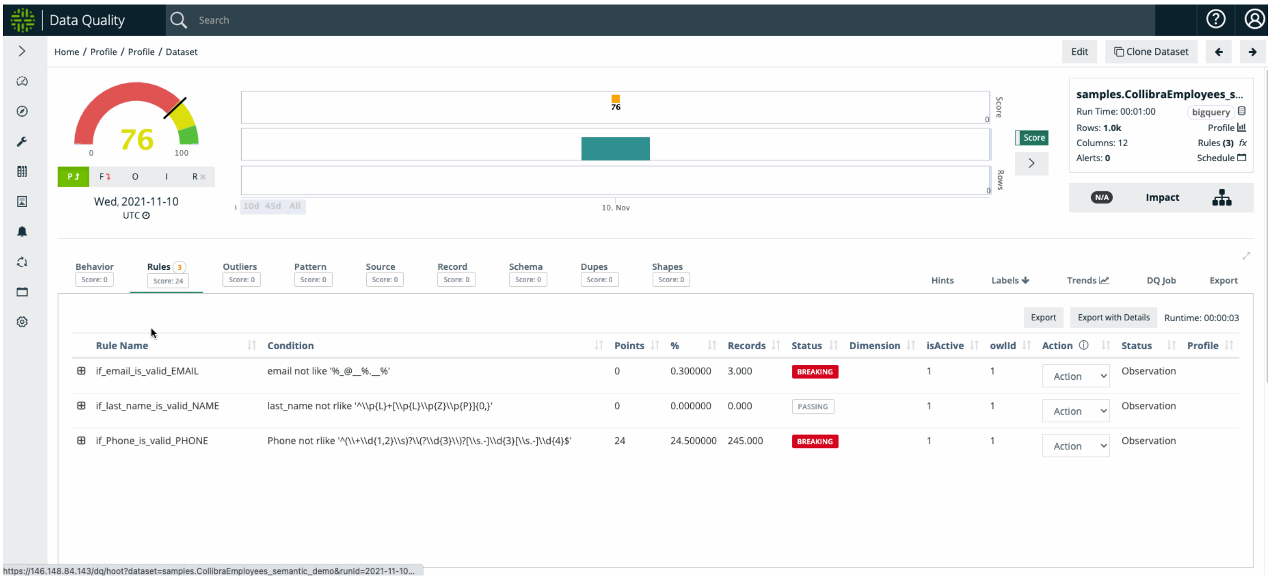


DATASET	SOURCE TYPE	SCHEMA PARENT FOLDER	TABLE FILE NAME	META TAGS	SERVER FILE PATH	ACTIONS
samples.CollibraEmployees_semantic_demo D A R *samples.CollibraEmployees_semantic_demo*	*bigquery*	samples	CollibraEmployees		www.googleapis.com	Actions

Showing 1 to 1 of 1 entries (filtered from 5,897 total entries)

Step 3: Rerun your DQ Job with applied Data Concept.

Please rerun your DQ Job so that Collibra Data Quality can 1) profile your data, 2) auto-generate the rules based on the Semantics under the Data Concept, and 3) highlight any break records.



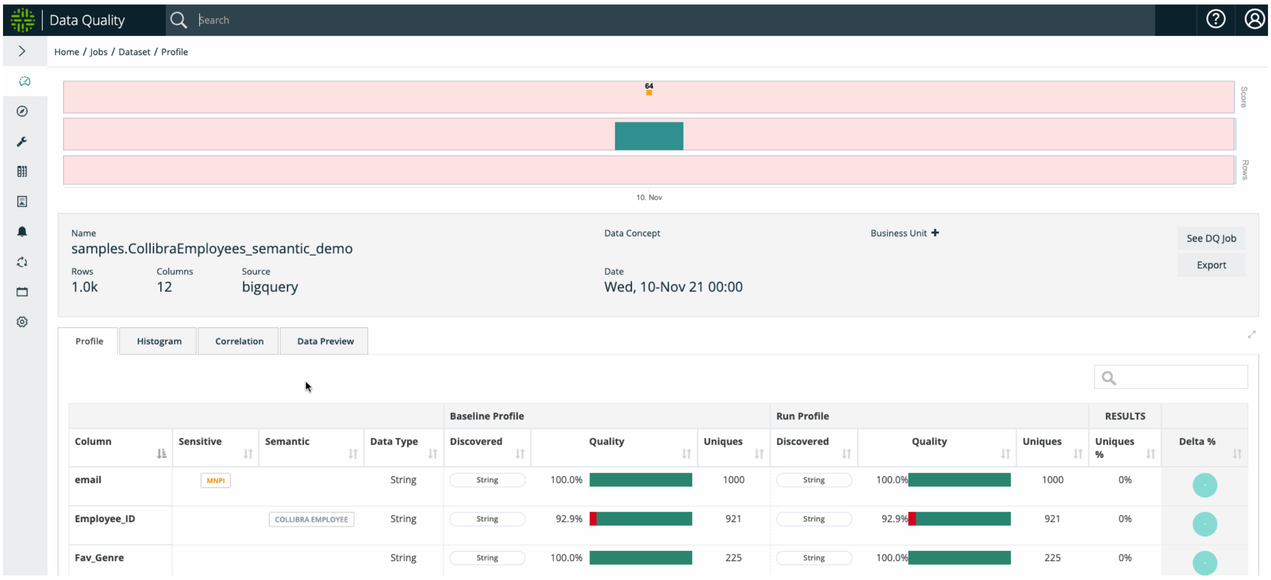
Rule Name	Condition	Points	%	Records	Status	Dimension	isActive	owlId	Action	Status	Profile
⊞ if_email_is_valid_EMAIL	email not like '%_@__%.__%'	0	0.300000	3.000	BREAKING		1	1	Action	Observation	
⊞ if_last_name_is_valid_NAME	last_name not rlike '^\\p{L}+[\\p{L}\\p{Z}\\p{P}]{0,}'	0	0.000000	0.000	PASSING		1	1	Action	Observation	
⊞ if_Phone_is_valid_PHONE	Phone not rlike '^(\\+\\d{1,2}\\s)?\\(?\\d{3}\\)?[\\s.-]\\d{3}[\\s.-]\\d{4}$'	24	24.500000	245.000	BREAKING		1	1	Action	Observation	

https://146.148.84.143/dq/hoot?dataset=samples.CollibraEmployees_semantic_demo&runId=2021-11-10...

Success! Review Findings

On the Profile page, observe the newly tagged Semantics on the applicable columns.

On the DQ Job page, browse your newly created rules based on Semantics, as well as any corresponding rule breaks.



Name
samples.CollibraEmployees_semantic_demo

Rows 1.0k
Columns 12
Source bigquery

Data Concept

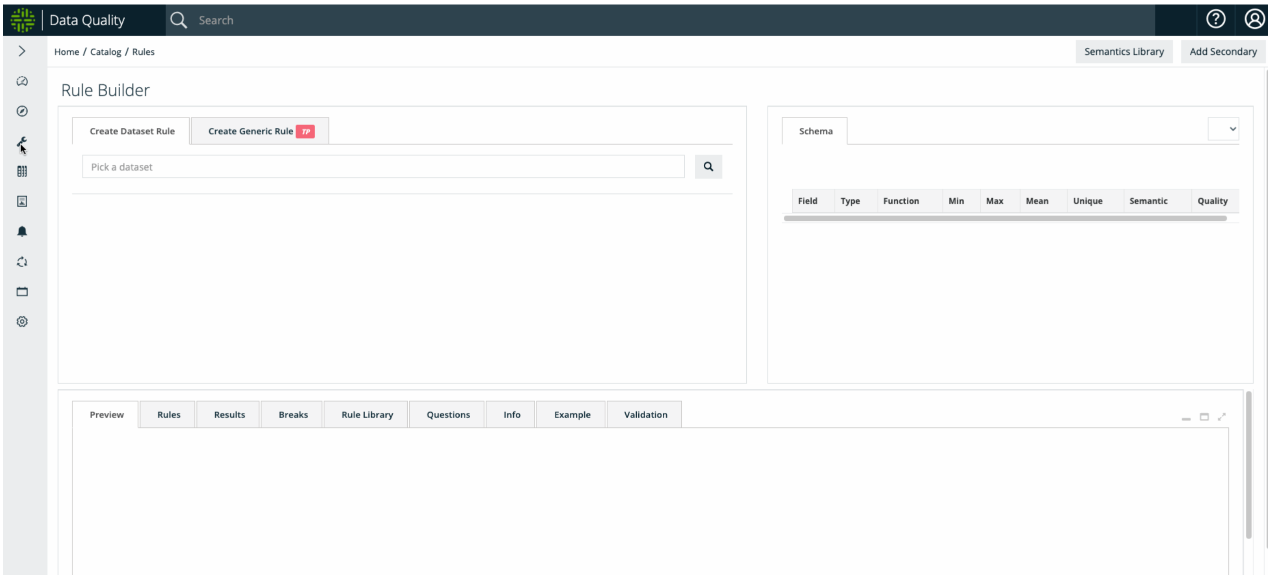
Date
Wed, 10-Nov 21 00:00

Business Unit ✚

				Baseline Profile			Run Profile			RESULTS	
Column	Sensitive	Semantic	Data Type	Discovered	Quality	Uniques	Discovered	Quality	Uniques	Uniques %	Delta %
email	MNPI		String	String	100.0%	1000	String	100.0%	1000	0%	●
Employee_ID		COLLIBRA EMPLOYEE	String	String	92.9%	921	String	92.9%	921	0%	●
Fav_Genre			String	String	100.0%	225	String	100.0%	225	0%	●

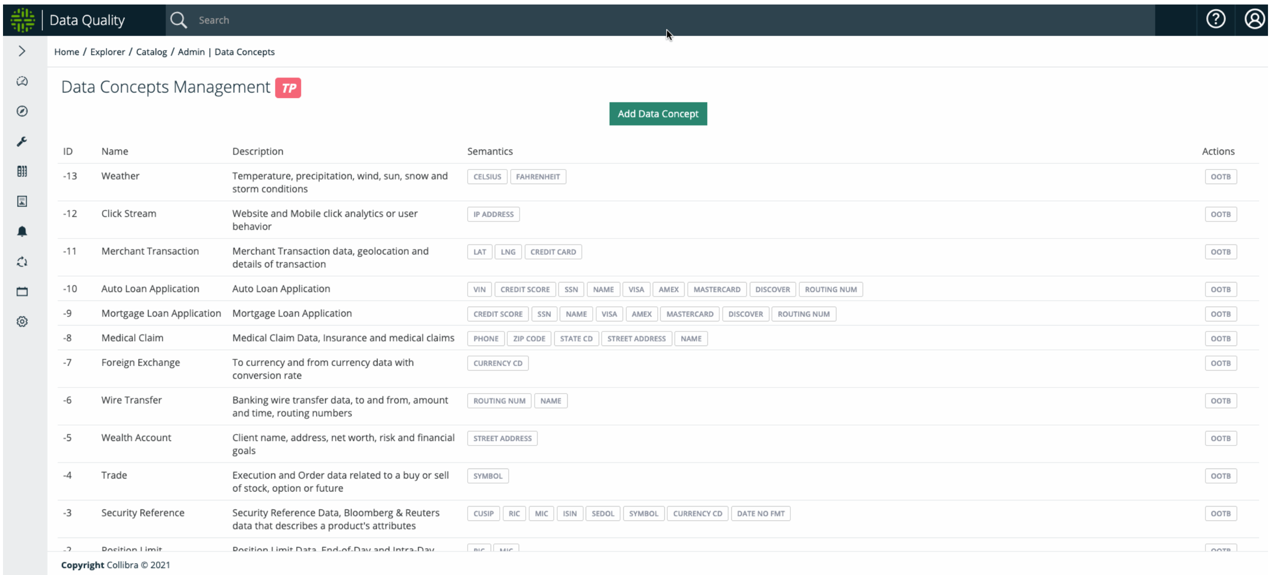
Creating and Managing Semantics

Create, test, and manage your Semantics in Collibra Data Quality in your **Rule Builder** wizard on the **Create Generic Rule** tab. Below is an example of creating a RegEx Semantic.



Administering Data Concepts

Setup your data concepts once and let the entire organization benefit by unifying all datasets to a common understanding in the admin Data Concepts page.



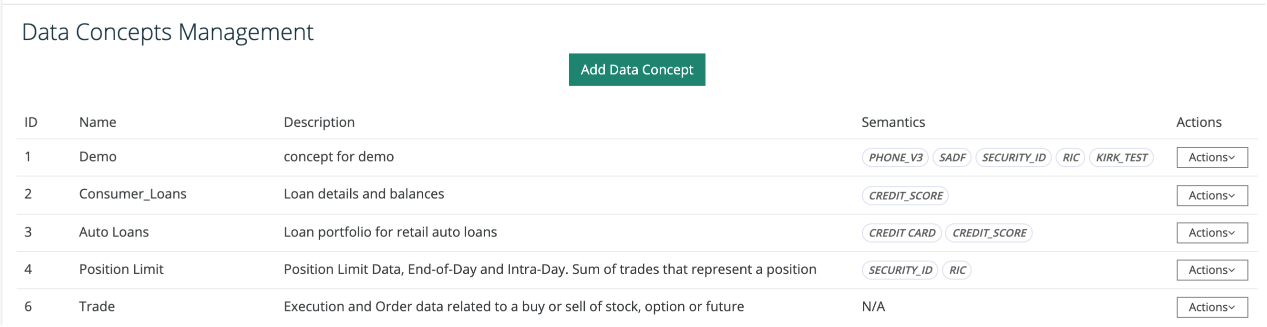
Home / Explorer / Catalog / Admin | Data Concepts

Data Concepts Management TP

Add Data Concept

ID	Name	Description	Semantics	Actions
-13	Weather	Temperature, precipitation, wind, sun, snow and storm conditions	CELSIUS, FAHRENHEIT	OOTB
-12	Click Stream	Website and Mobile click analytics or user behavior	IP ADDRESS	OOTB
-11	Merchant Transaction	Merchant Transaction data, geolocation and details of transaction	LAT, LNG, CREDIT CARD	OOTB
-10	Auto Loan Application	Auto Loan Application	VIN, CREDIT SCORE, SSN, NAME, VISA, AMEX, MASTERCARD, DISCOVER, ROUTING NUM	OOTB
-9	Mortgage Loan Application	Mortgage Loan Application	CREDIT SCORE, SSN, NAME, VISA, AMEX, MASTERCARD, DISCOVER, ROUTING NUM	OOTB
-8	Medical Claim	Medical Claim Data, Insurance and medical claims	PHONE, ZIP CODE, STATE CD, STREET ADDRESS, NAME	OOTB
-7	Foreign Exchange	To currency and from currency data with conversion rate	CURRENCY CD	OOTB
-6	Wire Transfer	Banking wire transfer data, to and from, amount and time, routing numbers	ROUTING NUM, NAME	OOTB
-5	Wealth Account	Client name, address, net worth, risk and financial goals	STREET ADDRESS	OOTB
-4	Trade	Execution and Order data related to a buy or sell of stock, option or future	SYMBOL	OOTB
-3	Security Reference	Security Reference Data, Bloomberg & Reuters data that describes a product's attributes	CUSIP, RIC, MIC, ISIN, SEDOL, SYMBOL, CURRENCY CD, DATE NO FMT	OOTB
-2	Position Limit	Position Limit Data, End-of-Day and Intra-Day	RIC, MIC	OOTB

Copyright Collibra © 2021



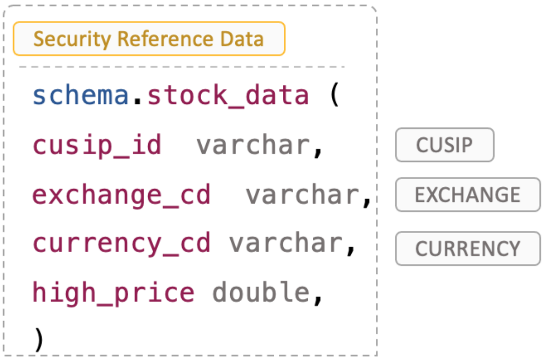
Data Concepts Management

Add Data Concept

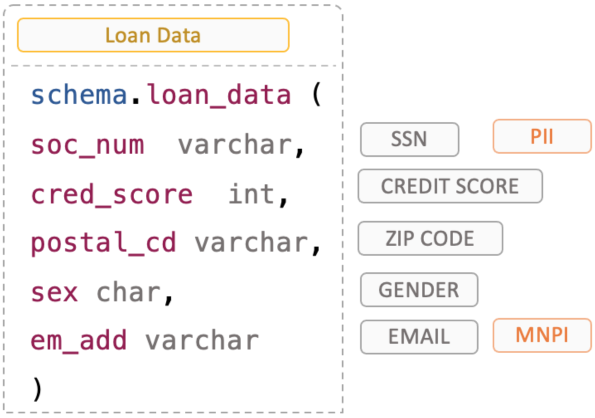
ID	Name	Description	Semantics	Actions
1	Demo	concept for demo	PHONE_V3, SADF, SECURITY_ID, RIC, KIRK_TEST	Actions
2	Consumer_Loans	Loan details and balances	CREDIT_SCORE	Actions
3	Auto Loans	Loan portfolio for retail auto loans	CREDIT CARD, CREDIT_SCORE	Actions
4	Position Limit	Position Limit Data, End-of-Day and Intra-Day. Sum of trades that represent a position	SECURITY_ID, RIC	Actions
6	Trade	Execution and Order data related to a buy or sell of stock, option or future	N/A	Actions

Physical Schemas to Semantics

Below you can see the benefit of organized metadata. PDEs or `physical data elements` organized/tagged by semantics. This allows for sub-second searches while in catalog or searching for data to figure out where all your PII data lives, or what systems have "loan data".



```
schema.stock_data (
cusip_id  varchar,
exchange_cd  varchar,
currency_cd varchar,
high_price double,
)
```

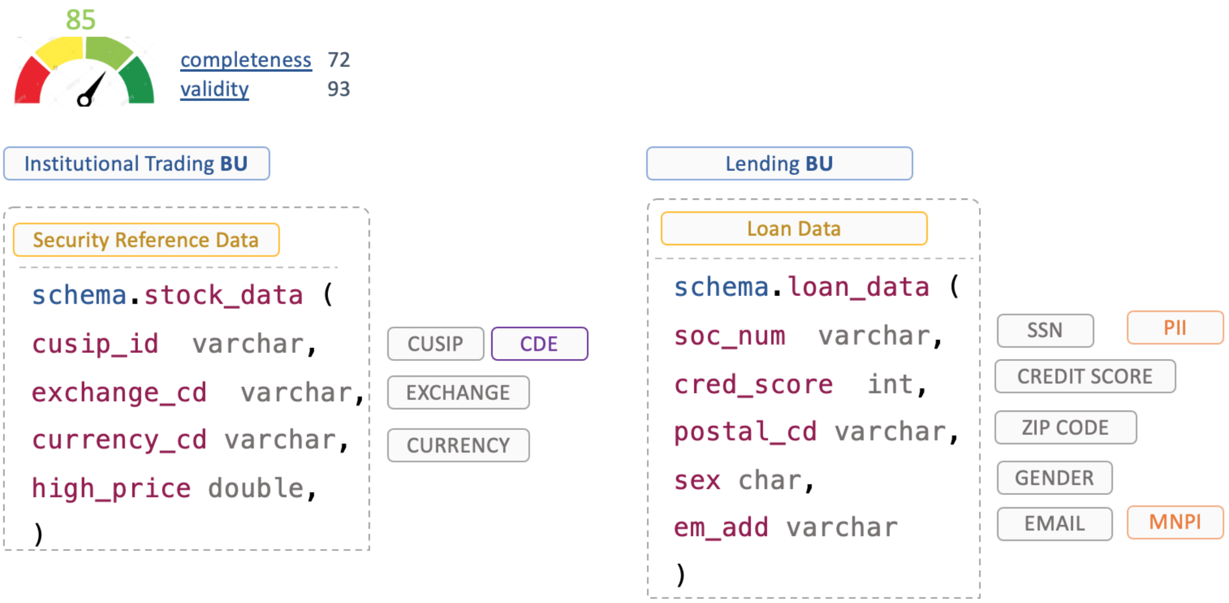


```
schema.loan_data (
soc_num  varchar,
cred_score  int,
postal_cd varchar,
sex char,
em_add varchar
)
```

Above you can see Data Concepts in Yellow, Semantics in Gray and Sensitive labels in Orange. Enabling you to organize all your data in classes, search and discover types no matter what system they live in or what the PDE column name is. Transforming technical types into business metadata.

Business Unit Roll up Reporting

Now that we have all PDEs discovered and tagged and rolled up into business terms, we can roll up technical assets like database tables and files into business reports across departments and non technical concepts.



```
schema.stock_data (
cusip_id  varchar,
exchange_cd  varchar,
currency_cd varchar,
high_price double,
)
```

```
schema.loan_data (
soc_num  varchar,
cred_score  int,
postal_cd varchar,
sex char,
em_add varchar
)
```

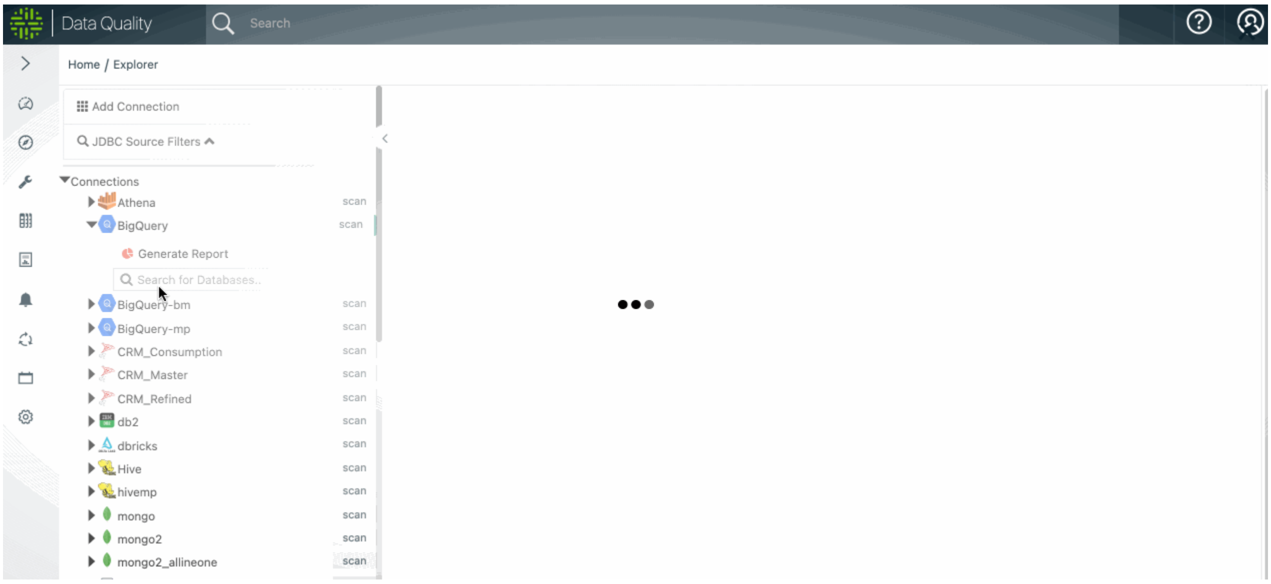
More

Collibra DQ advanced features.

When specific DQ challenges require specific DQ detection techniques, Collibra DQ offers a wide variety of advanced functionality. While Schema and Shapes utilize auto-discovery, other detection algorithms are best suited for users that understand their data and have specific use-cases in mind. Read more to understand if specific dimensions can be applied to your data.

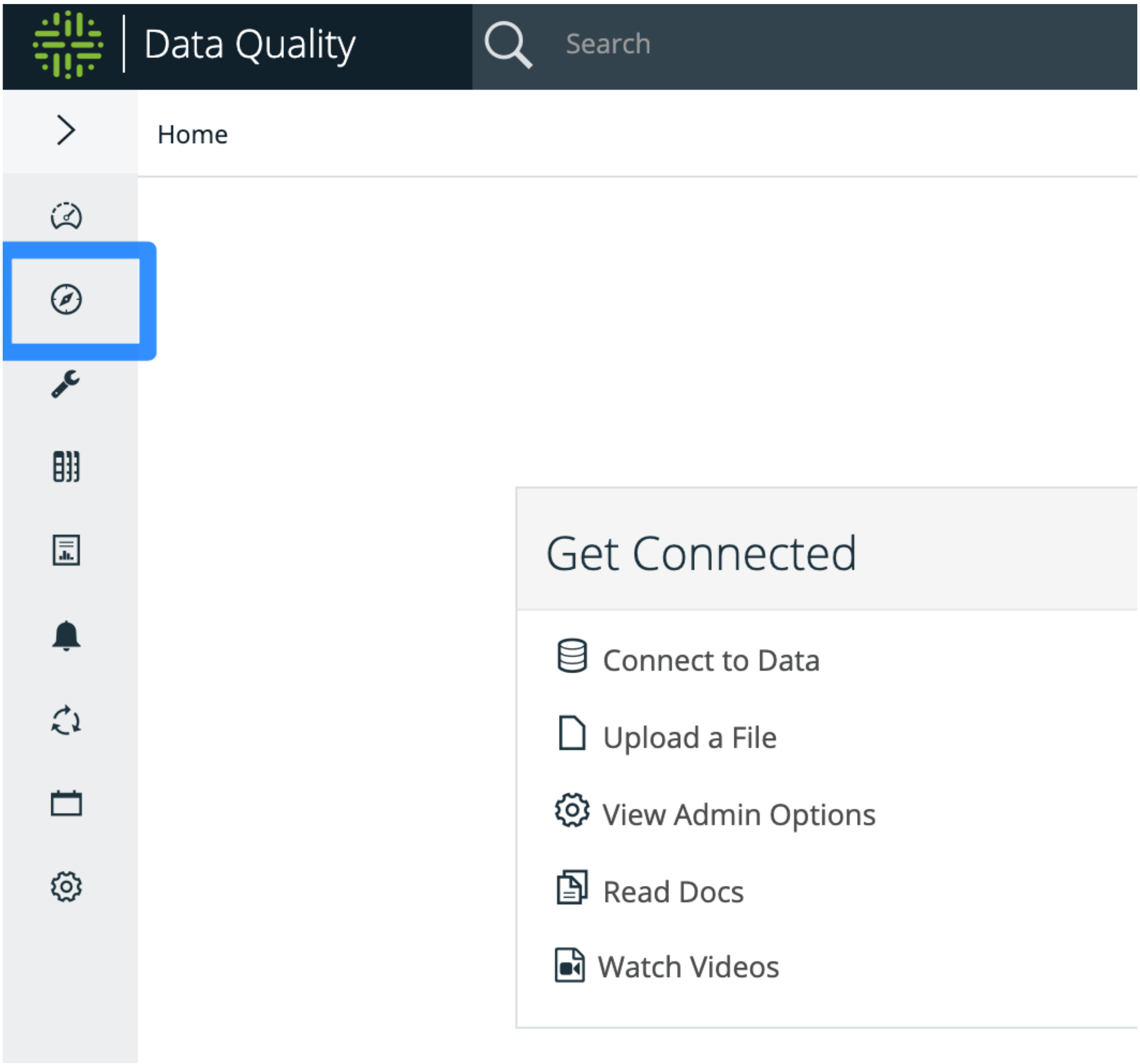
Explorer (no-code)

A no-code option to get started quickly and onboard a data set.



Getting Started

This page can be accessed by clicked the Explorer option (the compass icon).

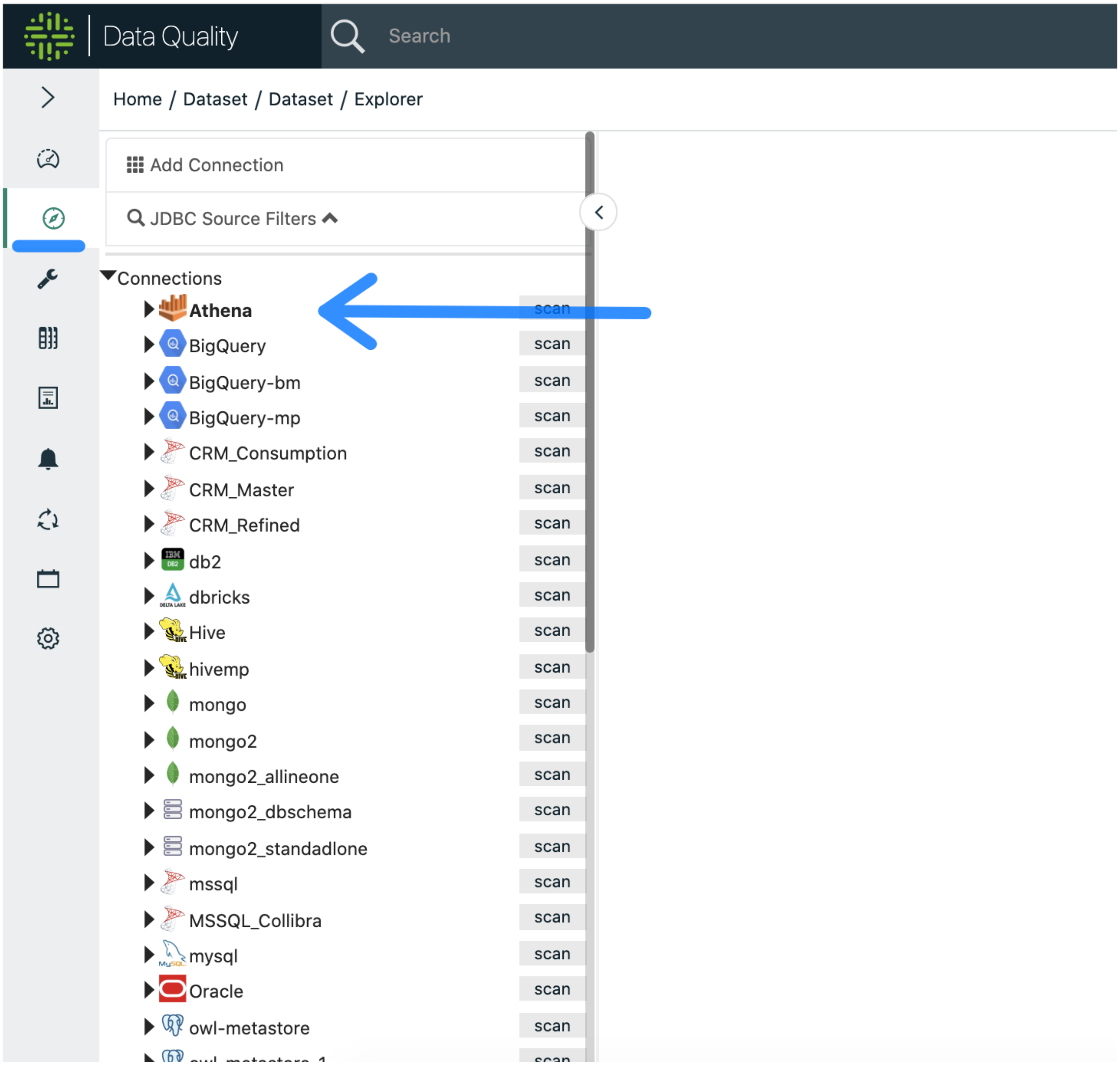


Get Connected

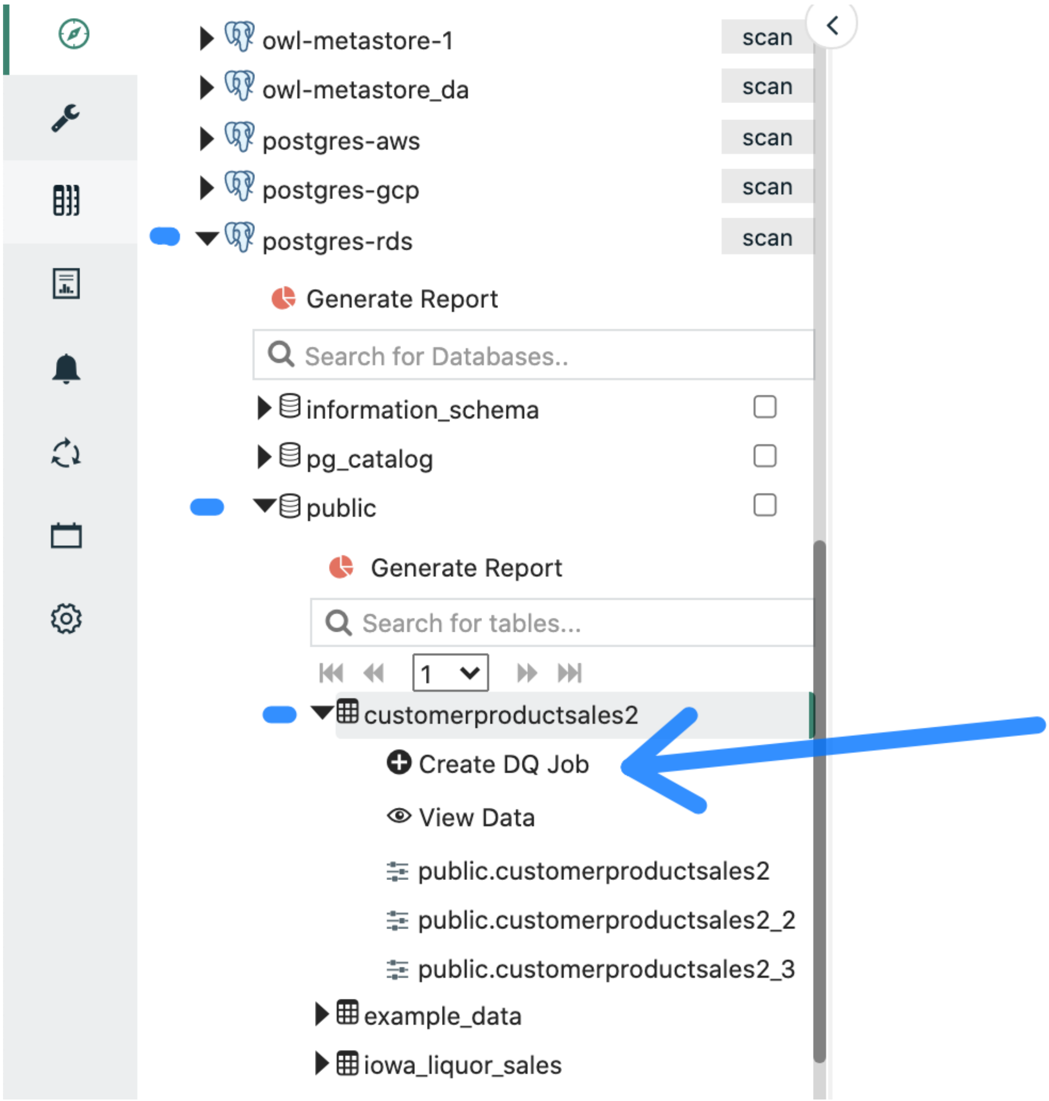
- Connect to Data
- Upload a File
- View Admin Options
- Read Docs
- Watch Videos

Note All UI functionality has corresponding API endpoints to define, run, and get results programmatically.

Select Your Data Source



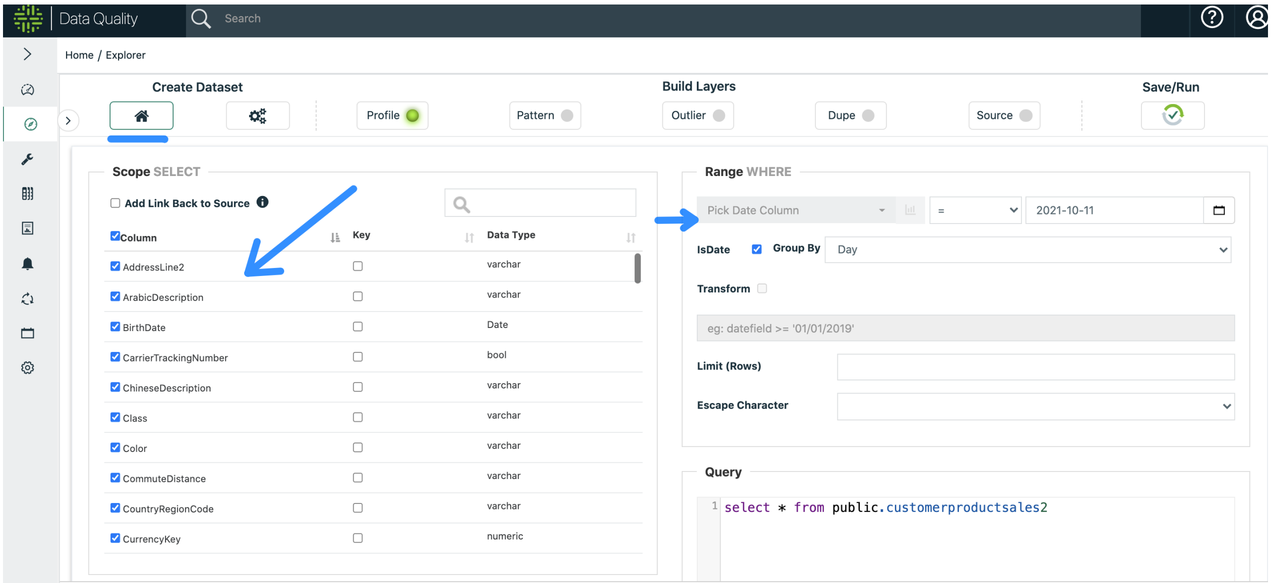
Create a new DQ Job by clicking +Create DQ Job



View Data is an interactive option to run queries and explore the data

The bar chart icon will take you to a profile page of the dataset created prior to Explorer 2

Select The Scope and Define a Query



Scope SELECT

□ Add Link Back to Source

☑Column	Key	Data Type
☑ AddressLine2	□	varchar
☑ ArabicDescription	□	varchar
☑ BirthDate	□	Date
☑ CarrierTrackingNumber	□	bool
☑ ChineseDescription	□	varchar
☑ Class	□	varchar
☑ Color	□	varchar
☑ CommuteDistance	□	varchar
☑ CountryRegionCode	□	varchar
☑ CurrencyKey	□	numeric

Range WHERE

Pick Date Column = 2021-10-11

IsDate ☑ Group By Day

Transform □

eg: datefield >= '01/01/2019'

Limit (Rows)

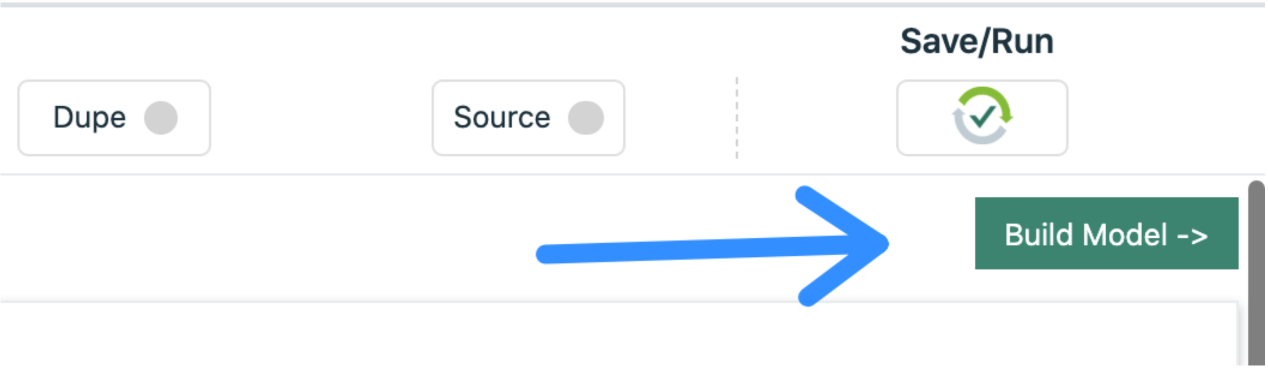
Escape Character

Query

```
select * from public.customerproductsales2
```

Pick Date Column if your dataset contains an appropriate time filter

Click Build Model -> to Save and Continue

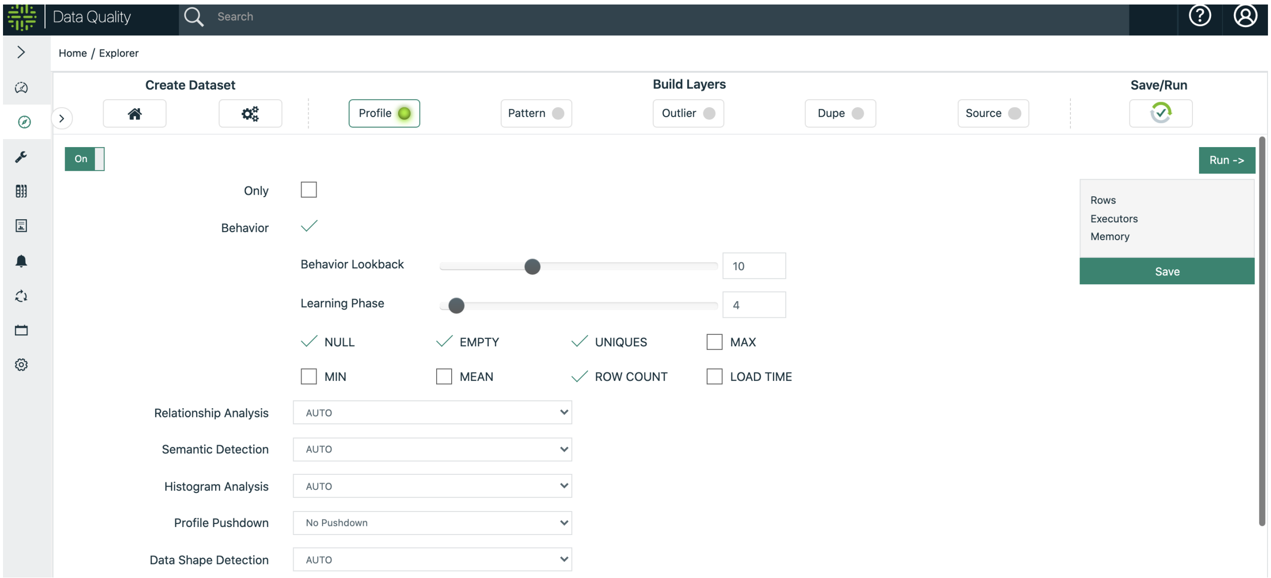


Transform Tab (advanced / optional)

Transform

Click Build Model -> to Save and Continue

Profile



On

Only □

Behavior ✓

Behavior Lookback 10

Learning Phase 4

✓ NULL ✓ EMPTY ✓ UNIQUES □ MAX

□ MIN □ MEAN ✓ ROW COUNT □ LOAD TIME

Relationship Analysis AUTO

Semantic Detection AUTO

Histogram Analysis AUTO

Profile Pushdown No Pushdown

Data Shape Detection AUTO

Use the drop-downs to enable different analysis. Best practice is to leave the defaults.

Pattern (advanced / optional)

Toggle on Pattern to enable this layer.

Click +Add to define a group and series of columns.

Patterns (advanced)

Click Save to and Click Outlier to Continue

Outlier (advanced / optional)

Outliers (advanced)

Click Save to and Click Dupe to Continue

Dupe (advanced / optional)

Duplicates (advanced)

Click Save to and Click Source to Continue

Source (advanced / optional)

Navigate to the source dataset.

Click Preview to interlace the columns.

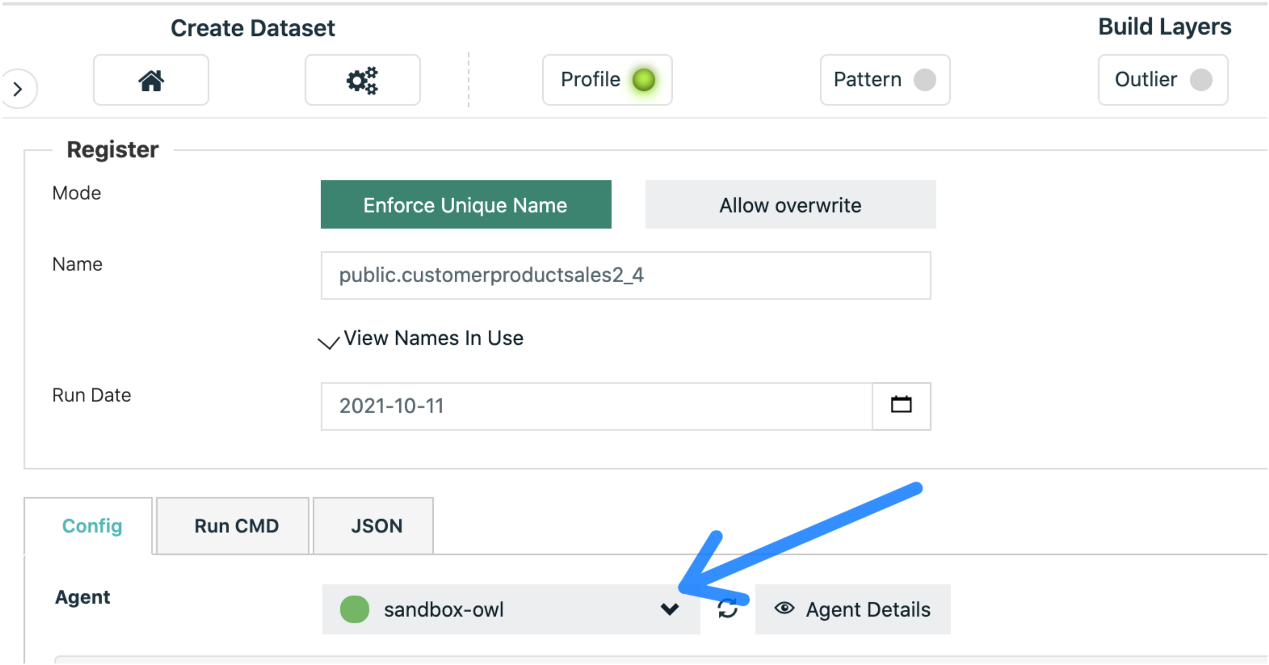
Manually map the columns by dragging left to right or deselect columns.

Source (advanced)

Click Save to and Click Save/Run to Continue

Run

1. Select an agent.
2. Click Estimate Job.
3. Click Run to start the job.



Create Dataset

Build Layers

Profile ● Pattern ● Outlier ●

Register

Mode: Enforce Unique Name | Allow overwrite

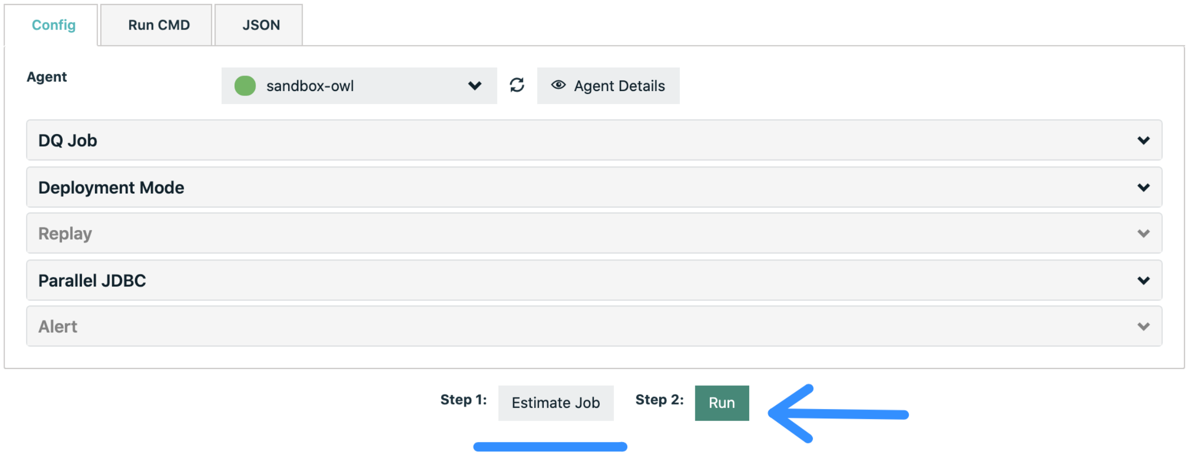
Name: public.customerproductsales2_4

View Names In Use

Run Date: 2021-10-11

Config | Run CMD | JSON

Agent: sandbox-owl | Agent Details



Config | Run CMD | JSON

Agent: sandbox-owl | Agent Details

DQ Job

Deployment Mode

Replay

Parallel JDBC

Alert

Step 1: Estimate Job

Step 2: Run

Note *If you do not see your agent, please verify the agent has been assigned to your connection via Adding a connection to a DQ Agent.

Canceling a DQ Job

If a DQ Job is in progress, incorrectly submitted, or stuck in Staged status, you can cancel the job by clicking the Actions drop-down list and selecting **Terminate job**. If you have an email address configured for alerts to be sent, two alerts are sent when a job is terminated.

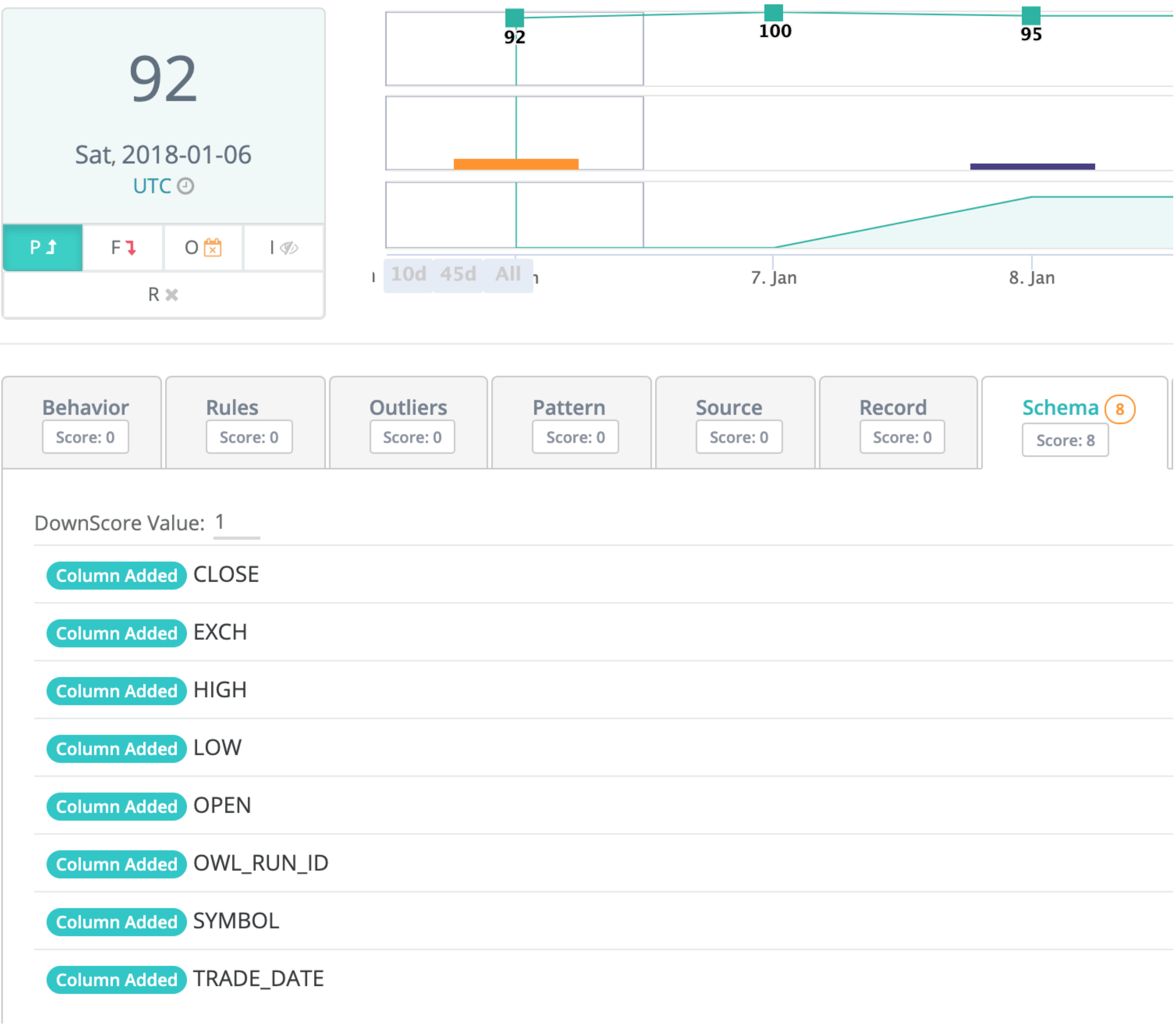
> **Note** Jobs in the Spark UI display a Finished status when terminated, even though they are terminated from the Collibra DQ UI.

Schema (automatic)

Detect schema evolution and unexpected schema changes.

Data set schemas are the columns or fields that define the dataset. They are often located in the header row of a tabular file or database table. However, JSON and XML are two examples of formats that include schema columns that are not in the header but rather nested throughout the document. OwlDQ automatically without needing to turn on any features detects the schema columns as well as reads or infers their data types (varchar, string, double, decimal, int, date, timestamp, etc.). Owl observes each data set so if a column is ever altered, removed or added it will automatically raise the event via its standard composite scoring system.

Scoring... Alerting... Schema Detection... Automatically



DownScore Value: 1

Column Added CLOSE

Column Added EXCH

Column Added HIGH

Column Added LOW

Column Added OPEN

Column Added OWL_RUN_ID

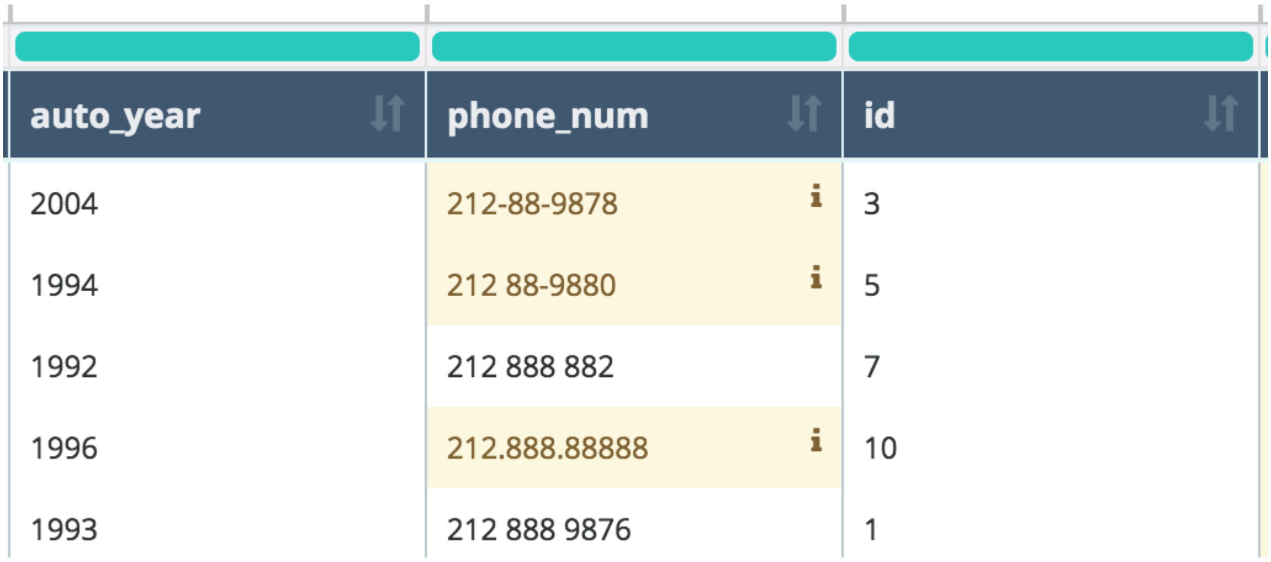
Column Added SYMBOL

Column Added TRADE_DATE

Schema Evolution is one of Owl's 9 DQ dimensions. It can be an important measurement for data stewards to understand how the data set is changing overtime. The orange bar on the chart shows a change in schema and allows for drilling in over time.

Shapes (automatic)

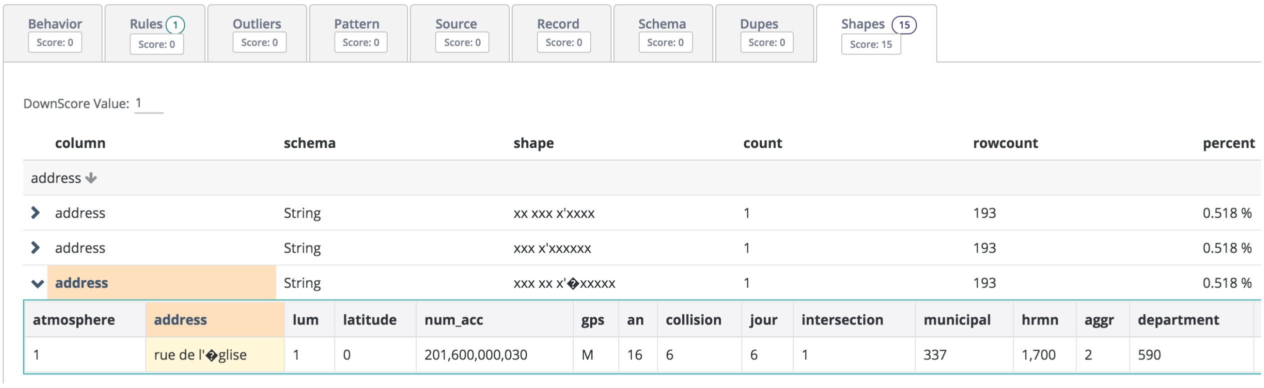
Collibra Data Quality automatically detects inconsistencies in data formats. These inconsistencies are where Data Scientists spend an enormous amount of time cleaning the data before building a ML model. Many reports have documented that over 80% of the time it takes to build a credible model comes from first understanding all the different formats and then writing munging or ETL style code to clean it before processing. What about all the patterns the process or person doesn't even know about?



auto_year	phone_num	id
2004	212-88-9878 ℹ	3
1994	212 88-9880 ℹ	5
1992	212 888 882	7
1996	212.888.88888 ℹ	10
1993	212 888 9876	1

Drill-in to any Shape anomaly and see a visual example

See an itemized list view of the most infrequent or odd shapes in your datasets.



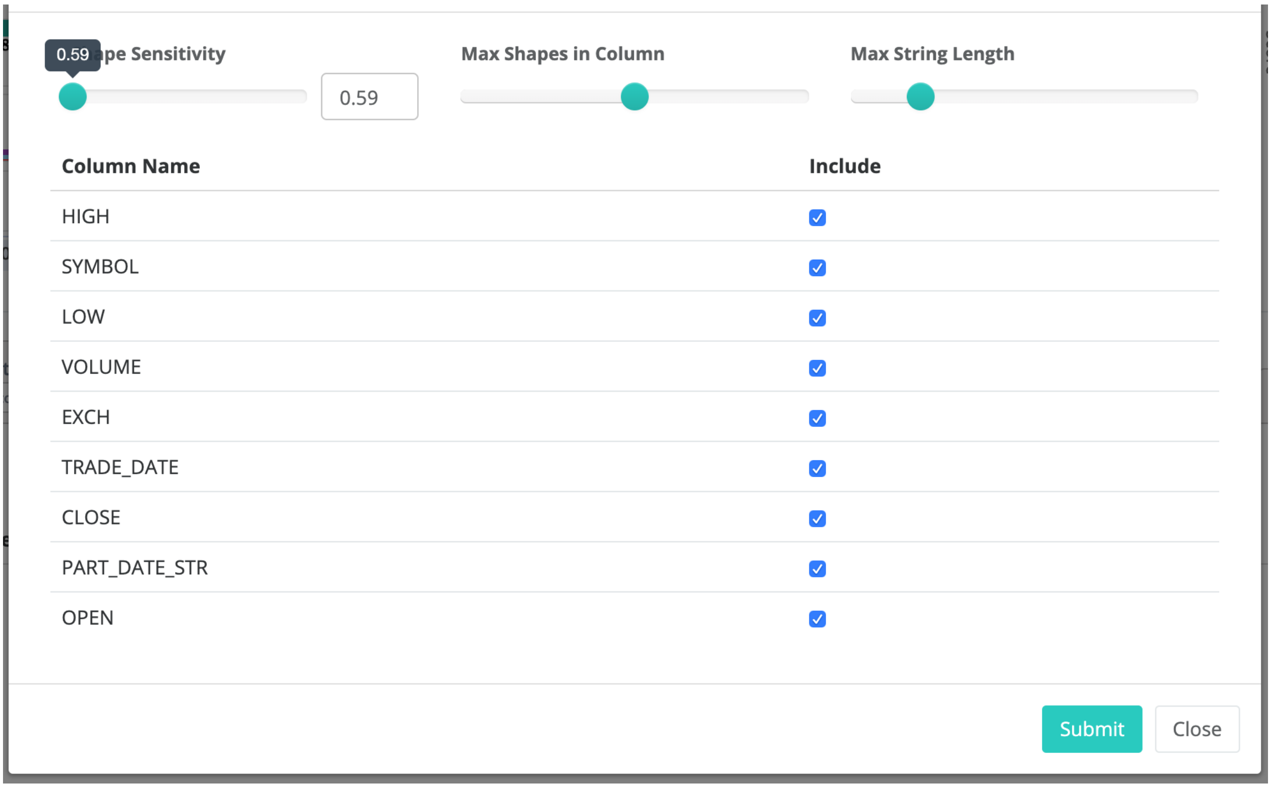
DownScore Value: 1

	column	schema	shape	count	rowcount	percent
address ↓						
›	address	String	xx xxx x'xxxx	1	193	0.518 %
›	address	String	xxx x'xxxxxx	1	193	0.518 %
⌄	**address**	String	xxx xx x'�xxxxx	1	193	0.518 %

atmosphere	address	lum	latitude	num_acc	gps	an	collision	jour	intersection	municipal	hrmn	aggr	department
1	rue de l'�glise	1	0	201,600,000,030	M	16	6	6	1	337	1,700	2	590

Shape Tuning

By clicking the gear icon in the upper right corner of the SHAPE tab on the HOOT page.



Column Name	Include
HIGH	☑
SYMBOL	☑
LOW	☑
VOLUME	☑
EXCH	☑
TRADE_DATE	☑
CLOSE	☑
PART_DATE_STR	☑
OPEN	☑

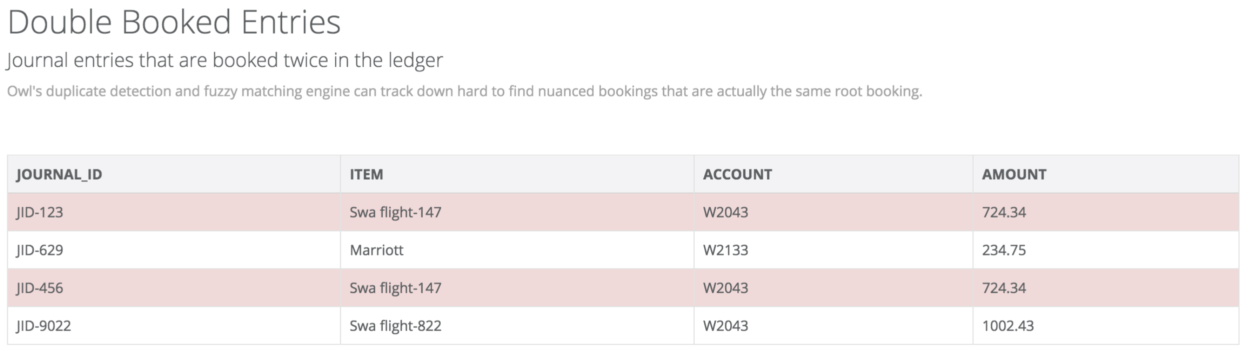
Duplicates (advanced)

This is an advanced opt-in feature.

General Ledger. Accounting use-case

https://owl-analytics.com/general-ledger

Whether you're looking for a fuzzy matching percent or single client cleanup, Owl's duplicate detection can help you sort and rank the likelihood of duplicate data.



Double Booked Entries

Journal entries that are booked twice in the ledger

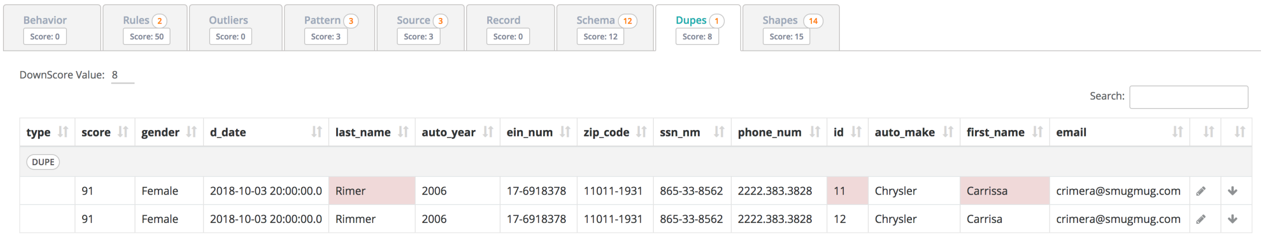
Owl's duplicate detection and fuzzy matching engine can track down hard to find nuanced bookings that are actually the same root booking.

JOURNAL_ID	ITEM	ACCOUNT	AMOUNT
JID-123	Swa flight-147	W2043	724.34
JID-629	Marriott	W2133	234.75
JID-456	Swa flight-147	W2043	724.34
JID-9022	Swa flight-822	W2043	1002.43

```
-f "file:///home/ec2-user/single_customer.csv" \
-d "," \
-ds customers \
-rd 2018-01-08 \
-dupe \
-dupenocase \
-depth 4
```

User Table has duplicate user entry

Carrisa Rimmer vs Carrissa Rimer

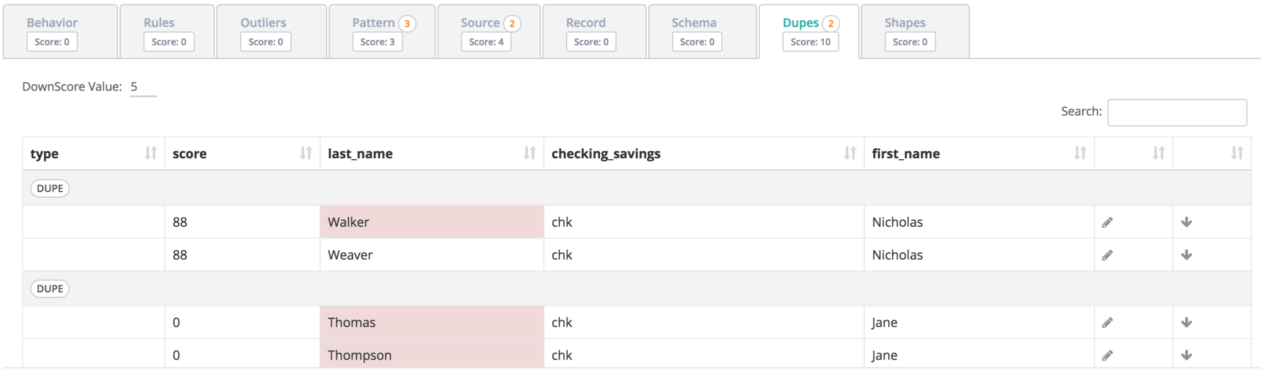


DownScore Value: 8

type	score	gender	d_date	last_name	auto_year	ein_num	zip_code	ssn_nm	phone_num	id	auto_make	first_name	email		
DUPE															
	91	Female	2018-10-03 20:00:00.0	Rimer	2006	17-6918378	11011-1931	865-33-8562	2222.383.3828	11	Chrysler	Carrissa	crimera@smugmug.com	✎	↓
	91	Female	2018-10-03 20:00:00.0	Rimmer	2006	17-6918378	11011-1931	865-33-8562	2222.383.3828	12	Chrysler	Carrisa	crimera@smugmug.com	✎	↓

ATM customer data with only a 88% match

As you can see below, less than a 90% match in most cases is a false positive. Each dataset is a bit different, but in many cases you should tune your duplicates to roughly a 90+% match for interesting findings.



DownScore Value: 5

type	score	last_name	checking_savings	first_name		
DUPE						
	88	Walker	chk	Nicholas	✎	↓
	88	Weaver	chk	Nicholas	✎	↓
DUPE						
	0	Thomas	chk	Jane	✎	↓
	0	Thompson	chk	Jane	✎	↓

Simple DataFrame Example

```
val l = Seq(
  ("Kirk", "Haslbeck", "2018-02-24 8:30:45", 18),
  ("Kirk", "Hasselbach", "2018-02-23 8:30:45", 11),
  ("Kirt", "Haslbeck", "2018-02-22 8:30:45", 10),
  ("Kirk", "hasselback", "2018-02-21 8:30:45", 12),
  ("kirk", "Haslbeck", "2018-02-20 8:30:45", 10)
)

val df = l.toDF("fname","lname", "app_date", "price")
val owl = new Owl(df).dupesDF
```

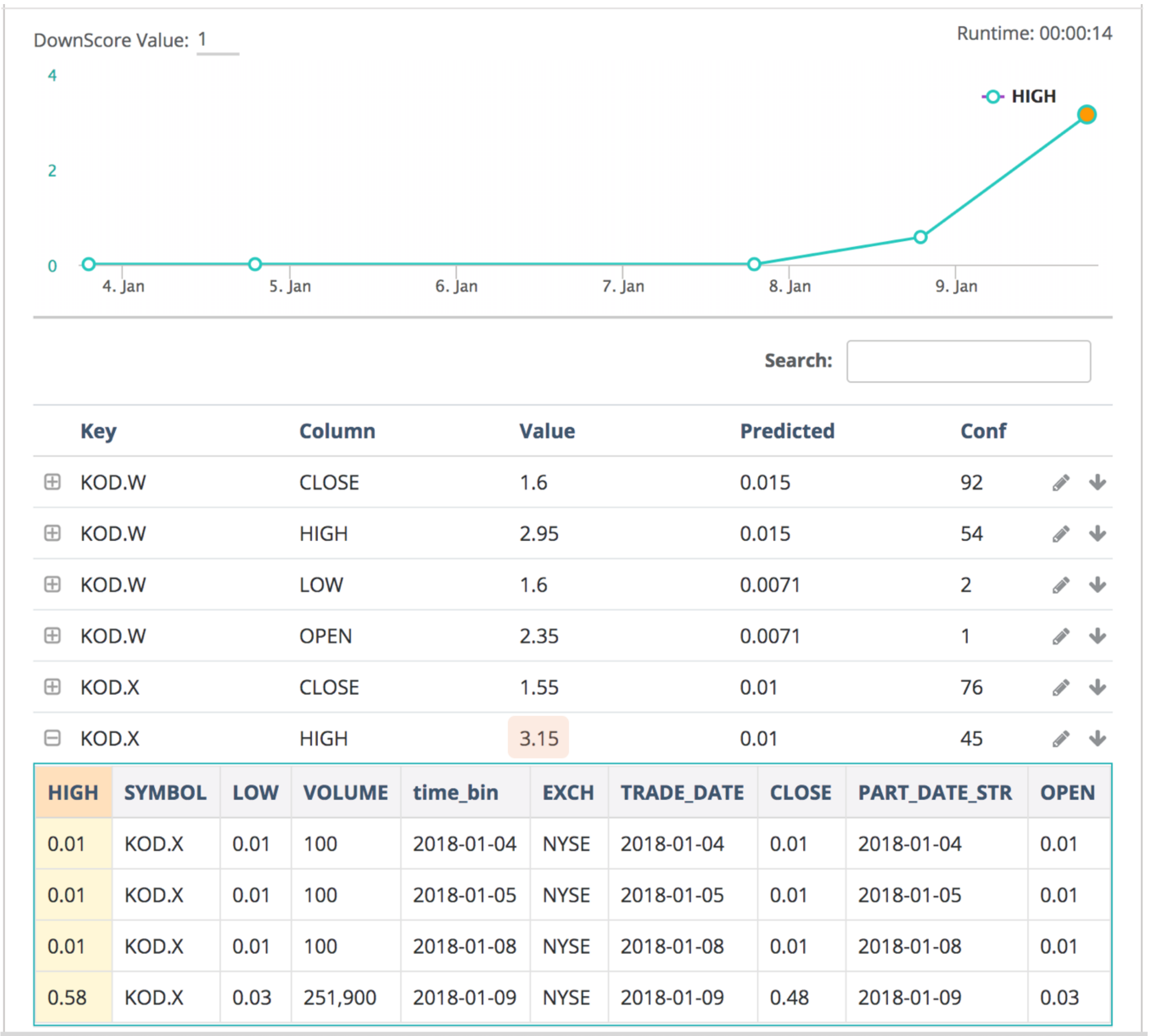
distance	records
0.16	DUPE [score: 83][Kirk,Hasselbach,2018-02-23 8:30:45] [Kirt,Haslbeck,2018-02-22 8:30:45]
0.083	DUPE [score: 91][Kirk,Haslbeck,2018-02-24 8:30:45] [Kirt,Haslbeck,2018-02-22 8:30:45]
0.083	DUPE [score: 91][Kirk,Haslbeck,2018-02-24 8:30:45] [Kirk,Hasselbach,2018-02-23 8:30:45]

Outliers (advanced)

> **Note** This is an advanced opt-in feature.

Numerical Outliers

Kodak Coin! In 2018 Kodak announced themselves as Kodak Coin and witnessed a steep change in their stock price. Collibra Data Quality automatically captured this event and provided the ability to drill into the item.



DownScore Value: 1

Runtime: 00:00:14

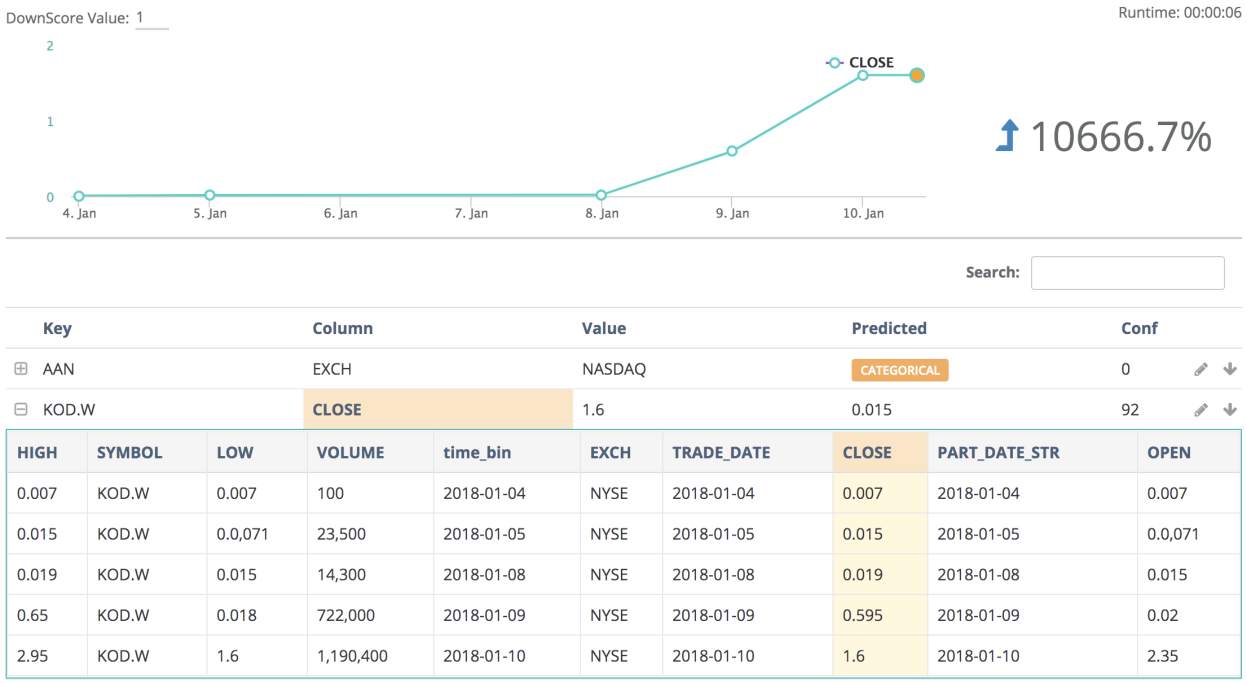
Search:

	Key	Column	Value	Predicted	Conf	
⊞	KOD.W	CLOSE	1.6	0.015	92	✎ ↓
⊞	KOD.W	HIGH	2.95	0.015	54	✎ ↓
⊞	KOD.W	LOW	1.6	0.0071	2	✎ ↓
⊞	KOD.W	OPEN	2.35	0.0071	1	✎ ↓
⊞	KOD.X	CLOSE	1.55	0.01	76	✎ ↓
⊟	KOD.X	HIGH	3.15	0.01	45	✎ ↓

HIGH	SYMBOL	LOW	VOLUME	time_bin	EXCH	TRADE_DATE	CLOSE	PART_DATE_STR	OPEN
0.01	KOD.X	0.01	100	2018-01-04	NYSE	2018-01-04	0.01	2018-01-04	0.01
0.01	KOD.X	0.01	100	2018-01-05	NYSE	2018-01-05	0.01	2018-01-05	0.01
0.01	KOD.X	0.01	100	2018-01-08	NYSE	2018-01-08	0.01	2018-01-08	0.01
0.58	KOD.X	0.03	251,900	2018-01-09	NYSE	2018-01-09	0.48	2018-01-09	0.03

Complex outliers made Simple

Even though DQ uses complex formulas to identify the correct outliers in a dataset, it uses simple terms when displaying them. If you notice below the change happened gradually, therefore if you only compared avgs or previous values you would not understand the full impact of this price change. 0% changed from yesterday and its moving/trailing avg would have caught up.



	Key	Column	Value	Predicted	Conf
⊞	AAN	EXCH	NASDAQ	CATEGORICAL	0
⊟	KOD.W	CLOSE	1.6	0.015	92

HIGH	SYMBOL	LOW	VOLUME	time_bin	EXCH	TRADE_DATE	CLOSE	PART_DATE_STR	OPEN
0.007	KOD.W	0.007	100	2018-01-04	NYSE	2018-01-04	0.007	2018-01-04	0.007
0.015	KOD.W	0.0,071	23,500	2018-01-05	NYSE	2018-01-05	0.015	2018-01-05	0.0,071
0.019	KOD.W	0.015	14,300	2018-01-08	NYSE	2018-01-08	0.019	2018-01-08	0.015
0.65	KOD.W	0.018	722,000	2018-01-09	NYSE	2018-01-09	0.595	2018-01-09	0.02
2.95	KOD.W	1.6	1,190,400	2018-01-10	NYSE	2018-01-10	1.6	2018-01-10	2.35

Dynamic history options

Data may not always enter your data pipeline on time and as expected due to weekend, holidays, errors, etc. To help capture outliers in spite of gaps, there are two main options:

- 1) Extend the lookback period (to 10 days from 5 days, for example)
- 2) Utilize additional flags per below (fllbminrow new as of 2021.11)

Flag	Description	Example
fllbminrow	File Lookback Minimum Rows: determines minimum number of rows that a previous file scan needs to be counted as file lookback	-fllbminrow 1 (counts nay DQ scans with 1 or more row in minimum history) -fllbminrow 0 (default behavior, row count does not matter)
dllb	Date Lookback: determines how many days of learning	-dllb 5 (5 days)

Upper & Lower Bound Limits

Collibra DQ automatically detects and flags data that falls outside of preset **Upper Bound** or **Lower Bound** limits. If data is detected outside of these limits, an alert is generated to notify of an outlier. Setting these limits allows you to finetune your ability to identify outliers.

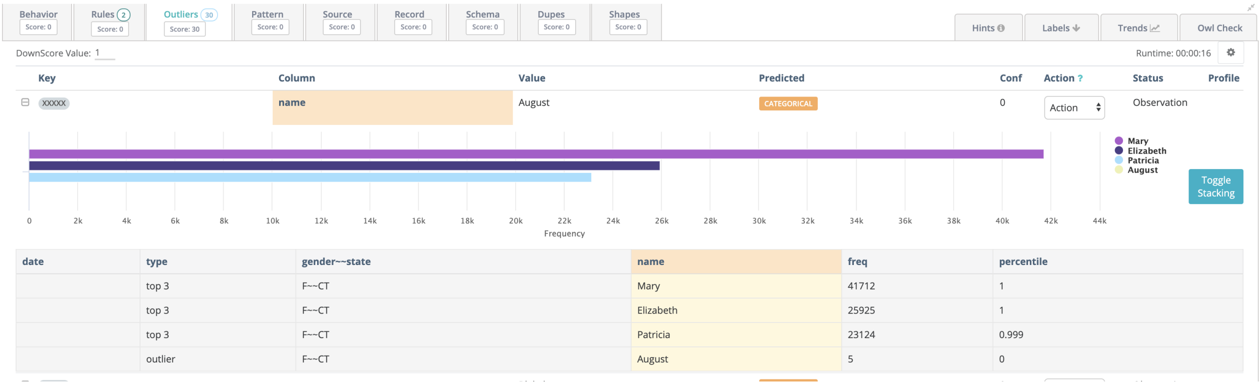
Categorical Outliers

Categorical Outliers are much different than numerical outliers and require separate techniques to automatically capture meaningful anomalies. The details regarding Owl's methodology and testing can be found below, 3 minute read on the topic.

Categorical Outliers Don't Exist

DQ will automatically learn the normal behavior of your String and Categorical attributes such as STOCK,OPTION,FUTURE or state codes such as MD,NC,D.C. When a strange pattern occurs (e.g NYC instead of NY), DQ will show this as a categorical outlier.

DQ is able to detect Categorical Outliers both with and without taking time into account. If a time dimension is not provided, DQ will calculate the distribution of categorical values within the available data, and identify the values that fall into the most infrequent percentile (configurable).



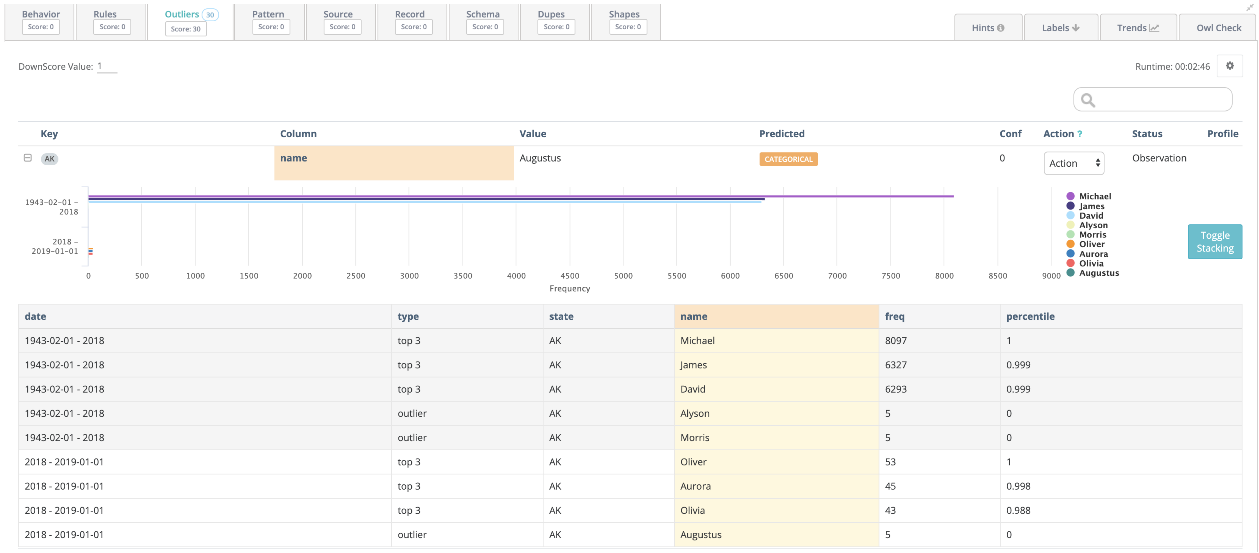
DownScore Value: 1

Runtime: 00:00:16

Key	Column	Value	Predicted	Conf	Action ?	Status	Profile
XXXXX	name	August	CATEGORICAL	0	Action	Observation	

date	type	gender~~state	name	freq	percentile
	top 3	F~~CT	Mary	41712	1
	top 3	F~~CT	Elizabeth	25925	1
	top 3	F~~CT	Patricia	23124	0.999
	outlier	F~~CT	August	5	0

If a time dimension is provided, DQ will first identify infrequent categories in the historical context and then in the context of the current Owlcheck. Only values that are historically infrequent or non-existent, and are infrequent in the current run will be considered Outliers.



DownScore Value: 1

Runtime: 00:02:46

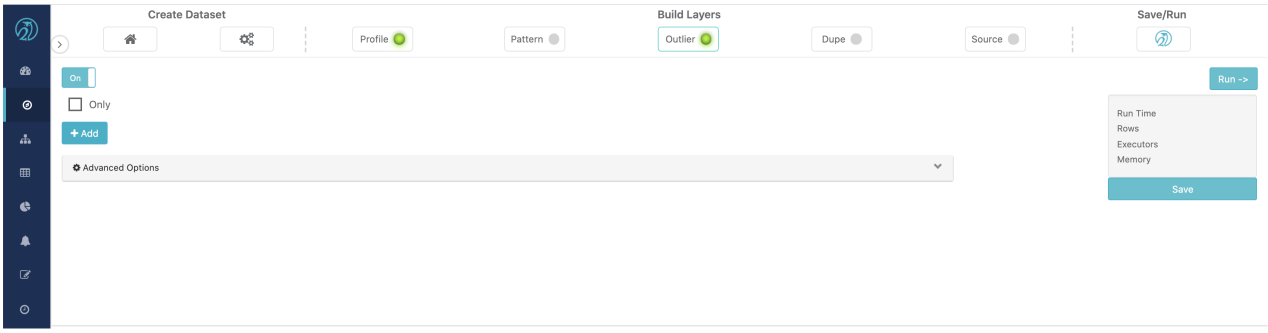
Key	Column	Value	Predicted	Conf	Action ?	Status	Profile
AK	name	Augustus	CATEGORICAL	0	Action	Observation	

date	type	state	name	freq	percentile
1943-02-01 - 2018	top 3	AK	Michael	8097	1
1943-02-01 - 2018	top 3	AK	James	6327	0.999
1943-02-01 - 2018	top 3	AK	David	6293	0.999
1943-02-01 - 2018	outlier	AK	Alyson	5	0
1943-02-01 - 2018	outlier	AK	Morris	5	0
2018 - 2019-01-01	top 3	AK	Oliver	53	1
2018 - 2019-01-01	top 3	AK	Aurora	45	0.998
2018 - 2019-01-01	top 3	AK	Olivia	43	0.988
2018 - 2019-01-01	outlier	AK	Augustus	5	0

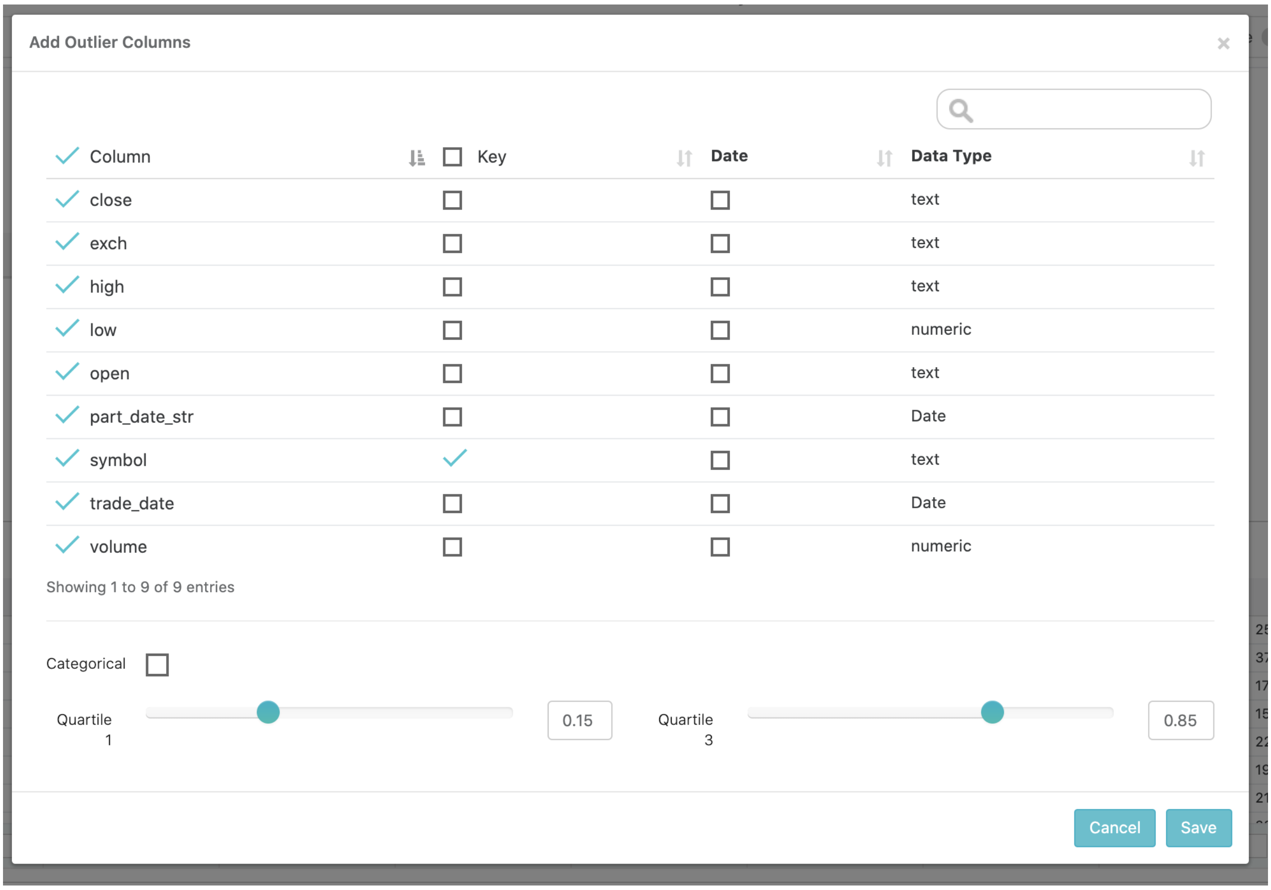
Training Outlier Detection Model

Although DQ uses different techniques to detect Numerical and Categorical Outliers, the training process is very similar.

At a minimum, DQ requires historical data that can be used as the training dataset. If no other input is provided, DQ will calculate the normal range for each selected column and look for numerical and categorical outliers within the training dataset without any further context. The output will essentially consist of infrequent values that fall outside the normal range fo each column.



To obtain more targeted results, the DQ requires a "key" column. This column will be used to provide context by grouping each column by the key column. Defining a good key column tends to provide results that are a better indicators of actual data quality issues instead of simply infrequent values.


Add Outlier Columns

✓ Column	☐ Key	Date	Data Type
✓ close	☐	☐	text
✓ exch	☐	☐	text
✓ high	☐	☐	text
✓ low	☐	☐	numeric
✓ open	☐	☐	text
✓ part_date_str	☐	☐	Date
✓ symbol	✓	☐	text
✓ trade_date	☐	☐	Date
✓ volume	☐	☐	numeric

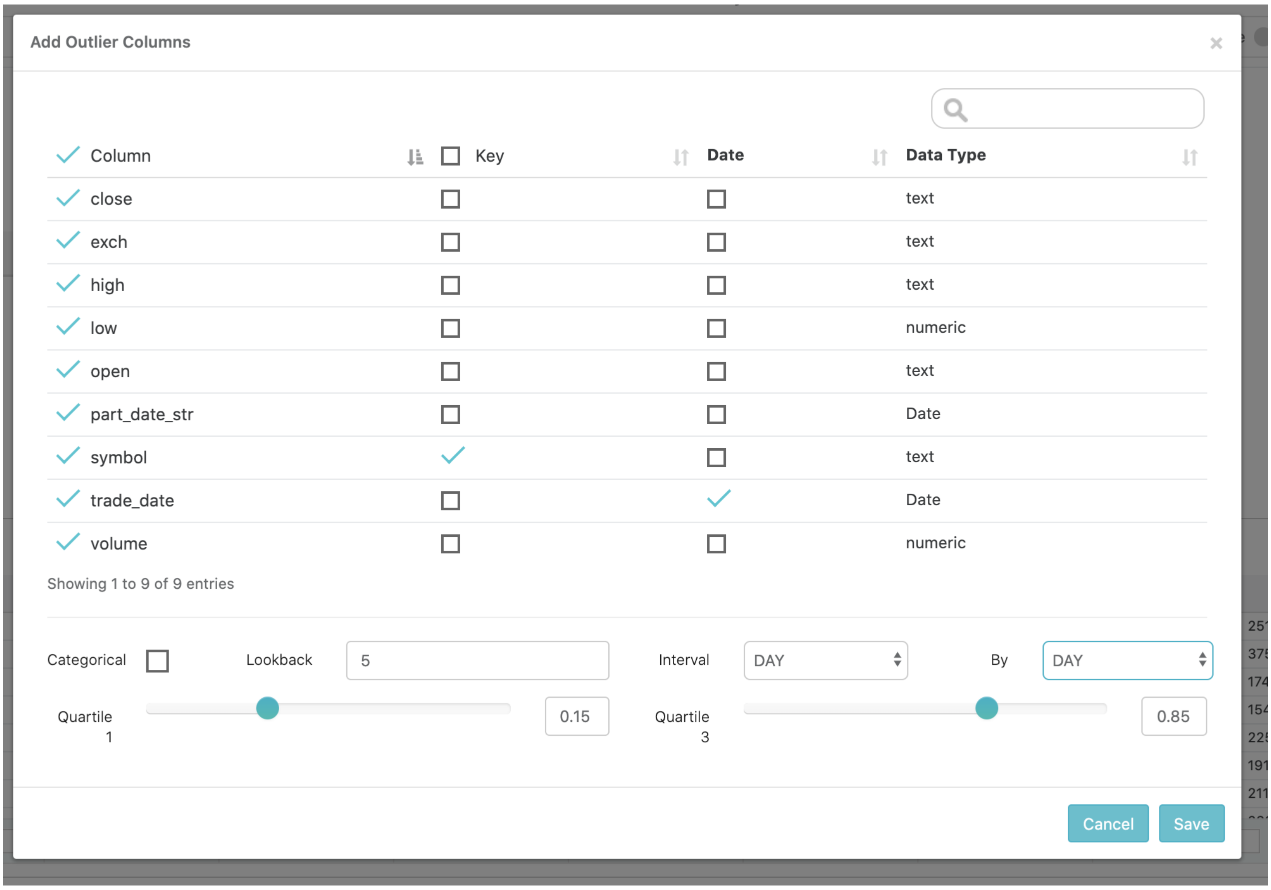
Showing 1 to 9 of 9 entries

Categorical ☐

Quartile 1: 0.15

Quartile 3: 0.85

Another input that can make outlier detection more precise is a data/time column and a look back period. This enables a more precise calculation of the normal range for a column and in the case of numerical outliers, makes it possible for DQ to establish a trend. Given a time column and key column, DQ will not only identify numerical outliers, it will plot the historical trend of the column value trailing the outlier.



Add Outlier Columns

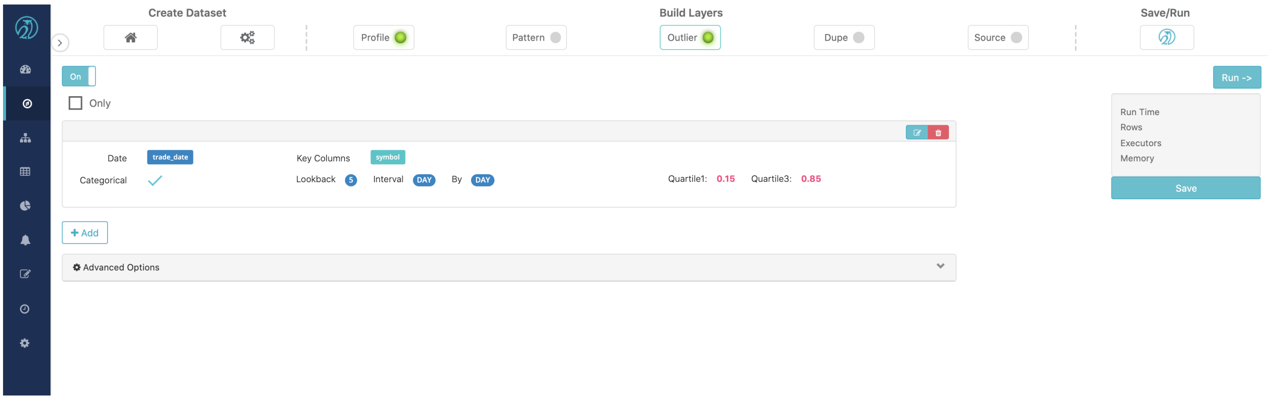
✓ Column	□ Key	Date	Data Type
✓ close	□	□	text
✓ exch	□	□	text
✓ high	□	□	text
✓ low	□	□	numeric
✓ open	□	□	text
✓ part_date_str	□	□	Date
✓ symbol	✓	□	text
✓ trade_date	□	✓	Date
✓ volume	□	□	numeric

Showing 1 to 9 of 9 entries

Categorical □ Lookback 5 Interval DAY By DAY

Quartile 1 0.15 Quartile 3 0.85

DQ also allows further refinement of the time dimension by defining time bins and processing intervals. By default, when given a time column, DQ will bin the data into days and process the data in daily interval. However, if the data is high frequency, day bins and day intervals might be too coarse grained. In this case, it might make more sense to group the data into bins on the minute and process the data in hour or minute intervals. The same concept applies in the other direction. What if the data is already aggregated on the month or year? In this case, it makes more sense to set the bins and intervals to month by month or month by year.



□ Only

Date: trade_date

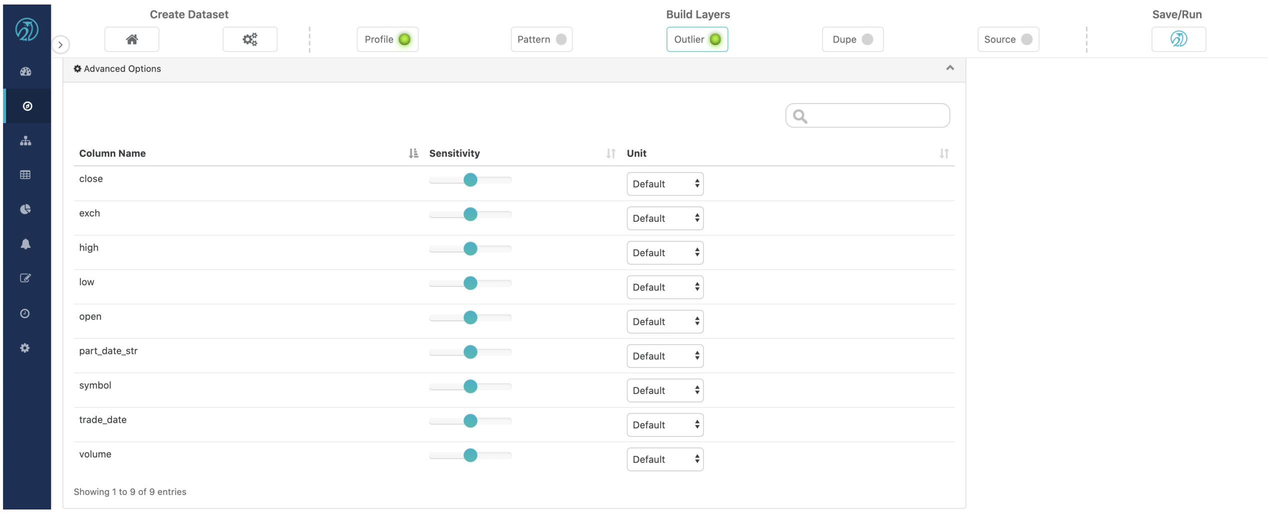
Key Columns: symbol

Categorical: ✓

Lookback 5 Interval DAY By DAY

Quartile1: 0.15 Quartile3: 0.85

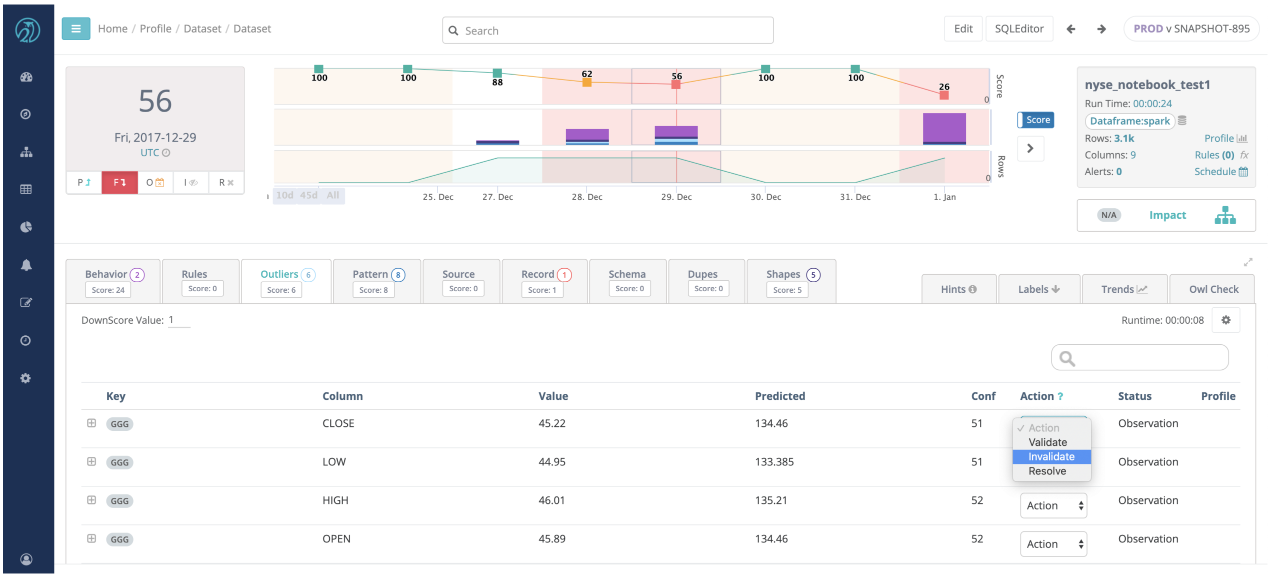
Some data may be measured in really small or large units or contain a lot of noise. In this case, DQ allows the user to adjust the sensitivity level and unit of measure for outlier detection on each column. Click the advanced tab to make these adjustments.



Column Name	Sensitivity	Unit
close		Default
exch		Default
high		Default
low		Default
open		Default
part_date_str		Default
symbol		Default
trade_date		Default
volume		Default

Showing 1 to 9 of 9 entries

Once Outlier detection is complete for a given run, it's time to tune the scoring of the model. DQ allows the user to label any outlier findings as legitimate, thus preventing that outlier from being detected in the future or effecting the score of the current run. In addition, it is possible to define the significance of an outlier finding to a given dataset. This can be accomplished by setting how many quality points should be deducted for each outlier finding on any given run on that dataset. It is also possibly to adjust sensitivity and unit of measure of future runs by clicking on the small gear icon on the far left of the screen.



nyse_notebook_test1
Run Time: 00:00:24
Dataframe:spark
Rows: 3.1k
Columns: 9
Alerts: 0
Profile
Rules (0)
Schedule

DownScore Value: 1

Runtime: 00:00:08

Key	Column	Value	Predicted	Conf	Action ?	Status	Profile
GGG	CLOSE	45.22	134.46	51	Action	Observation	
GGG	LOW	44.95	133.385	51		Observation	
GGG	HIGH	46.01	135.21	52	Action	Observation	
GGG	OPEN	45.89	134.46	52	Action	Observation	

Spark DataFrame Example

Categorical Outliers

```
val assetClass =
Seq("STOCK","OPTION","FUTURE","STOCK","OPTION","FUTURE","STOCK","STOCK", "FUTURE",
    "STOCK","OPTION","FUTURE","STOCK","OPTION","FUTURE","STOCK","STOCK", "FUTURE",
    "STOCK","OPTION","FUTURE","STOCK","OPTION","FUTURE","STOCK","STOCK", "FUTURE",
    "STOCK","OPTION","FUTURE","STOCK","OPTION","FUTURE","STOCK","STOCK", "FUTURE",
    "STOCK","OPTION","FUTURE","STOCK","OPTION","FUTURE","STOCK","STOCK", "FUTURE",
    "STOCK","OPTION","FUTURE","STOCK","OPTION","FUTURE","STOCK","STOCK", "FUTURE",
    "SWAP", "OPTION", "STOCK","SWAP", "SWAP", "FUTRS", "STOCK", "OPTION","FUTURE",
    "OPTION", "STOCK" )

val df = assetClass.toDF("ASSET")
val outliers = new Owl(df).outliersDF("ASSET")
```

Key	Column	Value	Prediction	Confidence
	ASSET	FUTRS	FUTURES	

Real World Example

Imagine you are the data manager at Iowa Department of Commerce, Alcoholic Beverage Division. As part of the Department's open data initiative, the monthly Iowa liquor sales data are available to the public for analysis. (Thank you Iowa!)

An Iowan data analyst emails you about a data quality issue with **address** for store #2508 in the year 2016. You quickly run a SQL query on your data warehouse to see what is going on.

```
-- Assuming Postgres DB
select date_trunc('MONTH', "date") "date_month", address, count
(*) "sales_count"
from iowa_liquor_sales
where "date" >= '2016-01-01' and "date" < '2017-01-01' and
store_number = '2508'
group by date_trunc('MONTH', "date"), address
order by date_month, address
```

date_month	address	sales_count
2016-01-01 00:00:00	1843 JOHNSON AVENUE, N.W.	422
2016-02-01 00:00:00	1843 JOHNSON AVENUE, N.W.	451
2016-03-01 00:00:00	1843 JOHNSON AVENUE, N.W.	579
2016-04-01 00:00:00	1843 JOHNSON AVENUE, N.W.	404
2016-05-01 00:00:00	1843 Johnson Avenue, N.W.	625
2016-06-01 00:00:00	1843 Johnson Avenue, N.W.	695
2016-07-01 00:00:00	1843 Johnson Avenue, N.W.	457
2016-08-01 00:00:00	1843 Johnson Avenue, N.W.	744
2016-09-01 00:00:00	1843 Johnson Avenue, N.W.	681
2016-10-01 00:00:00	1843 Johnson Avenue, N.W.	728
2016-11-01 00:00:00	1843 Johnson Avenue, N.W.	1062
2016-12-01 00:00:00	1843 Johnson Avenue, N.W.	992

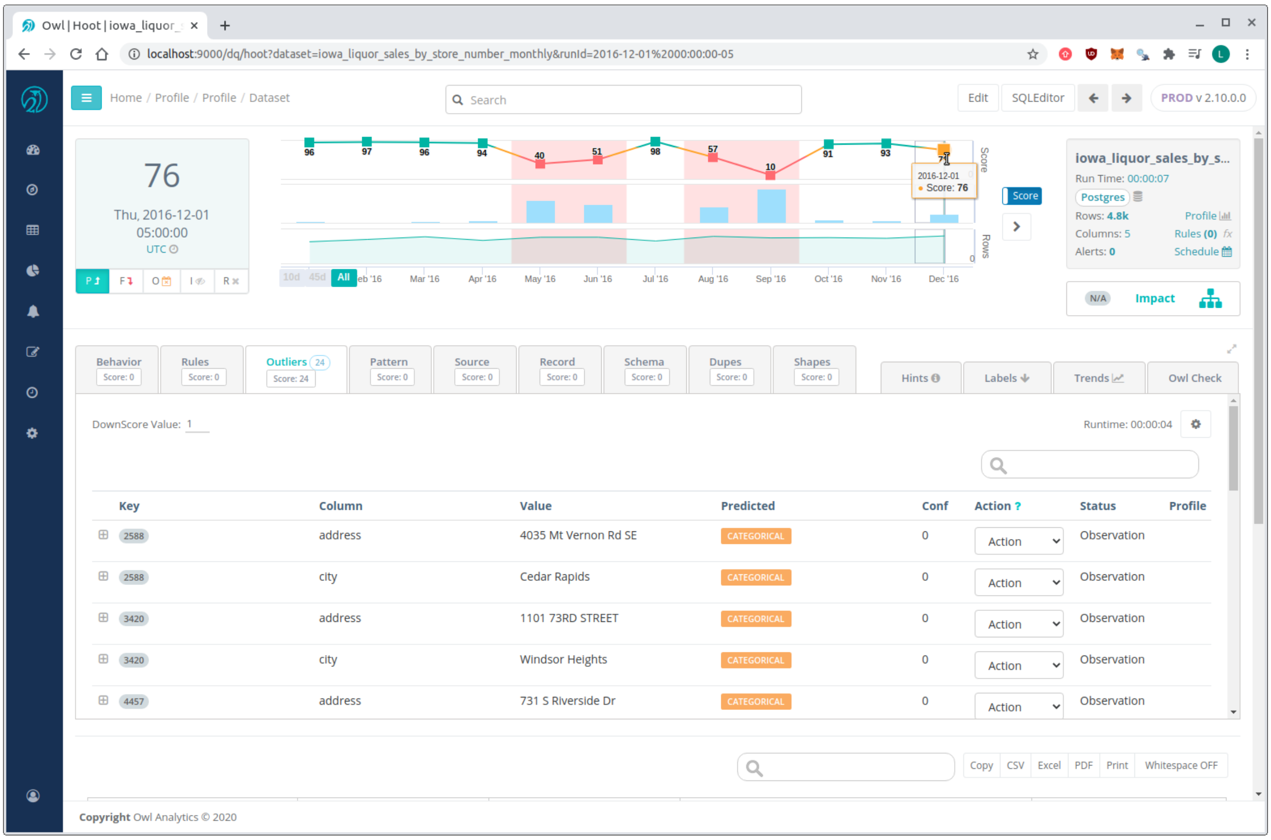
Because `store_number` is an unique number assigned to the store who ordered the liquor, the inconsistent `address` values for the same store pose data quality problem. But `address` is a string value that can take many forms. For store #2508, the reported address value has a shifted behavior from all capital letters starting on May 2016. For other cases, it might be completely different behavior change that you would have to manually check one by one. With over 2,000 unique stores, 19 million rows, and 8 years of data, you need an automated way to detect meaningful categorical outliers.

The following command shows an example of running monthly OwlDQ Checks, from the month of Jan 2016 to the month of December 2016. Each monthly run looks back 3 months of data to establish a baseline for categorical columns that you suspect would have similar data quality issues: `store_name`, `address`, and`city`.

```
/opt/owl/bin/owlcheck
  # connection information to data
  -lib "/opt/owl/drivers/postgres/" -driver "org.-
postgresql.Driver"
  -c, "jdbc:postgresql://localhost:5432/postgres"
  -u, "postgres", "-p", "password"
  # Specify dataset name
  -ds "iowa_liquor_sales_by_store_number_monthly"
  # Specify date filter for the last filter, e.g. date >= '2016-
12-01' and date < '2017-01-01'
  -rd "2016-12-01" -rdEnd "2017-01-01"
  # SQL query template (${rd} and ${rdEnd} matches with -rd and
-rdEnd
  -q "select distinct on (date, store_number) date, store_num-
ber, store_name, address, city
       from iowa_liquor_sales where date >= '${rd}' and date <
'${rdEnd}' "
  # Turn on Outliers
  -dl
  # Group on store_number (optional if no grouping)
  -dlkey "store_number"
  # Specify column that is of date type (optional, if running
OwlCheck without time context)
  -dc "date"
  # Specify columns to run Outlier analysis (if not specified,
all the columns in query are included in analysis)
  -dlinc "store_name,address,city"
  # Specify 3 month lookback for each OwlCheck
  -dllb 3
  # Run Monthly OwlCheck
  -tbin "MONTH"
  # "backrun" Convenient way to run 12 preceding MONTHly owl
check
  -br 12
```

Results

The `-br 12` option ran 12 monthly OwlChecks for every month of 2016. The figure below shows OwlCheck Hoot page for the lastest run of dataset `iowa_liquor_sales_by_store_numbers_monthly`. The Hoot page shows that OwlCheck identified 24 Outliers among 4.8k rows of unique date x store_number for month of December, 2016.



localhost:9000/dq/hoot?dataset=iowa_liquor_sales_by_store_number_monthly&runId=2016-12-01%2000:00:00-05

76

Thu, 2016-12-01
05:00:00
UTC

iowa_liquor_sales_by_s...
Run Time: 00:00:07
Rows: 4.8k
Columns: 5
Alerts: 0

DownScore Value: 1

Runtime: 00:00:04

Key	Column	Value	Predicted	Conf	Action ?	Status	Profile
⊞ 2588	address	4035 Mt Vernon Rd SE	CATEGORICAL	0	Action	Observation	
⊞ 2588	city	Cedar Rapids	CATEGORICAL	0	Action	Observation	
⊞ 3420	address	1101 73RD STREET	CATEGORICAL	0	Action	Observation	
⊞ 3420	city	Windsor Heights	CATEGORICAL	0	Action	Observation	
⊞ 4457	address	731 S Riverside Dr	CATEGORICAL	0	Action	Observation	

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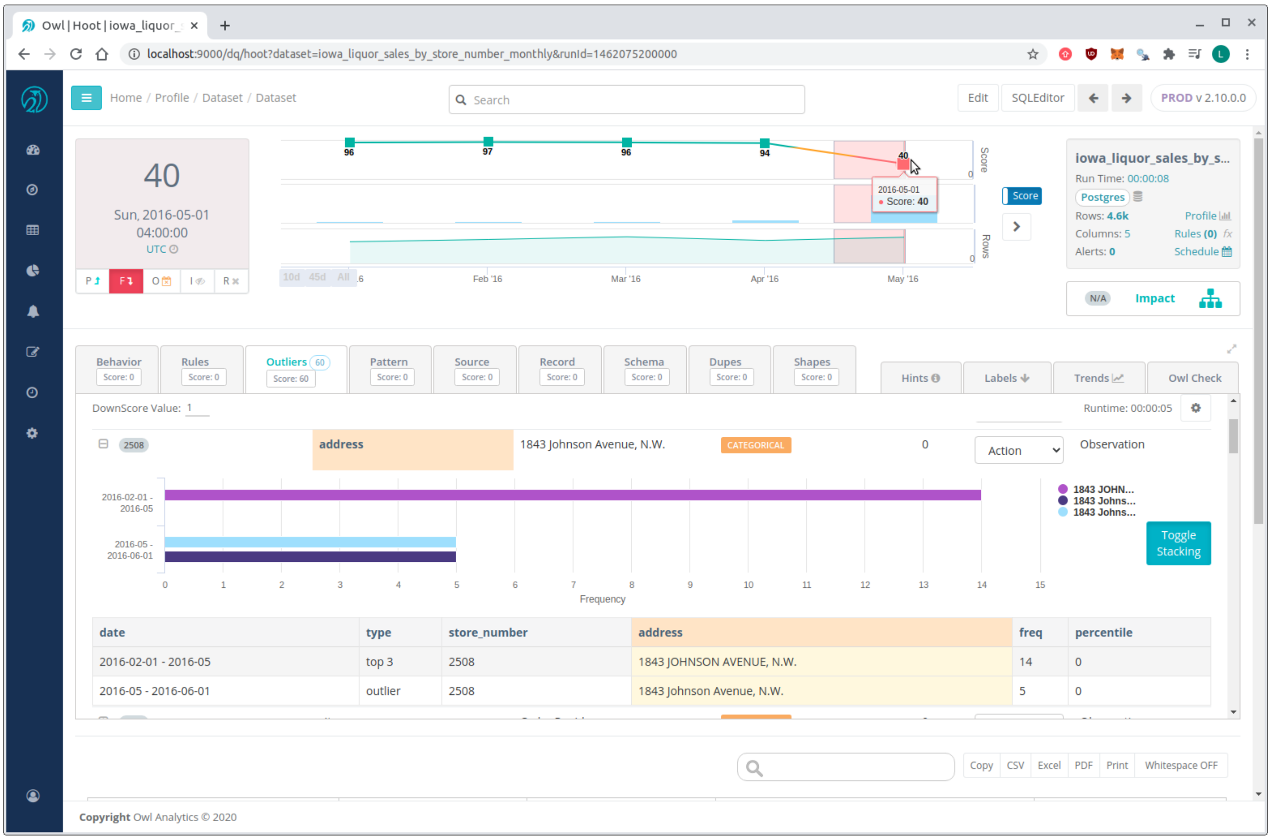
Since the original data quality issue that inspired us to run OwlCheck is from May 2016, we can navigate to specific run date 2016-05-01 by click on the line graph on top. Then searching for store #2508 on the **key** column shows outlier detected for **column** `address`. Press [+] for that row to see contextual details about this detected value.



date	type	store_number	address	freq	percentile
2016-02-01 - 2016-05	top 3	2508	1843 JOHNSON AVENUE, N.W.	14	0
2016-05 - 2016-06-01	outlier	2508	1843 Johnson Avenue, N.W.	5	0

We can verify that OwlCheck identified the outlier of interest among other 60 data quality issues. Using OwlCheck, you can identify issues at scale for past data (using backrun), current (using simple OwlCheck), and future (using scheduled jobs).

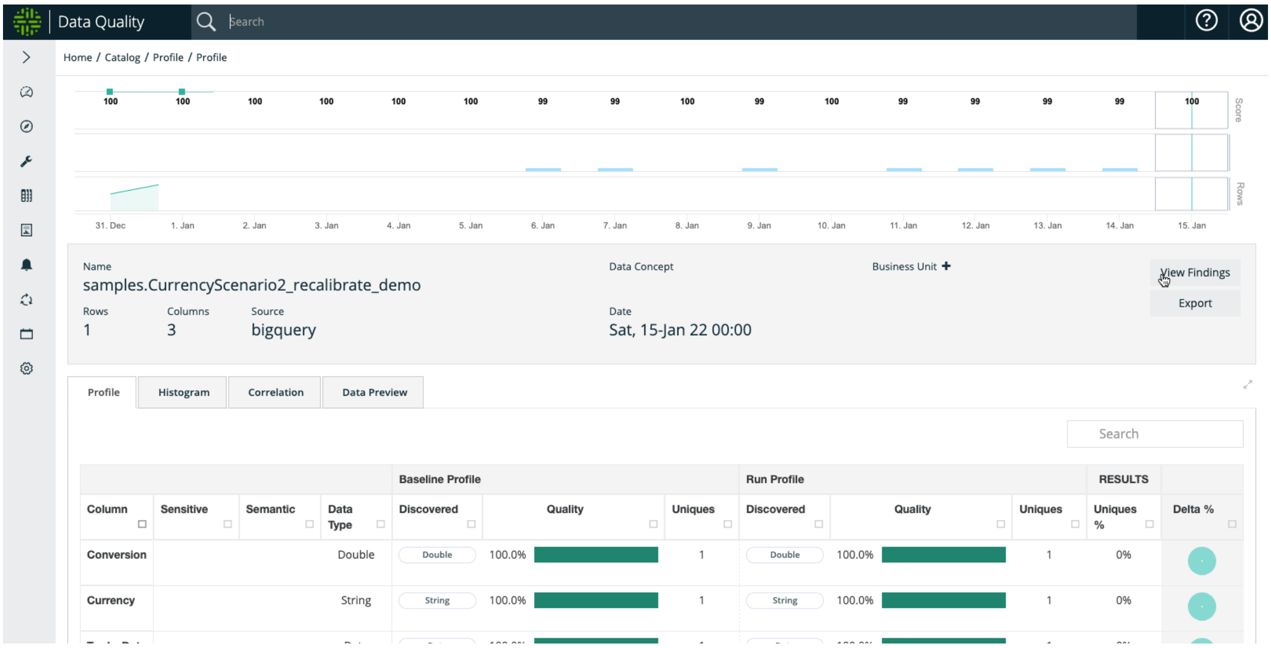
Tech Preview [TP] Outlier Calibration

Use Case

When A) using Outliers and B) faced with an event such as a stock split or currency devaluation, it may be helpful to calibrate the outlier boundaries within Collibra DQ to avoid surfacing non-issues for a period of time.

Example Step #1: No Action Necessary

In the video below, Collibra DQ Outliers were set to a high sensitivity. The USDEUR conversion rate on January 6th in the sample dataset may be considered reasonable and the user can 1) rerun the dataset with lower sensitivity or 2) downtrain the unintended Outlier anomalies.



Home / Catalog / Profile / Profile

Name
samples.CurrencyScenario2_recalibrate_demo

Data Concept

Business Unit

Rows 1

Columns 3

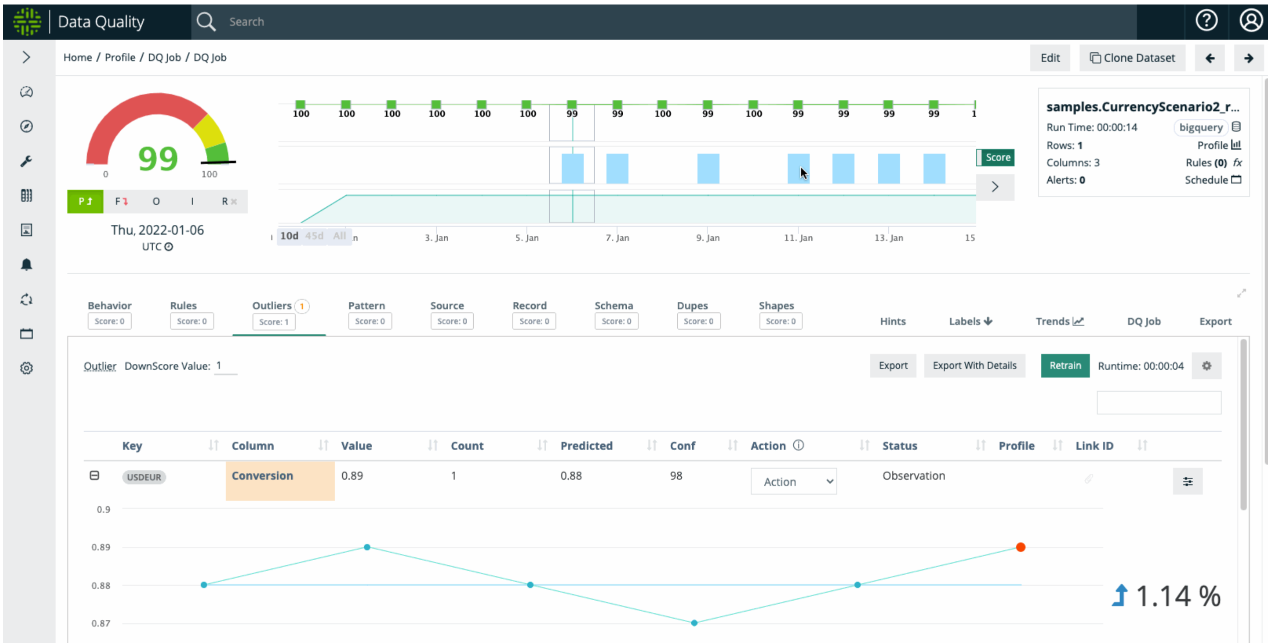
Source bigquery

Date Sat, 15-Jan 22 00:00

				Baseline Profile			Run Profile			RESULTS	
Column	Sensitive	Semantic	Data Type	Discovered	Quality	Uniques	Discovered	Quality	Uniques	Uniques %	Delta %
Conversion			Double	Double	100.0%	1	Double	100.0%	1	0%	
Currency			String	String	100.0%	1	String	100.0%	1	0%	

Example Step #2: Macro Event That User Understands e.g. Currency Devaluation or Stock Split

When examining the outlier on January 11th, the dataset depicts that the USDEUR conversion shot up to 3.14, which in our hypothetical example coincides with an explainable macroeconomic phenomenon. As such, the user may not want Outlier anomalies to trigger for a period of time.



Home / Profile / DQ Job / DQ Job

Thu, 2022-01-06
UTC

samples.CurrencyScenario2_r...
Run Time: 00:00:14 bigquery
Rows: 1 Profile
Columns: 3 Rules (0)
Alerts: 0 Schedule

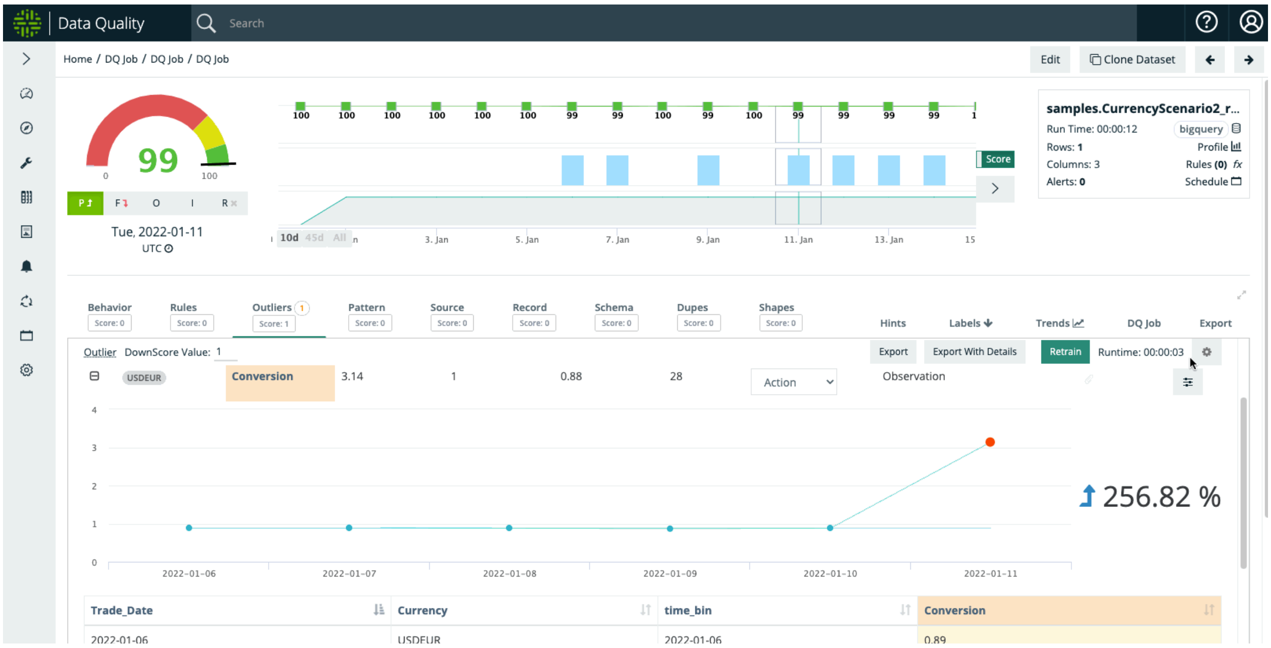
Outlier DownScore Value: 1

Runtime: 00:00:04

Key	Column	Value	Count	Predicted	Conf	Action	Status	Profile	Link ID
USDEUR	Conversion	0.89	1	0.88	98	Action	Observation		

Example Step #3: User Wants To Suppress Outliers

Once Outlier Calibration is enabled, a user can select the boundaries and duration of the 'suppression' period. And once the DQ Job is re-run for the selected date(s), the outliers will not trigger an anomaly / downscore.



Outlier DownScore Value: 1

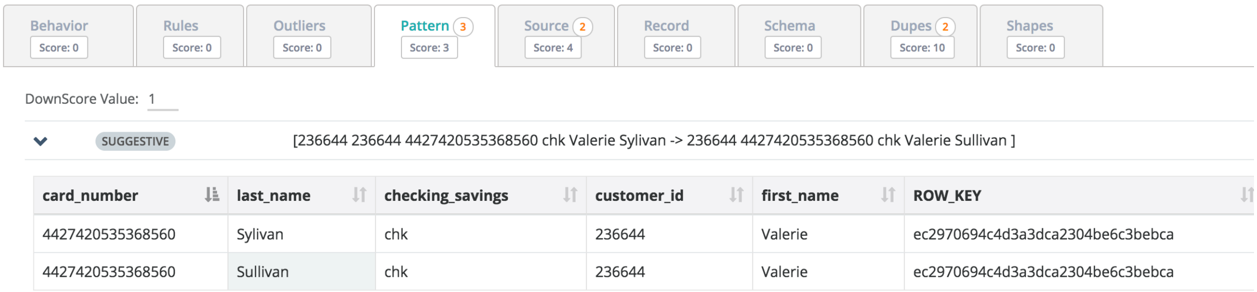
USDEUR	Conversion	3.14	1	0.88	28	Action	Observation

Trade_Date	Currency	time_bin	Conversion
2022-01-06	USDEUR	2022-01-06	0.89

Patterns (advanced)

> **Note** This is an advanced opt-in feature.

Owl uses the latest advancements in data science and ML to find deep patterns across millions of rows and columns. In the example below it noticed that Valerie is likely the same user as she has the same customer_id and card_number but recently showed up with a different last name. Possible misspelling or data quality issue?



DownScore Value: 1

SUGGESTIVE [236644 236644 4427420535368560 chk Valerie Sylivan -> 236644 4427420535368560 chk Valerie Sullivan]

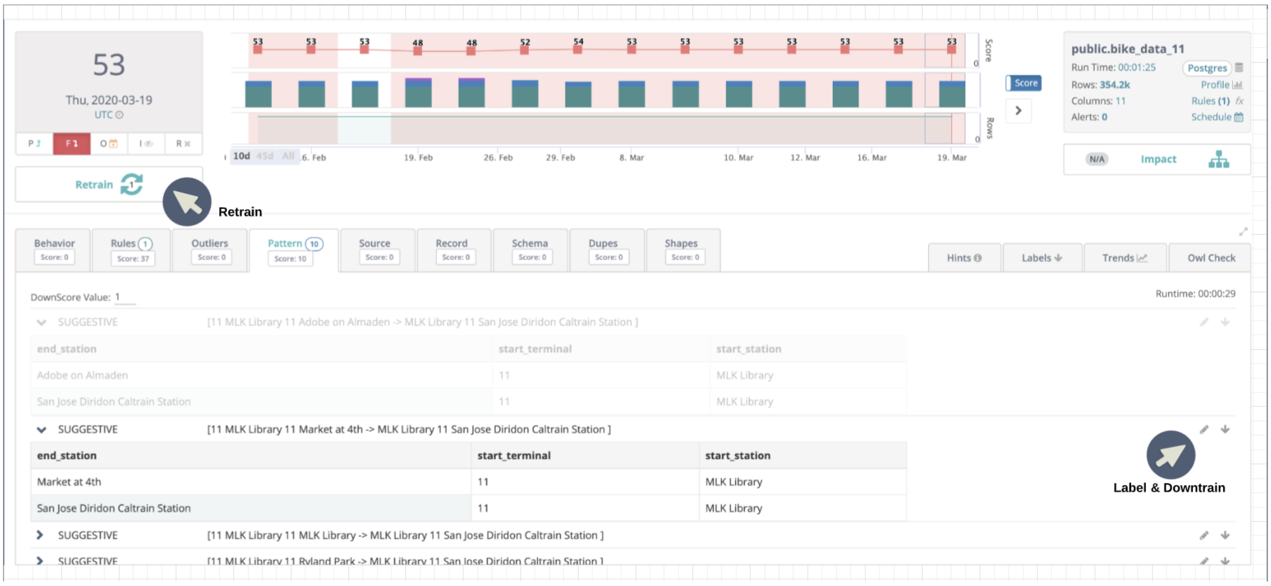
card_number	last_name	checking_savings	customer_id	first_name	ROW_KEY
4427420535368560	Sylivan	chk	236644	Valerie	ec2970694c4d3a3dca2304be6c3bebca
4427420535368560	Sullivan	chk	236644	Valerie	ec2970694c4d3a3dca2304be6c3bebca

Training Anti-Pattern Detection Model

When the Patterns feature is enabled, DQ builds a collection of patterns that it identifies within the data. It will then use that collection to identify values that break established patterns. For example, in the image below, DQ learned that a bike route that starts at "MLK library" will end at "San Jose Diridon Caltrain Station". However, when the current day's data cross referenced against this pattern, DQ detects an anti-pattern where a trip starts at "MLK Library" but ends at "Market at 4th". DQ raises this anti-pattern as a data quality issue and highlights the what it believes the "end_station" value should have been.

To build a Pattern model, DQ requires historical data that contains the valid patterns and if possible, a date/time column. The user can then needs to define the date/time column, the look back period, and what columns make up the pattern. In the image below, the pattern was composed of "end_station", "start_terminal", "start_station".

It is possible that an apparent anti-pattern finding is actually valid data and not a data quality issue. In this case, DQ allows the user to further instruct the existing Patterns model on how to properly score and handle the findings. For example, if it turns out that "Market at 4th" is actually a valid "end_station" for a bike trip, the user can negate the identified anti-pattern by labeling it as valid. This action instructs DQ to not raise this particular anti-pattern again. DQ also rescores the current Owlcheck results to reflect the user's feedback. In addition, it is possible to define the weight of an anti-pattern finding on the current dataset by setting the numerical value to deduct per finding.



public.bike_data_11
Run Time: 00:01:25
Rows: 354.2k
Columns: 11
Alerts: 0

DownScore Value: 1

Runtime: 00:00:29

SUGGESTIVE [11 MLK Library 11 Adobe on Almaden -> MLK Library 11 San Jose Diridon Caltrain Station]

end_station	start_terminal	start_station
Adobe on Almaden	11	MLK Library
San Jose Diridon Caltrain Station	11	MLK Library

SUGGESTIVE [11 MLK Library 11 Market at 4th -> MLK Library 11 San Jose Diridon Caltrain Station]

end_station	start_terminal	start_station
Market at 4th	11	MLK Library
San Jose Diridon Caltrain Station	11	MLK Library

SUGGESTIVE [11 MLK Library 11 MLK Library -> MLK Library 11 San Jose Diridon Caltrain Station]

SUGGESTIVE [11 MLK Library 11 Ryland Park -> MLK Library 11 San Jose Diridon Caltrain Station]

Fraud Detection?

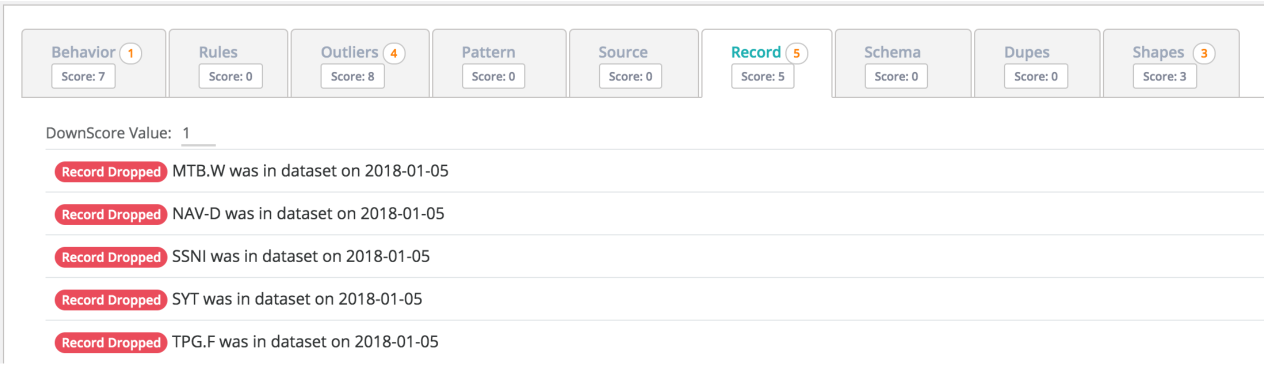
Think about a scenario where a dataset has a SSN column along with FNAME, LNAME and many others. What if your traditional rules engine passes because one of the rows has a valid SSN and a valid Name but the SSN doesn't belong to that person (his or her name and address, etc.)? This is where data mining can derive more sophisticated insights than a rules based approach.

Records (advanced)

> **Note** This is an advanced opt-in feature.

Where did my rows go?

Collibra DQ is constantly learning which records or rows in a dataset are most common. In the case below the NYSE had a reasonable dataset volume (row count).



DownScore Value: 1

Record Dropped MTB.W was in dataset on 2018-01-05

Record Dropped NAV-D was in dataset on 2018-01-05

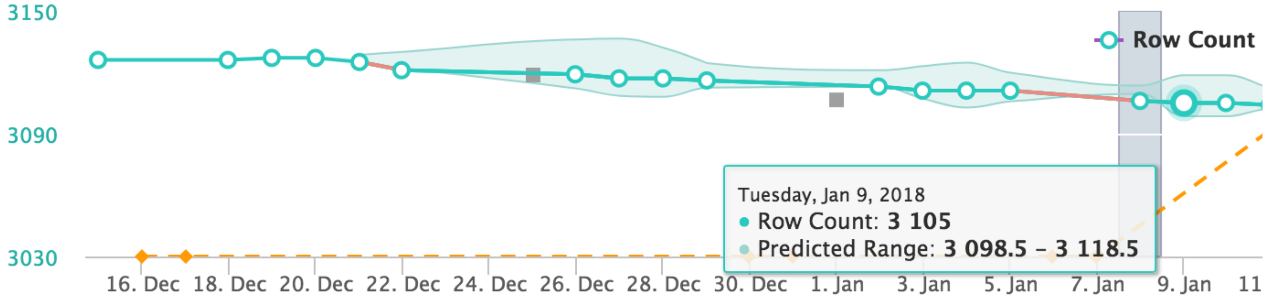
Record Dropped SSNI was in dataset on 2018-01-05

Record Dropped SYT was in dataset on 2018-01-05

Record Dropped TPG.F was in dataset on 2018-01-05

Row Count Trend

We can see the rows dipping just slightly outside their predicted range. Arguably a subtle drop, yet abnormal to not represent these companies that typically do trade on the NYSE. Were they de-listed?



Source (advanced)

> **Note** This is an advanced opt-in feature.

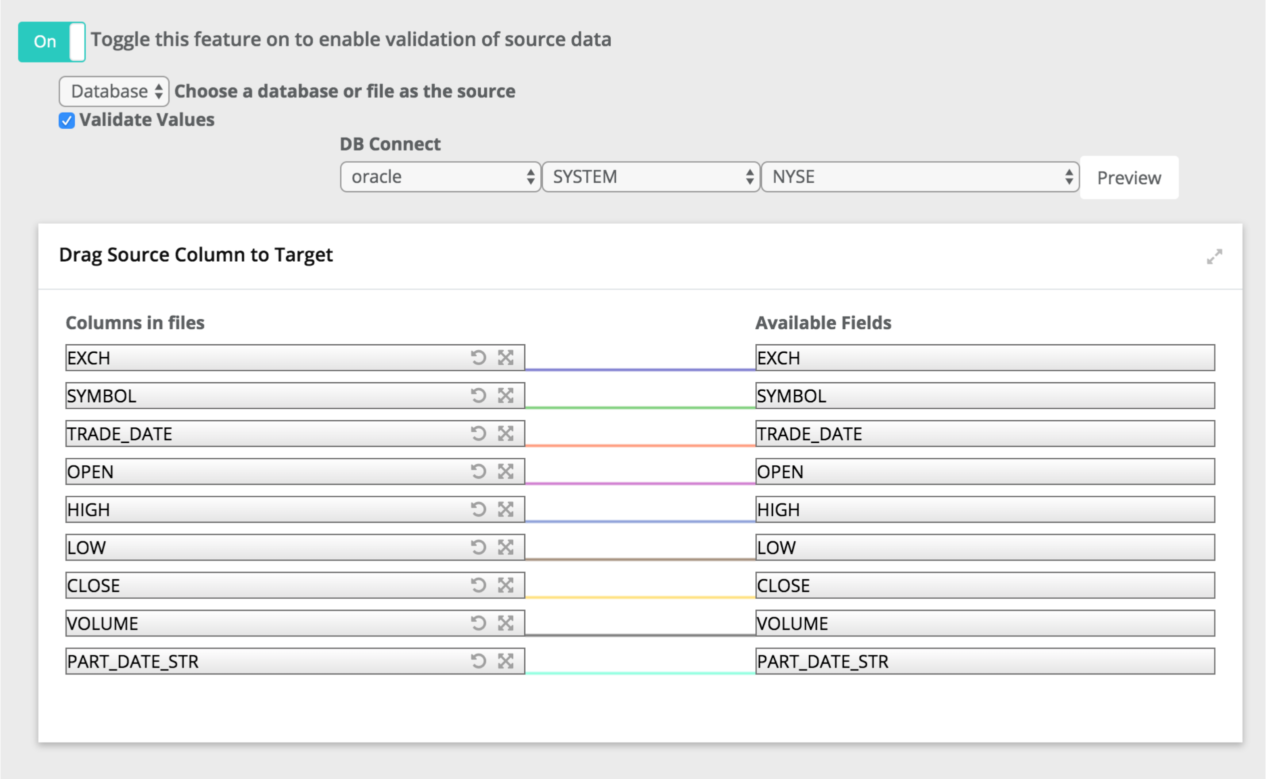
Does your data-lake reconcile with your upstream system?

Copying data from one system to another is probably the most common data activity to all organizations. Collibra DQ refers to this as source to target. As simple as this activity sounds, DQ has found that most of the time files and database tables are not being copied properly. To ensure and protect against target systems getting out of sync or not matching the originating source, turn on `-vs` to validate that the source matches the target.

A row count is not enough...

The most common check we encounter is a row count. However, a row count does not account for:

- Schema differences - Boolean to Int, Decimal to Double with precision loss, Timestamps and Dates.
- Value differences - Char or Varchars with whitespace vs Strings, null chars, delimiter fields that cause shifting, and much more.



On Toggle this feature on to enable validation of source data

Database Choose a database or file as the source

☑ Validate Values

DB Connect: oracle | SYSTEM | NYSE

Drag Source Column to Target

Columns in files	Available Fields
EXCH	EXCH
SYMBOL	SYMBOL
TRADE_DATE	TRADE_DATE
OPEN	OPEN
HIGH	HIGH
LOW	LOW
CLOSE	CLOSE
VOLUME	VOLUME
PART_DATE_STR	PART_DATE_STR

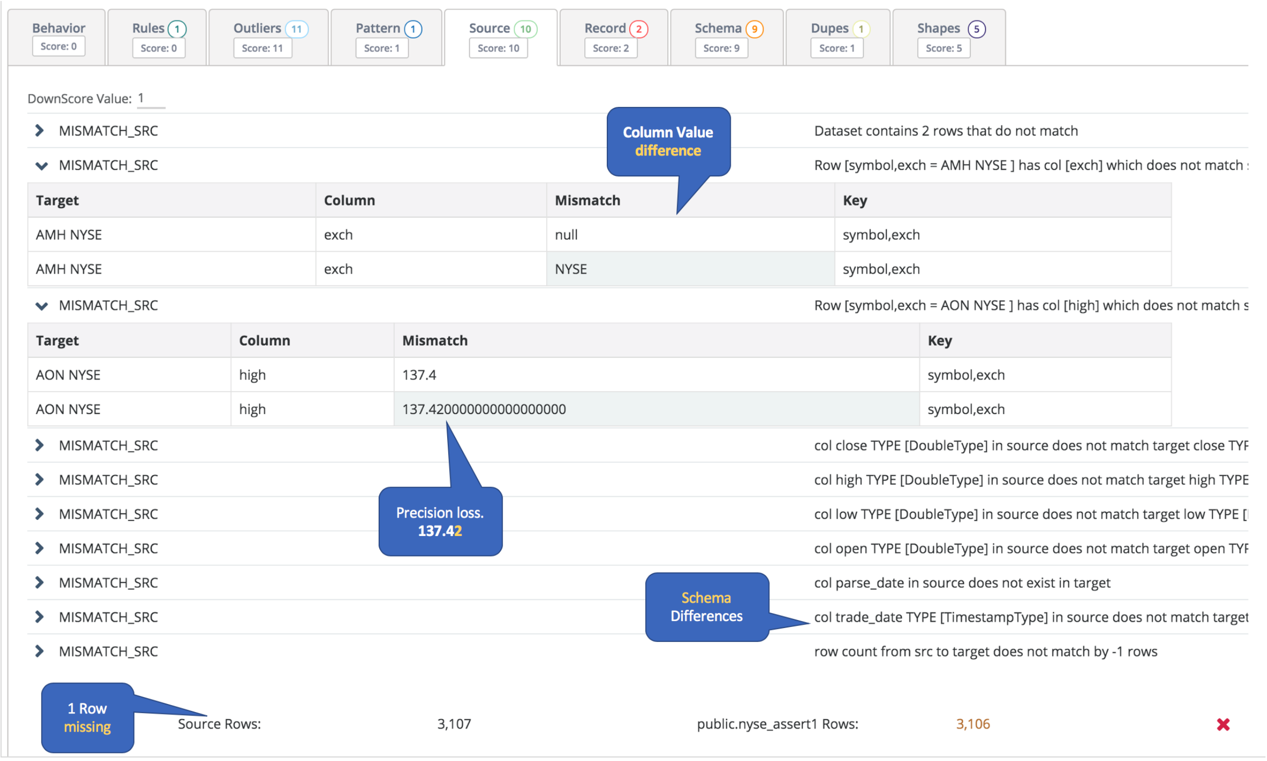
DQCheck Created from Wizard

The DQ Wizard GUI creates the below OwlCheck which it can execute from the GUI by clicking RUN or by pasting at the cmdline.

```
-lib /home/ec2-user/owl/drivers/valdrivers \
-driver org.postgresql.Driver \
-u user -p password \
-c "jdbc:postgresql://ec2-34-227-151-67.compute-1.amazon-
aws.com:5432/postgres" \
-q "select * from public.dateseries4" \
-ds psql_dateseries2 -rd 2018-11-07 \
-srcq select dz, sym as symz, high as highz, low as lowz, close
as closez, volume as volumez, changed as changedz, changep as
changepz, adjclose as adjclosez, open as openz from lake.d-
ateseries \
-srcu user \
-srcp password \
-srcds mysqlSYMZ \
-srcd com.mysql.cj.jdbc.Driver \
-srcc "jdbc:mysql://owldatalake.chzid9w0hpyi.us-east-1.rd-
s.amazonaws.com:3306/lake" \ -valsrckey "SYMZ" \
-vs \
-valsrcinc "dz,symz,open-
z,highz,lowz,closez,volumez,changedz,changepz,adjclosez"
```

End of Day Stock Data from Oracle to Mysql

In this example we loaded NYSE_EOD data in both Oracle and Mysql and then used Collibra DQ's Source Validation feature. We see 3 main classes of issues. 1) The row count is off by 1 row, this means a row was dropped or went missing when the data was copied. 2) The schemas don't exactly match. 3) In 2 cases the values are different at the cell level. NULL vs NYSE and 137.4 vs 137.42.



DownScore Value: 1

MISMATCH_SRC Dataset contains 2 rows that do not match

MISMATCH_SRC Row [symbol,exch = AMH NYSE] has col [exch] which does not match :

Target	Column	Mismatch	Key
AMH NYSE	exch	null	symbol,exch
AMH NYSE	exch	NYSE	symbol,exch

MISMATCH_SRC Row [symbol,exch = AON NYSE] has col [high] which does not match s

Target	Column	Mismatch	Key
AON NYSE	high	137.4	symbol,exch
AON NYSE	high	137.420000000000000000	symbol,exch

MISMATCH_SRC col close TYPE [DoubleType] in source does not match target close TYF

MISMATCH_SRC col high TYPE [DoubleType] in source does not match target high TYPE

MISMATCH_SRC col low TYPE [DoubleType] in source does not match target low TYPE [I

MISMATCH_SRC col open TYPE [DoubleType] in source does not match target open TYF

MISMATCH_SRC col parse_date in source does not exist in target

MISMATCH_SRC col trade_date TYPE [TimestampType] in source does not match target

MISMATCH_SRC row count from src to target does not match by -1 rows

Source Rows: 3,107 public.nyse_assert1 Rows: 3,106 ✖

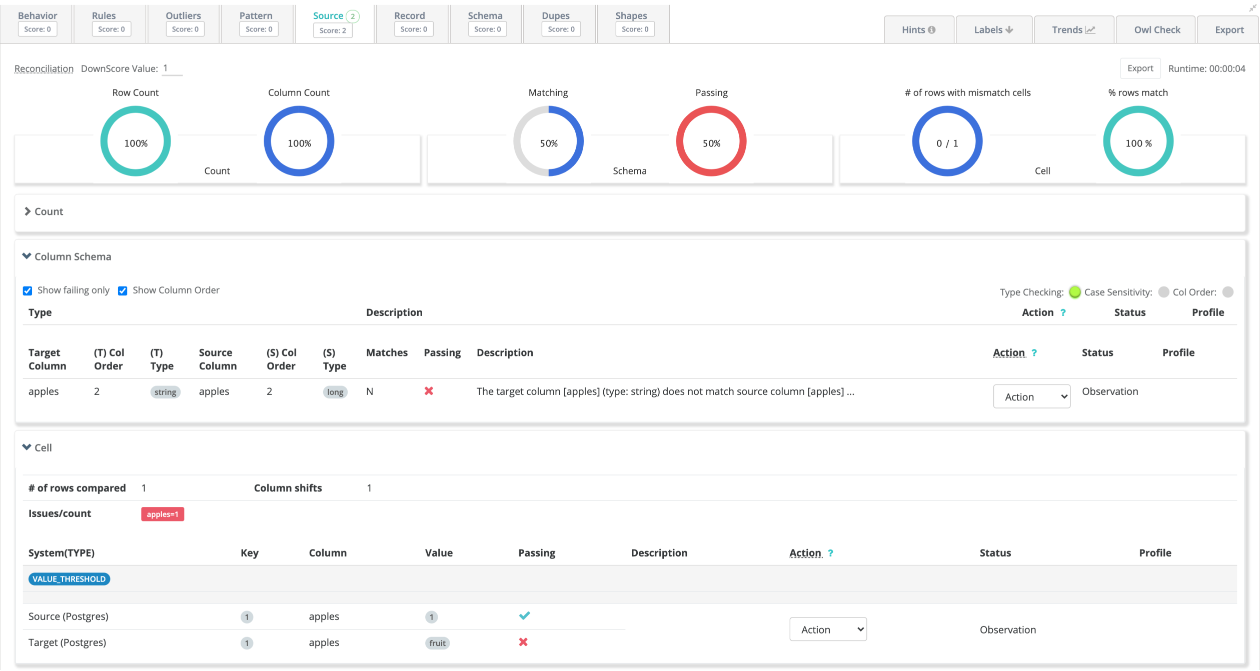
Column Value difference

Precision loss. 137.42

Schema Differences

1 Row missing

Latest View in 2.13+



Reconciliation DownScore Value: 1

Runtime: 00:00:04

› Count

⌄ Column Schema

☑ Show failing only ☑ Show Column Order

Type Checking: ● Case Sensitivity: ● Col Order: ●

Type	Description	Action ?	Status	Profile

Target Column	(T) Col Order	(T) Type	Source Column	(S) Col Order	(S) Type	Matches	Passing	Description	Action ?	Status	Profile
apples	2	string	apples	2	long	N	✖	The target column [apples] (type: string) does not match source column [apples] ...	Action	Observation	

⌄ Cell

# of rows compared	1	Column shifts	1
Issues/count	apples=1		

System(TYPE)	Key	Column	Value	Passing	Description	Action ?	Status	Profile
VALUE_THRESHOLD								
Source (Postgres)	1	apples	1	✓		Action	Observation	
Target (Postgres)	1	apples	fruit	✖				

Pushdown

Pushdown feature description

Some of the Collibra DQ features support pushdown to avoid transferring large dataset from data source (Database, Cloud storage, file systems etc.) into Spark. When pushdown is enabled and supported, the DQ Job will generate SQL queries to offload the compute to the data source, reducing the amount of data transfer and Spark computation of the DQ Job. Not all features support pushdown nor pushdown completely eliminate data transfer.

Why use pushdown

To analyze a dataset for DQ findings as part of a DQ Job, CDQ uses Spark as the compute engine to power the analysis. This requires the dataset to be loaded into Spark as a Spark DataFrame, and the DQ Job performance (job completion speed) is limited by Spark resources available and the complexity of the job. This data transfer from data source to Spark is dependent on two of the following factors:

1. Bandwidth limitation at the data source
   If the DQ Job requires pulling 100 million rows from a SQL Database, then the Input/Output limit of transferring data out of SQL Database into the Spark cluster will greatly increase the overall speed of the DQ Job.

2. Compute limitation at the data source for complex queries
   If the DQ Job requires complex queries to create the dataset (via `-q`), then this computation is done at the SQL Database level. Some examples of "complex" queries are:

   ```
   -q "SELECT * FROM public.very_long_table_of_transactions WHERE date = ${rd} and department = 'finance'"
   ```

   This query can take long time at the database level due to `WHERE` clause filtering a very long table on columns `date` and `department` that may not be indexed properly, leading to a full table scan without a `LIMIT` clause specified.

   ```
   -q "SELECT * FROM public.very_long_table_of_transactions transactions INNER JOIN public.departments departments ON transactions.department_id = departiments.id WHERE transactions.date = ${rd} and departments.name = 'finance'"
   ```

   This query can take long time at the database level due to a join between tables.

3. Resource limitation at the data source
   The data source may not have enough hardware resource available to efficiently fulfill the query and/or handle multiple DQ Jobs & other non-CDQ applications requesting data.

The bottleneck due to data transfer can be viewed in Jobs page > Job Logs > LOAD stage. This data loading step is the first step for all DQ Jobs. However, pushdown feature can be used to *reduce* (NOT eliminate) the data transfer & compute to Spark from the data source, if the DQ Job specified does not require loading all the data into Spark.

In summary, speed of loading the data from data source to Spark is a `-q query compute time at data source` + `network transfer of -q result between data source and Spark`. Pushdown can reduce both elements, but the efficiency gained is dependent on the complexity of `-q` query and how big the dataset from `-q`result would have been without pushdown.

How pushdown is efficient

Some of the Spark compute performed by the DQ Job can be translated into SQL queries that most relational databases support natively. In such a case, the DQ Job does not need to load all the rows of the dataset. Instead, the DQ Job can query the data source for the results of those SQL queries and reduce the amount of data transferring out of the data source. The results of these SQL queries are almost always lead to smaller amount of data compared to the full dataset defined by `-q`. Only some of the DQ Job features require the full dataset to be loaded into Spark. Therefore, pushdown can be a useful tool to speed up the overall DQ Job speed -- **provided that the speed of executing these SQL queries are faster than the speed of transferring the data out of the data source into Spark**. In most use cases, pushdown leads to faster DQ Job execution for large datasets. If the `-q` query is sufficiently complex, then the speed reduced by transferring less data into Spark can be cancelled out by the multiple frequent SQL queries made to the data source by the Pushdown process (because each query may have have redundant compute due to the complexity of `-q`).

How pushdown works in CDQ

Using pushdown only *reduces* the amount of data transferred out of the data source. It does NOT skip the LOAD stage in DQ Job. Every DQ Job requires a small sample of rows (10-20) of the dataset defined by `-q` in order to generate Data Preview and analyze schema information for the dataset run. This means the `-q` query may be fully computed at data source before the sampling can occur (depending on the complexity of the `-q`). In such a case, sampling 10-20 rows of data is not a quick and immediate LOAD stage and only efficiency gain comes from lack of transferring data between data source and Spark.

Therefore, pushdown feature would be most efficient if `-q` is a simple select query with simple where filtering. The benefit comes from the fact that if your dataset defined by `-q` results in 100 million rows, only 10-20 rows of the dataset defined by `-q` will be loaded into Spark.

Profile with pushdown will then generate a series of SQL queries and query the data source again for aggregate metric data. Depending on the dataset, these multiple SQL queries can be more efficient than loading all the data into Spark and computing these aggregate metric in Spark. The results between *Profile* with *pushdown* and *Profile* without *pushdown* are (practically) identical.

Profile: pushdown vs no pushdown

Here is the summary of Profile activity with details regarding pushdown support

Feature	Supports pushdown	Description
Row Count	Yes	Computes row count of the dataset.
Distinct Count	Yes	The number of distinct values in a column.
Mean	Yes	The average of all the values in the column. Supports numeric columns only.
Min / Max	Yes	The minimum and maximum values of the column. Supports numeric and boolean columns only.
NULL Count	Yes	The number of null values in the column.

Feature	Supports pushdown	Description
EMPTY Count	Yes	The number of empty values in the column. Supports string columns only.
TYPE Count	Yes	The number of different types inferred in a column (if any).
TopN / BottomN	No	Computes the top 5 most frequent (TopN) and least frequent (BottomN) values. Supports all types. This result is displayed as a frequency bar chart in Profile page. If pushdown is enabled, then TopN and BottomN values are not displayed. Related features like Stat Rules (Distribution) are also disabled.
Data Shape Detection	No	Detects shapes of the values based on Shape parameters provided (automatic or manual).
Histogram	No	Creates histogram of the values in the column.
Correlation Matrix	No	Creates correlation matrix. Supports only numeric columns.

Snowflake Pushdown

> **Note** As of 2022.08, Snowflake Pushdown is only available as a private beta for participating customers. Since this is a beta feature, some capabilities may be limited.

Pushdown is an alternative computation method for running a DQ job, where all of the job's processing is submitted to a SQL data warehouse, such as Snowflake. Snowflake Pushdown jobs generate SQL queries to offload the compute to the data source, reducing the amount of data transfer and Spark computation of the DQ Job.

By running a Snowflake Pushdown job, you can:

- Reduce latency.
- Eliminate dependencies on Spark compute to run Collibra Data Quality, and increase processing speeds.
- Eliminate the egress costs for running DQ Jobs against large data sets.
- Auto-scale based on your processing requirements.

For more information on Snowflake, see the Snowflake documentation.

Prerequisites

Before running Snowflake Pushdown jobs, a user with Admin permissions must:

- Successfully run the Pushdown setup script.
- Enable Pushdown from the Collibra DQ UI.

Pushdown vs. Pull Up

Collibra DQ Pull Up is a DQ Job without pushdown, where all of the processing is executed inside the Apache Spark compute engine. Source data is stored inside a database, where Spark reads it out, and the parameters you set when you select a scope, define a range, and add build layers, are partitioned and sorted. The results of the profile job are then recorded in the DQ Metastore. Depending on the size of your data set and the number of DQ checks performed, this process can greatly slow run times because Spark has its own compute resources, such as memory and CPUs. Pull up has limited support for profiling but you can't run it without setting up Spark.

With Snowflake Pushdown, the Collibra DQ Agent, which creates the Apache Spark DQ Job, is no longer needed. No agent is required to submit a Snowflake Pushdown job because all of the processing is sent directly to Snowflake. Therefore, Agent ID is always set to 0 for Snowflake Pushdown jobs.

With Snowflake, you can also scale your compute needs based on the specific requirements of your DQ Job. This is because Snowflake's architecture features auto-scaling, which allows you to automatically scale up, or *burst*, to 64 or 128 nodes when you require greater processing needs. Snowflake also automatically scales down when your DQ Job does not require robust processing. With auto-scaling, the processing of your data is enhanced, improving runtime performance and removing the egress costs of reading large amounts of data.

Features and Limitations of Snowflake Pushdown

> **Note** As of 2022.08, Snowflake Pushdown is only available as a private beta for participating customers. Since this is a beta feature, some capabilities may be limited.

This section describes the features and limitations of using Collibra Data Quality's Snowflake Pushdown capability to run a DQ Job.

> **Warning** To use Snowflake Pushdown, you must be a participant in the private beta. This feature is currently unavailable for non-participants.

Features

The following table shows the features unique to DQ Jobs run using Snowflake Pushdown processing.

Feature	Description
Dynamic date filter	A togglable option that allows you to filter column data dynamically by runDate $.
Configurable number of connections	Allows you to set the number of open connections between 1-5 so you can run jobs in parallel and improve the performance of profile jobs.
Cancel jobs	Unlike Spark compute jobs, you can cancel the SQL queries of Snowflake Pushdown jobs.
No agent	Pushdown runs the database engine to execute jobs directly, removing the need for agents. Agent ID = 0.
More control over autometrics	With minimal clicks, you can apply autometrics, such as row count and uniqueness, from the UI.

Limitations

Currently, there are some limitations with Snowflake Pushdown since it is in private beta as of 2022.08:

- The cancel jobs feature is currently unavailable, though it will be available in an upcoming release.
- Only DQ Native Rules are supported, though support for Freeform rules is planned in a future release.
- Profile and Rules are supported layers, but Outliers, Patterns, Dupes, Shapes, and Records are not yet supported.
- We do not currently support Okta integration, though support for it is planned in a future release.
- You cannot currently run a job from the command line. This functionality will be supported in an upcoming release.

Running a Snowflake Pushdown job

> **Note** As of 2022.08, Snowflake Pushdown is only available as a private beta for participating customers. Since this is a beta feature, some capabilities may be limited.

This section shows you how to get started with the three scanning methods of a Snowflake Pushdown job.

Steps

1. From Explorer, select your Snowflake connection with the PD icon next to it.

   > **Note** For the PD icon to be visible, you need to enable Pushdown when you establish your Snowflake connection.

2. Select your schema.
3. Click Create DQ Job.
   The Job creator page opens.

4. Select a scanning method. Since the steps and procedures vary by scanning method, refer to the documentation associated with each scanning method for further instructions.

Scanning method	Description
Full Scan	Scans your full table to show all results. This is the standard scanning method.
Partial Scan	Scans a section of your table for more targetd results than a full scan.
SQL Query	Allows you to manually write and compile a SQL query for an advanced scan of your table.

> **Note** More advanced layers beyond basic profile jobs will soon be available to customers participating in the private beta.

AdaptiveRules

AdaptiveRules are common metrics used to observe changes to your data. These can be applied or removed from the AdaptiveRules tab on the Add Layers workflow by selecting or deselecting AdaptiveRules.

The following table shows a list of AdaptiveRules measured by Collibra Data Quality and whether they are applied by default.

AdaptiveRule type	Subtype	Description	Default?
Availability	N/A	Observe changes to the row count and loading time in your table.	N/A
	Row count	Monitor the row count change in your table.	True
	Loading time	Monitor loading time changes.	False
Distribution	N/A	Observe the number of unique values in a table.	N/A

AdaptiveRule type	Subtype	Description	Default?
	Uniqueness	Monitor a column's cardinality within the range of previous DQ Jobs	True
Conformity	N/A	Observe columns with values that fall outside of the normal range.	N/A
	Min	Monitor columns with min values outside the normal range.	False
	Mean	Monitor columns with mean values outside the normal range.	False
	Max	Monitor columns with max values outside the normal range.	False
Completeness	N/A	Observe columns in your table containing null values or empty fields.	N/A
	Null values	Monitor columns for null values.	True
	Empty values	Monitor columns for empty data.	True

Note You can always apply or remove AdaptiveRules, but if you bypass the configuration, the DQ Job will still run correctly with the default AdaptiveRules applied.

Shapes

A shape is the format of data in a string column. Enabling Shapes lets you discover inconsistencies in the data formats of a column. For example, when analyzing a date column, Collibra DQ may detect different string formats of the same meaning, such as 11-15-2022, 11/15/2022, and 11.15.2022.

The Shapes feature is on by default, but you can choose to toggle it off. You can also manually control the advanced options by checking the Manual checkbox.

Option	Description
Occurrences	Set occurrences between 0.001-5 to show shapes that occur less than the percentage you set.
Format per column	Set format per column between 0-100 to identify columns with more formats than the number you set. This helps identify columns that are too noisy, meaning they do not have a consistent format for detection.
Character length	Set character length between 0-100 to identify string lengths that are greater than the number you set. Character lengths beyond the set value are considered free from fields and do not have a format for detection.
Data shape granular	Considers the length of the shape and differentiates between numerical and letter formats. For the length of a shape to be detected, data shape granular must be enabled.

Replay

Replay gives you a historical behavior profile of your data by looking back into past runs to show how the data looked on a certain day, month, or year. To enable Replay, select the dropdown icon on the Run button and select **Replay**.

Running a Full Scan

> **Note** As of 2022.08, Snowflake Pushdown is only available as a private beta for participating customers. Since this is a beta feature, some capabilities may be limited.

A full scan is a scan of your entire table. When running a full scan, you do not need to select columns or apply filters to rows because all columns are selected by default. Various DQ Layers, such as autometrics, are also applied by default. A full scan is commonly used to obtain a high-level overview of your data.

Prerequisites

You have an Connectivity to Snowflake and Pushdown enabled.

Steps

1. From Explorer, select your Snowflake connection with the PD icon next to it.

   > **Note** For the PD icon to be visible, you need to enable Pushdown when you establish your Snowflake connection.

2. Select your schema.
3. Click **Create DQ Job**.
   The Job creator page opens.
4. Select **Full Scan**.
5. Optionally add layers or toggle default settings.
   - Certain AdaptiveRules are enabled by default. You can optionally toggle them on and off.
   - Shapes are enabled by default. You can optionally toggle them on and off, and configure more advanced options by selecting the Manual checkbox.
6. Click **Next**.
   The Review page opens.

7. Review your DQ scan.
8. Select **Run**.

   A dialog appears and tracks the status of your Snowflake Pushdown job.

   > **Note** More advanced layers beyond basic profile jobs will soon be available to customers participating in the private beta.

What's next?

After running a Full Scan, go to the Jobs page to Profile (automatic).

Running a Partial Scan

> **Note** As of 2022.08, Snowflake Pushdown is only available as a private beta for participating customers. Since this is a beta feature, some capabilities may be limited.

A partial scan only scans the sections of your table that you specify Select columns, apply row filters, and add DQ layers to fine tune your DQ scan and obtain a targeted understanding of your data.

Prerequisites

You have an Connectivity to Snowflake and Connectivity to Snowflake.

Steps

1. From Explorer, select your Snowflake connection with the PD icon next to it.

   > **Note** For the PD icon to be visible, you need to enable Pushdown when you establish your Snowflake connection.

2. Select your schema.
3. Click **Create DQ Job**.
   The Job creator page opens.

4. Select **Partial Scan**.
   The Select columns view appears.
5. Select your columns by checking or unchecking the checkboxes associated with a particular column.
6. Click **Next**.
   Alternatively, you can click Select rows from the left workflow menu.
   The Select rows view appears.
7. Select a filter type to apply a specific filter.

Filter Type	Description
Time Slice	Scans a range of dates or times.
Row Filter	Scans a section of rows.
Limit	Scans a random sample of rows.

8. Click **Next**.
   Alternatively, you can click **Add layers** from the left workflow menu.
   The Add layers view appears.

9. Optionally add layers or toggle default settings.

   - Certain AdaptiveRules are enabled by default. You can optionally toggle them on and off.

   - Shapes are enabled by default. You can optionally toggle them on and off, and configure more advanced options by selecting the Manual checkbox.

10. Click **Next**.
    The Review page opens.

11. Review your DQ scan.

12. Select **Run**.
    A dialog appears and tracks the status of your Snowflake Pushdown job.

Time Slice

Time slice is a filter that lets you select a range of dates or times for your DQ scan. To apply a time slice filter, select **Add**, configure your preferences in the Add Time Slice modal, then select **Save** to save your filter. When a filter is successfully saved, a badge displays on the Time Slice tile and the number of applied filters is reflected in the left workflow menu.

Edit Time Slice modal

Component	Description
Column of reference	Select a column from your table for the application to analyze.
Date	When toggled on, the date filter lets you filter column data based on run date `${rd}`.
Visualize	Displays an autogenerated bar chart of days where data is available in your data set.
Operator	Select an operator, such as =or >, upon which the app bases its operation.
Run Date	Select a run date to allow the application to scan sections of your table, add a new date to it, and then run again. By selecting Run Date, a dynamic result is returned at runtime.

Row Filter

Row Filter scans a section of rows from your table. To add a Row Filter, select **Add**, configure your preferences in the Add Filter modal, then select **Save** to save your filter. When a filter is successfully saved, a badge displays on the Time Slice tile, and the number of applied filters is reflected in the left workflow menu.

Add Filter modal

Component	Description
Column of reference	Select a column from your table for the application to analyze.
Date	
Visualize	Displays an autogenerated bar chart of days where data is available in your data set.
Operator	Select an operator, such as =or >, upon which the app bases its operation.

Component	Description
Value	

Limit

Limit scans a random sample of rows based on the maximum number of rows you set. To apply a limit, specify the number of rows greater than 0 for DQ to scan.

> **Note** More advanced layers beyond basic profile jobs will soon be available to customers participating in the private beta.

What's next?

After running a Partial Scan, go to the Jobs page to Profile (automatic).

Scanning with SQL Query

> **Note** As of 2022.08, Snowflake Pushdown is only available as a private beta for participating customers. Since this is a beta feature, some capabilities may be limited.

The SQL Query option lets you write and compile a query manually for an advanced scan of your table.

Prerequisites

You have an Connectivity to Snowflake and Connectivity to Snowflake.

Steps

1. From Explorer, select your Snowflake connection with the PD icon next to it.

   > **Note** For the PD icon to be visible, you need to enable Pushdown when you establish your Snowflake connection.

2. Select your schema.
3. Click **Create DQ Job**.

   The Job creator page opens.

4. Select **SQL Query**.

   The SQL view opens.
5. Write and compile a SQL query.

   > **Note** To switch to Standard view and return to the Running a Partial Scan workflow, select the three-dots menu icon and select **Standard view**. Any changes made to your SQL query are lost when you switch between views.

6. Click **Next**.

   Alternatively, you can click **Add layers** from the left workflow menu.

   The Add layers view appears.

7. Optionally add layers or toggle default settings.
    - Certain AdaptiveRules are enabled by default. You can optionally toggle them on and off.
    - Shapes are enabled by default. You can optionally toggle them on and off and configure more advanced options by selecting the Manual checkbox.
8. Click **Next**.
   The Review page opens.
9. Review your DQ scan.
10. Click **Run**.
    A dialog appears and tracks the status of your Snowflake Pushdown job.

> **Note** More advanced layers beyond basic profile jobs will soon be available to customers participating in the private beta.

What's next?

After scanning with SQL Query, go to the Jobs page to Profile (automatic).

Summary

Click or Code

Collibra DQ offers easy to use no (low) code options for getting started quickly. Alternatively, more technical users may prefer programmatic APIs.

Core Components

Collibra DQ offers a full DQ suite to cover the unique challenges of each data set.

9 Dimensions of DQ

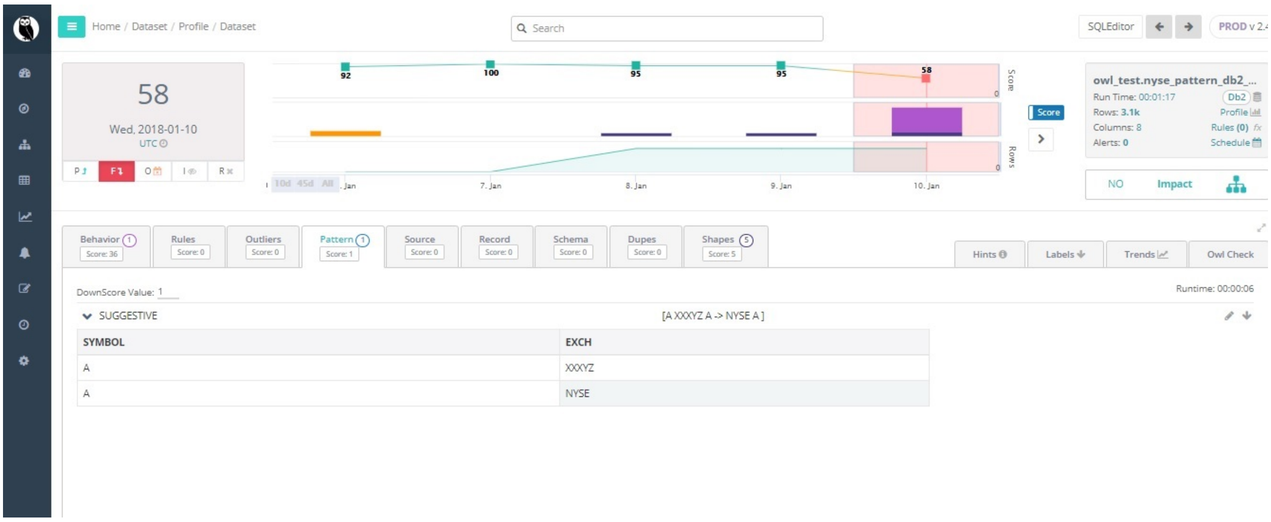
1. Behaviors - Data observability
2. Rules - SQL-based rules engine

3. Schema - When columns are added or dropped
4. Shapes - Typos and Formatting Anomalies
5. Duplicates - Fuzzy matching, Identify similar but not exact entries
6. Outliers - Anomalous records, clustering, time-series, categorical
7. Pattern - Classification, cross-column & parent/child anomalies
8. Record - Deltas for a given column(s)
9. Source - Source to target reconciliation

Check out our videos to learn more

Behavior

Imagine a column going null, automatic row count checks - does your data behave/look/feel the same way it has in the past.



owl_test.nyse_pattern_db2_...
Run Time: 00:01:17 Db2
Rows: 3.1k Profile
Columns: 8 Rules (0)
Alerts: 0 Schedule

DownScore Value: 1

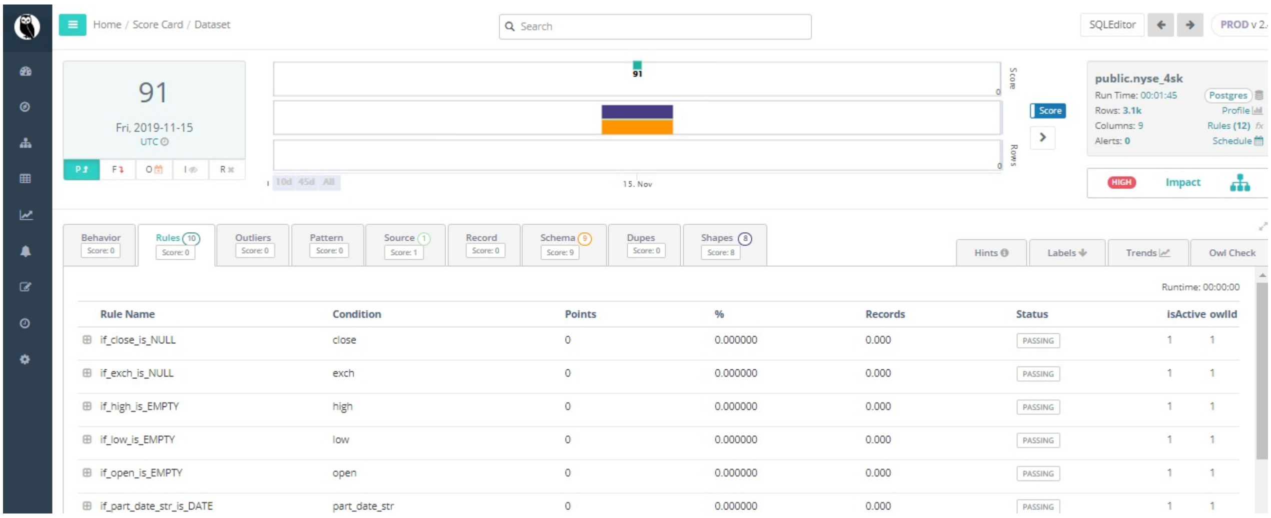
Runtime: 00:00:06

SUGGESTIVE [A XXXYZ A -> NYSE A]

SYMBOL	EXCH
A	XXXYZ
A	NYSE

Rules

Assures only values compliant with your data rules are allowed within a data object.

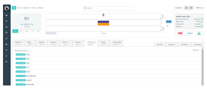


Runtime: 00:00:00

Rule Name	Condition	Points	%	Records	Status	isActive	owlId
if_close_is_NULL	close	0	0.000000	0.000	PASSING	1	1
if_exch_is_NULL	exch	0	0.000000	0.000	PASSING	1	1
if_high_is_EMPTY	high	0	0.000000	0.000	PASSING	1	1
if_low_is_EMPTY	low	0	0.000000	0.000	PASSING	1	1
if_open_is_EMPTY	open	0	0.000000	0.000	PASSING	1	1
if_part_date_str_is_DATE	part_date_str	0	0.000000	0.000	PASSING	1	1

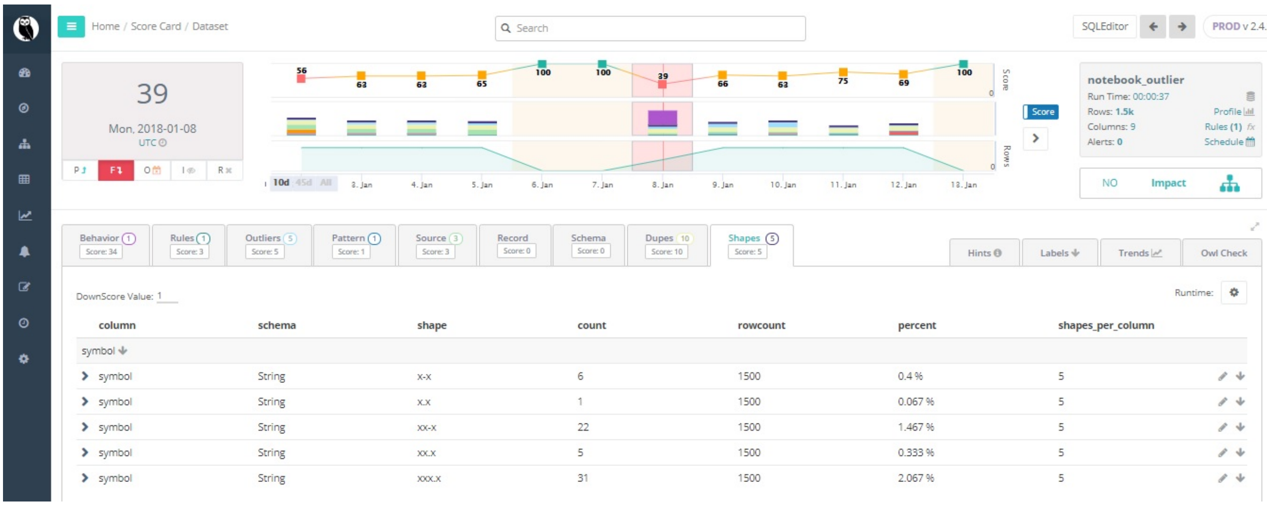
Schema

Columns add or dropped.



Shapes

Infrequent formats.



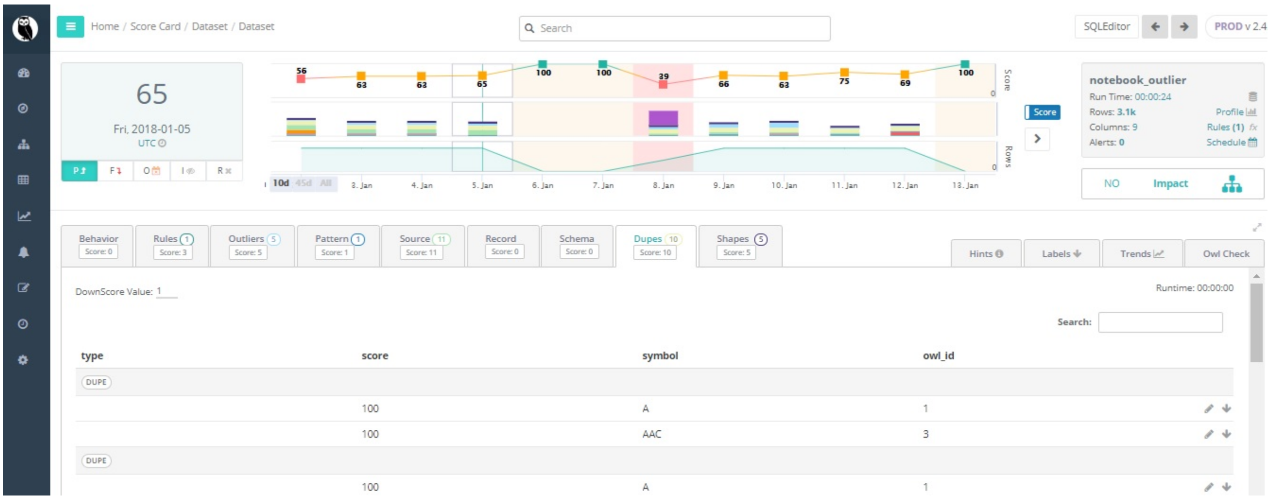
DownScore Value: 1

Runtime:

column	schema	shape	count	rowcount	percent	shapes_per_column
symbol						
symbol	String	x-x	6	1500	0.4 %	5
symbol	String	x.x	1	1500	0.067 %	5
symbol	String	xx-x	22	1500	1.467 %	5
symbol	String	xx.x	5	1500	0.333 %	5
symbol	String	xxx.x	31	1500	2.067 %	5

Dupes

Fuzzy matching to identify entries that have been added multiple times with similar but not exact detail.



notebook_outlier
Run Time: 00:00:24
Rows: 3.1k
Columns: 9
Alerts: 0
Profile
Rules (1)
Schedule

DownScore Value: 1

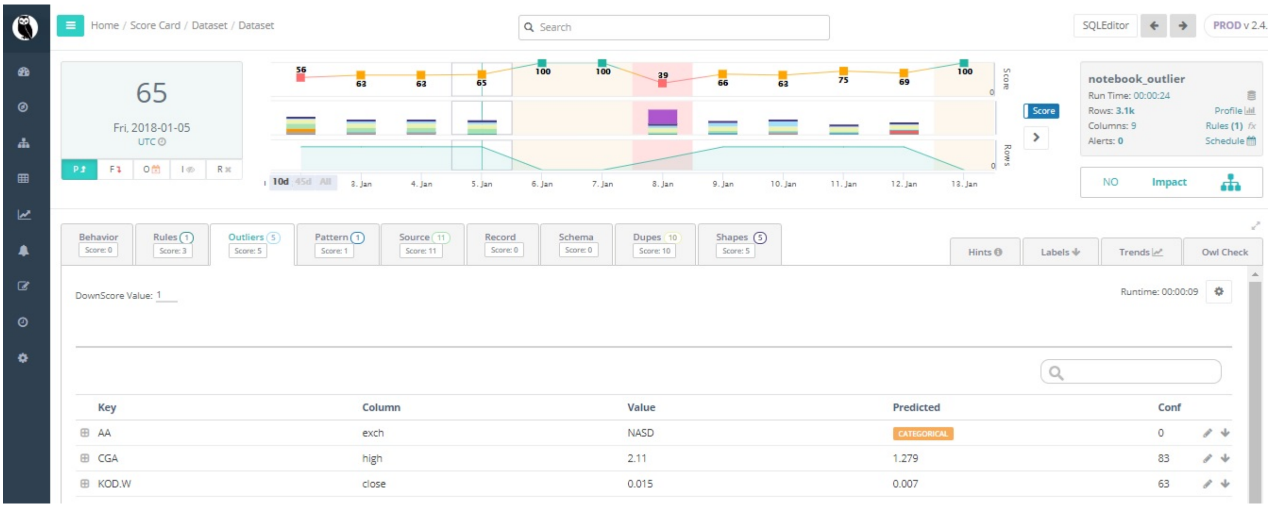
Runtime: 00:00:00

Search:

type	score	symbol	owl_id
DUPE			
	100	A	1
	100	AAC	3
DUPE			
	100	A	1

Outliers

Data points that differ significantly from other observations.



notebook_outlier
Run Time: 00:00:24
Rows: 3.1k
Columns: 9
Alerts: 0
Profile
Rules (1)
Schedule

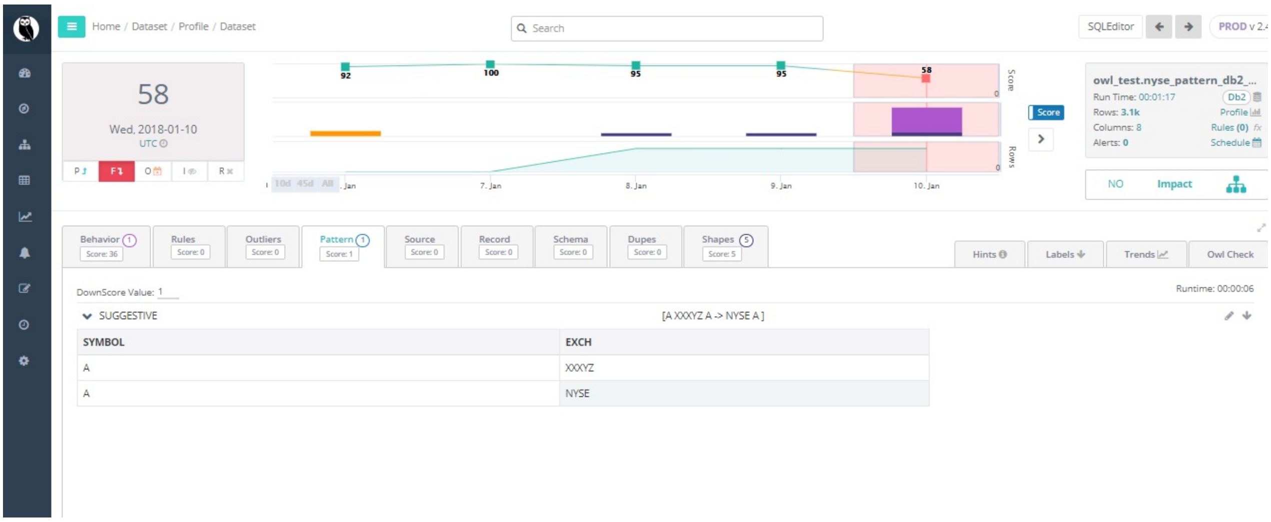
DownScore Value: 1

Runtime: 00:00:09

Key	Column	Value	Predicted	Conf
AA	exch	NASD	CATEGORICAL	0
CGA	high	2.11	1.279	83
KOD.W	close	0.015	0.007	63

Pattern

Recognizing relevant patterns between data examples.



DownScore Value: 1

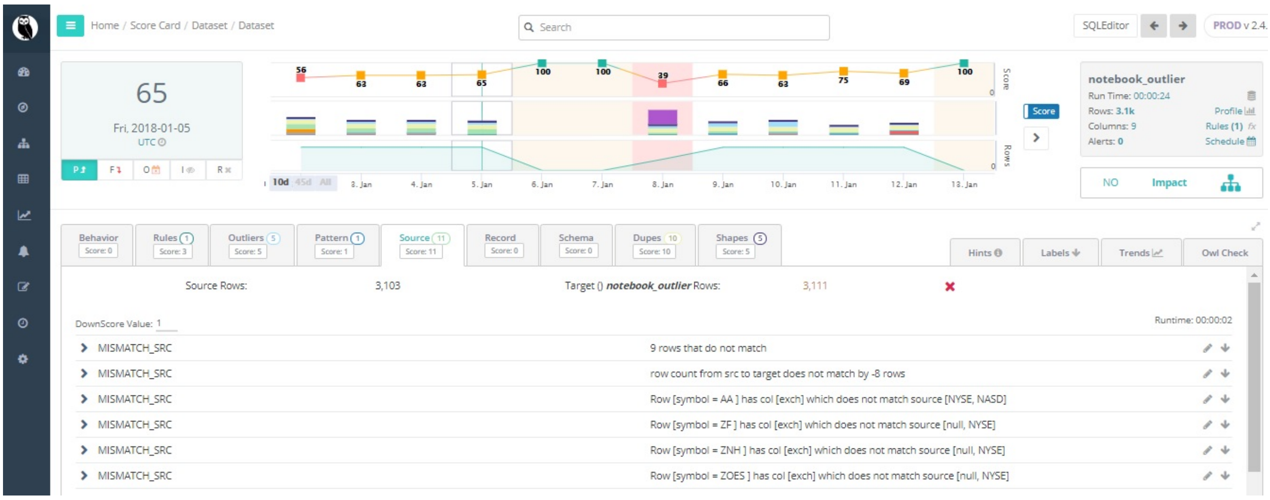
Runtime: 00:00:06

SUGGESTIVE [A XXXYZ A -> NYSE A]

SYMBOL	EXCH
A	XXXYZ
A	NYSE

Source

Validating source to target accuracy.



Source Rows: 3,103 Target () ***notebook_outlier*** Rows: 3,111 ✗

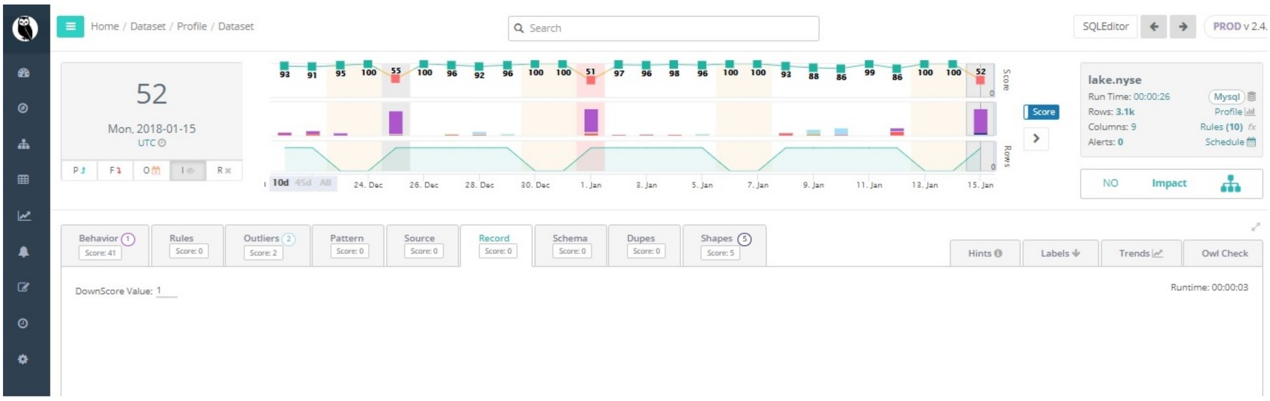
DownScore Value: 1

Runtime: 00:00:02

MISMATCH_SRC	9 rows that do not match
MISMATCH_SRC	row count from src to target does not match by -8 rows
MISMATCH_SRC	Row [symbol = AA] has col [exch] which does not match source [NYSE, NASD]
MISMATCH_SRC	Row [symbol = ZF] has col [exch] which does not match source [null, NYSE]
MISMATCH_SRC	Row [symbol = ZNH] has col [exch] which does not match source [null, NYSE]
MISMATCH_SRC	Row [symbol = ZOES] has col [exch] which does not match source [null, NYSE]

Record

Deltas for a given column.



lake.nyse
Run Time: 00:00:26
Rows: 3.1k
Columns: 9
Alerts: 0

Behavior Score: 41
Rules Score: 0
Outliers Score: 2
Pattern Score: 0
Source Score: 0
Record Score: 0
Schema Score: 0
Dupes Score: 0
Shapes Score: 5

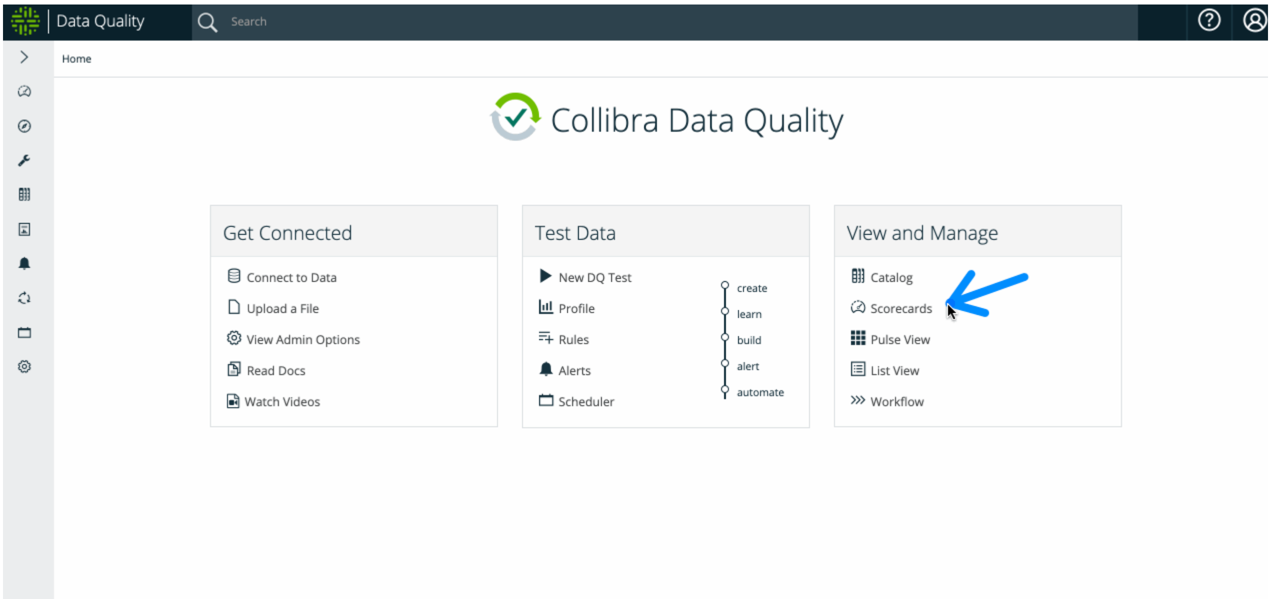
DownScore Value: 1

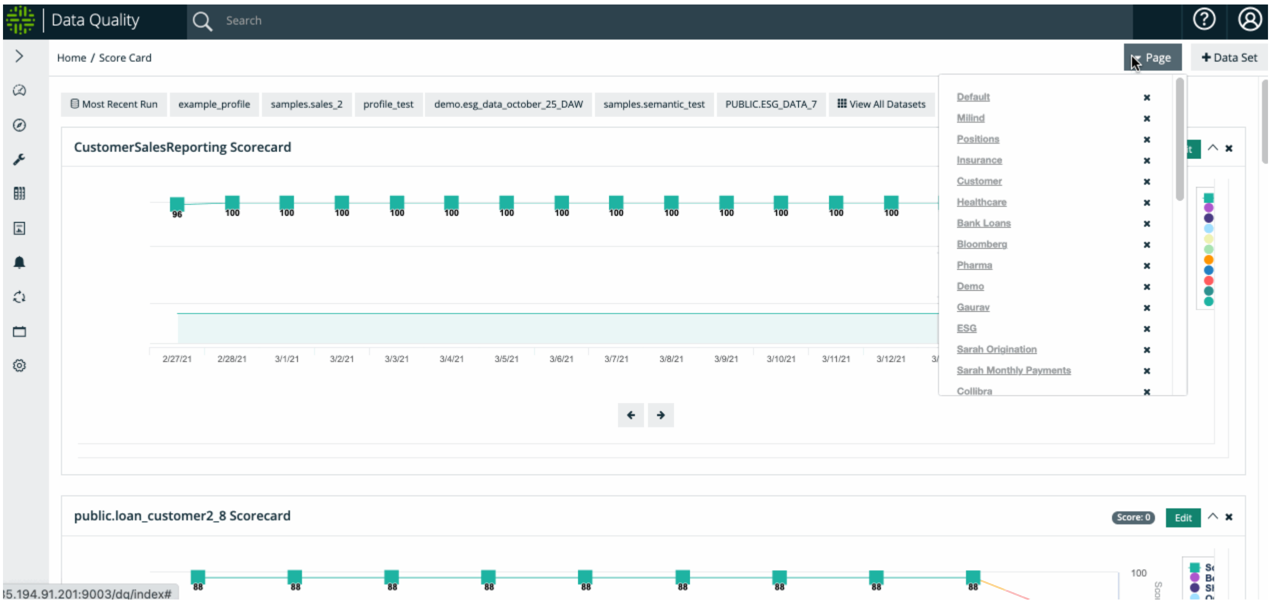
Runtime: 00:00:03

Chapter 8

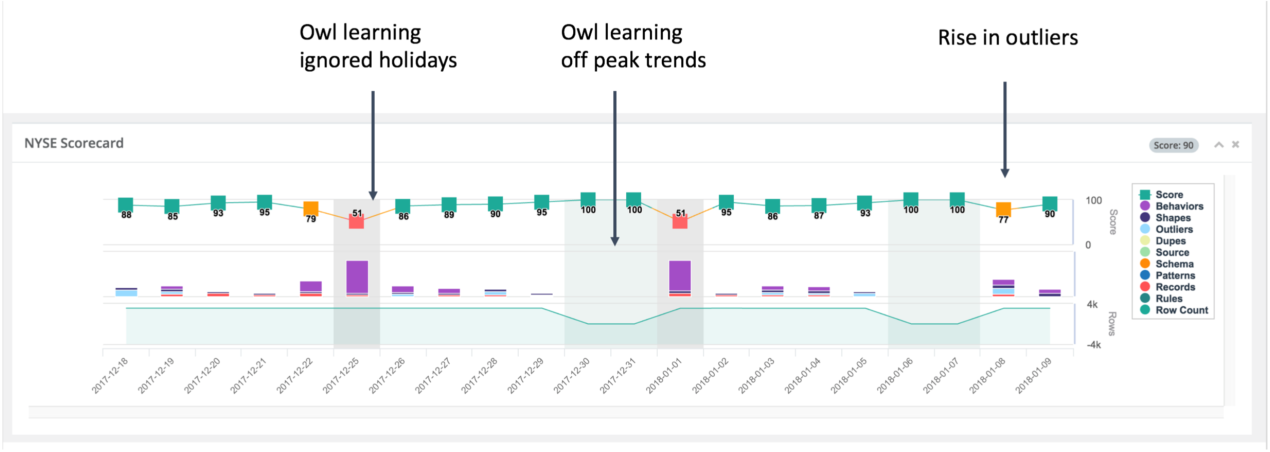
Collibra DQ Scorecards

Overview





Scorecards allow you to visualize the health and consistency of a data set over time. DQ highlights macro and micro trends, for example, weekend loads vs weekday loads or behavioral item changes per day, and display them on the dataset scorecard.

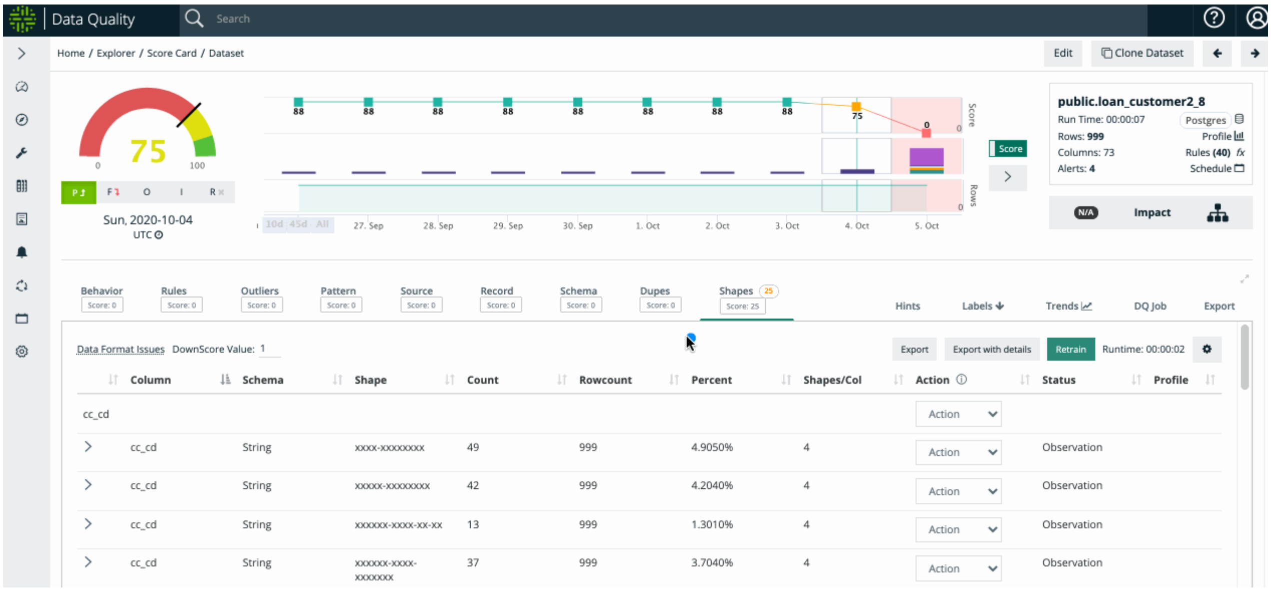


Data Quality Over Time, Drill-In and Roll-Up

Data quality doesn't mean a one time check or once a year project. Data is the life blood flowing through your organization. It's mandatory to know how your data is behaving right now, yesterday and over time to gain an understanding of the trends. For insights to be meaningful, we need to see both the lowest granularity and the big picture. DQ's approach lets you drill all the way into the exact moment the issue arose, as well as zoom out to see how your data is behaving month to month. This makes DQ useful at many different levels in your organization's heirarchy - a Data Steward might be more concerned with a recent change in data and want to correct it using Service Now immediately, whereas a Chief Data Officer might be more concerned with the overall health of the organization's data.

Scoring

Scoring can be completely controlled by the end-user with out of the box defaults.



Sun, 2020-10-04
UTC

public.loan_customer2_8
Run Time: 00:00:07
Postgres
Rows: **999**
Profile
Columns: 73
Rules **(40)** *fx*
Alerts: **4**
Schedule

Behavior	Rules	Outliers	Pattern	Source	Record	Schema	Dupes	Shapes
Score: 0	Score: 0	Score: 0	Score: 0	Score: 0	Score: 0	Score: 0	Score: 0	Score: 25

Data Format Issues DownScore Value: 1
Runtime: 00:00:02

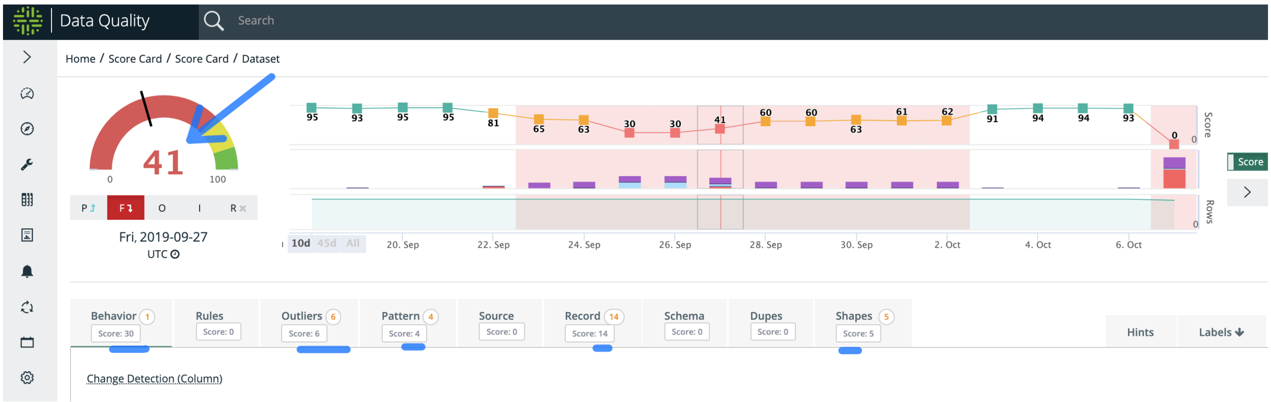
	Column	Schema	Shape	Count	Rowcount	Percent	Shapes/Col	Action	Status	Profile
cc_cd								Action		
>	cc_cd	String	xxxx-xxxxxxxx	49	999	4.9050%	4	Action	Observation	
>	cc_cd	String	xxxxx-xxxxxxxx	42	999	4.2040%	4	Action	Observation	
>	cc_cd	String	xxxxxx-xxxx-xx-xx	13	999	1.3010%	4	Action	Observation	
>	cc_cd	String	xxxxxx-xxxx-xxxxxxx	37	999	3.7040%	4	Action	Observation	

Collibra Data Quality provides a data quality assessment that scans nine dimensions of a data set to assure the integrity of that data. The nine dimensions include behavior, rules, outliers, pattern, source, record, schema, duplicates, and shapes.

OwlCheck produces a data quality score from 0-100. 100 represents no integrity issues found in the data set. The score numerically represents the integrity of that data. For example, the score of 100 tells the data analyst that there are zero data quality issues in that data set.

DQ scans your data with the same frequency. You load your data - Owl scans nine dimensions of DQ and summarizes the results into a score from 0-100.

Aggregate Score



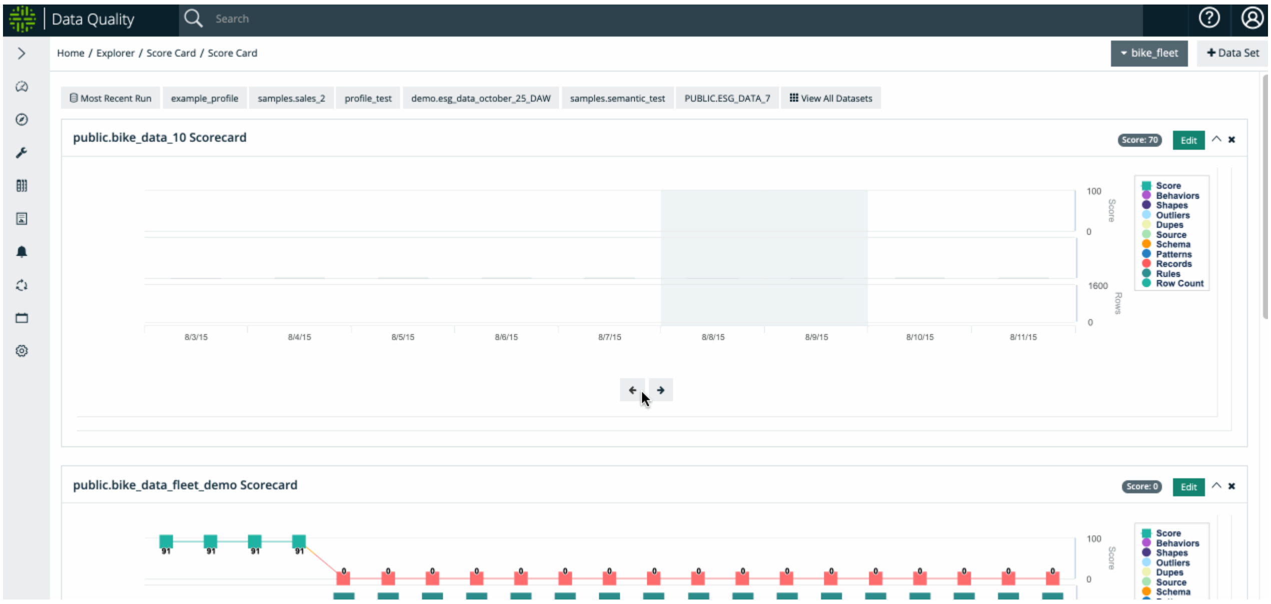
Fri, 2019-09-27
UTC

Behavior 1	Rules	Outliers 6	Pattern 4	Source	Record 14	Schema	Dupes	Shapes 5
Score: 30	Score: 0	Score: 6	Score: 4	Score: 0	Score: 14	Score: 0	Score: 0	Score: 5

Change Detection (Column)

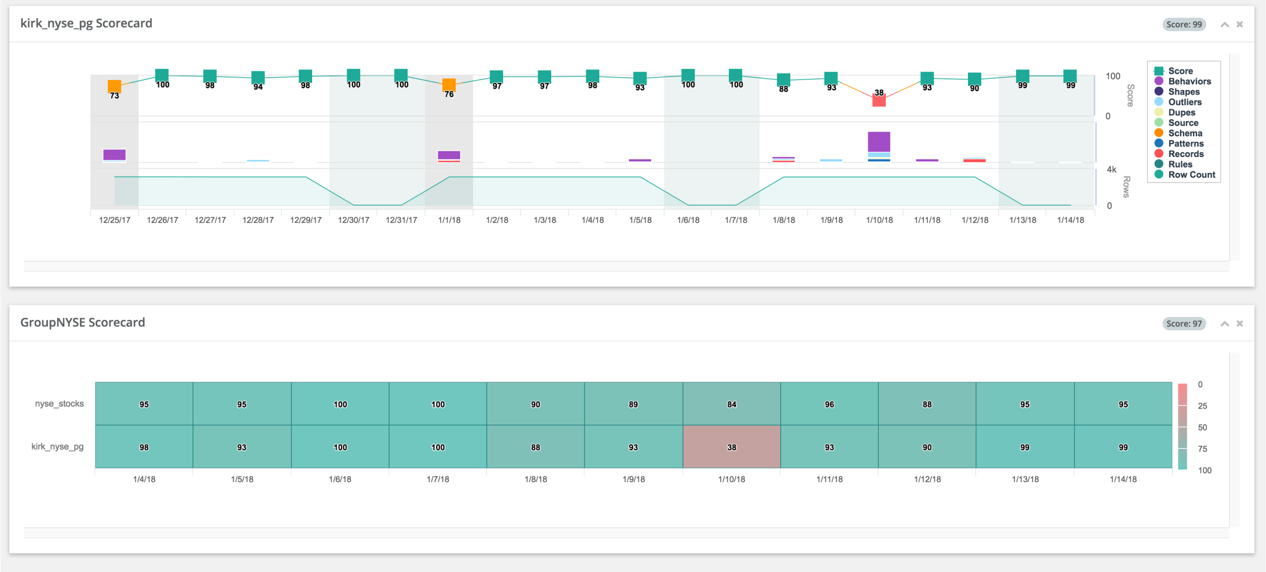
> **Note** Each dimension can be custom weighted and rules can contain custom scoring severity. In this example, the deducted score (59) from the starting score (100) equals an overall score of 41.

Page View



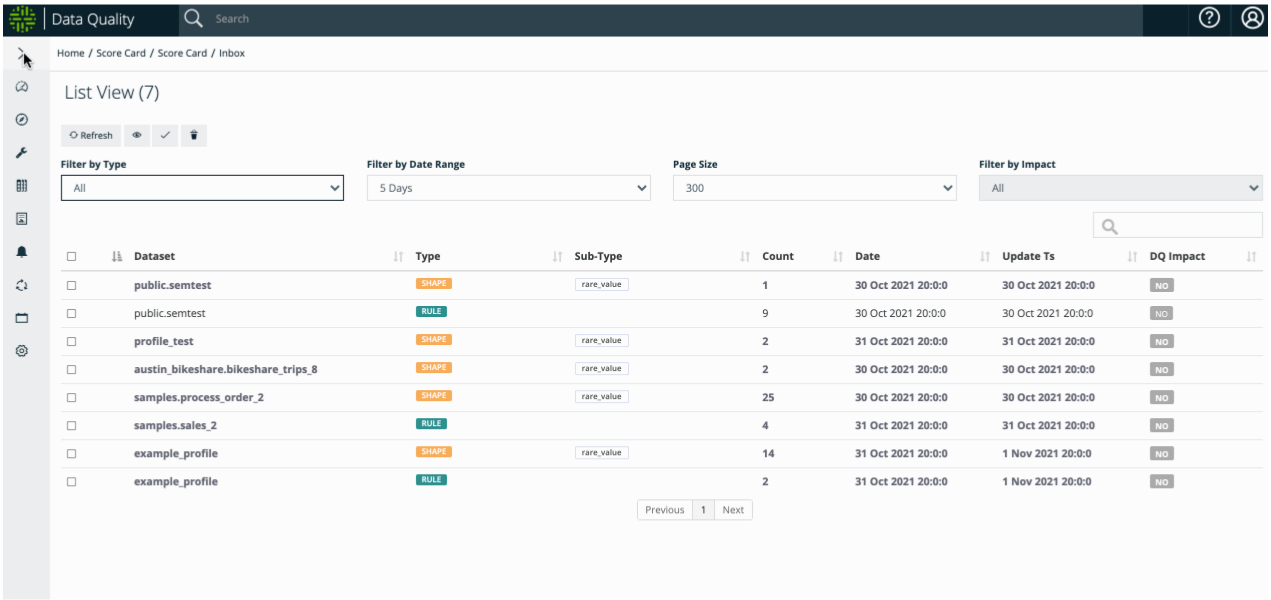
Visually and logically group data sets together to create a heat-map of blindspots.

Similarly to job control and build frameworks like Jenkins, we always want to know the health of our data sets. Did it recently fail? Does it commonly fail on Mondays? What is the aggregate or composite score for multiple data sets? DQ allows you to define scheduled health checks that depend on the success/failure status of any number of data sets. This protects the downstream process consumers from pulling erroneous data into their models.



	1/4/18	1/5/18	1/6/18	1/7/18	1/8/18	1/9/18	1/10/18	1/11/18	1/12/18	1/13/18	1/14/18
nyse_stocks	95	95	100	100	90	89	84	96	88	95	95
kirk_nyse_pg	98	93	100	100	88	93	38	93	90	99	99

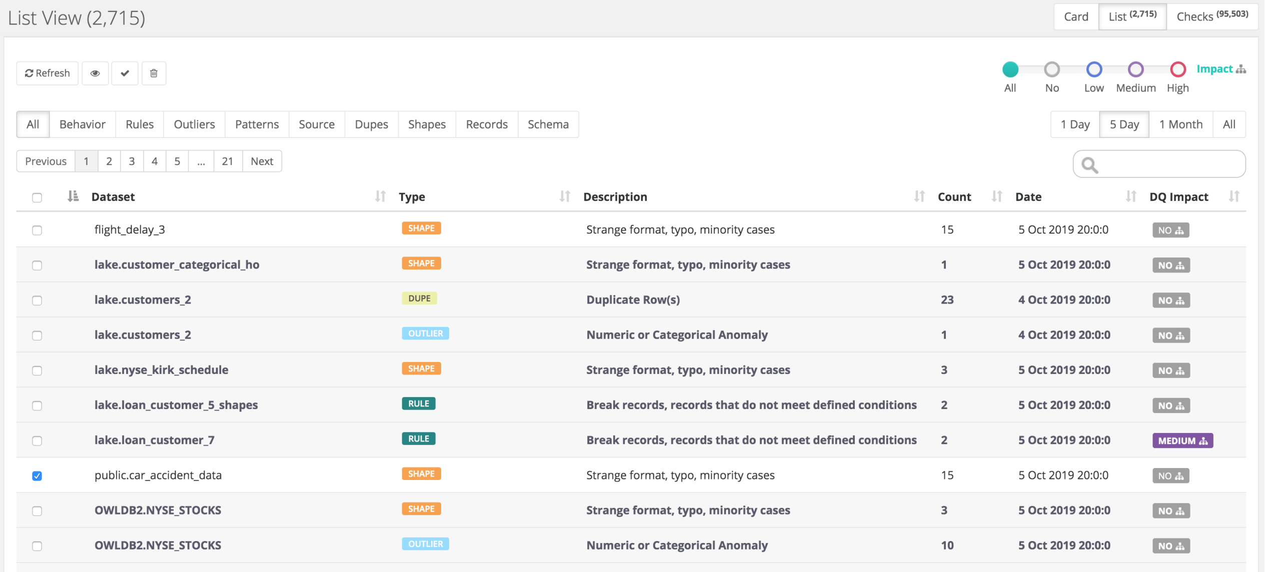
List View



Filter by Type: All
Filter by Date Range: 5 Days
Page Size: 300
Filter by Impact: All

□	Dataset	Type	Sub-Type	Count	Date	Update Ts	DQ Impact
□	public.semtest	SHAPE	rare_value	1	30 Oct 2021 20:0:0	30 Oct 2021 20:0:0	NO
□	public.semtest	RULE		9	30 Oct 2021 20:0:0	30 Oct 2021 20:0:0	NO
□	profile_test	SHAPE	rare_value	2	31 Oct 2021 20:0:0	31 Oct 2021 20:0:0	NO
□	austin_bikeshare.bikeshare_trips_8	SHAPE	rare_value	2	30 Oct 2021 20:0:0	30 Oct 2021 20:0:0	NO
□	samples.process_order_2	SHAPE	rare_value	25	30 Oct 2021 20:0:0	30 Oct 2021 20:0:0	NO
□	samples.sales_2	RULE		4	31 Oct 2021 20:0:0	31 Oct 2021 20:0:0	NO
□	example_profile	SHAPE	rare_value	14	31 Oct 2021 20:0:0	1 Nov 2021 20:0:0	NO
□	example_profile	RULE		2	31 Oct 2021 20:0:0	1 Nov 2021 20:0:0	NO

Find DQ issues across all data sets in your data lake. Rank them, sort them, search them and limit them by time.



□	Dataset	Type	Description	Count	Date	DQ Impact
□	flight_delay_3	SHAPE	Strange format, typo, minority cases	15	5 Oct 2019 20:0:0	NO
□	lake.customer_categorical_ho	SHAPE	Strange format, typo, minority cases	1	5 Oct 2019 20:0:0	NO
□	lake.customers_2	DUPE	Duplicate Row(s)	23	4 Oct 2019 20:0:0	NO
□	lake.customers_2	OUTLIER	Numeric or Categorical Anomaly	1	4 Oct 2019 20:0:0	NO
□	lake.nyse_kirk_schedule	SHAPE	Strange format, typo, minority cases	3	5 Oct 2019 20:0:0	NO
□	lake.loan_customer_5_shapes	RULE	Break records, records that do not meet defined conditions	2	5 Oct 2019 20:0:0	NO
□	lake.loan_customer_7	RULE	Break records, records that do not meet defined conditions	2	5 Oct 2019 20:0:0	MEDIUM
☑	public.car_accident_data	SHAPE	Strange format, typo, minority cases	15	5 Oct 2019 20:0:0	NO
□	OWLDB2.NYSE_STOCKS	SHAPE	Strange format, typo, minority cases	3	5 Oct 2019 20:0:0	NO
□	OWLDB2.NYSE_STOCKS	OUTLIER	Numeric or Categorical Anomaly	10	5 Oct 2019 20:0:0	NO

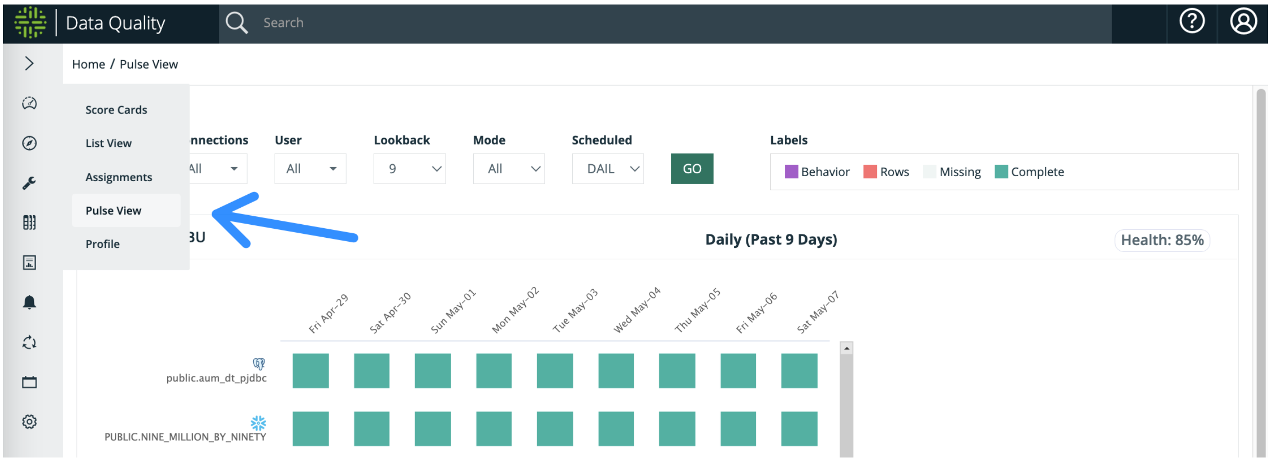
How Do I Take Action on Lots of Alerts?

One of the most frequently asked questions is how to operationalize and take action on all of the issues that are seemingly valid yet overwhelming. DQ seems to find many valid issues in your data sets, but there are many more issues in your data than expected. The list view helps by first limiting to a time range, for example, issues that have occurred less than five days, or possibly even just issues that occurred today. This will likely result in a large reduction in the issue count. In addition, you might limit issues to those DQ issues that have a business impact. This means other downstream processes or data sets are connected to this data set and field. You only get the business impact feature if you have enabled the DQ Graph module. This results in another drastic reduction in issues because now you are limited to issues that recently occurred and have impact to the business. Finally, you might filter by the "class" or "type" of DQ issue, such as Rules or Outliers. It is common in a large data lake that after taking these steps you are left with the one or five top ranking issues in your lake. These are likely the issues that should be prioritized and moved into a remediation queue.

Pulse View

View a heatmap or your DQ jobs.

Navigate to the Pulse View dashboard.

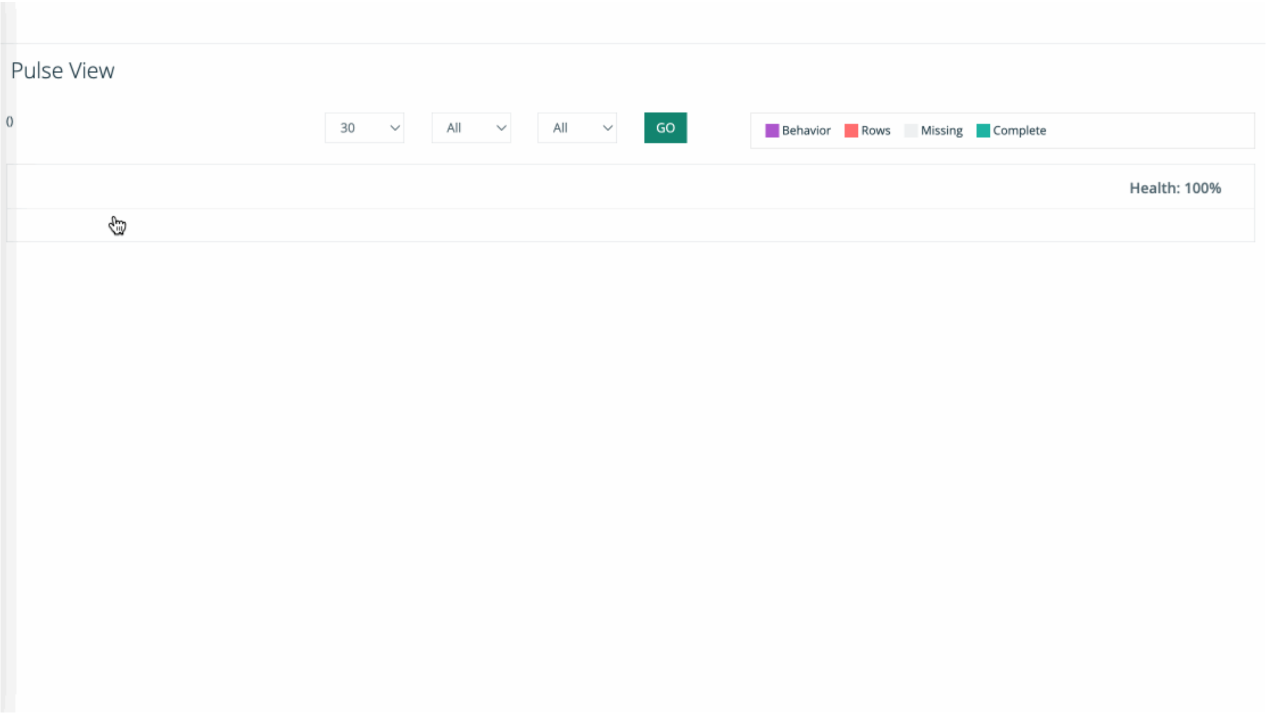


nnections All
User All
Lookback 9
Mode All
Scheduled DAIL

Daily (Past 9 Days)

Health: 85%

View jobs and health by business unit, scheduled frequency, data source, and more.



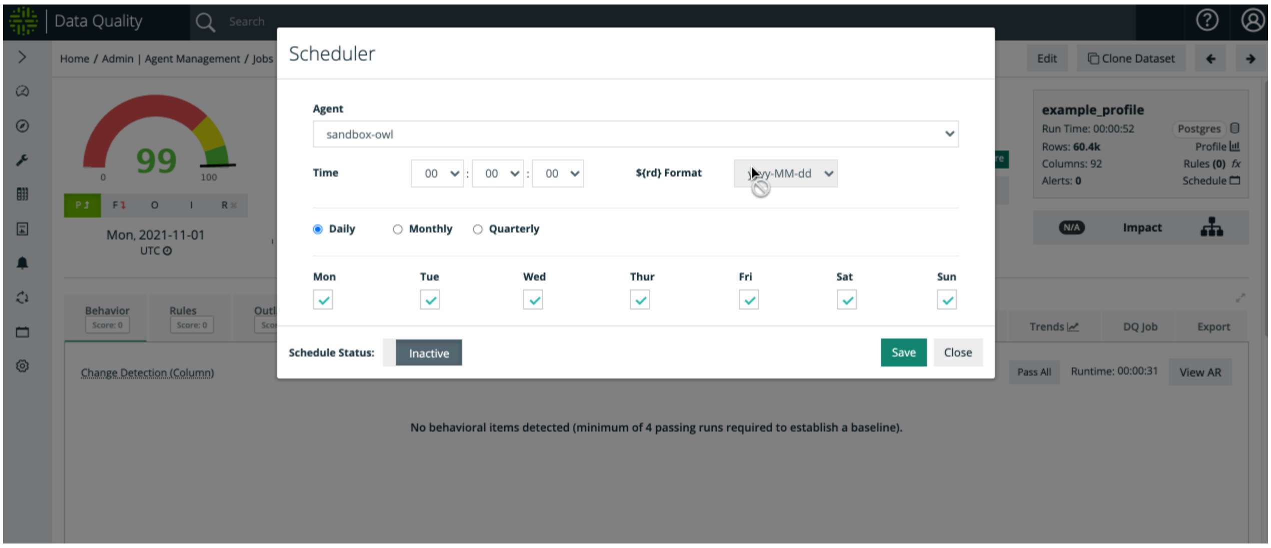
Health: 100%

Chapter 9

Collibra DQ Scheduler

Schedule a Job

After you successfully run a job, you can schedule that job to run automatically. Do this by updating the template (if needed) and clicking the schedule icon in the hoot page. To change the template, you can use the -rd variable: $ in your query to set dynamic dates or date ranges for your scheduled job.



Scheduler

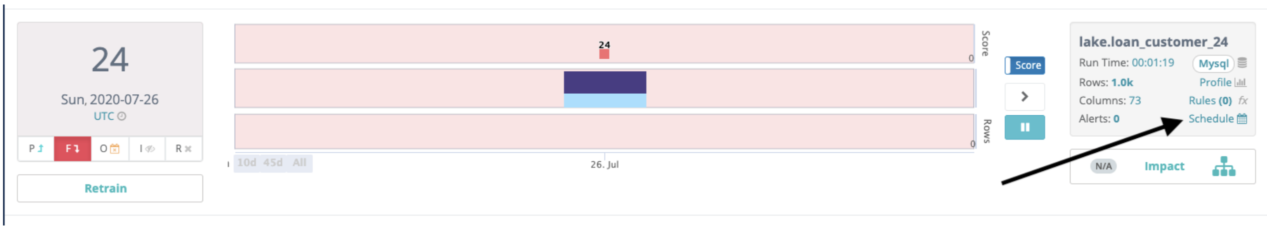
Agent: sandbox-owl

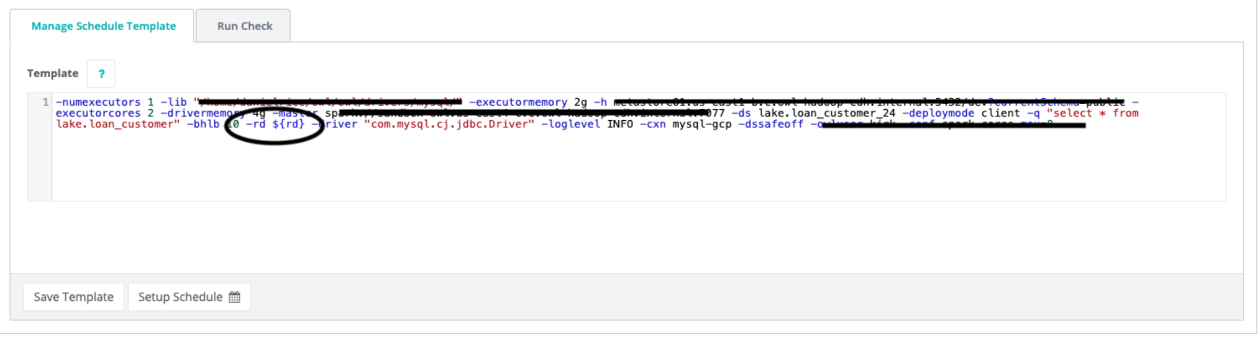
Time: 00 : 00 : 00 ${rd} Format: yyyy-MM-dd

● Daily ○ Monthly ○ Quarterly

Mon	Tue	Wed	Thur	Fri	Sat	Sun
☑	☑	☑	☑	☑	☑	☑

Schedule Status: Inactive





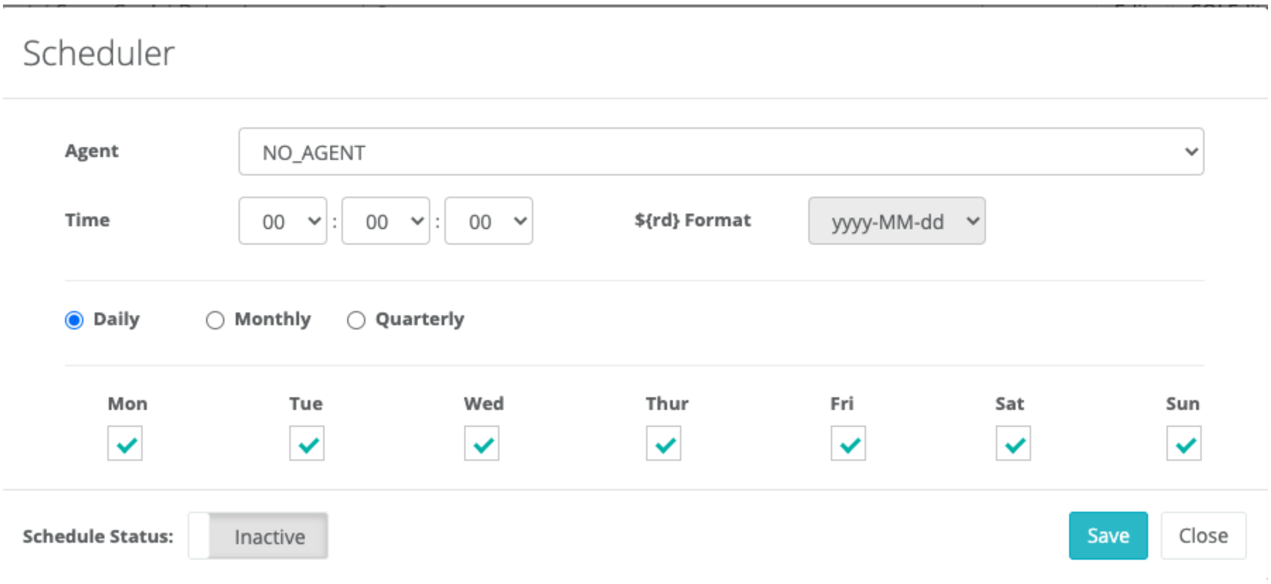
Manage Schedule Template | Run Check

Template

```
-numexecutors 1 -lib "[redacted]" -executormemory 2g -h [redacted] -
executorcores 2 -drivermemory 4g -master sp[redacted]077 -ds lake.loan_customer_24 -deploymode client -q "select * from
lake.loan_customer" -bhlb 10 -rd ${rd} -driver "com.mysql.cj.jdbc.Driver" -loglevel INFO -cxn mysql-gcp -dssafeoff -[redacted]
```

Save Template | Setup Schedule

Here you can choose the Agent to run the job, the frequency (daily/monthly/quarterly) and the time of day:



Scheduler

Agent: NO_AGENT

Time: 00 : 00 : 00

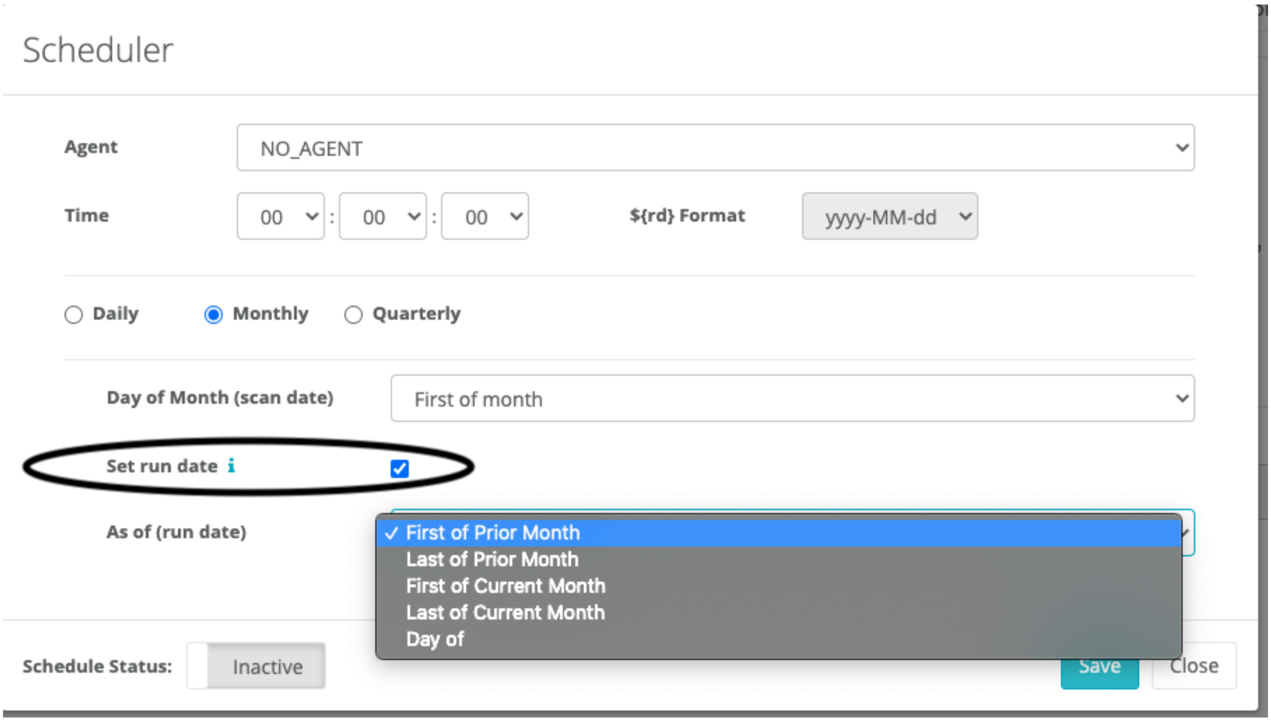
${rd} Format: yyyy-MM-dd

● Daily ○ Monthly ○ Quarterly

Mon	Tue	Wed	Thur	Fri	Sat	Sun
☑	☑	☑	☑	☑	☑	☑

Schedule Status: Inactive

If your monthly or quarterly jobs are loaded after the month or quarter has ended, you can schedule the job for the day when the data has landed, but set the offset to the proper run date required for charting/reporting.



Scheduler

Agent: NO_AGENT

Time: 00 : 00 : 00

${rd} Format: yyyy-MM-dd

○ Daily ● Monthly ○ Quarterly

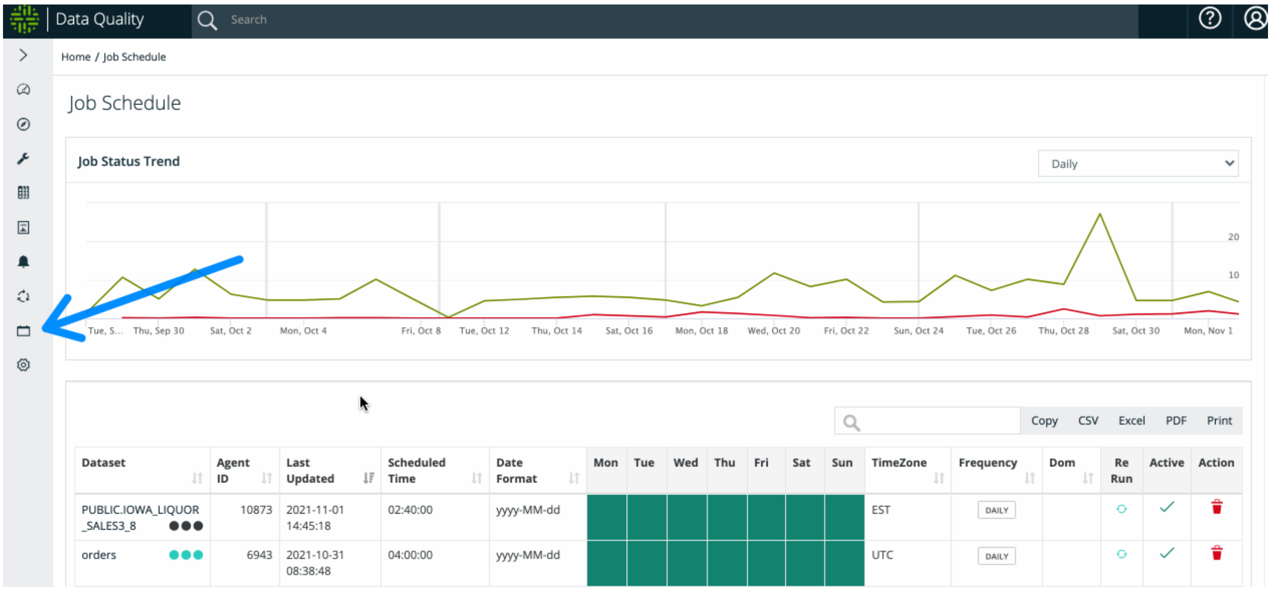
Day of Month (scan date): First of month

Set run date i ☑

As of (run date):

Schedule Status: Inactive

Schedule Management



Job Schedule

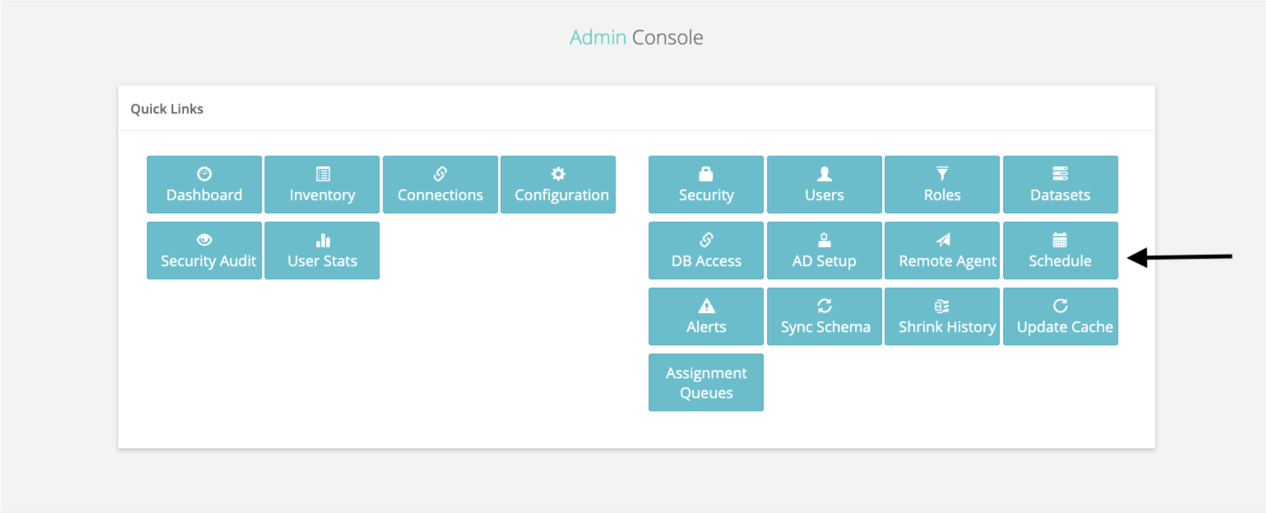
Dataset	Agent ID	Last Updated	Scheduled Time	Date Format	Mon	Tue	Wed	Thu	Fri	Sat	Sun	TimeZone	Frequency	Dom	Re Run	Active	Action
PUBLIC.IOWA_LIQUOR_SALES3_8 ●●●	10873	2021-11-01 14:45:18	02:40:00	yyyy-MM-dd	🟩	🟩	🟩	🟩	🟩	🟩	🟩	EST	DAILY		⟳	✓	🗑
orders ●●●	6943	2021-10-31 08:38:48	04:00:00	yyyy-MM-dd	🟩	🟩	🟩	🟩	🟩	🟩	🟩	UTC	DAILY		⟳	✓	🗑

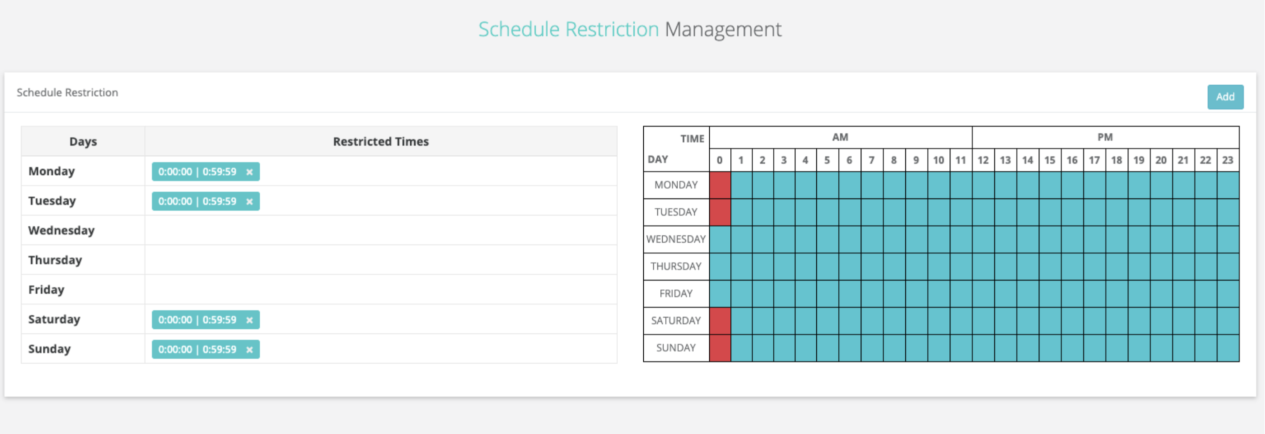
Enable Scheduled Jobs from your environment variable in owl-env.sh:

SCHEDULE_ENABLED = TRUE/FALSE (Default = TRUE)

Limit Scheduler Open Time-slots:

If you don't want automated jobs to be running during business hours, or for a particular day/time on any given day of the week, you can set "off-limit" times so authorized users don't select them when scheduling a job.





Schedule Restriction Management

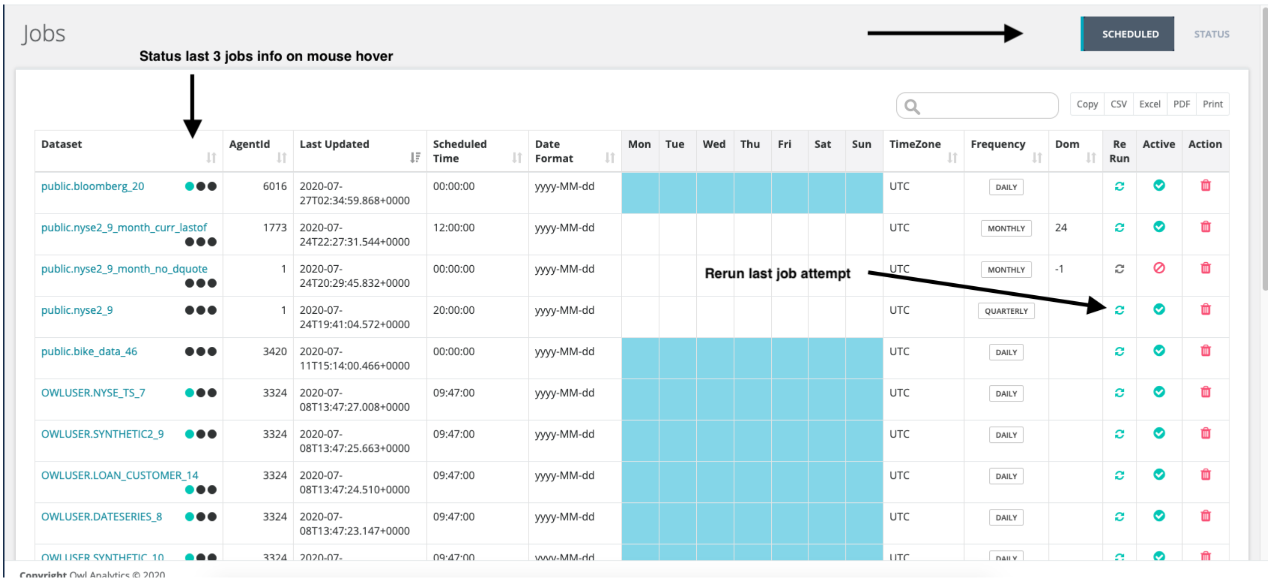
Schedule Restriction

Days	Restricted Times
Monday	0:00:00 | 0:59:59 ×
Tuesday	0:00:00 | 0:59:59 ×
Wednesday	
Thursday	
Friday	
Saturday	0:00:00 | 0:59:59 ×
Sunday	0:00:00 | 0:59:59 ×

TIME	AM												PM											
DAY	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
MONDAY	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦
TUESDAY	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦
WEDNESDAY	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦
THURSDAY	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦
FRIDAY	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦
SATURDAY	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦
SUNDAY	🟥	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦	🟦

View/Re-Run Scheduled Jobs

You can view your schedule jobs from the scheduled tab on the jobs page.



Jobs

Status last 3 jobs info on mouse hover

Rerun last job attempt

Dataset	AgentId	Last Updated	Scheduled Time	Date Format	Mon	Tue	Wed	Thu	Fri	Sat	Sun	TimeZone	Frequency	Dom	Re Run	Active	Action
public.bloomberg_20 ●●●	6016	2020-07-27T02:34:59.868+0000	00:00:00	yyyy-MM-dd	🟦	🟦	🟦	🟦	🟦	🟦	🟦	UTC	DAILY		⟳	✓	🗑
public.nyse2_9_month_curr_lastof ●●●	1773	2020-07-24T22:27:31.544+0000	12:00:00	yyyy-MM-dd								UTC	MONTHLY	24	⟳	✓	🗑
public.nyse2_9_month_no_dquote ●●●	1	2020-07-24T20:29:45.832+0000	00:00:00	yyyy-MM-dd								UTC	MONTHLY	-1	⟳	⊘	🗑
public.nyse2_9 ●●●	1	2020-07-24T19:41:04.572+0000	20:00:00	yyyy-MM-dd								UTC	QUARTERLY		⟳	✓	🗑
public.bike_data_46 ●●●	3420	2020-07-11T15:14:00.466+0000	00:00:00	yyyy-MM-dd	🟦	🟦	🟦	🟦	🟦	🟦	🟦	UTC	DAILY		⟳	✓	🗑
OWLUSER.NYSE_TS_7 ●●●	3324	2020-07-08T13:47:27.008+0000	09:47:00	yyyy-MM-dd	🟦	🟦	🟦	🟦	🟦	🟦	🟦	UTC	DAILY		⟳	✓	🗑
OWLUSER.SYNTHETIC2_9 ●●●	3324	2020-07-08T13:47:25.663+0000	09:47:00	yyyy-MM-dd	🟦	🟦	🟦	🟦	🟦	🟦	🟦	UTC	DAILY		⟳	✓	🗑
OWLUSER.LOAN_CUSTOMER_14 ●●●	3324	2020-07-08T13:47:24.510+0000	09:47:00	yyyy-MM-dd	🟦	🟦	🟦	🟦	🟦	🟦	🟦	UTC	DAILY		⟳	✓	🗑
OWLUSER.DATESERIES_8 ●●●	3324	2020-07-08T13:47:23.147+0000	09:47:00	yyyy-MM-dd	🟦	🟦	🟦	🟦	🟦	🟦	🟦	UTC	DAILY		⟳	✓	🗑
OWLUSER.SYNTHETIC_10 ●●●	3324	2020-07-	09:47:00	yyyy-MM-dd	🟦	🟦	🟦	🟦	🟦	🟦	🟦	UTC	DAILY		⟳	✓	🗑

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Chapter 10

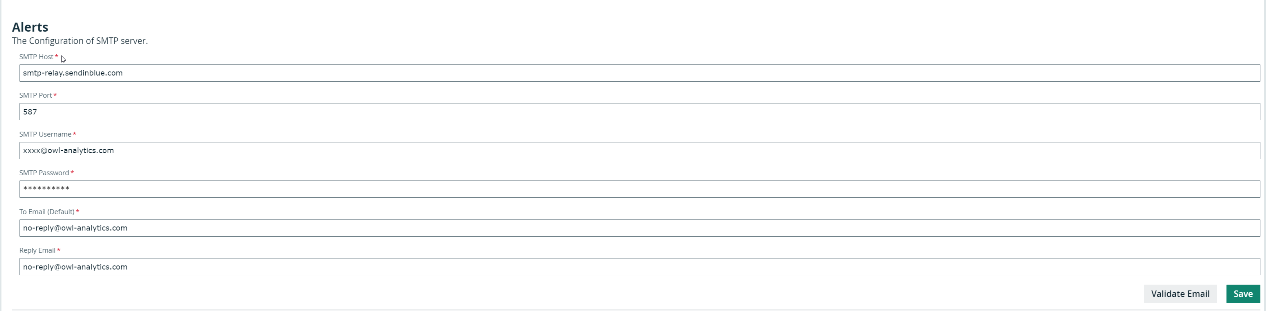
Collibra DQ Alerts

Email Alerts

Email alerts let you send emails to specified recipients when an alert condition is met for a given dataset.

Setting up an email server using the WebApp

To configure the SMTP server, click the gear icon in the left navigation pane and then click **Alerts**.



Alerts

The Configuration of SMTP server.

SMTP Host *: smtp-relay.sendinblue.com

SMTP Port *: 587

SMTP Username *: xxxx@owl-analytics.com

SMTP Password *: **********

To Email (Default) *: no-reply@owl-analytics.com

Reply Email *: no-reply@owl-analytics.com

Setting a condition to send an alert

You can set specific conditions so that an email alert is sent to recipients when those conditions are met.

1. Go to the **Alert Definitions** page under **Alerts**.
2. Select a dataset from the Alert Builder searchbar.
3. Enter an **Alert Name**, for example, score less than 75.
4. Define a **Condition**.

Condition Type	Description	Example
Built-in	Conditions that do not require any predefined rules to trigger alerts. To use built-in conditions, enter the condition, an operator, and a value. Available built-in conditions are: ○ score ○ row count	score < 75

Condition Type	Description	Example
Rules	Conditions that are tied to datasets as predefined, saved rules. To use rule conditions, enter the rule upon which the alert condition is based. Rule conditions can be configured based on: ◦ SQL Based Rules previously saved to a dataset. ◦ Stat Rules previously saved to a dataset. **Tip** You can configure dataset-level stat rules as conditions without previously saving them to a dataset. **Note** Because rule validation does not occur in the Alert Builder, it is not recommended to use rules that are not already saved to a dataset.	$rowCount > 1

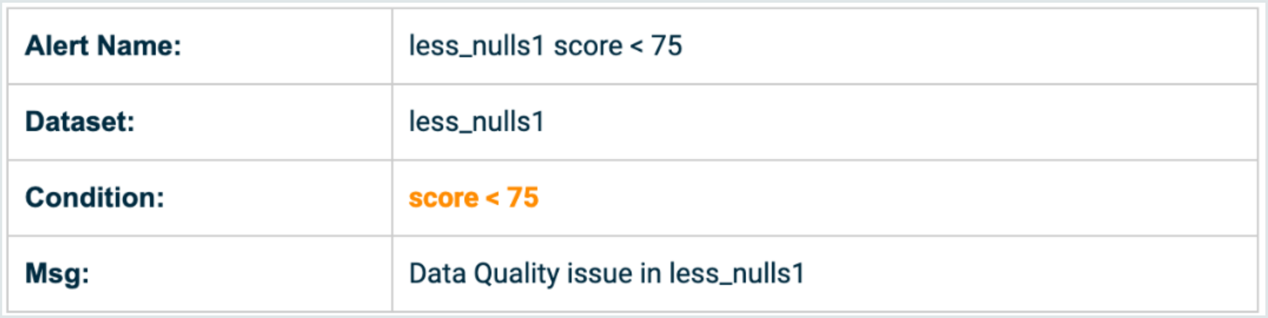
5. Optionally enter a **Batch Name.**
6. Enter an **Alert Recipient** as a recipient of email alerts, for example, test.user-@collibra.com.
7. Optionally enter a **Custom Message**, for example, Alert when a score is less than 75.
8. Click **Save**.

For more information on creating rules to use as rule conditions, see Adding a Rule.

To use the batch name to create a consolidated list of alerts and distribution lists for a set of notifications per dataset, see Email Batch Alerts.

DQ Alerts for datasets

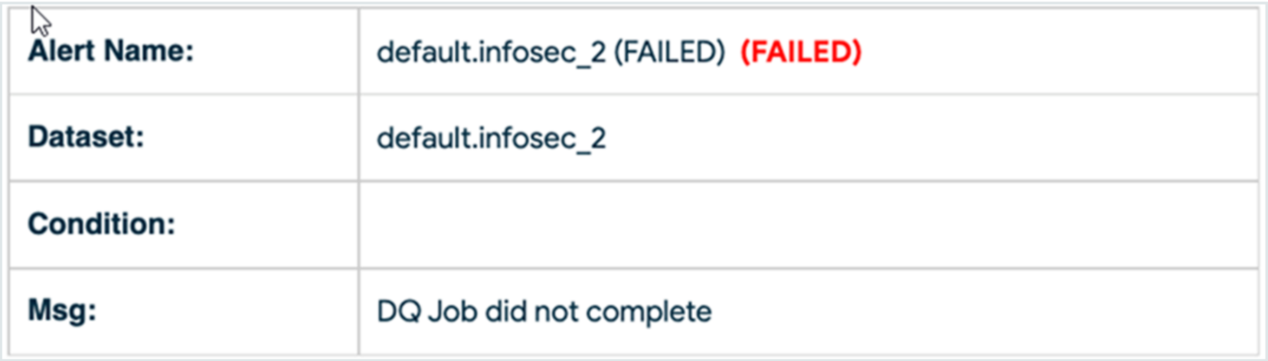
You can set DQ alerts for datasets so that you are notified based on certain conditions that are triggered on the datasets. Below is what a dataset email looks like in your inbox. Make sure your email client didn't mark the email as spam and that the SMTP server was set up properly.



Alert Name:	less_nulls1 score < 75
Dataset:	less_nulls1
Condition:	**score < 75**
Msg:	Data Quality issue in less_nulls1

DQ Alerts for failed jobs

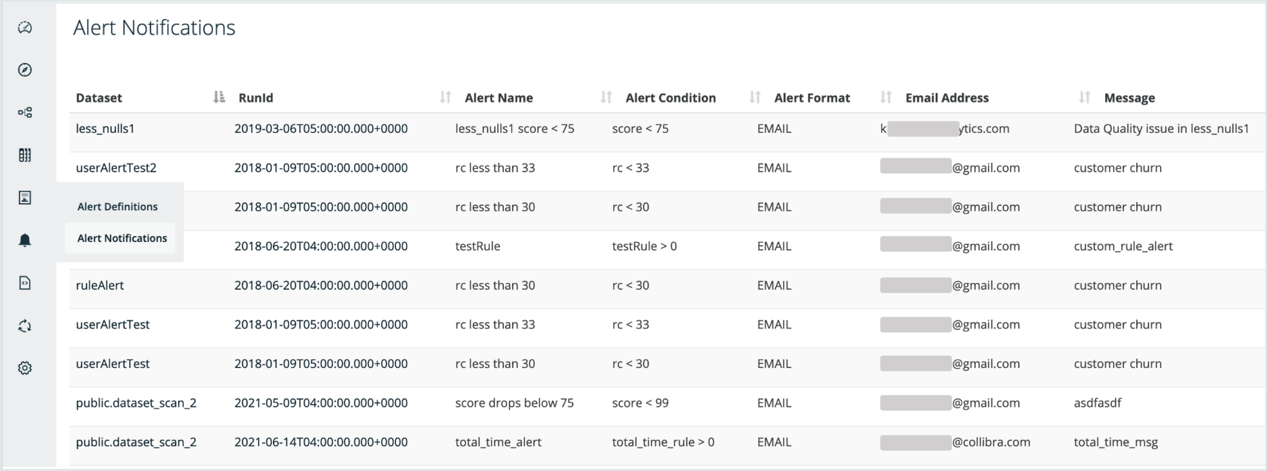
Another scenario is when the DQ Job fails to run or has an exception and, therefore, never gets the chance to score the data or run the alert condition. This is a failed alert that's automatically sent to the email address based on the Admin/SMTP settings defined in the To Email (Default) fields in the Admin console.



Alert Name:	default.infosec_2 (FAILED) **(FAILED)**
Dataset:	default.infosec_2
Condition:	
Msg:	DQ Job did not complete

Alert Notification in Web UI

There are also alert notifications in the web UI. This can be helpful to confirm that the email alerts were sent out and who should have received the notifications.



Alert Notifications

Dataset	RunId	Alert Name	Alert Condition	Alert Format	Email Address	Message
less_nulls1	2019-03-06T05:00:00.000+0000	less_nulls1 score < 75	score < 75	EMAIL	k[redacted]ytics.com	Data Quality issue in less_nulls1
userAlertTest2	2018-01-09T05:00:00.000+0000	rc less than 33	rc < 33	EMAIL	[redacted]@gmail.com	customer churn
	2018-01-09T05:00:00.000+0000	rc less than 30	rc < 30	EMAIL	[redacted]@gmail.com	customer churn
	2018-06-20T04:00:00.000+0000	testRule	testRule > 0	EMAIL	[redacted]@gmail.com	custom_rule_alert
ruleAlert	2018-06-20T04:00:00.000+0000	rc less than 30	rc < 30	EMAIL	[redacted]@gmail.com	customer churn
userAlertTest	2018-01-09T05:00:00.000+0000	rc less than 33	rc < 33	EMAIL	[redacted]@gmail.com	customer churn
userAlertTest	2018-01-09T05:00:00.000+0000	rc less than 30	rc < 30	EMAIL	[redacted]@gmail.com	customer churn
public.dataset_scan_2	2021-05-09T04:00:00.000+0000	score drops below 75	score < 99	EMAIL	[redacted]@gmail.com	asdfasdf
public.dataset_scan_2	2021-06-14T04:00:00.000+0000	total_time_alert	total_time_rule > 0	EMAIL	[redacted]@collibra.com	total_time_msg

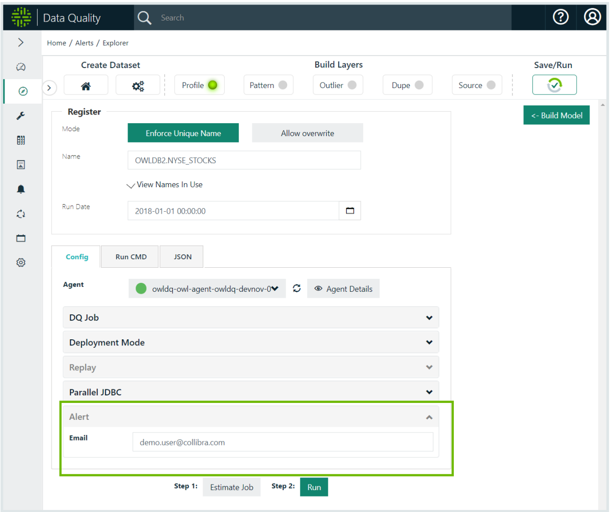
Setting up the email server programmatically

If you are in a notebook or pipeline, you may prefer to use the Scala/Spark API to create the Email Server.

```
    val emailServer = OwlUtils.createEmailServer("smtp-
relay.sendinblue.com", 587)
    emailServer.setUsername("abc@owl-analytics.com")
    emailServer.setPassword("abc")
    emailServer.setCurrentSet(1)
    Util.EmailServerDaoFactory.delete(emailServer)
    Util.EmailServerDaoFactory.insert(emailServer)
```

Setting up DQ Alerts for jobs stuck in Staged status

Occasionally, jobs become stuck in Staged status after an attempted run. When you create a dataset in Explorer, you can set up alerts from the Config tab by entering an email address in the Email field before the first run of a newly created job.



Mode: Enforce Unique Name

Name: OWLDB2.NYSE_STOCKS

Run Date: 2018-01-01 00:00:00

Agent: owldq-owl-agent-owldq-devnov-0

Email: demo.user@collibra.com

When an email address is assigned to a dataset, an initial alert is sent 1 hour after a job becomes stuck in Staged. Additional alerts are sent every 24 hours a job remains in Staged, and these alerts persist until the job is no longer stuck. After resolution, previous runs of a job no longer in Staged are marked as Unknown.

Alerts for jobs stuck in Staged include:

- The Job ID.
- The name of the dataset.
- The agent status.
- A descriptive reason for why the job is stuck in staged and possible actions to take for remediation.

> **Note** If multiple alerts are configured for a particular job, an alert is sent for each one that is configured.

Setting up SMTP alerts without a username or password

Some alert settings are configurable without requiring a username or password when you set up an email server. To configure this type of alert:

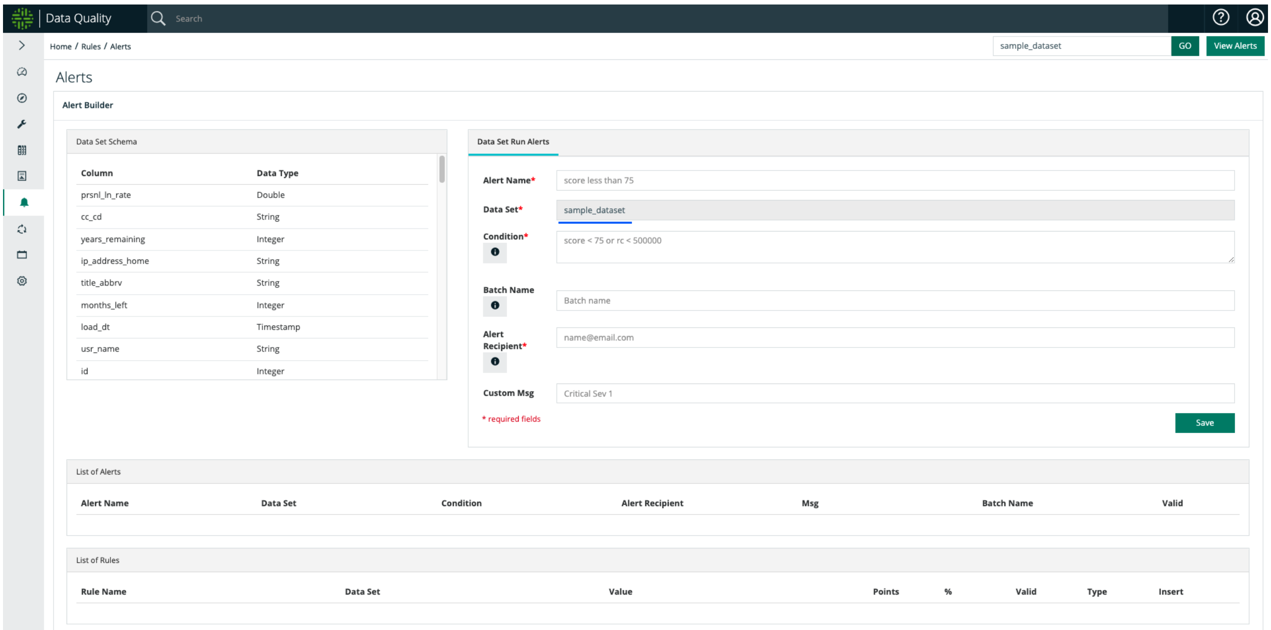
1. Select the **gear icon** in the left navigation pane and then select **Settings**.
2. From Settings, select **App Config** in the upper right and then select **Add Custom**.
3. Enter a property in the **name** field and a value in the **value** field.
4. Select **Add**.

Property	Default Value	Description
mail.smtp.auth	True	When set to **True**, the server attempts to authenticate the user using the AUTH command. When set to **False**, username and password authentication are turned off.
mail.smtp.starttls.enable	True	When set to **True** and TLS is supported by the server, this enables the use of the STARTTLS command to switch the connection to a TLS-protected connection before issuing any login commands. When TLS is not supported by your mail server, this property must be set to **False**.

> **Note** These properties are preset to their default values. For example, mail.stmp.auth is preset to True.

Email Batch Alerts

The Batch Alerts functionality allows you to setup a single alert with multiple recipients. Click the Alerts icon in the left navigation pane and then click Alert Definitions.



sample_dataset

Alerts

Alert Builder

Data Set Schema

Column	Data Type
prsnl_ln_rate	Double
cc_cd	String
years_remaining	Integer
ip_address_home	String
title_abbrv	String
months_left	Integer
load_dt	Timestamp
usr_name	String
id	Integer

Data Set Run Alerts

Alert Name* score less than 75

Data Set* sample_dataset

Condition* score < 75 or rc < 500000

Batch Name: Batch name

Alert Recipient* name@email.com

Custom Msg: Critical Sev 1

* required fields

List of Alerts

Alert Name	Data Set	Condition	Alert Recipient	Msg	Batch Name	Valid

List of Rules

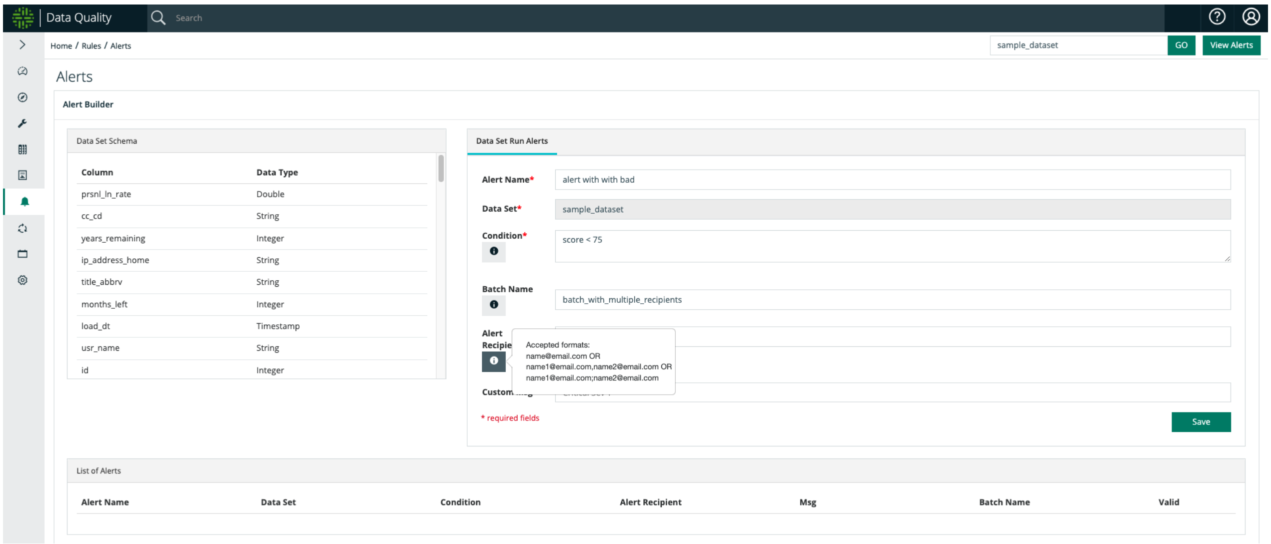
Rule Name	Data Set	Value	Points	%	Valid	Type	Insert

In the Batch Name field, specify a batch name for the multiple recipients. Multiple recipients are specified by comma (,) AND/OR semicolon (;) delimiters.

> **Note** You can specify either single or multiple recipients.

The accepted formats for email are "name@email.com" OR "name1@email.com,name2@email.com" OR "name1@email.com;name2@email.com".

You can update the batch at any time.



Alerts

Alert Builder

Data Set Schema

Column	Data Type
prsnl_ln_rate	Double
cc_cd	String
years_remaining	Integer
ip_address_home	String
title_abbrv	String
months_left	Integer
load_dt	Timestamp
usr_name	String
id	Integer

Data Set Run Alerts

Alert Name* alert with with bad

Data Set* sample_dataset

Condition* score < 75

Batch Name batch_with_multiple_recipients

Alert Recipie

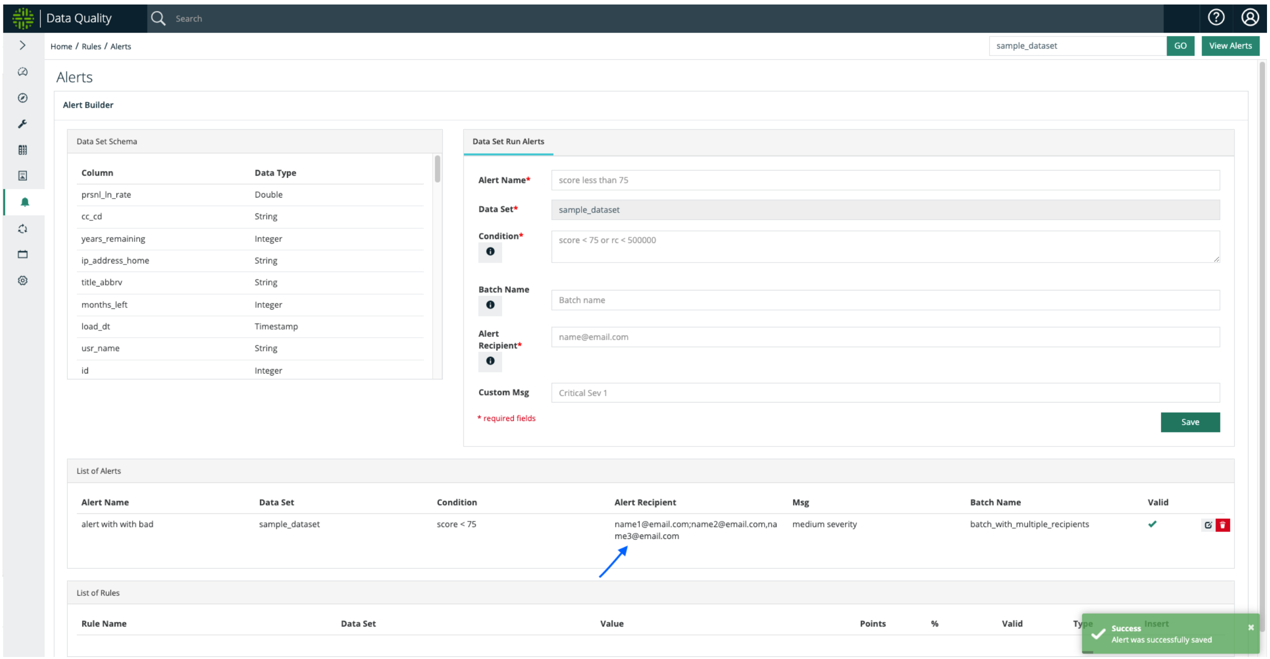
Accepted formats:
name@email.com OR
name1@email.com,name2@email.com OR
name1@email.com;name2@email.com

Custom

* required fields

List of Alerts

Alert Name	Data Set	Condition	Alert Recipient	Msg	Batch Name	Valid



Alerts

Alert Builder

Data Set Schema

Column	Data Type
prsnl_ln_rate	Double
cc_cd	String
years_remaining	Integer
ip_address_home	String
title_abbrv	String
months_left	Integer
load_dt	Timestamp
usr_name	String
id	Integer

Data Set Run Alerts

Alert Name* score less than 75

Data Set* sample_dataset

Condition* score < 75 or rc < 500000

Batch Name Batch name

Alert Recipient* name@email.com

Custom Msg Critical Sev 1

* required fields

List of Alerts

Alert Name	Data Set	Condition	Alert Recipient	Msg	Batch Name	Valid
alert with with bad	sample_dataset	score < 75	name1@email.com;name2@email.com,name3@email.com	medium severity	batch_with_multiple_recipients	✓

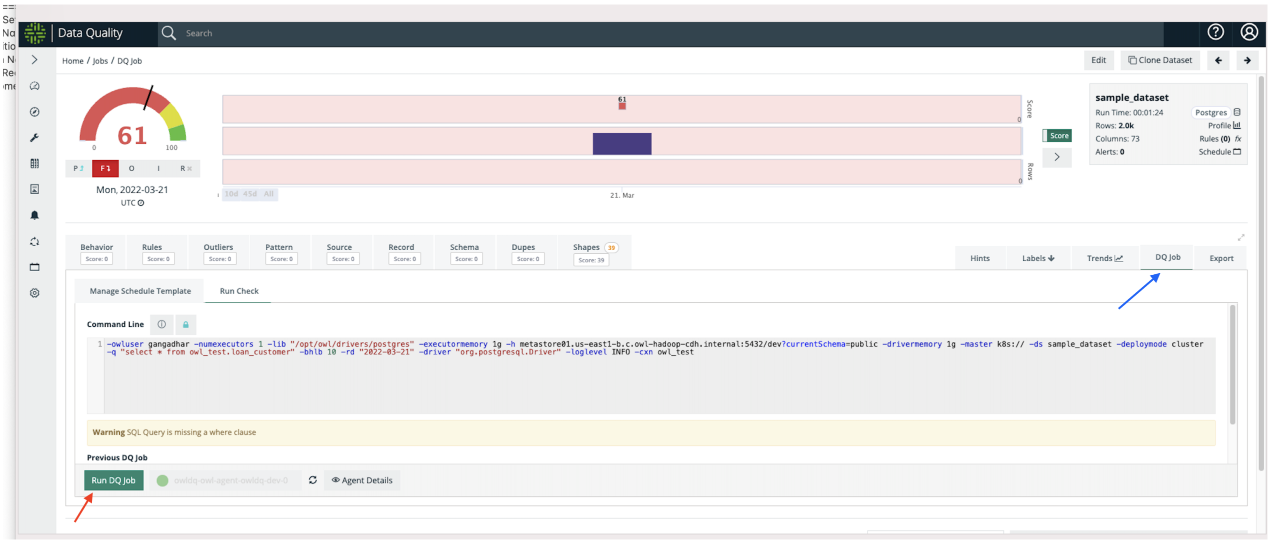
List of Rules

Rule Name	Data Set	Value	Points	%	Valid	Type	Insert

Success
Alert was successfully saved

After a job runs, it checks the data set with condition email not sent and batch name not empty. If this condition is met, an email is sent to all recipients in the batch.

You can also run the DQ jobs manually from **DQ Job** tab.



Mon, 2022-03-21
UTC

sample_dataset
Run Time: 00:01:24
Rows: 2.0k
Columns: 73
Alerts: 0
Postgres
Profile
Rules (0)
Schedule

Behavior Score: 0 | Rules Score: 0 | Outliers Score: 0 | Pattern Score: 0 | Source Score: 0 | Record Score: 0 | Schema Score: 0 | Dupes Score: 0 | Shapes Score: 39

Command Line

```
-owluser gangadhar -numexecutors 1 -lib "/opt/owl/drivers/postgres" -executormemory 1g -h metastore01.us-east1-b.c.owl-hadoop-cdh.internal:5432/dev?currentSchema=public -drivermemory 1g -master k8s:// -ds sample_dataset -deploymode cluster
-q "select * from owl_test.loan_customer" -bhlb 10 -rd "2022-03-21" -driver "org.postgresql.Driver" -loglevel INFO -cxn owl_test
```

Warning SQL Query is missing a where clause

Previous DQ Job

Alert for Batch Schedule

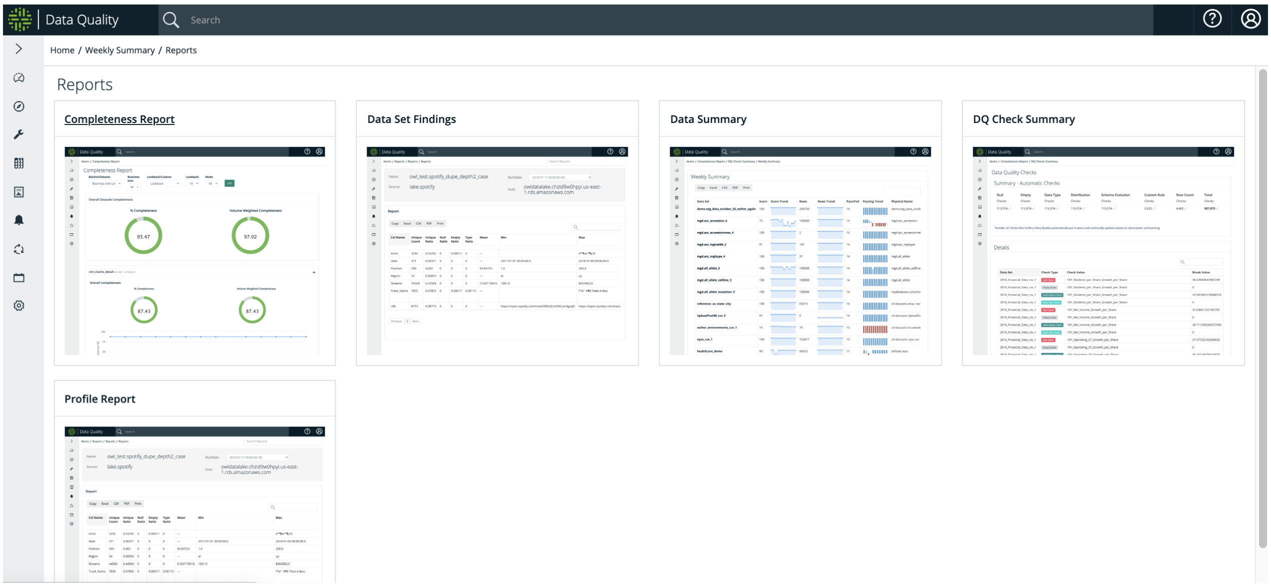
https://dq-docs.collibra.com/scheduler/schedule-owlchecks

Chapter 11

Collibra DQ Reports

Built-In

Collibra DQ provides various out of the box reports that allow you to access insights quickly.



Home / Weekly Summary / Reports

Reports

Completeness Report

Data Set Findings

Data Summary

DQ Check Summary

Profile Report

Completeness Report

This section provides information on how to generate a Collibra DQ Completeness Report to determine what percentage of your data is complete.

What is Data Completeness?

Completeness answers the question of what percentage of your data is complete, or "filled in" (i.e., not `EMPTY` or `NULL`). Using this report, you can view the completeness of a column, a collection of tables, a business unit or data set (file or table), or almost any completeness query.

Completeness of your data is important because it shows whether data is inaccurate, invalid, the wrong type, or missing altogether, which can leave you without any data. Sometimes data values can be missing for valid reasons, which requires a better understanding of the context of whether the missing data is bad for business or acceptable.

Steps

To generate a Completeness report, follow these steps.

1. Login to the Collibra DQ instance.
2. Click the 📊 icon in the left navigation pane.

   The Reports page opens.
3. Click the **Completeness Report** link.
4. From the BizUnit/Dataset drop-down list, select one of the following options:
   - **Business Unit Level**
     i. From the Business Unit drop-down list, select a business unit, or **All**.
     ii. Proceed to step 5.
   - **Dataset Level**
     i. In the Dataset search field, enter a data set for which you want to run the report. You can also enter a partial word to locate data sets in the system.
     ii. Proceed to step 5.
5. From the Lookback/Custom drop-down list, select one of the following options:
   - **Lookback**
     i. From the Lookback drop-down list, select the number of days back to include in the report. You can choose up to 30 days back.
     ii. From the Mode drop-down list, select one of the following options:
        - **All**: includes all jobs in the system.
        - **DRAFT**: includes only the jobs that are in draft mode.
        - **PUBLISHED**: includes the jobs that have been published.

     iii. Proceed to step 6.
   - **Custom Range**
     i. From the RunDate/UpdateTime drop-down list, select one of the following options:
        i. **Run Date**: date/time the data represents.
        ii. **Update Time**: time the DQ job ran.

     ii. In the Date Range field, select a date range by clicking in the from/to fields and choosing the dates using the interactive calendars.
     iii. From the Mode drop-down list, select one of the following options:
        - **All**: includes all reports in the system.
        - **DRAFT**: includes only the reports that are in draft mode.
        - **PUBLISHED**: includes the reports that have been published.

    iv. Proceed to step 6.

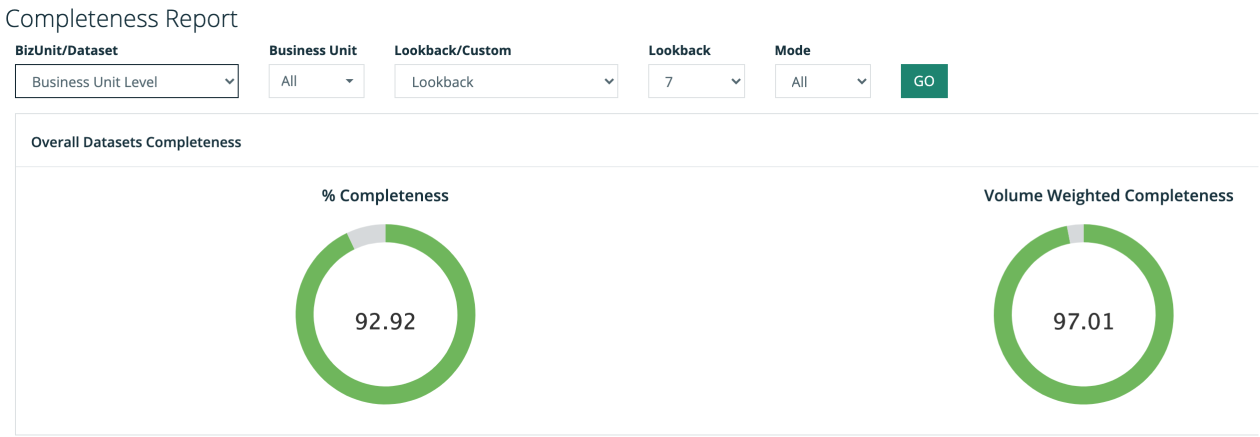
6. Click **GO**.

   The results display based on your input.

> **Note** When looking at completeness over time, you should differentiate between the time the DQ job ran (update time) or the date/time the data represents (run date). For example, you could load stock data today but the data loaded was for last week.

All View

The **All** view represents the completeness of data sets throughout the entire Collibra DQ app. The **% Completeness** chart measures all the data, which shows around 93% complete in the following example. The **Volume Weighted Completeness** chart also measures the volume of the data, which shows around 97%.

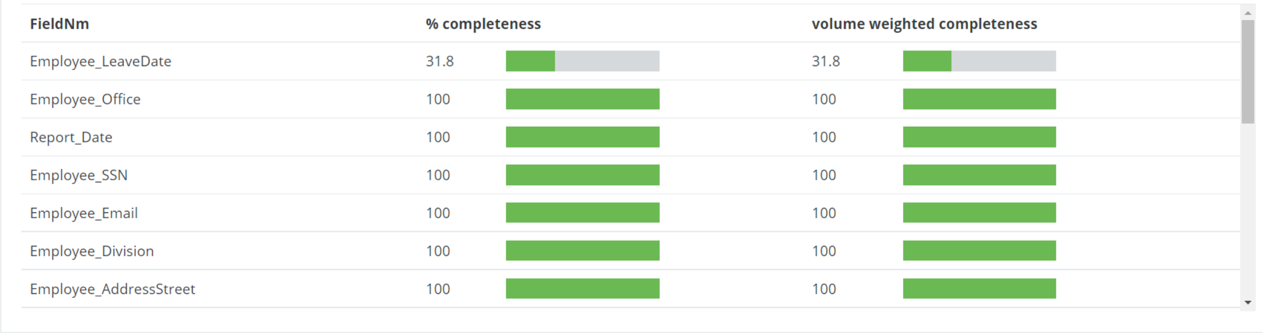


Completeness Report

BizUnit/Dataset: Business Unit Level
Business Unit: All
Lookback/Custom: Lookback
Lookback: 7
Mode: All

Column View

The column view shows the completeness of specific data sets, which makes it easy to see the columns that are least complete and, therefore, of possible concern. The columns range from 0% to 100% complete.

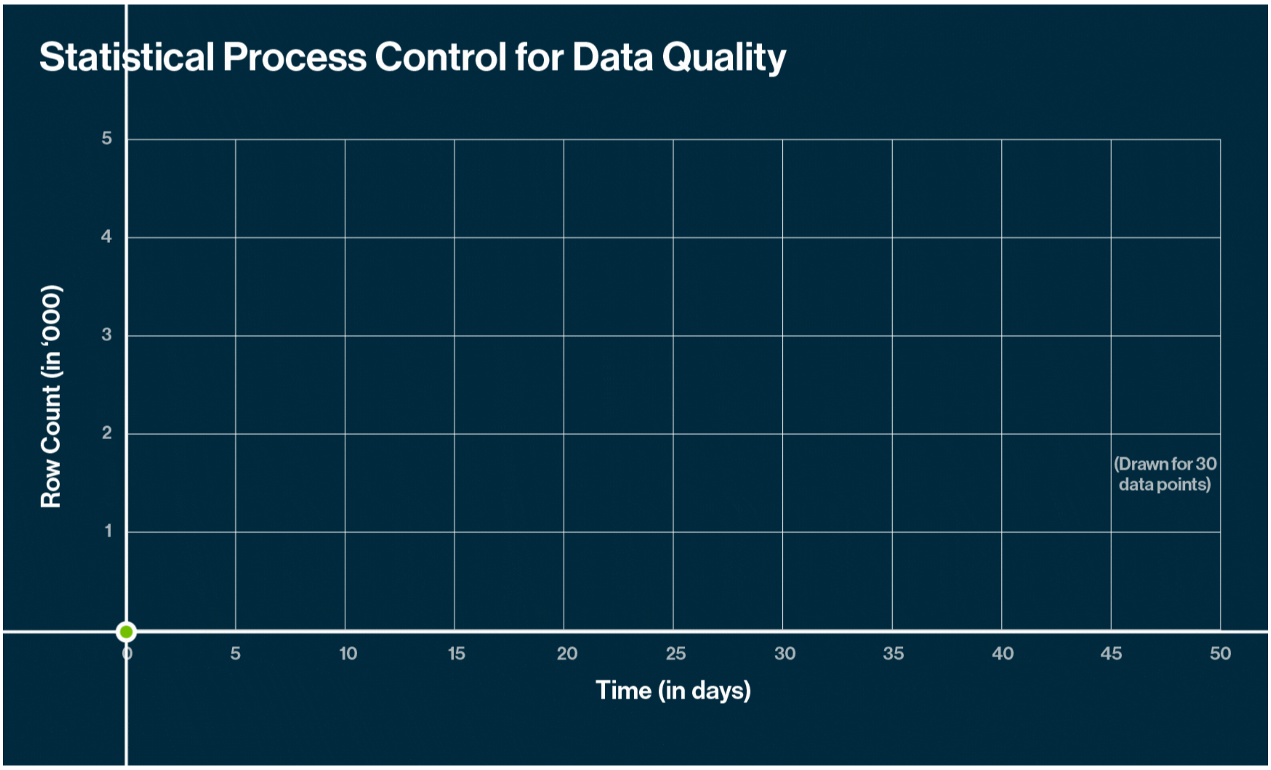


FieldNm	% completeness	volume weighted completeness
Employee_LeaveDate	31.8	31.8
Employee_Office	100	100
Report_Date	100	100
Employee_SSN	100	100
Employee_Email	100	100
Employee_Division	100	100
Employee_AddressStreet	100	100

Behavioral Analytics for Completeness

For a different approach to completeness management, see the Collibra DQ Behavior feature. This approach uses the data itself to create baselines and profiles to understand which completeness issues matter and, therefore, require you to take some kind of action.

To generate statistical process around completeness in the events you are most concerned about, and alert you to a change in slope (a drastic change in completeness), see the Collibra DQ Job Back Run and Profile (automatic) features.



Coverage Report

What is a Data Quality Coverage Report

The Coverage Report provides a view that shows DQ coverage across all your technical data sets (for example, schemas, files, tables, and items in the database) via a donut chart, as well as time-series bar charts that show the DQ run level information aggregated by month.

Steps

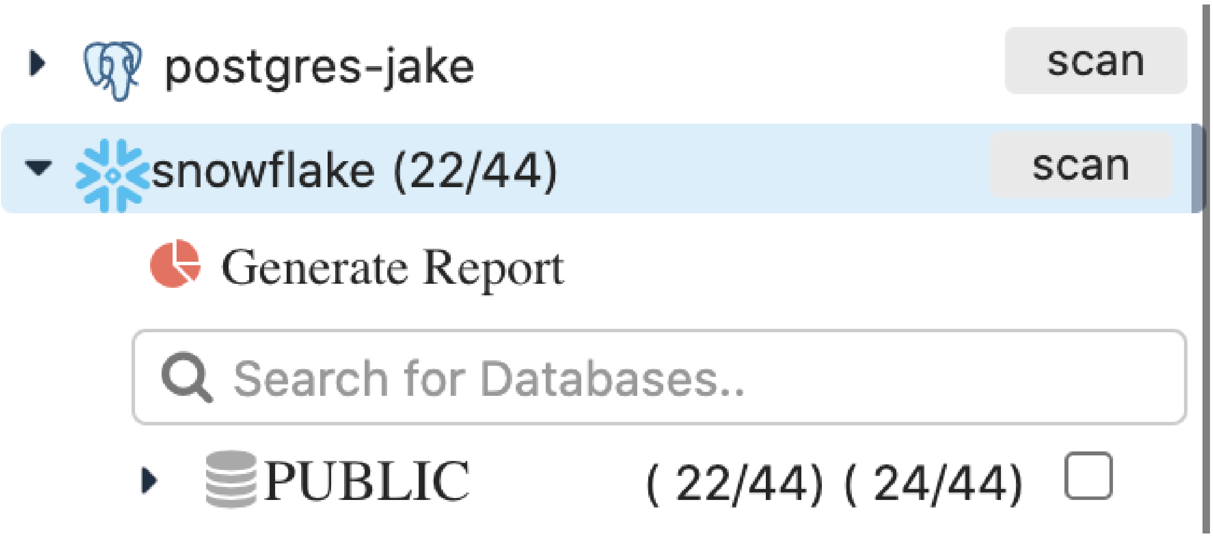
To generate a Coverage Report, follow these steps.

1. Log in to the Collibra DQ instance.
2. Click the Explorer icon in the left navigation pane. The Explorer view opens.
3. In Connections, select one of the databases, for which you want to generate a report and click **Generate Report**. The Coverage Report displays. The report includes a donut chart showing the percentage of all schemas in the database that are running data quality on them and interactive bar charts showing which data sets are running data quality jobs on a monthly basis.
4. To see how many new data quality jobs have been added, click one of the following bar charts (the green color represents new DQ jobs and the gray are the existing jobs):

View	Description
1m	Shows new and existing jobs after one month.
3m	Shows new and existing jobs after three months.
6m	Shows new and existing jobs after six months.
YTD	Shows new and existing jobs year-to-date.
1y	Shows new and existing jobs after one year.
All	Shows new and existing jobs for the entire range of months.

5. To generate a Coverage Report for a specific schema, expand the schema and click **GenerateReport**. The Coverage Report displays for that schema. You can click into the charts to see specific information for DQ coverage for this schema.

In the following screenshot, `(22/44)` next to the PUBLIC schema represents 22 out of 44 tables that have DQ jobs running on them and `(24/24)` represents 24 out of 44 jobs that have been cataloged, meaning they are registered and have metadata.



Data Set Findings

What is the Data Set Findings Report

The Data Quality Data Set Findings Report allows you to search for a particular data set and generate a profile report. You can copy, print, and export the report to an Excel or CSV file format.

> **Note** As of the 2022.08 release, PDF is no longer a supported file format for exporting and printing reports. These functions are now restricted to the CSV file format only.

Steps

To generate a Data Set Findings Report, follow these steps.

1. Login to the Collibra DQ instance.Click the 📊 icon in the left navigation pane.

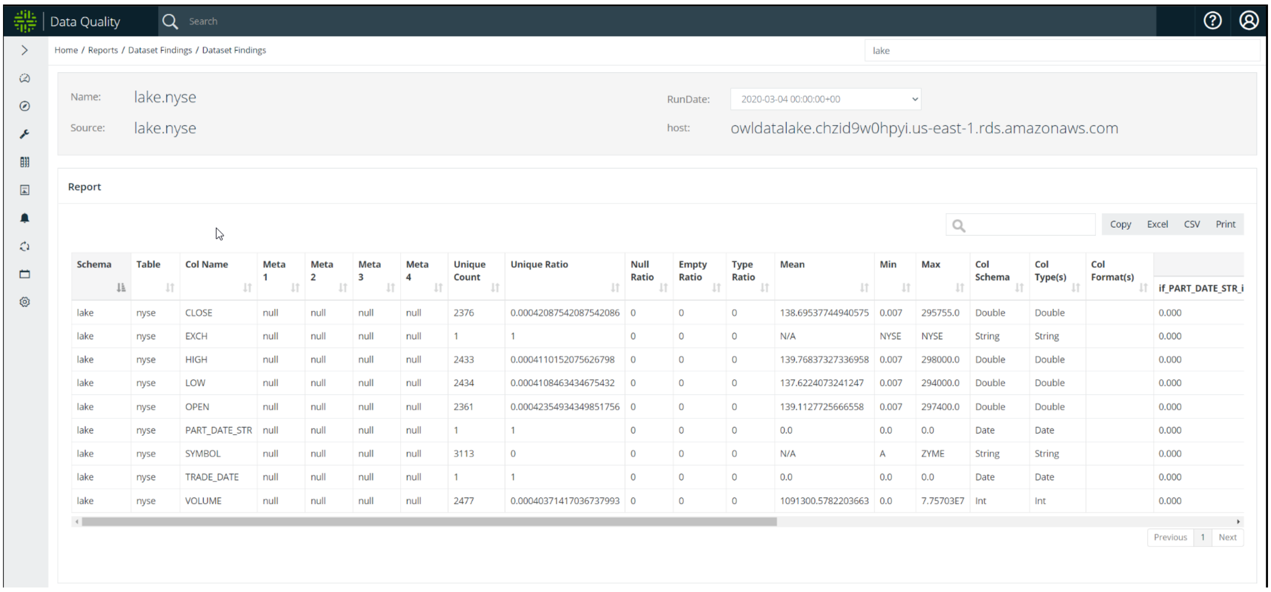
   The Reports page opens.
2. Select the **Data Set Findings** tile.
3. In the search bar in the upper right corner, enter the name of your target data set.

   A list of available data sets populates in the dropdown menu.
4. Select the **data set** for which you want to view and export results.

   The Data Set Findings page displays for your data set.

   The report includes the name, source, RunDate, and host of your data set, as well as columns that highlight specific data about it.
5. Toggle the ⇅ icon at the top of the column to sort the data that displays in the columns in ascending or descending order.
6. Filter the report results by entering information in the search bar. For example, if you enter a number in the search field, any report result that includes the number displays.
7. Click **Copy**, **Excel**, **CSV**, or **Print** at the top right of the columns to copy, print, or export your reports.
8. Navigate the pages of your report by clicking the **Previous** and **Next** pagination buttons, located bottom-right of the columns.

The following screenshot is an example of a Data Set Findings Report for the lake.nyse data set.



Name: lake.nyse

Source: lake.nyse

RunDate: 2020-03-04 00:00:00+00

host: owldatalake.chzid9w0hpyi.us-east-1.rds.amazonaws.com

Report

Schema	Table	Col Name	Meta 1	Meta 2	Meta 3	Meta 4	Unique Count	Unique Ratio	Null Ratio	Empty Ratio	Type Ratio	Mean	Min	Max	Col Schema	Col Type(s)	Col Format(s)	if_PART_DATE_STR_i
lake	nyse	CLOSE	null	null	null	null	2376	0.00042087542087542086	0	0	0	138.69537744940575	0.007	295755.0	Double	Double		0.000
lake	nyse	EXCH	null	null	null	null	1	1	0	0	0	N/A	NYSE	NYSE	String	String		0.000
lake	nyse	HIGH	null	null	null	null	2433	0.0004110152075626798	0	0	0	139.76837327336958	0.007	298000.0	Double	Double		0.000
lake	nyse	LOW	null	null	null	null	2434	0.0004108463434675432	0	0	0	137.6224073241247	0.007	294000.0	Double	Double		0.000
lake	nyse	OPEN	null	null	null	null	2361	0.00042354934349851756	0	0	0	139.1127725666558	0.007	297400.0	Double	Double		0.000
lake	nyse	PART_DATE_STR	null	null	null	null	1	1	0	0	0	0.0	0.0	0.0	Date	Date		0.000
lake	nyse	SYMBOL	null	null	null	null	3113	0	0	0	0	N/A	A	ZYME	String	String		0.000
lake	nyse	TRADE_DATE	null	null	null	null	1	1	0	0	0	0.0	0.0	0.0	Date	Date		0.000
lake	nyse	VOLUME	null	null	null	null	2477	0.00040371417036737993	0	0	0	1091300.5782203663	0.0	7.75703E7	Int	Int		0.000

Summary Reports

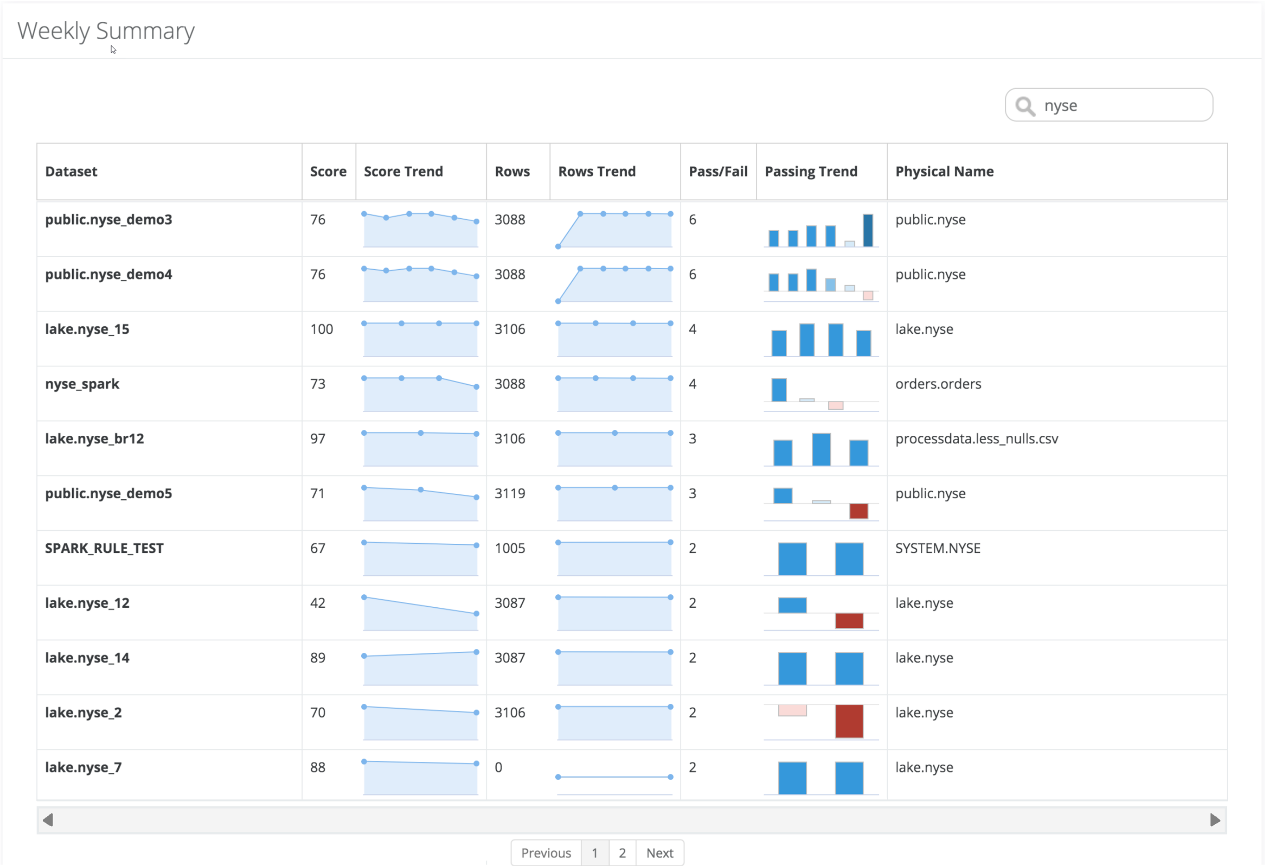
Collibra Data Quality Summary reports provide information about your data sets rolled up in high level summaries. These reports include the Weekly Summary Report and Data Quality Checks Report.

What is the Weekly Summary Report?

When you operate a large data lake or several large data environments, it's helpful to have a way to report across different dimensions at an executive summary level. You may want to know the health or coverage per line of business, department or tenet, or per database.

The Collibra Data Quality Weekly Summary Report automatically aggregates a simple series of the high level trends for each data set, which allows you to see the DQ scores and trends, as well as row counts and passing runs in a weekly report. You can copy, export, and print this report to an Excel or CSV file format.

> **Note** As of the 2022.08 release, PDF is no longer a supported file format for exporting and printing reports. These functions are now restricted to the CSV file format only.



Weekly Summary

Dataset	Score	Score Trend	Rows	Rows Trend	Pass/Fail	Passing Trend	Physical Name
public.nyse_demo3	76		3088		6		public.nyse
public.nyse_demo4	76		3088		6		public.nyse
lake.nyse_15	100		3106		4		lake.nyse
nyse_spark	73		3088		4		orders.orders
lake.nyse_br12	97		3106		3		processdata.less_nulls.csv
public.nyse_demo5	71		3119		3		public.nyse
SPARK_RULE_TEST	67		1005		2		SYSTEM.NYSE
lake.nyse_12	42		3087		2		lake.nyse
lake.nyse_14	89		3087		2		lake.nyse
lake.nyse_2	70		3106		2		lake.nyse
lake.nyse_7	88		0		2		lake.nyse

Steps

To generate a Weekly Summary report, follow these steps.

1. Login to the Collibra DQ instance.
2. Click the icon in the left navigation pane.

   The Reports page opens.
2. Select the **Data Summary** tile.

   The Weekly Summary report displays.

The following table describes the report columns.

Column	Description
Dataset	The data sets scanned over one week.

Column	Description
Score	The average data quality score of a data set over one week.
Score Trend	A line graph representation of data quality scores over one week. Hover over the blue dots to see the score trend.
Rows	The total number of rows of a particular data set scanned over one week.
Rows Trend	A line graph representation of row count over one week. Hover over the blue dots to see the rows trend.
Pass/Fail	Total number of DQ scans, whether they pass or fail.
Passing Trend	A histogram of DQ scans that passed (blue) or failed (red) over one week. Hover over the blue dots to see the passing trend.
Table/File Name	The name of the table or file in use.

3. Toggle the ↓ icon at the top of the column to sort the data that displays in the columns in ascending or descending order.

4. Filter the report results by entering information in the search bar. For example, if you enter a number in the search field, any report result that includes that number displays.

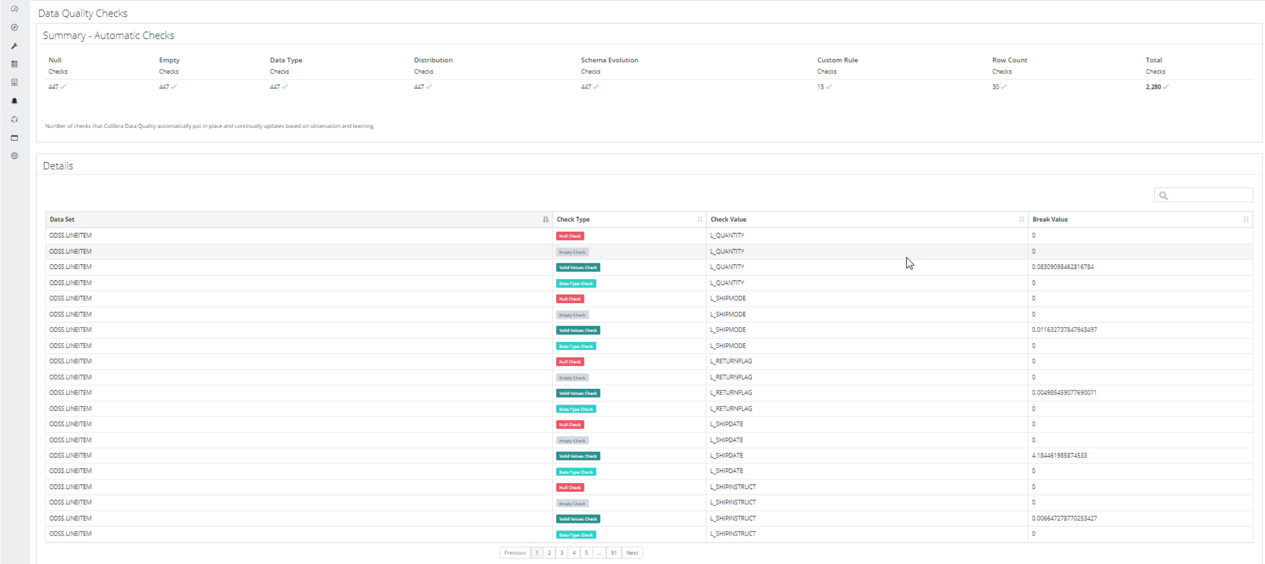
5. Click **Copy**, **Excel**, **CSV**, or **Print** at the top right of the columns to copy, export, and print the report.

6. Navigate the pages of your report by clicking the **Previous** and **Next** pagination buttons, located at the bottom of the columns.

What is the Data Quality Checks Report?

The Data Quality Checks Report provides a number of automatic checks of your data sets that are continually updated, based on observation and learning. This report includes the type of check performed and the check value and break value per data set. There is also a summary report that rolls up the number of automatic DQ checks done.

> **Note** As of the 2022.08 release, PDF is no longer a supported file format for exporting and printing reports. These functions are now restricted to the CSV file format only.



Data Quality Checks

Summary - Automatic Checks

Null Checks	Empty Checks	Data Type Checks	Distribution Checks	Schema Evolution Checks	Custom Rule Checks	Row Count Checks	Total Checks
447 ✓	447 ✓	447 ✓	447 ✓	447 ✓	15 ✓	30 ✓	2,280 ✓

Number of checks that Collibra Data Quality automatically put in place and continually updates based on observation and learning

Details

Data Set	Check Type	Check Value	Break Value
ODSS.LINEITEM	Null Check	L_QUANTITY	0
ODSS.LINEITEM	Empty Check	L_QUANTITY	0
ODSS.LINEITEM	Valid Values Check	L_QUANTITY	0.08309098462816784
ODSS.LINEITEM	Data Type Check	L_QUANTITY	0
ODSS.LINEITEM	Null Check	L_SHIPMODE	0
ODSS.LINEITEM	Empty Check	L_SHIPMODE	0
ODSS.LINEITEM	Valid Values Check	L_SHIPMODE	0.011632737847943497
ODSS.LINEITEM	Data Type Check	L_SHIPMODE	0
ODSS.LINEITEM	Null Check	L_RETURNFLAG	0
ODSS.LINEITEM	Empty Check	L_RETURNFLAG	0
ODSS.LINEITEM	Valid Values Check	L_RETURNFLAG	0.004985459077690071
ODSS.LINEITEM	Data Type Check	L_RETURNFLAG	0
ODSS.LINEITEM	Null Check	L_SHIPDATE	0
ODSS.LINEITEM	Empty Check	L_SHIPDATE	0
ODSS.LINEITEM	Valid Values Check	L_SHIPDATE	4.184461985874533
ODSS.LINEITEM	Data Type Check	L_SHIPDATE	0
ODSS.LINEITEM	Null Check	L_SHIPINSTRUCT	0
ODSS.LINEITEM	Empty Check	L_SHIPINSTRUCT	0
ODSS.LINEITEM	Valid Values Check	L_SHIPINSTRUCT	0.006647278770253427
ODSS.LINEITEM	Data Type Check	L_SHIPINSTRUCT	0

Steps

To see the Data Quality Checks report, follow these steps.

1. Login to the Collibra DQ instance.
2. Click the icon in the left navigation pane.

   The Reports page opens.
2. Select the **DQ Check Summary** tile.

   The Data Quality Checks report displays.

   This report includes a summary of the number of checks that Collibra DQ automatically ran at the top of the report and the details, which are described in the following table.

Column	Description
Data Set	The name of the data set.
Check Type	The type of check that DQ ran.

Column	Description
Check Value	The value associated with this check.
Break Value	The number of points associated with a rule break, which are then subtracted from a data quality score.

3. Toggle the ↓ icon at the top of the column to sort the data that displays in the columns in ascending or descending order.
4. Filter the report results by entering information in the search bar. For example, if you enter a number in the search field, any report result that includes that number displays.
5. Navigate the pages of your report by clicking the **Previous** and **Next** pagination buttons, located at the bottom of the columns.

Custom

Custom reports can be leveraged by connecting your favorite BI tool on the underlying reporting mart. Below are a few queries that can be used as inspiration for building your own reports. Please refer to the ERD diagram for a larger list of tables.

Long Running Jobs

```
select dataset,run_id,total_time from dataset_activity where total_
time is not null order by total_time desc
```

Jobs Submitted

```
select * from owlcheck_q
```

Jobs by User

```
select count(*) as owlchecks, username from owlcheck_q where updt_ts
< now() group by username order by owlchecks desc
```

Jobs by User, Dataset

```
select count(*), user_nm, dataset from dev.public.owl_check_history
group by user_nm, dataset order by count desc
```

Largest by Row Count

```
select dataset,rc as row_count from dataset_scan order by rc desc
```

Jobs by Month

```
with grp as ( select date_trunc('MONTH', run_id) as by_month from
dataset_scan where run_id < now() ) select count(*) as owlchecks,
by_month from grp group by by_month order by by_month desc
```

Rules by User

```
select count(*) as rules, user_nm from owl_rule group by user_nm
order by rules desc
```

By Spark(Cluster) Usage

```
select * from opt_spark order by num_executors desc
```

Jobs IDs from Agent

```
select remote_job_id from agent_q where remote_job_id is not null
```

Dataset Activity

```
select dataset,run_id,total_time from dataset_activity where total_
time is not null order by total_time desc
```

Jobs with Enriched Metrics

```
with activity as ( select dataset,run_id,total_time from dataset_
activity where total_time is not null order by total_time desc limit
100), scans as ( select * from dataset_scan where dataset in (select
dataset from activity) ), configs as ( select * from opt_spark where
dataset in (select dataset from activity)), schema as ( select count
(*) as col_cnt, dataset from dataset_schema where dataset in (select
dataset from activity) group by dataset ) SELECT A.dataset, A.run_
id, C.total_time, A.rc, D.col_cnt, B.driver_memory, B.num_
executors,B.executor_cores, B.executor_memory, B.master FROM scans A
INNER JOIN configs B ON A.dataset = B.dataset INNER JOIN activity C
ON A.dataset = C.dataset and A.run_id = C.run_id INNER JOIN schema D
on A.dataset = D.dataset ORDER BY C.total_time desc
```

Jobs. Load Times and Resources

```
with activity as ( select dataset,run_id,total_time from
public.dataset_activity where total_time is not null order by total_
time), scans as ( select * from public.dataset_scan where dataset in
(select dataset from activity) ), configs as ( select * from
public.opt_spark where dataset in (select dataset from activity)),
schema as ( select count(*) as col_cnt, dataset from public.dataset_
schema where dataset in (select dataset from activity) group by
dataset ) SELECT A.dataset, A.run_id, A.updt_ts, C.total_time, A.rc,
D.col_cnt, B.driver_memory, B.num_executors,B.executor_cores,
B.executor_memory, B.master FROM scans A INNER JOIN configs B ON
A.dataset = B.dataset INNER JOIN activity C ON A.dataset = C.dataset
and A.run_id = C.run_id INNER JOIN schema D on A.dataset = D.dataset
ORDER BY A.updt_ts desc limit 10
```

Dataset Scans and Scores By Schema

```
select * from public.dataset_scan where dataset like 'public.%';
```

Dataset Scans and Scores By Name

```
select * from public.dataset_scan where dataset ='public.atm_
customer';
```

Scans By Month By Schema - 'Public'

```
select dataset, DATE_TRUNC('MONTH', run_id) as run_id, count(*) as
Total_Scans from dataset_scan where dataset like 'public%' group by
dataset, run_id order by run_id asc
```

Rule Breaks Past 30 Days

```
select * from rule_output where run_id < NOW() - INTERVAL '30 DAY';
```

Scheduled Jobs Queue

```
select job_id,agent_id,dataset,run_id,status,activity,start_time
from public.owlcheck_q;
```

Column Counts from Dataset Schema

```
select dataset, count(*) from dataset_schema group by dataset;
```

Profiling Stats

```
select dataset, run_id, field_nm, (null_ratio * 100) as null_
percent, (empty_ratio * 100) as empty_percent, ROUND( CAST( ( 100 -
((null_ratio * 100) + (empty_ratio * 100)) ) as numeric), 3) as
completeness from public.dataset_field where updt_ts > '2020-06-01'
and dataset = 'ProcessOrder' and run_id > '2021-03-17 00:00:00+00'
order by completeness desc
```

Metadata / Schema / Datatypes

```
select * from public.dataset_schema;
```

Profile Stats

```
select * from public.dataset_field;
```

Locate Similar Columns

```
select distinct dataset, field_nm, max_abs from dataset_field where
max_abs = 'Wireless Telecommunications'
```

Same Column Names

```
select distinct dataset, field_nm from dataset_field where field_nm
= 'authenticated_user'
```

Similar Column Names

```
select distinct dataset,field_nm from dataset_field where field_nm
like '%id%'
```

Behavior Findings

```
select * from behavior where dataset='esg_data'
```

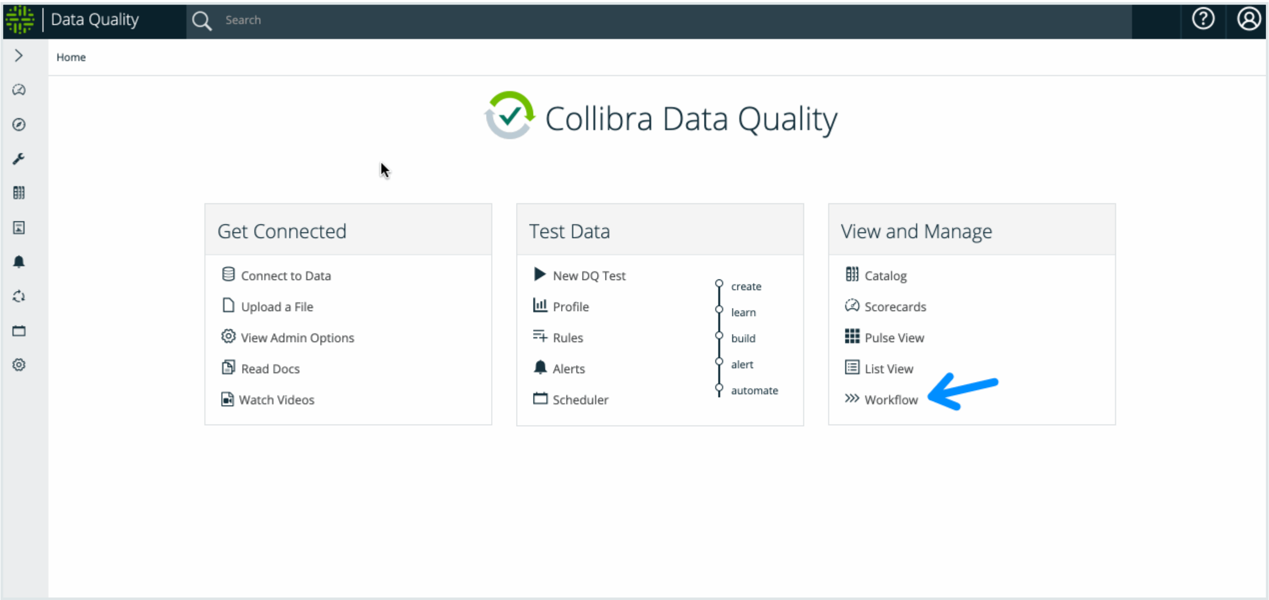
All Columns for Schema from Postgres Stats

```
SELECT table_name FROM information_schema.tables WHERE table_schema
= 'public' ORDER BY table_name
```

Chapter 12

Collibra DQ Workflows

Assignments Queue

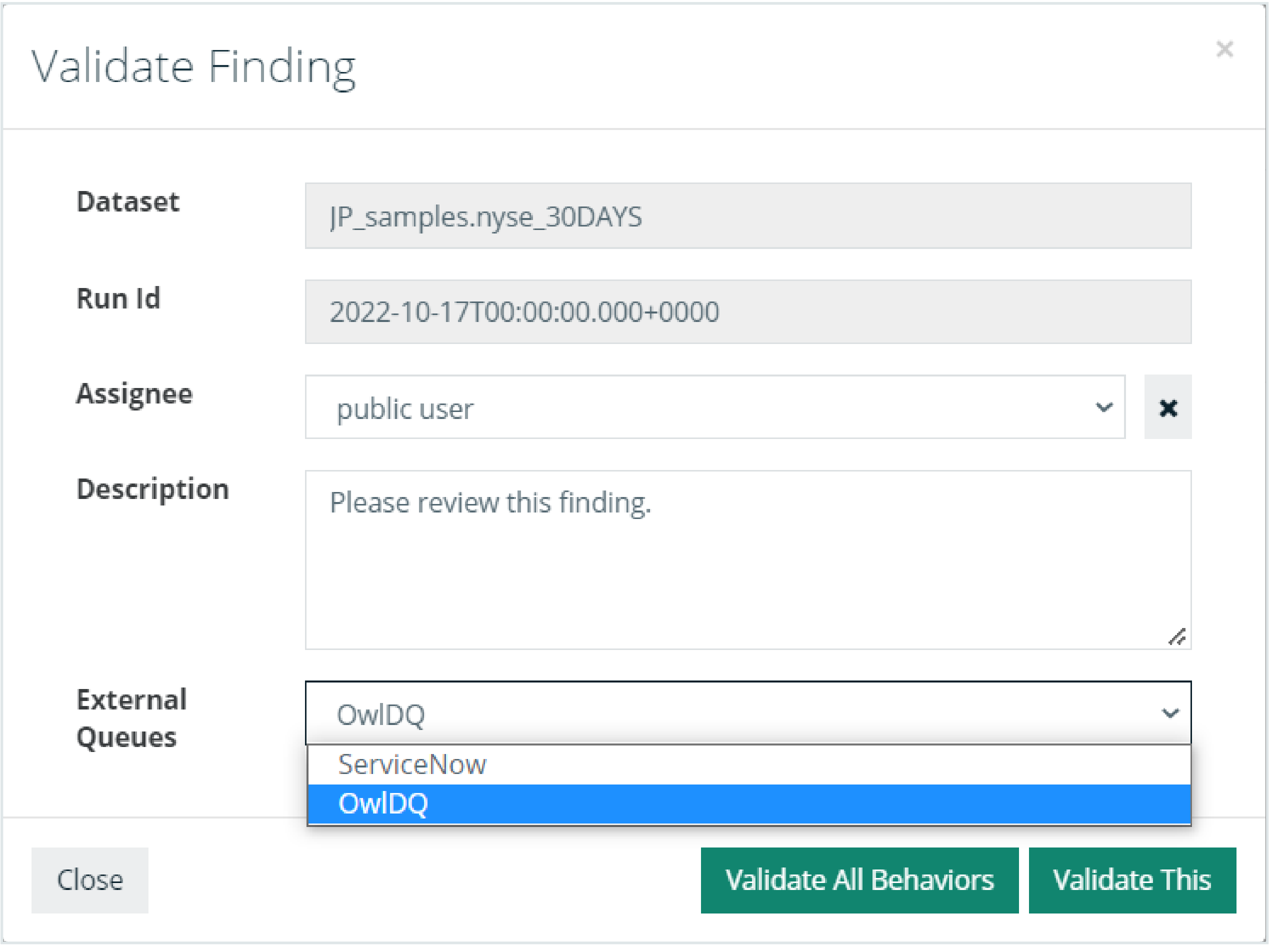


The Assignments Queue is a summary of existing DQ Job runs that can be filtered by behavior model assessment, user, and run status.

Collibra DQ provides observations that sometimes require review to validate. It often makes sense to assign the validation to a user who has access to the source data.

Assignments are handled by Collibra DQ internally, or via an existing ServiceNow queue when configured. Collibra DQ is the default configuration, but you can configure ServiceNow from the Assignments Queue section of the Admin Console.

To assign an observation to a user, go to the findings page of a previously run DQ Job. From the Action dropdown, select Validate or Resolve. Resolving a finding retrains your Job's quality score if any points were deducted. Alternatively, if you validate a finding, you can assign an item to a Collibra DQ user for further investigation.



Validate Finding

Dataset	JP_samples.nyse_30DAYS
Run Id	2022-10-17T00:00:00.000+0000
Assignee	public user
Description	Please review this finding.
External Queues	OwlDQ

If you do not select an assignee, the item is marked as valid but unassigned: Acknowledged.

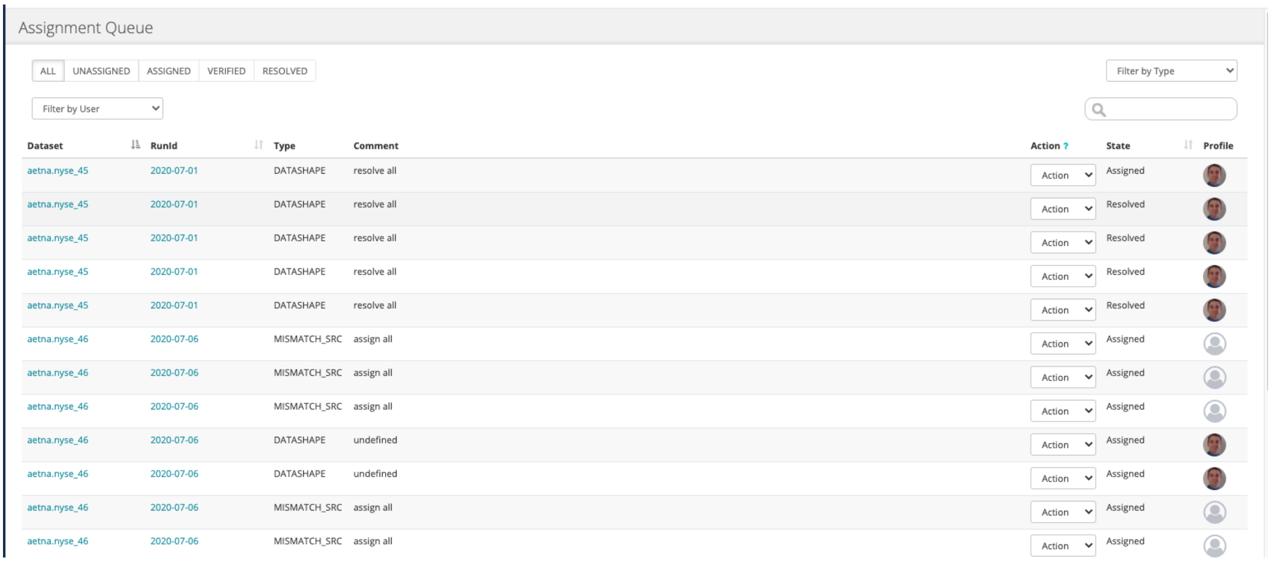
Optionally, you can enter a description to provide details for the assignee.

External Queues are where the source of the assignment is tracked. Tracking options include:

- Internally via the Internal Assignment page.
- Externally via External assignment.

Internal Assignment

Collibra has a built in Assignments Queue. You can assign any item to a user that has previously logged into the application. Select OwlDQ from the assignment dropdown after choosing the Validate option from the actions dropdown.

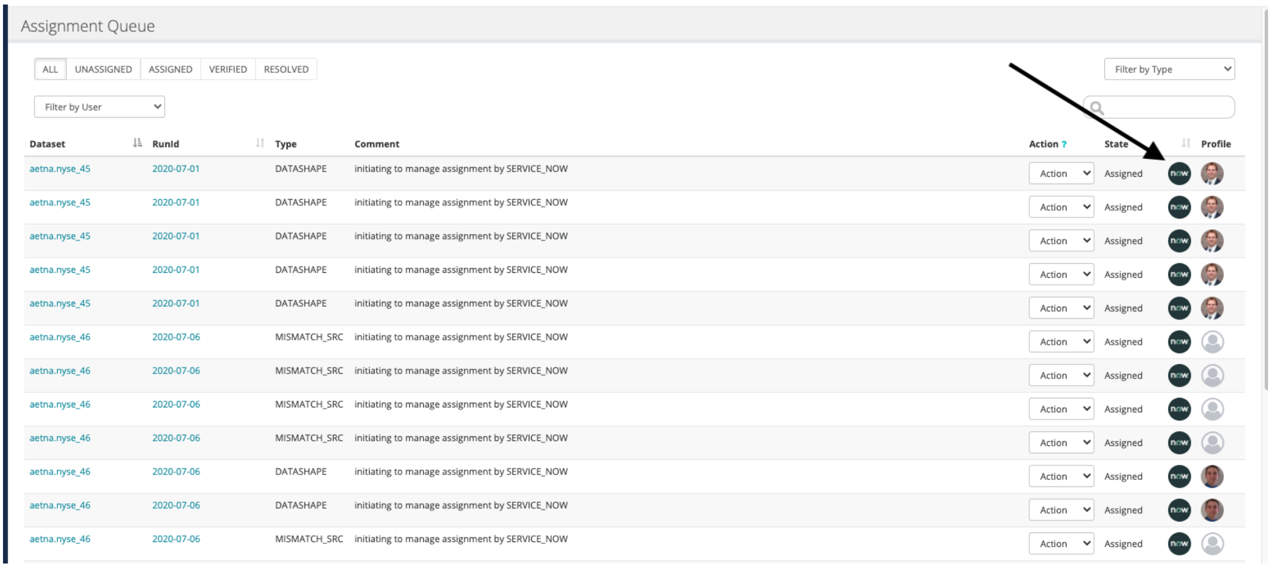


Assignment Queue

Dataset	RunId	Type	Comment	Action ?	State	Profile
aetna.nyse_45	2020-07-01	DATASHAPE	resolve all	Action	Assigned	
aetna.nyse_45	2020-07-01	DATASHAPE	resolve all	Action	Resolved	
aetna.nyse_45	2020-07-01	DATASHAPE	resolve all	Action	Resolved	
aetna.nyse_45	2020-07-01	DATASHAPE	resolve all	Action	Resolved	
aetna.nyse_45	2020-07-01	DATASHAPE	resolve all	Action	Resolved	
aetna.nyse_46	2020-07-06	MISMATCH_SRC	assign all	Action	Assigned	
aetna.nyse_46	2020-07-06	MISMATCH_SRC	assign all	Action	Assigned	
aetna.nyse_46	2020-07-06	MISMATCH_SRC	assign all	Action	Assigned	
aetna.nyse_46	2020-07-06	DATASHAPE	undefined	Action	Assigned	
aetna.nyse_46	2020-07-06	DATASHAPE	undefined	Action	Assigned	
aetna.nyse_46	2020-07-06	MISMATCH_SRC	assign all	Action	Assigned	
aetna.nyse_46	2020-07-06	MISMATCH_SRC	assign all	Action	Assigned	

External assignment

Collibra DQ has the ability to link to an Assignment Queue. You can assign any item to a user that has previously logged into the application and has a matching Service Now account. Choose the configured queue from the assignment drop-down list after selecting the **Validate** option from the actions drop-down list as previously described.

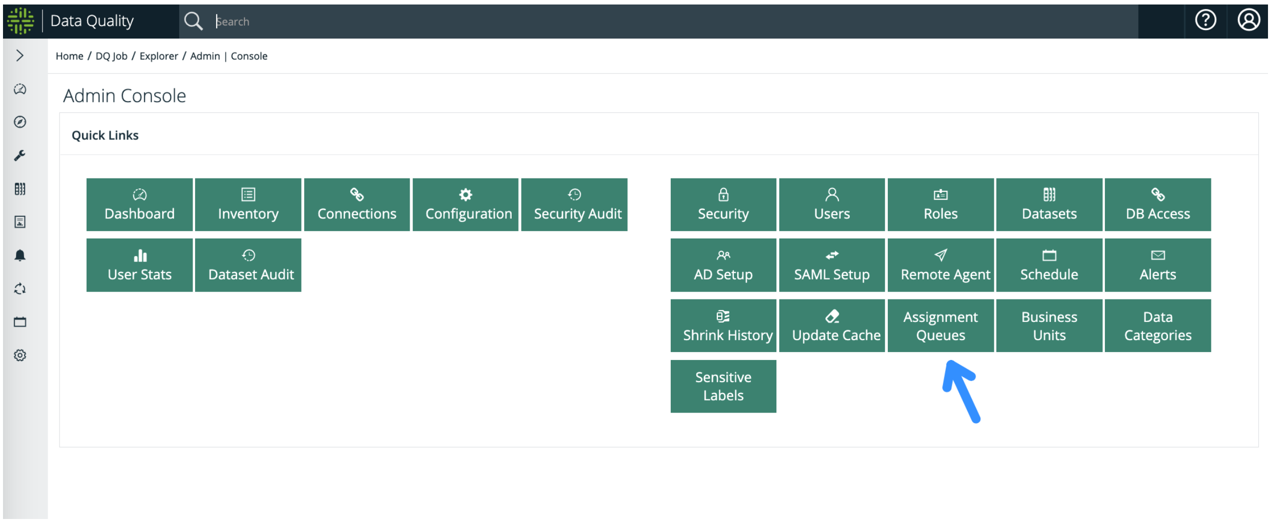


Assignment Queue

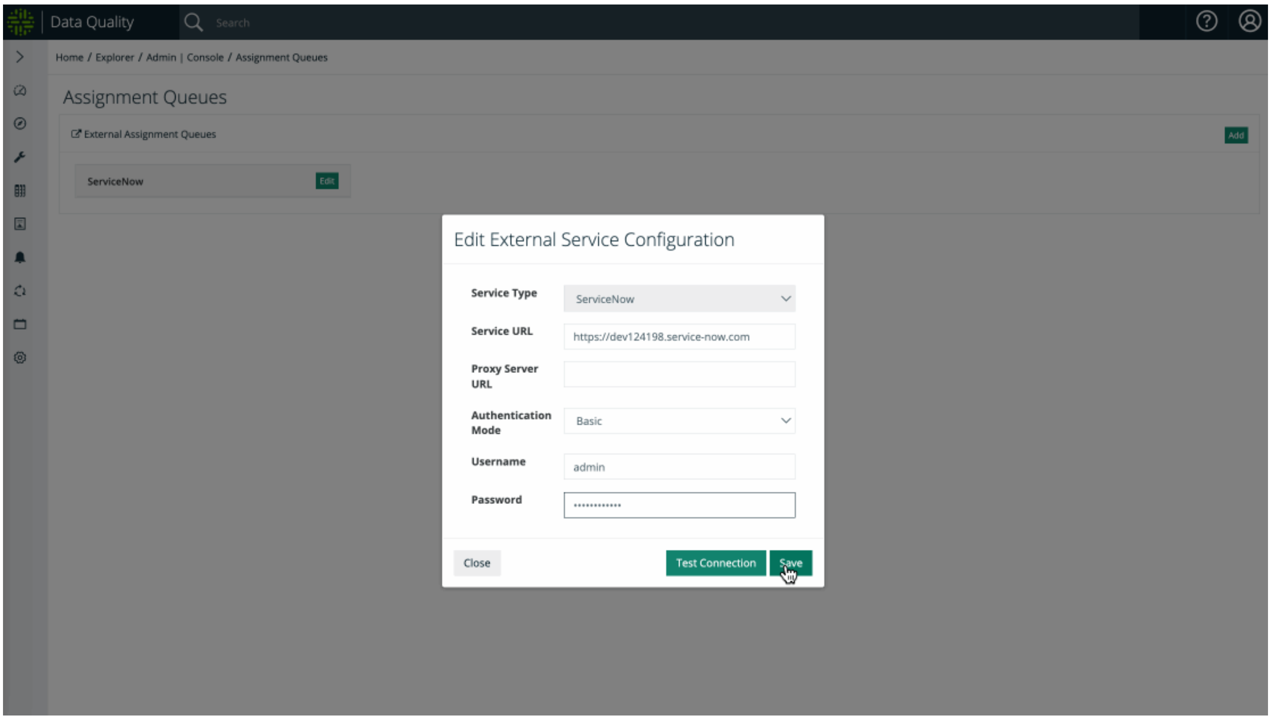
Dataset	RunId	Type	Comment	Action ?	State	Profile
aetna.nyse_45	2020-07-01	DATASHAPE	initiating to manage assignment by SERVICE_NOW	Action	Assigned	now
aetna.nyse_45	2020-07-01	DATASHAPE	initiating to manage assignment by SERVICE_NOW	Action	Assigned	now
aetna.nyse_45	2020-07-01	DATASHAPE	initiating to manage assignment by SERVICE_NOW	Action	Assigned	now
aetna.nyse_45	2020-07-01	DATASHAPE	initiating to manage assignment by SERVICE_NOW	Action	Assigned	now
aetna.nyse_45	2020-07-01	DATASHAPE	initiating to manage assignment by SERVICE_NOW	Action	Assigned	now
aetna.nyse_46	2020-07-06	MISMATCH_SRC	initiating to manage assignment by SERVICE_NOW	Action	Assigned	now
aetna.nyse_46	2020-07-06	MISMATCH_SRC	initiating to manage assignment by SERVICE_NOW	Action	Assigned	now
aetna.nyse_46	2020-07-06	MISMATCH_SRC	initiating to manage assignment by SERVICE_NOW	Action	Assigned	now
aetna.nyse_46	2020-07-06	MISMATCH_SRC	initiating to manage assignment by SERVICE_NOW	Action	Assigned	now
aetna.nyse_46	2020-07-06	DATASHAPE	initiating to manage assignment by SERVICE_NOW	Action	Assigned	now
aetna.nyse_46	2020-07-06	DATASHAPE	initiating to manage assignment by SERVICE_NOW	Action	Assigned	now
aetna.nyse_46	2020-07-06	MISMATCH_SRC	initiating to manage assignment by SERVICE_NOW	Action	Assigned	now

Warning To configure a queue, you must have ROLE_ADMIN or ROLE_ CONNECTION_MANAGER.

Go to the **Admin Console** and click **Assignment Queues.**\



Add or **Edit** a ServiceNow configuration from the corresponding page.\


Data Quality
Search
Home / Explorer / Admin | Console / Assignment Queues
Assignment Queues
External Assignment Queues
Add
ServiceNow
Edit
Close
Test Connection
Save

Edit External Service Configuration

Service Type: ServiceNow

Service URL: https://dev124198.service-now.com

Proxy Server URL:

Authentication Mode: Basic

Username: admin

Password: ••••••••••••

FAQ

Can anyone assign an item?

Anyone with access to the dataset and TRAIN role (if enabled) can assign an item. Users who have been assigned an item can resolve without the TRAIN role.

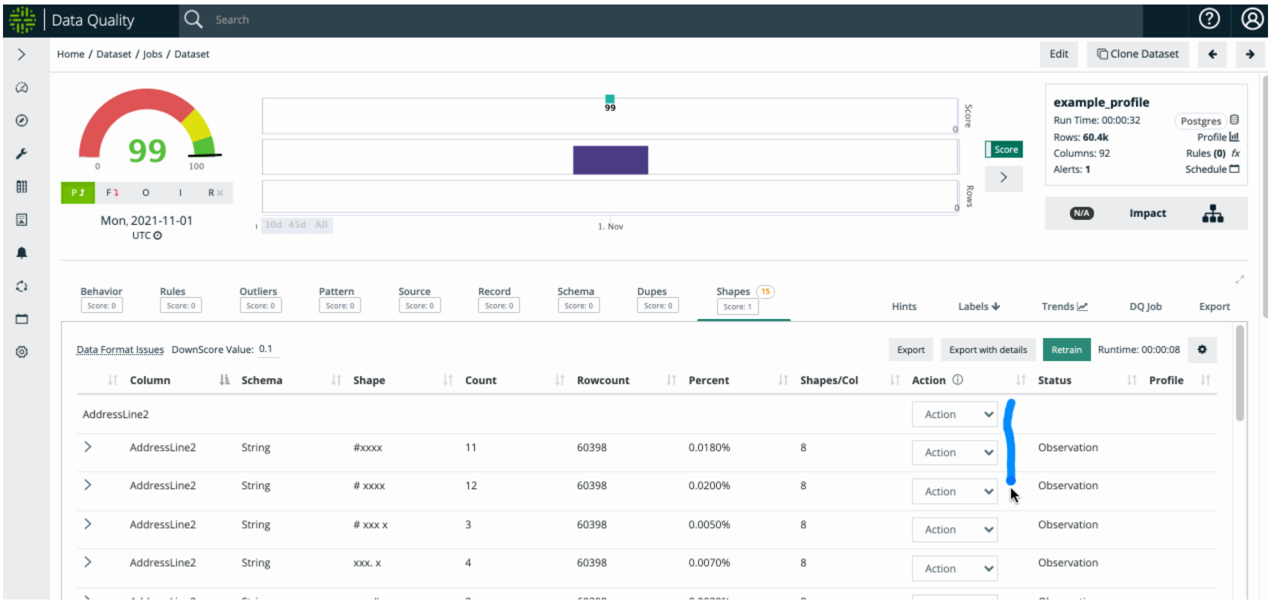
How do I add people to the assignment list

Once a person logs into the Collibra DQ Application they will get a profile and become eligible for assignment.

Labeling / Training

Item Labeling

Quickly click findings to trigger retraining.



Data Format Issues DownScore Value: 0.1

Column	Schema	Shape	Count	Rowcount	Percent	Shapes/Col	Action	Status	Profile
AddressLine2							Action		
AddressLine2	String	#xxxx	11	60398	0.0180%	8	Action	Observation	
AddressLine2	String	# xxxx	12	60398	0.0200%	8	Action	Observation	
AddressLine2	String	# xxx x	3	60398	0.0050%	8	Action	Observation	
AddressLine2	String	xxx. x	4	60398	0.0070%	8	Action	Observation	

Action labeling options

The following action labels instruct Collibra on how to handle a finding:

Action	Description
Validate	Instructs Collibr

Action	Description
	a to either assign

Action	Description
	pecific user for rev-

Action	Description
	Assignments Queue, or

Action	Description
	acknowledge without an a-

Action	Description
	ee that the finding is a

Action	Description
	Note: Validating a findin

Action	Description
	g does not improve your scor-

Action	Description

Action	Description
Invalidate	Instruct

Action	Description
	s Collib

Action	Description
	nore a fi

[illegible]	Description
	e to pass.

Action	Description
	in. Save: Allo

Action	Description
	ws you to mark

Action	Description
	ding as invalida-

Action	Description
	Save & Retrain:

Action	Description
	Allows you to inva-

Action	Description
	idate a finding and

Action	Description
	d invalidated finding-

Action	Description
	Note: When you have

Action	Description
	many findings to invali

Action	Description
	best to use the Save opt-

Action	Description
	dings are reviewed.

Action	Description
Resolve	Instructs Collibra to

Action	Description
	mark the finding as a

Action	Description
	vents it from appearing i

Action	Description
	ata quality scores.

Available actions by feature

Feature	Available actions
Behaviors	Validate, Resolve
Rules	Validate, Resolve

Feature	Available actions
Outliers	Validate, Invalidate, Resolve
Pattern	Validate, Invalidate, Resolve
Source	Validate, Invalidate, Resolve
Record	Validate, Resolve
Dupes	Validate, Invalidate, Resolve

Warning Some findings are ineligible for all labeling options. For example, you can only apply Validate and Resolve labels to findings that result from Rules.

Validating a finding

When you apply a validate label to a finding, you can assign it to another DQ user to review. This marks the finding for future runs and sends it to the internal Assignments Queue. You can also configure DQ to send assignments to an external queue, such as External assignment.

Invalidating a finding

Sometimes the findings page flags issues with your data that DQ discovers during a job run, but maybe you want DQ to ignore certain flagged issues. The invalidate label allows you to do that. After you add a descriptive annotation of your action, you can then select either Save or Save & Retrain.

Save

If you have a large number of findings that DQ has flagged, and you want to invalidate all of them at once instead of clicking through one at a time, select Save for all of the findings you would like to bulk invalidate. On your last finding, select Save & Retrain. All previously saved invalidated findings are removed and DQ retrains your data set.

Save & Retrain

When you Save & Retrain your data set, any previously deducted points from a flagged finding are restored and reflected in your overall data quality score. If you do not have many findings to invalidate, you can Save & Retrain individually instead of in bulk.

Resolving a finding

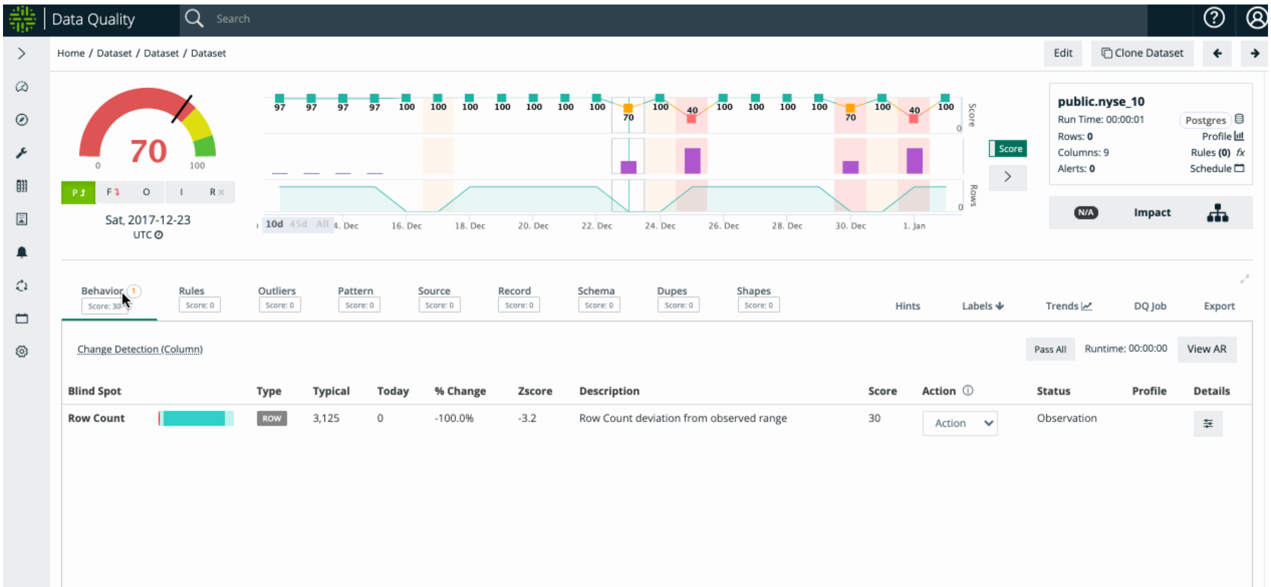
Some features, such as Behavior and Rules, only permit Validate and Resolve actions. When you cannot Validate a finding but you want to apply a label, select Resolve. The Resolve label prevents a finding from appearing in future runs of your data set, and does not immediately affect your data quality score when applied.

Recalling labeled findings

To modify a previously labeled finding, you can always access them through the Labels tab. Here you can edit an annotation or delete a label entirely. If you delete a label, it returns to the findings page, unlabeled. From there you can again choose to Validate, Invalidate, or Resolve it.

To closely analyze when a finding has received a label, who has applied it, and more, see also the Dataset Audit Trail.

Peak vs Off Peak



Sat, 2017-12-23
UTC

public.nyse_10
Run Time: 00:00:01
Rows: 0
Columns: 9
Alerts: 0
Postgres
Profile
Rules (0)
Schedule

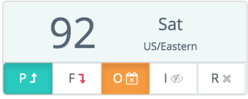
Change Detection (Column)

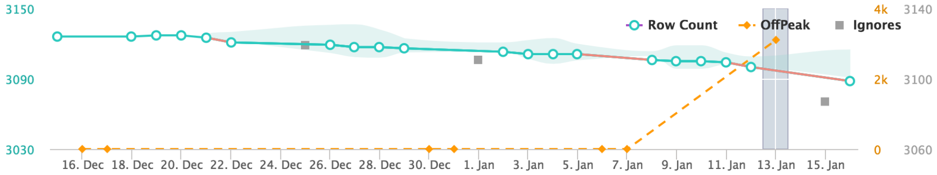
Runtime: 00:00:00

Blind Spot	Type	Typical	Today	% Change	Zscore	Description	Score	Action	Status	Profile	Details
Row Count	ROW	3,125	0	-100.0%	-3.2	Row Count deviation from observed range	30	Action	Observation		

But my Weekend runs are not the Same

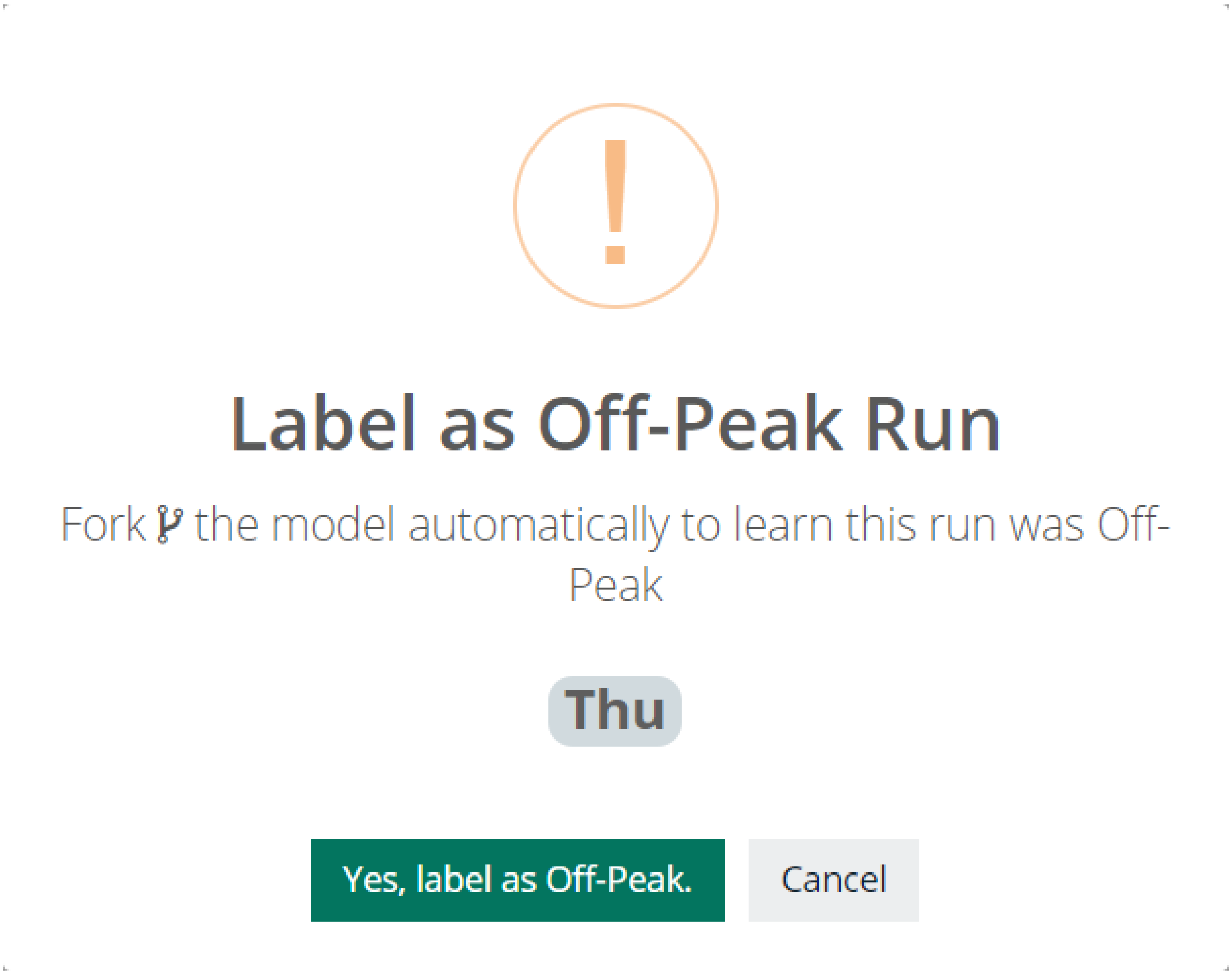
A common scenario that can fool behavioral analytics and machine learning is when you have a few different but normal patterns. Collibra has a rich labeling system that allows a user to fork the training model to learn these cycles individually without confusing the model.





Click the Green Button

By clicking the green button, you can label the day of the week as peak vs off peak. You can also chose your time zone - this will help determine the day of the week accurately. You only need to click the peak scheduler once and the model will learn and forecast this understanding for every run in the future. This feature commonly prompts for a re-train.



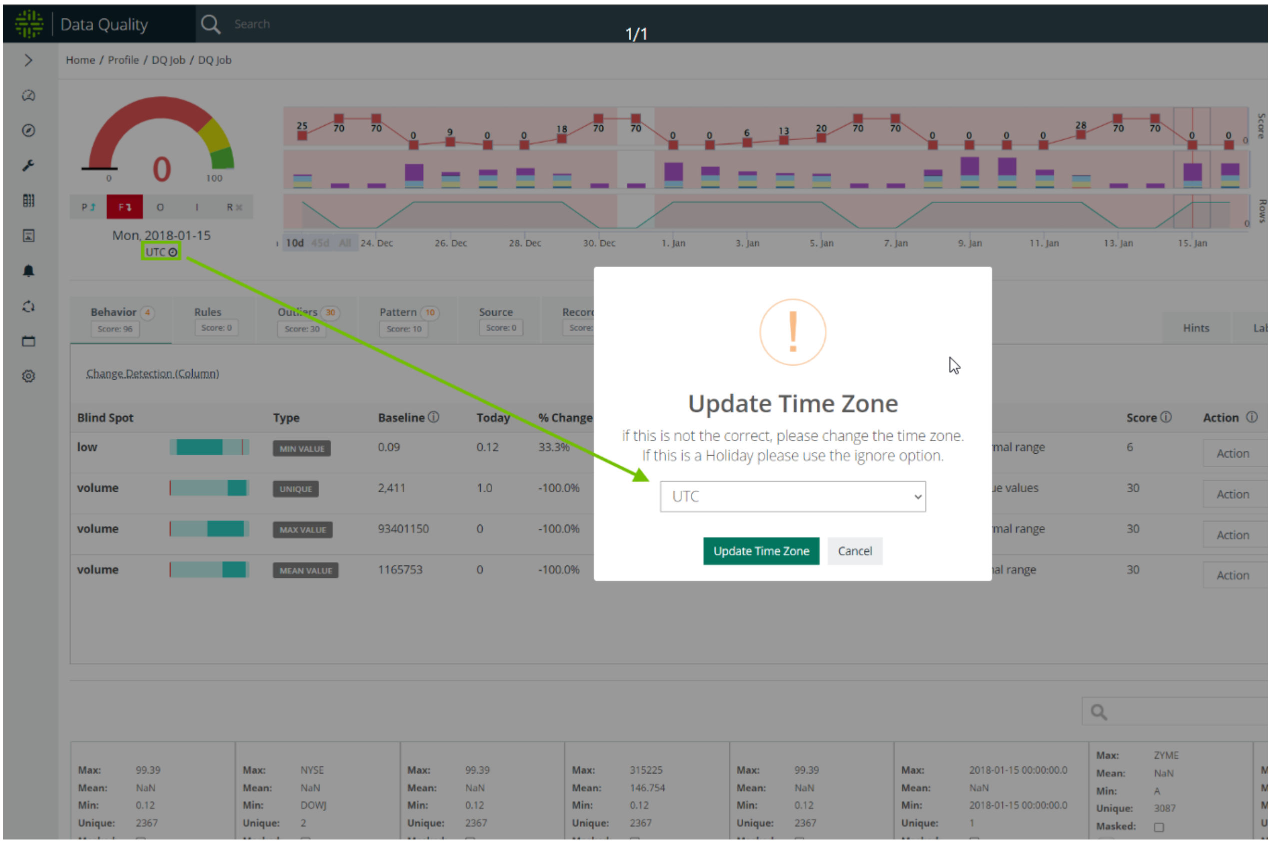
Label as Off-Peak Run

Fork ⑂ the model automatically to learn this run was Off-Peak

Time Zones

Updating time zones

By default, Collibra Data Quality's time zone associated with the RunID is located in Coordinated Universal Time (UTC). To update the server time zone, select the Update Time Zone link from the findings page. An Update Time Zone dialog displays with the option to select your time zone from the dropdown menu. Click the Update Time Zone button to confirm your selection.



Change Detection (Column)

Blind Spot	Type	Baseline	Today	% Change		Score	Action
low	MIN VALUE	0.09	0.12	33.3%	mal range	6	Action
volume	UNIQUE	2,411	1.0	-100.0%	ue values	30	Action
volume	MAX VALUE	93401150	0	-100.0%	mal range	30	Action
volume	MEAN VALUE	1165753	0	-100.0%	al range	30	Action

Update Time Zone

if this is not the correct, please change the time zone.
If this is a Holiday please use the ignore option.

UTC

Update Time Zone Cancel

Max: 99.39	Max: NYSE	Max: 99.39	Max: 315225	Max: 99.39	Max: 2018-01-15 00:00:00.0	Max: ZYME
Mean: NaN	Mean: NaN	Mean: NaN	Mean: 146.754	Mean: NaN	Mean: NaN	Mean: NaN
Min: 0.12	Min: DOWJ	Min: 0.12	Min: 0.12	Min: 0.12	Min: 2018-01-15 00:00:00.0	Min: A
Unique: 2367	Unique: 2	Unique: 2367	Unique: 2367	Unique: 2367	Unique: 1	Unique: 3087
						Masked: □

Note Since the server time zone can differ from the configurable RunID time zone on the findings page, data sets in List View may have different dates than the date listed on the findings page of the same data set. For example, a data set with a RunID in the default UTC time zone may appear as 2022-01-15 00:00:00 on the findings page, but because the server is located in US/Central time, the date appears as 2022-01-14 19:00:00.

Chapter 13

Collibra DQ DIC Integration

DQ Connector

Current Status: [Tech Preview]

Benefits

The Native DQ Connector brings intelligence from **Collibra Data Quality** into **Collibra Data Intelligence Cloud**. Once this integration is established, you will be able to bring in your Data Quality user-defined rules, metrics, and dimensions into **Collibra Data Catalog**.

Please note: Only data sources ingested by both Collibra Data Catalog and Collibra Data Quality will be able to synchronize Data Quality assets.

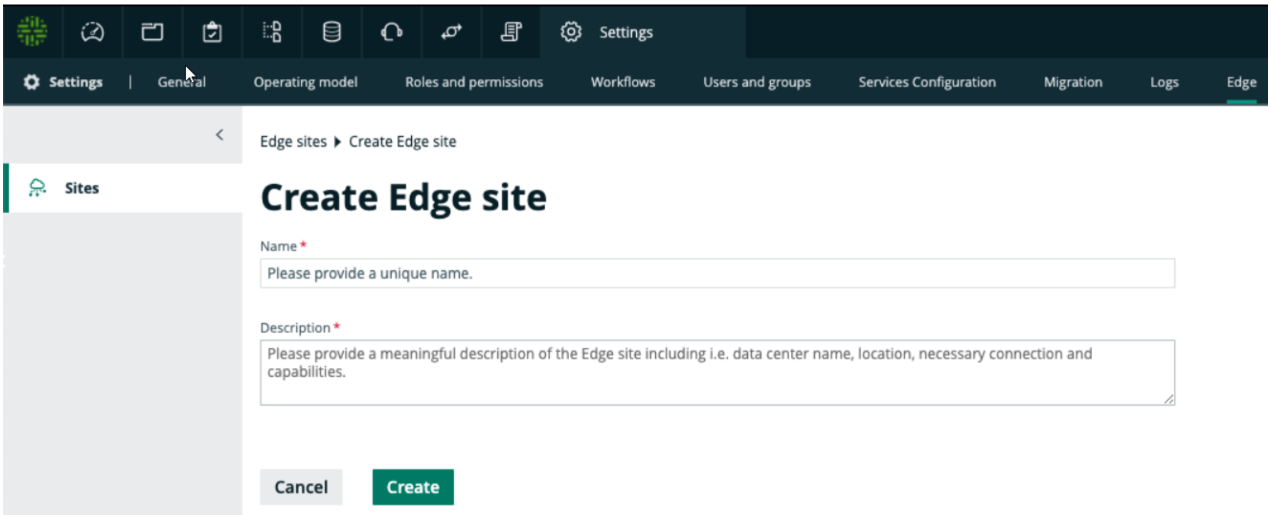
Step 0: Prerequisites

Resource	Notes
Collibra Edge Site	DQ Connector is a capability of Edge
Collibra Data Intelligence Cloud	2021.07 Release (or newer)
Collibra Data Quality	2.15 (or newer)
Database(s) and Driver(s)	Proper Access and Credentials (Username / Password)

Note Let's proceed after gathering all prerequisites!

Step 1: Create and Configure Edge and DQ Connector

1A. Create Edge site and Add Name e.g. 'Collibra-DQ-Edge' and Description (One-Time)


Settings
Settings | General Operating model Roles and permissions Workflows Users and groups Services Configuration Migration Logs Edge
Sites
Cancel
Create

Edge sites ▸ Create Edge site

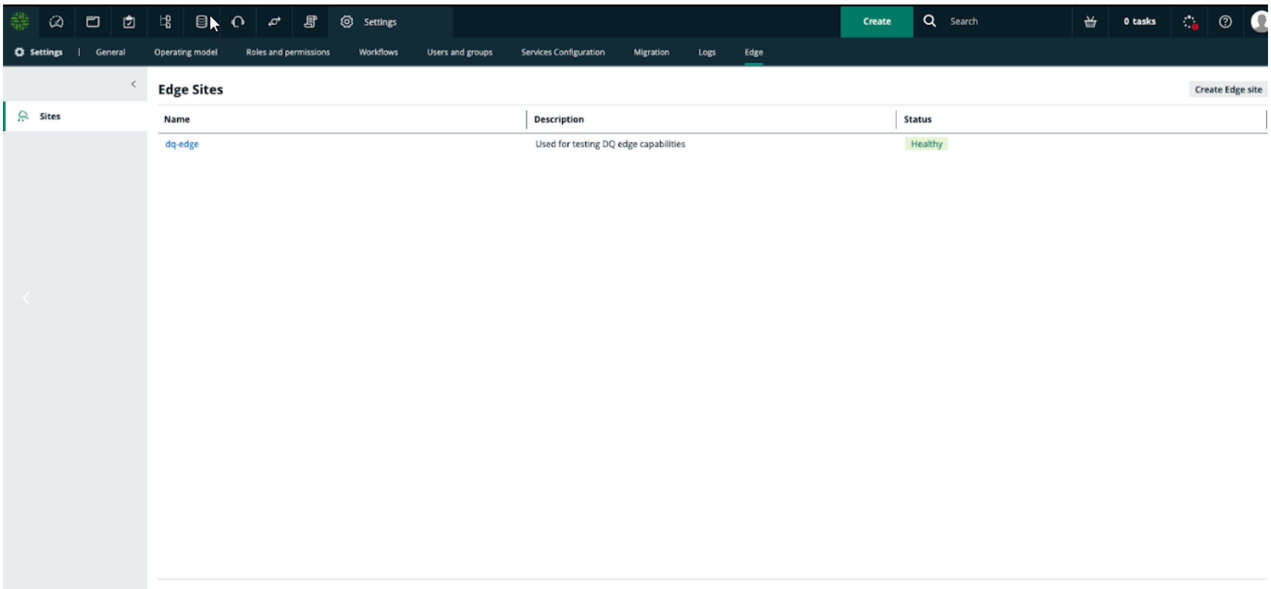
Create Edge site

Name *

Please provide a unique name.

Description *

Please provide a meaningful description of the Edge site including i.e. data center name, location, necessary connection and capabilities.


Settings
Create
Search
0 tasks
Settings | General Operating model Roles and permissions Workflows Users and groups Services Configuration Migration Logs Edge
Sites
Create Edge site

Edge Sites

Name	Description	Status
dq-edge	Used for testing DQ edge capabilities	Healthy

> **Note** For more detailed information on Edge installation and configuration, see Installing an Edge site.

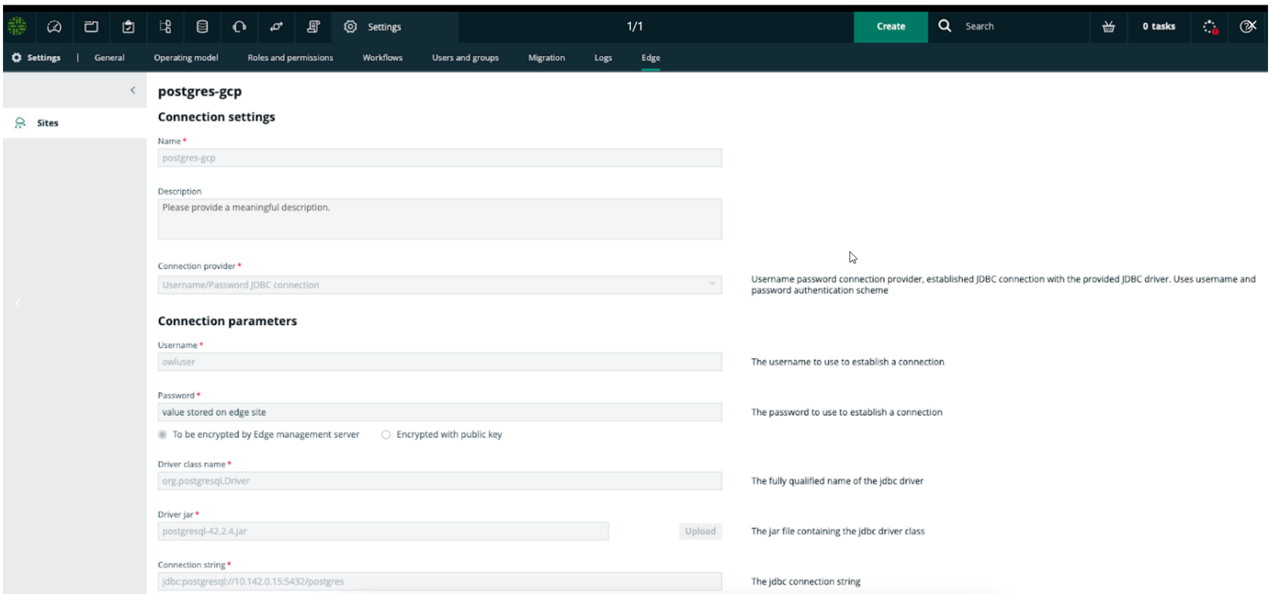
1B. Establish Edge’s Connection To Each Data Source (One-Time For Each Source)

Additional Steps in Collibra DG include:

- Provide Connection Name, which exactly matches Connection / System Name in Collibra DQ
- Select Connection type e.g. Username / Password JDBC driver
- Input Username and Password to connect to your data source
- Input fully qualified driver class name
- Upload Driver jar (to reduce potential conflicts, use same driver jar from Collibra DQ)
- Input Connection String Input credentials e.g. username / password or Kerberos config file
- Reminder: All of the above information should be the same as in Collibra DQ

Additional Steps in Collibra DQ include:

- Verify Connection ‘Name’ in DGC matches Connection ‘Name’ in Collibra DQ
- Verify ‘Connection string’ in DGC matches ‘Connection URL’ in Collibra DQ
- Verify ‘Driver class name’ in DGC matches ‘Driver Name’ in Collibra DQ
- Verify ‘Driver jar’ in DGC matches Driver used in ‘Driver Location’ in Collibra DQ (may require SSH)
    - Verifying the driver jar is only possible on standalone installs. This is not possible with container builds (k8s deployments), unless you kubectl into the pod and lookup the directory and jar directly.


Settings
1/1
Create
Search
0 tasks
Settings | General Operating model Roles and permissions Workflows Users and groups Migration Logs Edge
Sites
Upload

postgres-gcp

Connection settings

Name *
postgres-gcp

Description
Please provide a meaningful description.

Connection provider *
Username/Password JDBC connection
Username password connection provider, established JDBC connection with the provided JDBC driver. Uses username and password authentication scheme

Connection parameters

Username *
owluser
The username to use to establish a connection

Password *
value stored on edge site
● To be encrypted by Edge management server ○ Encrypted with public key
The password to use to establish a connection

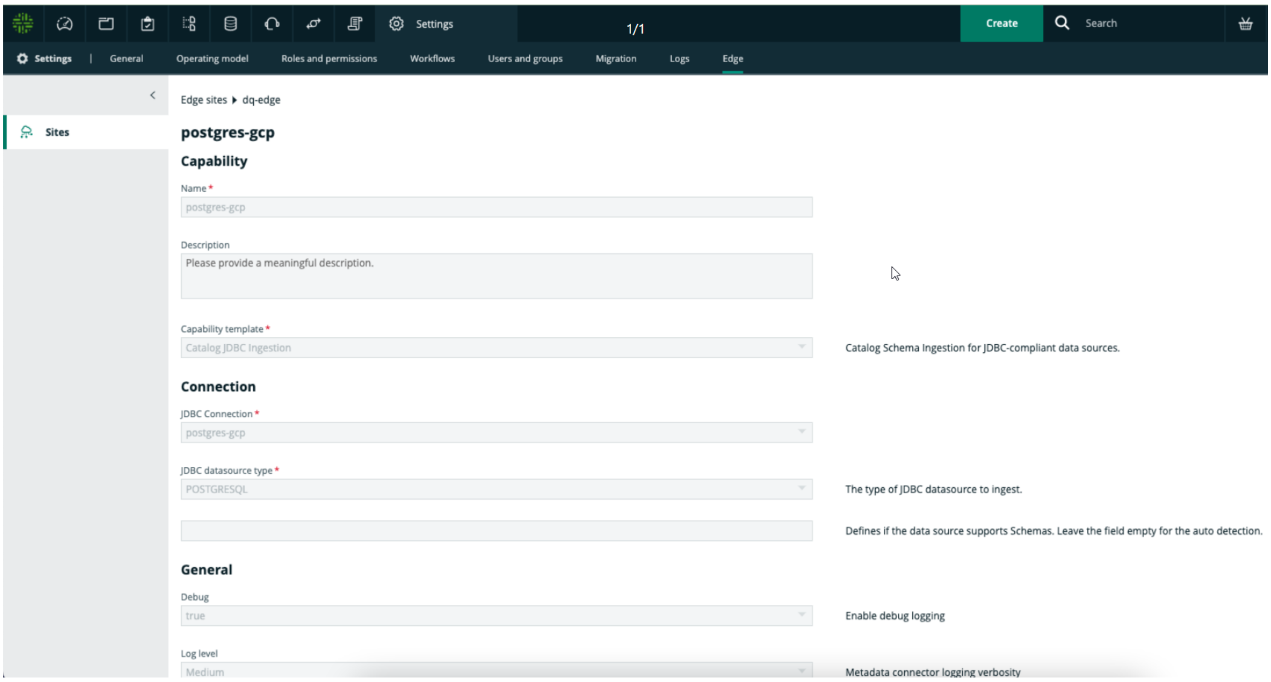
Driver class name *
org.postgresql.Driver
The fully qualified name of the jdbc driver

Driver jar *
postgresql-42.2.4.jar
The jar file containing the jdbc driver class

Connection string *
jdbc:postgresql://10.142.0.15:5432/postgres
The jdbc connection string

> **Warning** Important: Connection / System name (in this example, 'postgres-gcp') must exactly match the Connection / System Name in Collibra DQ

1C. Establish Catalog JDBC Ingestion Capability On Edge (One-Time For Each Data Source)


Settings
1/1
Create
Search
Settings | General Operating model Roles and permissions Workflows Users and groups Migration Logs Edge
Sites

Edge sites ▸ dq-edge

postgres-gcp

Capability

Name *
postgres-gcp

Description
Please provide a meaningful description.

Capability template *
Catalog JDBC Ingestion
Catalog Schema Ingestion for JDBC-compliant data sources.

Connection

JDBC Connection *
postgres-gcp

JDBC datasource type *
POSTGRESQL
The type of JDBC datasource to ingest.

Defines if the data source supports Schemas. Leave the field empty for the auto detection.

General

Debug
true
Enable debug logging

Log level
Medium
Metadata connector logging verbosity

1D: Configure Destinations For DQ Assets (Rules, Metrics, Dimensions) Within DQ Connector (One-Time)

Option A: Create New Destinations

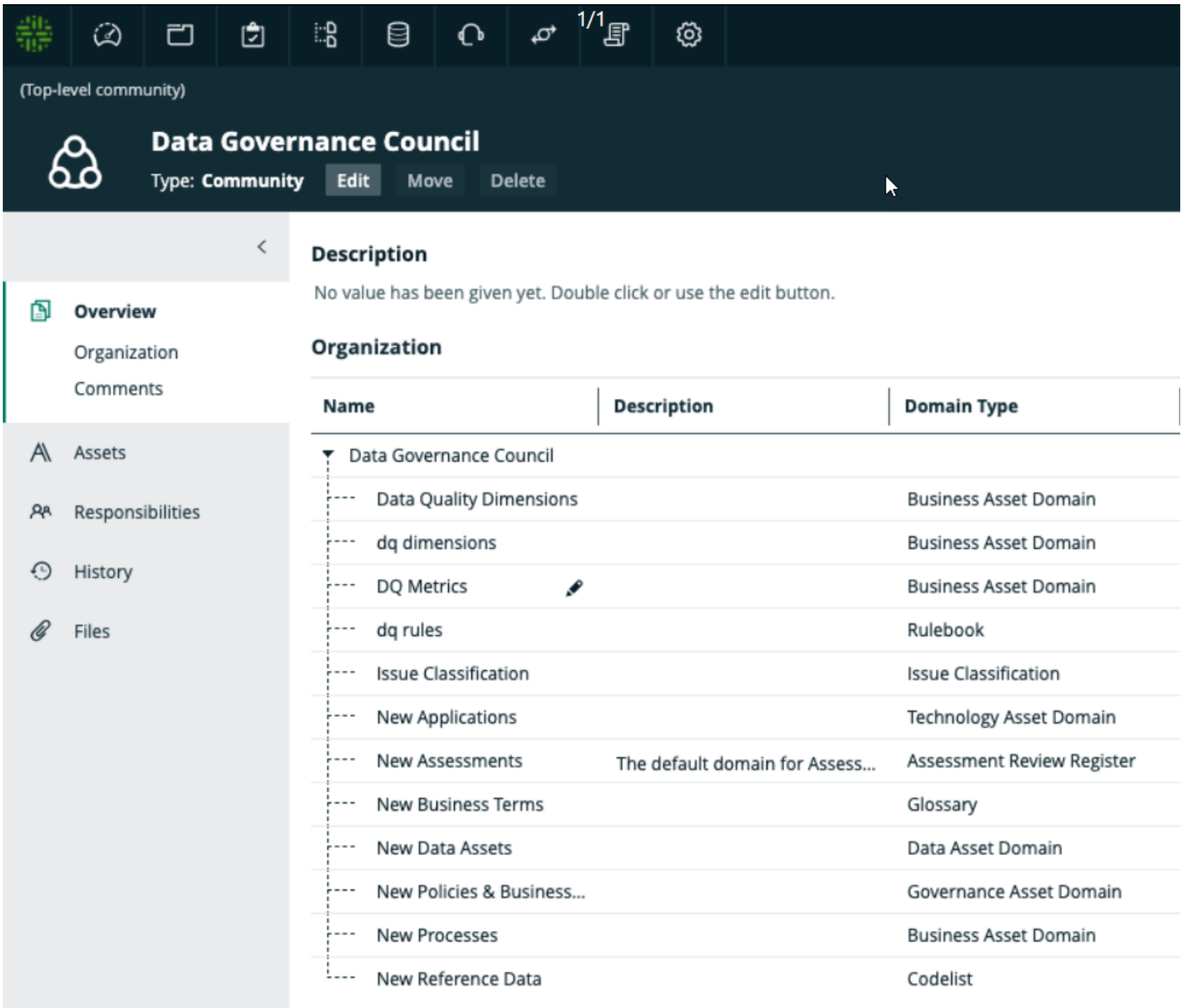
- Create New Rulebook Domain (suggested domain type) for DQ Rules and DQ Metrics
    - Global Create -> Search for and select 'Rulebook' under 'Governance Asset Domain' -> Select desired 'Community' e.g. 'Data Governance Council' -> Input name of Rulebook domain e.g. 'CDQ Rules', 'CDQ Metrics'

> **Note** Record your domain resource ID e.g. 2xxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxx (can be found in your URL) for Step 1G.

- Create New Business Asset Domain (suggested domain type) for DQ Dimensions
    - Global Create -> Search for and select 'Business Asset Domain' -> Select desired 'Community' e.g. 'Data Governance Council' -> Input name of domain e.g. 'CDQ Dimensions'
    - Record your domain resource ID e.g. 2xxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxx (can be found in your URL)

Option B: Use Existing Domains from existing Rulebook and Asset domains

> **Note** Record your domain resource ID e.g. 2xxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxx (can be found in your URL) for Step 1G.



Data Governance Council

Type: Community

Description

No value has been given yet. Double click or use the edit button.

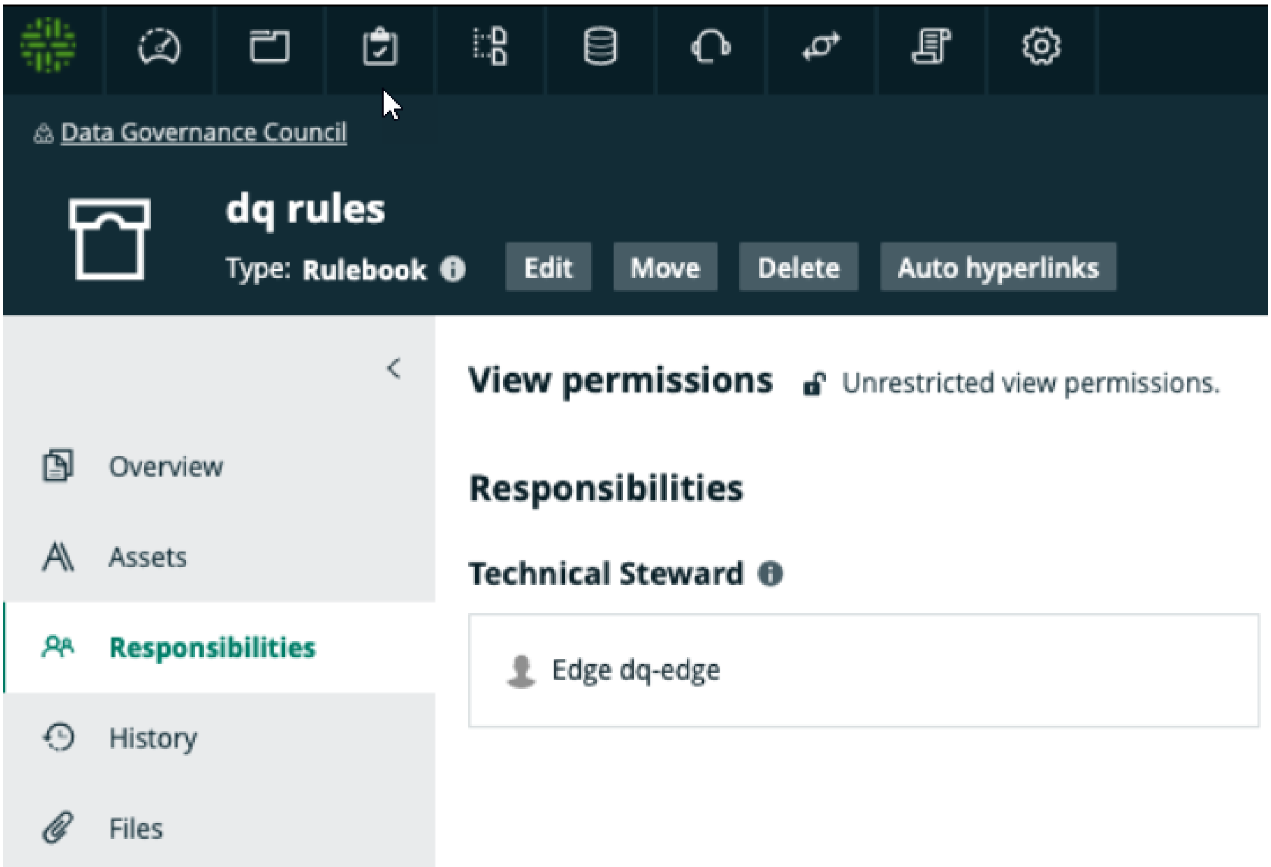
Organization

Name	Description	Domain Type
Data Governance Council		
Data Quality Dimensions		Business Asset Domain
dq dimensions		Business Asset Domain
DQ Metrics		Business Asset Domain
dq rules		Rulebook
Issue Classification		Issue Classification
New Applications		Technology Asset Domain
New Assessments	The default domain for Assess...	Assessment Review Register
New Business Terms		Glossary
New Data Assets		Data Asset Domain
New Policies & Business...		Governance Asset Domain
New Processes		Business Asset Domain
New Reference Data		Codelist

> **Note** You have now established destinations for where Collibra should ingest your User-Defined Rules, Metrics, and Dimensions.

1E. Assign Permissions for New Domains of DQ Assets (Rules, Metrics, Dimensions) (One-Time)

Please assign your Edge user as a **Technical Steward** in each of the domains specified in 1D, such that Edge can create and update assets into each respective domain. Ensure that your Edge user also has admin permissions assigned in order to create and update assets in the Catalog.



Data Governance Council

dq rules

Type: Rulebook

View permissions Unrestricted view permissions.

Responsibilities

Technical Steward

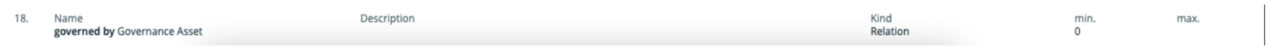
Edge dq-edge

> **Note** This step provides Edge with the proper permissions to create and update assets into the domains from the previous step.

1F. Allow DQ Assets To Attach To Tables and Column Assets (One-Time)

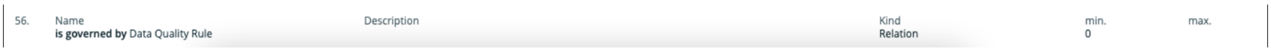
Now we need to add a few relations and update global assignment characteristics:

- **Table**: Settings -> Operating Model -> Relations -> Search in any column for 'Table' -> Global Assignment -> Characteristics -> Edit (larger of the two buttons) on right -> Add characteristic -> Search for and select 'governed by Governance Asset' -> Save



	Name	Description	Kind	min.	max.
18.	**governed by** Governance Asset		Relation	0	

- **Column**: Settings -> Operating Model -> Relations -> Search in any column for 'Column' -> Global Assignment -> Characteristics -> Edit (larger of the two buttons) on right -> Add characteristic -> Search for and select 'is governed by Data Quality Rule' -> Save



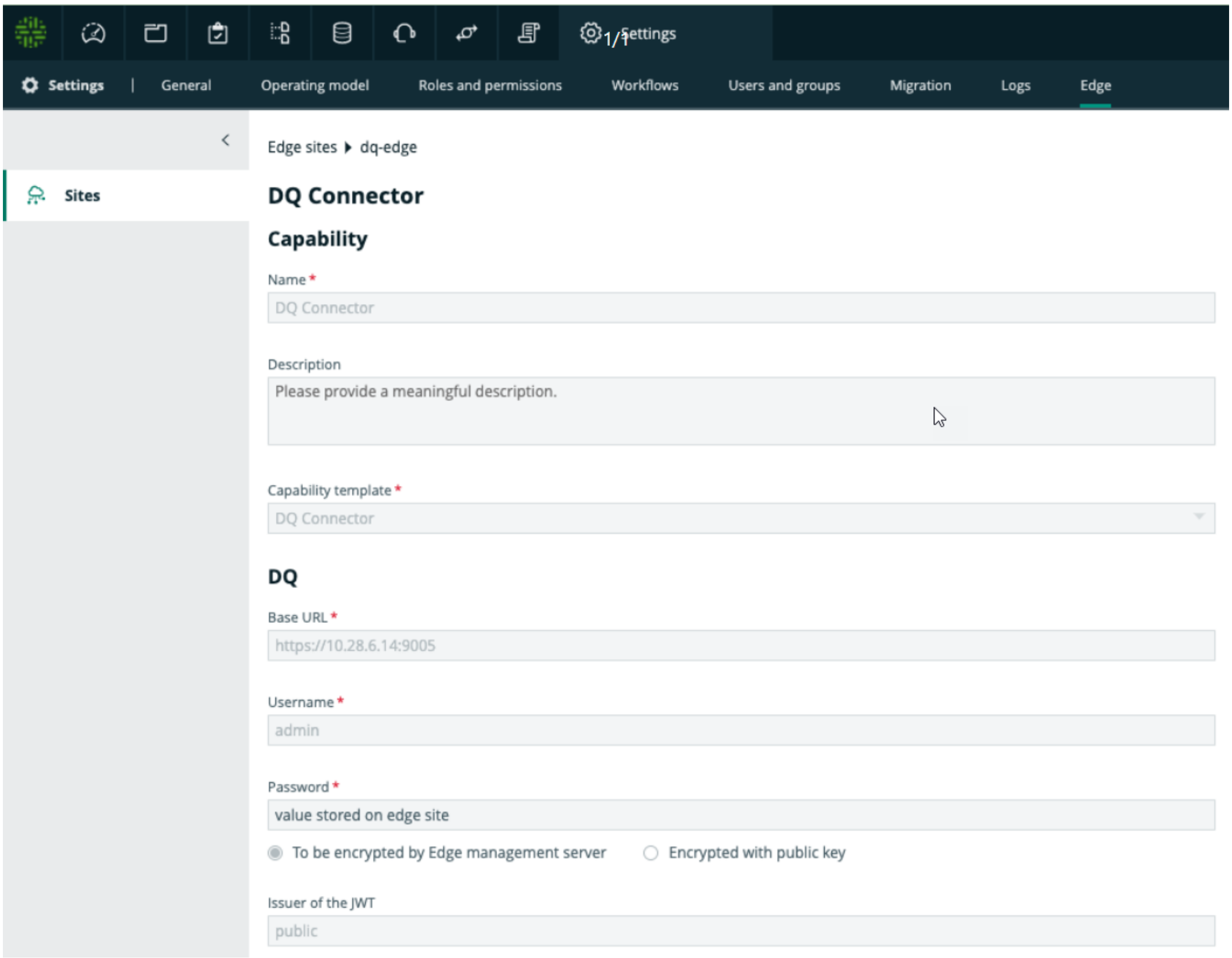
	Name	Description	Kind	min.	max.
56.	**is governed by** Data Quality Rule		Relation	0	

1G. Establish DQ Connector (One-Time)

DQ Connector is an Edge capability that will facilitate communication with your Collibra DQ instance

- Settings -> Edge -> Capabilities -> Add Capability -> Select 'DQ Connector' -> Input your Collibra DQ URL e.g. 'customerdq.collibra.com:port' input username and password
- Under the JWT Issuer, please ensure that you have the correct schema name for the database you are connecting to (either 'public' if single tenant, or the name of tenant).

> **Note** Remember from previous step 1D, you will need to provide your resource / UUIDs for your specified domains for DQ Rules, Metrics, and Dimensions.


1/1 Settings
Settings | General Operating model Roles and permissions Workflows Users and groups Migration Logs Edge
Sites

Edge sites ▸ dq-edge

DQ Connector

Capability

Name *
DQ Connector

Description
Please provide a meaningful description.

Capability template *
DQ Connector

DQ

Base URL *
https://10.28.6.14:9005

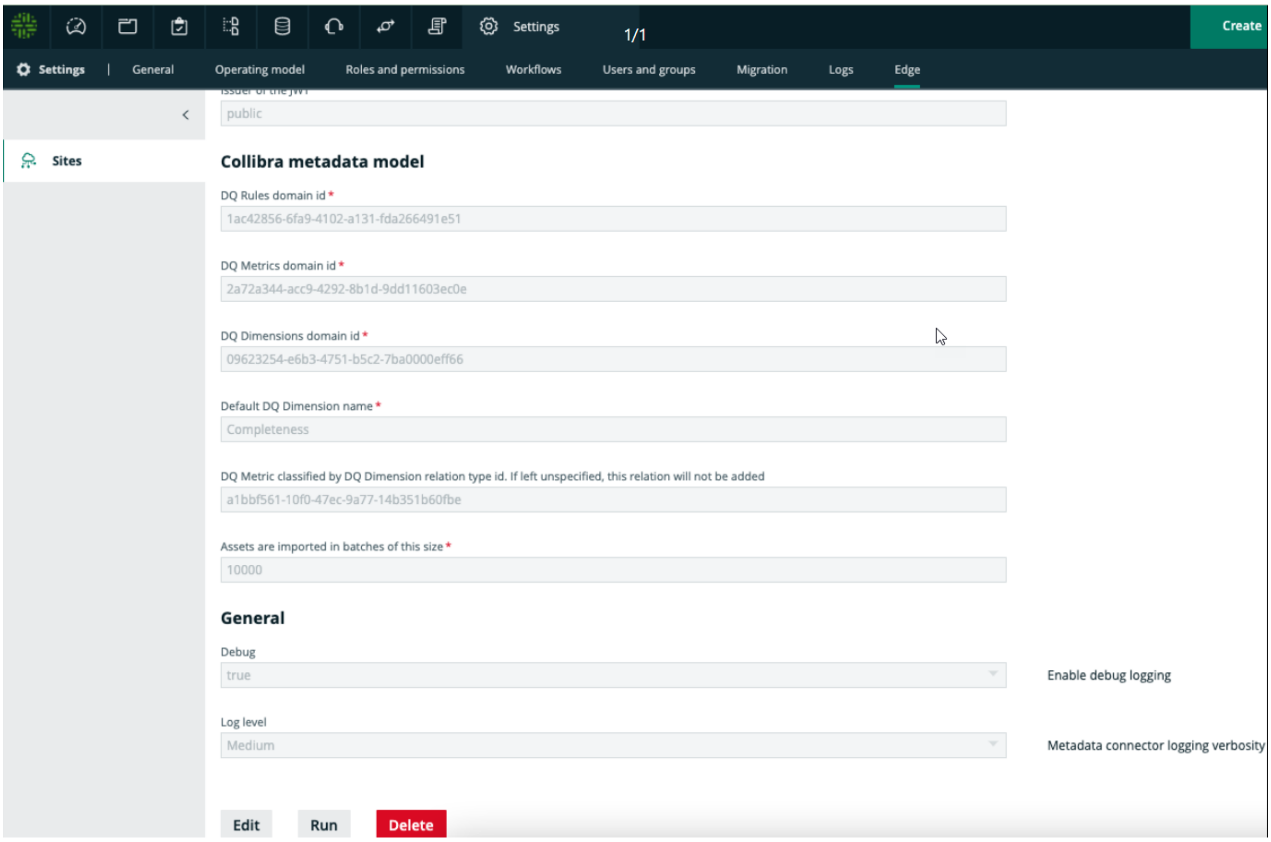
Username *
admin

Password *
value stored on edge site

● To be encrypted by Edge management server ○ Encrypted with public key

Issuer of the JWT
public

Specify DQ Asset Destinations Within DQ Connector



public

Collibra metadata model

DQ Rules domain id *
1ac42856-6fa9-4102-a131-fda266491e51

DQ Metrics domain id *
2a72a344-acc9-4292-8b1d-9dd11603ec0e

DQ Dimensions domain id *
09623254-e6b3-4751-b5c2-7ba0000eff66

Default DQ Dimension name *
Completeness

DQ Metric classified by DQ Dimension relation type id. If left unspecified, this relation will not be added
a1bbf561-10f0-47ec-9a77-14b351b60fbe

Assets are imported in batches of this size *
10000

General

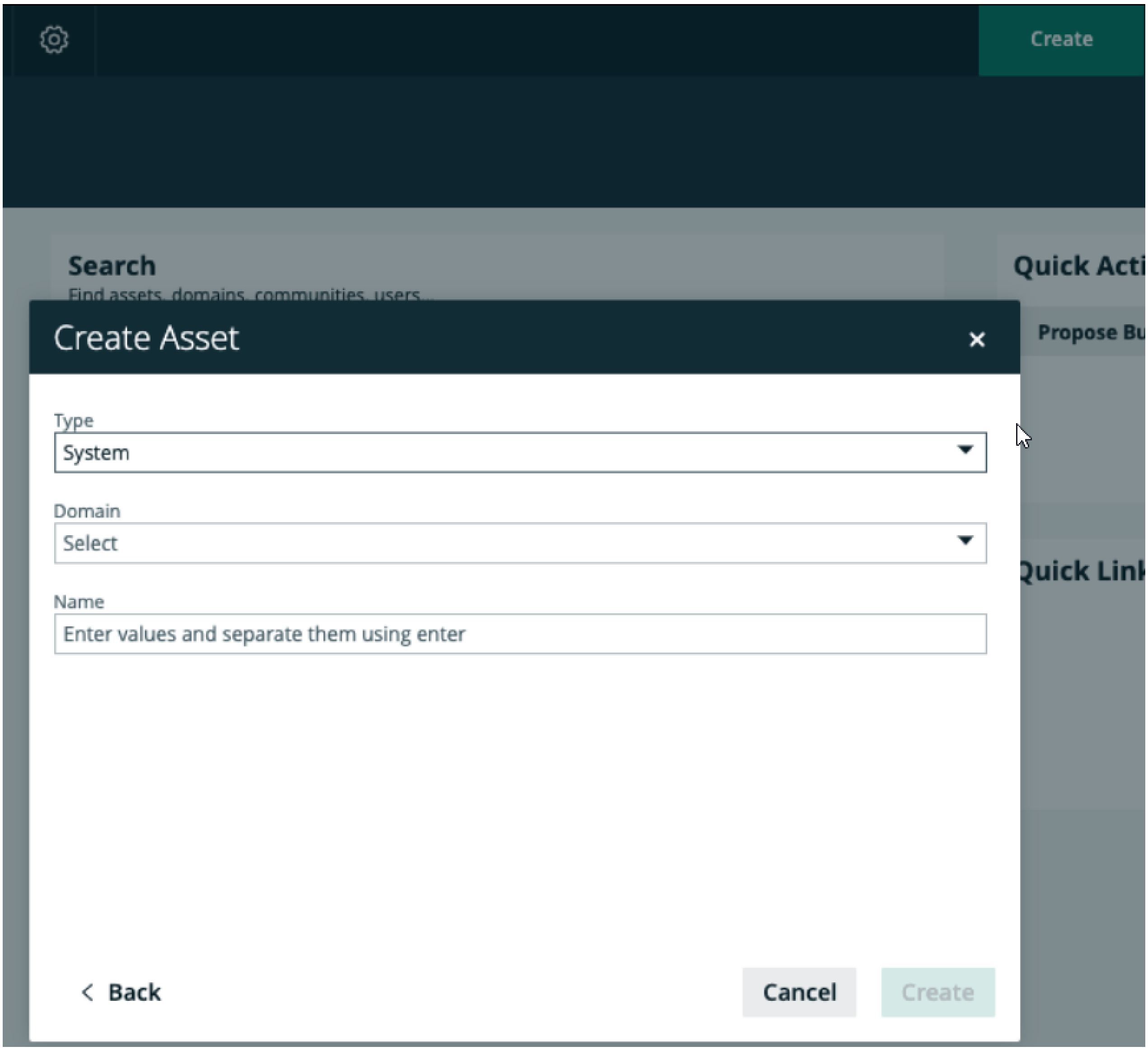
Debug
true
Enable debug logging

Log level
Medium
Metadata connector logging verbosity

Note You've now completed the initial one-time configuration.

Step 2: Register Edge Connections to Collibra Catalog

2A. Create System Asset Within Collibra Catalog To Connect To Edge



Create Asset

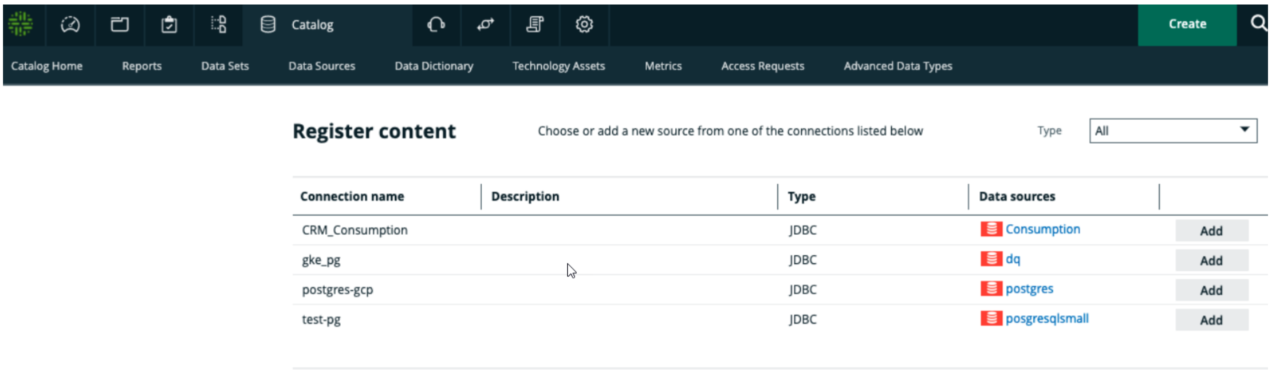
Type
System

Domain
Select

Name
Enter values and separate them using enter

Warning Important: Connection / System name (in this example, 'postgres-gcp') must exactly match the Connection / System Name in Collibra DQ.

2B. Register Edge Data Source to Collibra Catalog



Register content

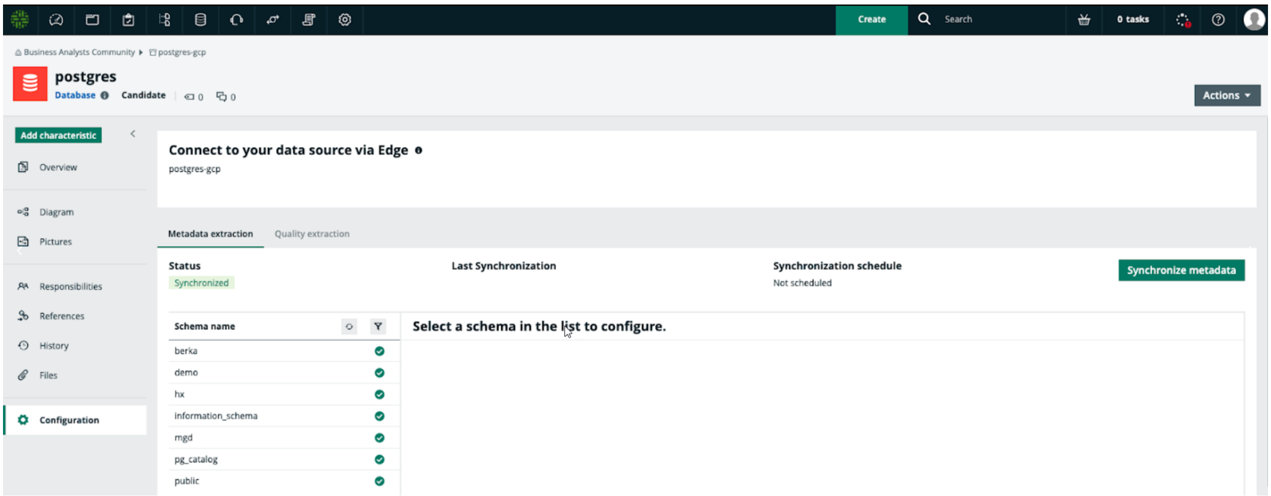
Choose or add a new source from one of the connections listed below

Type: All

Connection name	Description	Type	Data sources	
CRM_Consumption		JDBC	Consumption	Add
gke_pg		JDBC	dq	Add
postgres-gcp		JDBC	postgres	Add
test-pg		JDBC	posgresqlsmall	Add

Step 3: Start Ingesting Collibra Data Quality Into Catalog

> **Note** Prerequisite: Catalog will have ingested schemas on Edge.



postgres

Database · Candidate · 0 · 0

Connect to your data source via Edge

postgres-gcp

Status: Synchronized

Last Synchronization

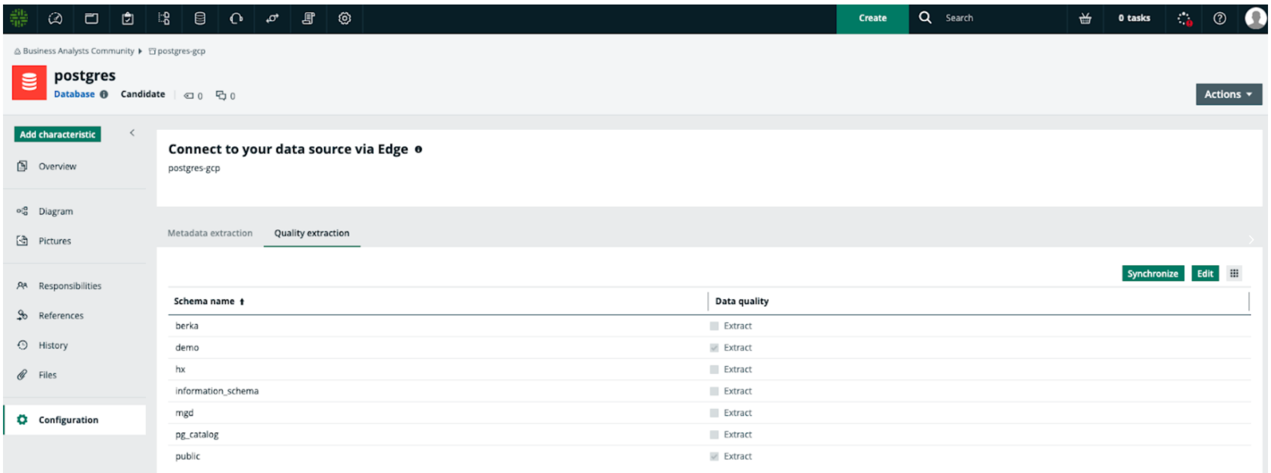
Synchronization schedule: Not scheduled

Schema name	
berka	✓
demo	✓
hx	✓
information_schema	✓
mgd	✓
pg_catalog	✓
public	✓

Select a schema in the list to configure.

> **Note** Prerequisite: Ensure targeted schemas have User-defined Rules, Metrics, and/or Dimensions within Collibra DQ that have been Executed

3A. Synchronize Data Quality for Selected Schemas

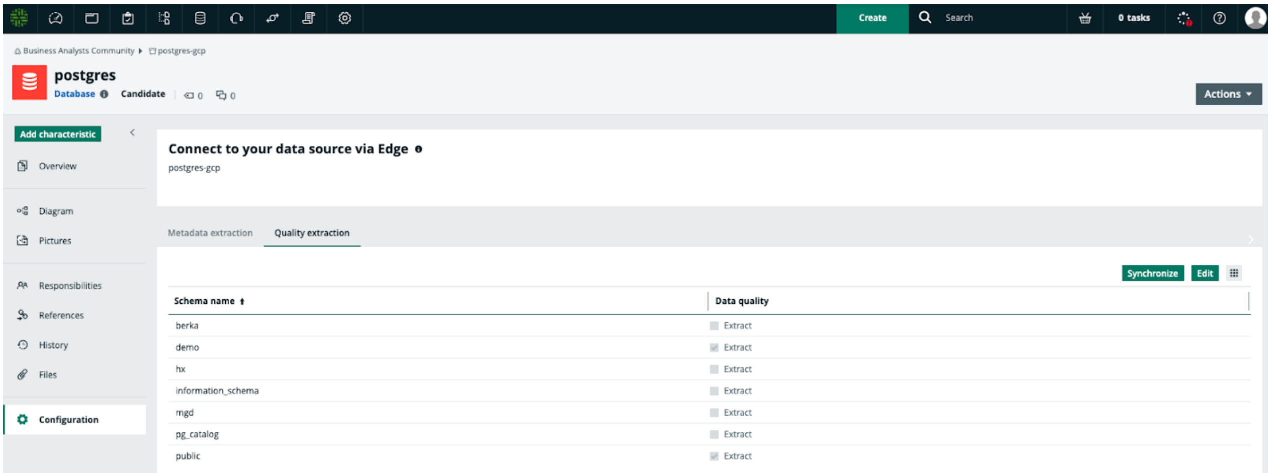


Connect to your data source via Edge

postgres-gcp

Schema name	Data quality
berka	☐ Extract
demo	☑ Extract
hx	☐ Extract
information_schema	☐ Extract
mgd	☐ Extract
pg_catalog	☐ Extract
public	☑ Extract

3B. Verify Data Quality Results in Collibra Catalog



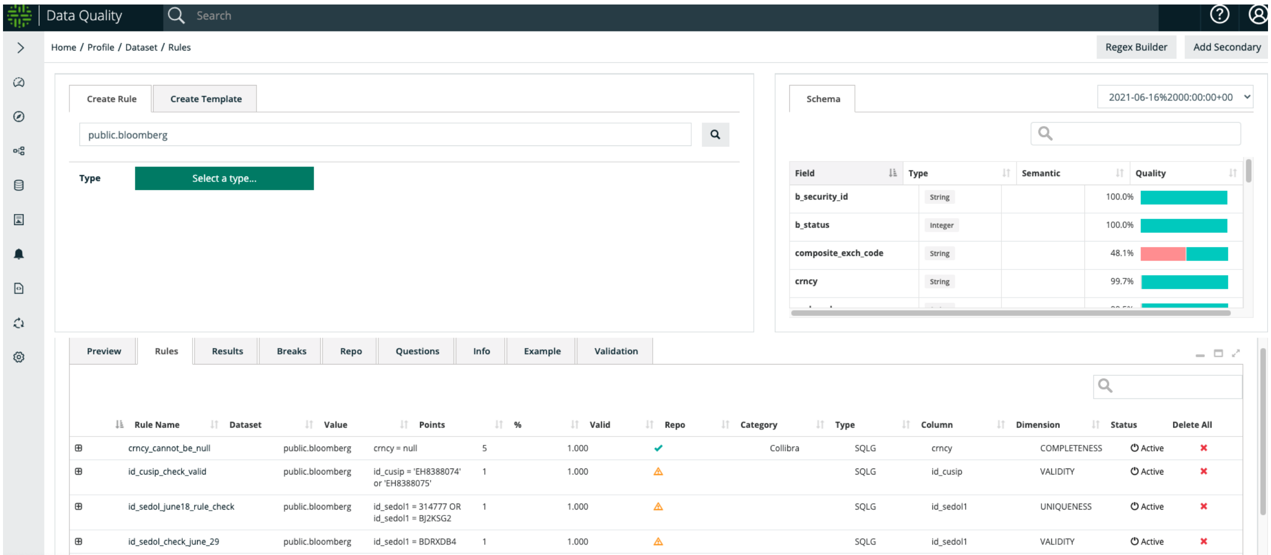
Connect to your data source via Edge

postgres-gcp

Schema name	Data quality
berka	☐ Extract
demo	☑ Extract
hx	☐ Extract
information_schema	☐ Extract
mgd	☐ Extract
pg_catalog	☐ Extract
public	☑ Extract

> **Note** The example output was successful.

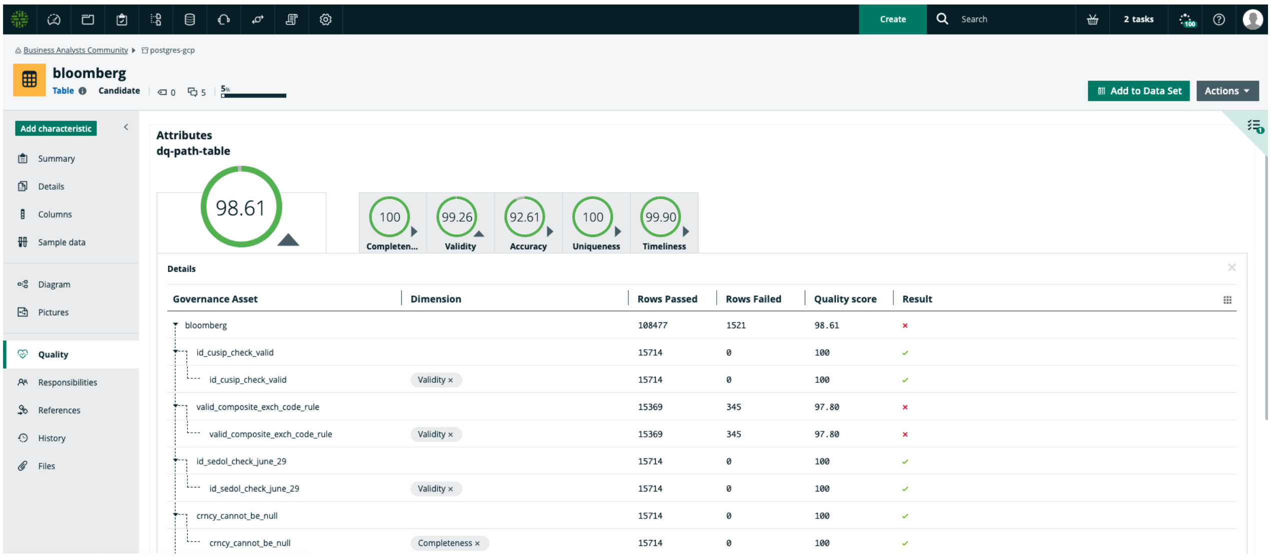
Appendix: Synchronization For Single Table in Data Quality and Data Catalog



public.bloomberg

Field	Type	Semantic	Quality
b_security_id	String		100.0%
b_status	Integer		100.0%
composite_exch_code	String		48.1%
crncy	String		99.7%

	Rule Name	Dataset	Value	Points	%	Valid	Repo	Category	Type	Column	Dimension	Status	Delete All
⊞	crncy_cannot_be_null	public.bloomberg	crncy = null	5		1.000	✓	Collibra	SQLG	crncy	COMPLETENESS	Active	✗
⊞	id_cusip_check_valid	public.bloomberg	id_cusip = 'EH8388074' or 'EH8388075'	1		1.000	⚠		SQLG	id_cusip	VALIDITY	Active	✗
⊞	id_sedol_june18_rule_check	public.bloomberg	id_sedol1 = 314777 OR id_sedol1 = BJ2KSG2	1		1.000	⚠		SQLG	id_sedol1	UNIQUENESS	Active	✗
⊞	id_sedol_check_june_29	public.bloomberg	id_sedol1 = BDRXDB4	1		1.000	⚠		SQLG	id_sedol1	VALIDITY	Active	✗



Governance Asset	Dimension	Rows Passed	Rows Failed	Quality score	Result
bloomberg		108477	1521	98.61	✗
id_cusip_check_valid		15714	0	100	✓
id_cusip_check_valid	Validity ×	15714	0	100	✓
valid_composite_exch_code_rule		15369	345	97.80	✗
valid_composite_exch_code_rule	Validity ×	15369	345	97.80	✗
id_sedol_check_june_29		15714	0	100	✓
id_sedol_check_june_29	Validity ×	15714	0	100	✓
crncy_cannot_be_null		15714	0	100	✓
crncy_cannot_be_null	Completeness ×	15714	0	100	✓

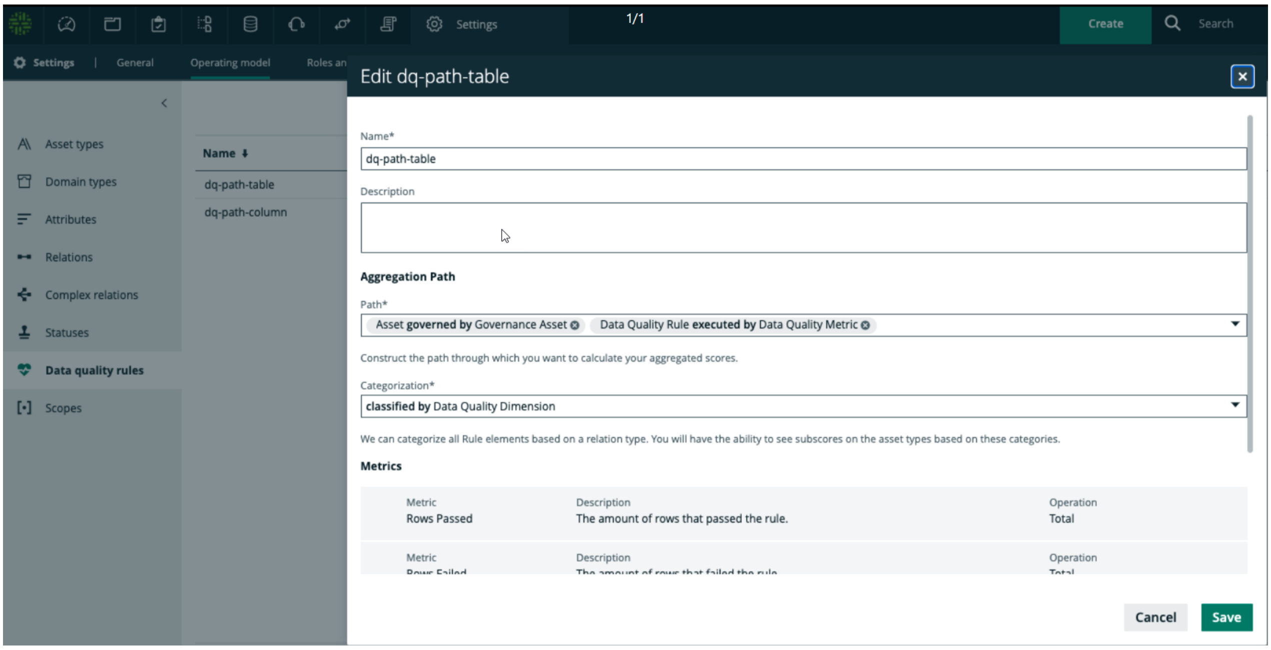
FAQ

Q: Known Limitations

- Only 1 source tenant from Collibra DQ can be specified
- On-demand ingestion (vs. scheduled)
- Can only specify 1 domain destination for each of Rules, Metrics, and Dimensions
- Only JDBC sources supported (no file sources)

Q: DQ Dashboard In DGC: I can verify the DQ Connector is synchronizing Data Quality Rules and Data Quality Metrics, but why don't Data Quality Dashboard Charts display?

A: Ensure correct **Aggregation Paths** and **Global Assignments** (or create, if none exist) for **Table** and **Column** below.



dq-path-table
dq-path-column

Edit dq-path-table

Name*
dq-path-table

Description

Aggregation Path

Path*
Asset **governed by** Governance Asset ⊗ Data Quality Rule **executed by** Data Quality Metric ⊗

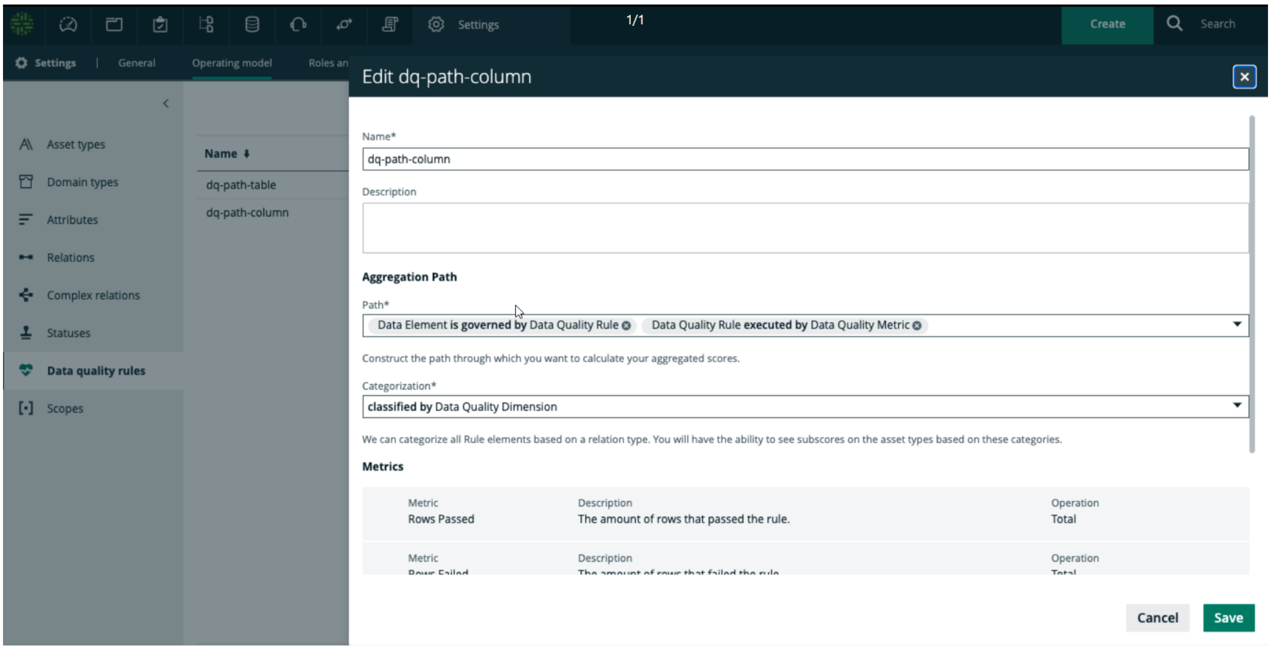
Construct the path through which you want to calculate your aggregated scores.

Categorization*
classified by Data Quality Dimension

We can categorize all Rule elements based on a relation type. You will have the ability to see subscores on the asset types based on these categories.

Metrics

Metric	Description	Operation
Rows Passed	The amount of rows that passed the rule.	Total
Rows Failed	The amount of rows that failed the rule.	Total



dq-path-table
dq-path-column

Edit dq-path-column

Name*
dq-path-column

Description

Aggregation Path

Path*
Data Element **is governed by** Data Quality Rule ⊗ Data Quality Rule **executed by** Data Quality Metric ⊗

Construct the path through which you want to calculate your aggregated scores.

Categorization*
classified by Data Quality Dimension

We can categorize all Rule elements based on a relation type. You will have the ability to see subscores on the asset types based on these categories.

Metrics

Metric	Description	Operation
Rows Passed	The amount of rows that passed the rule.	Total
Rows Failed	The amount of rows that failed the rule.	Total

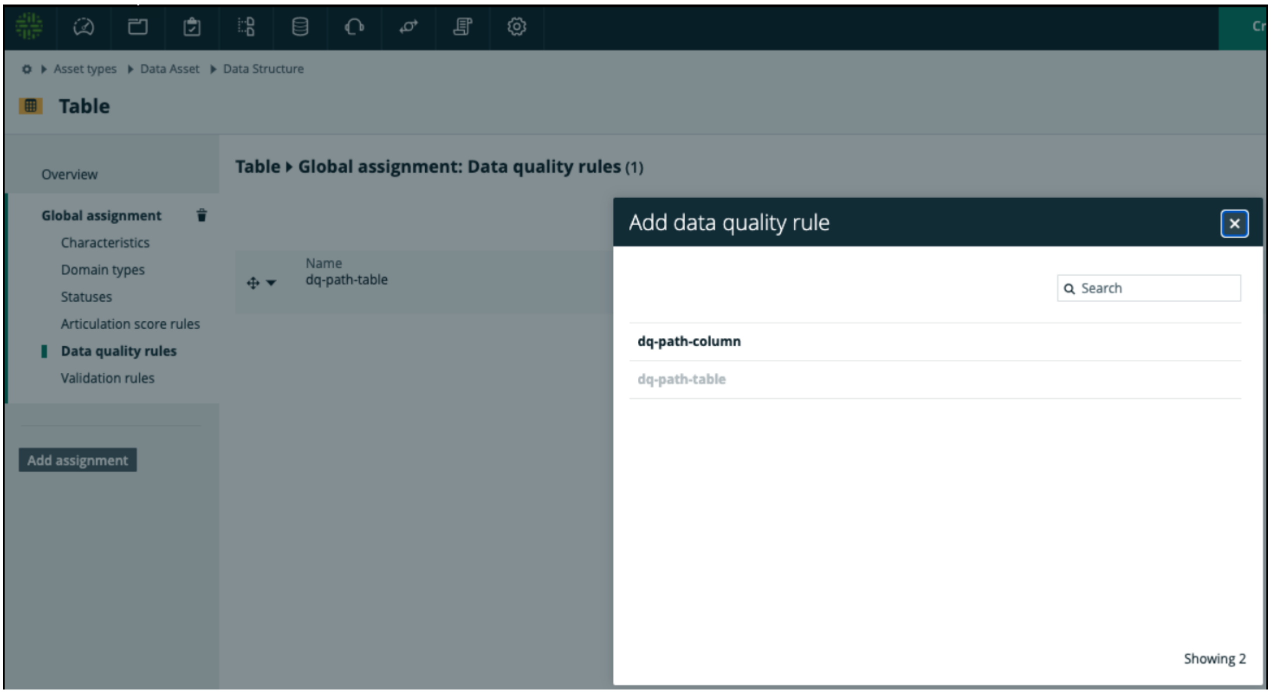


Table ▸ Global assignment: Data quality rules (1)

Name
dq-path-table

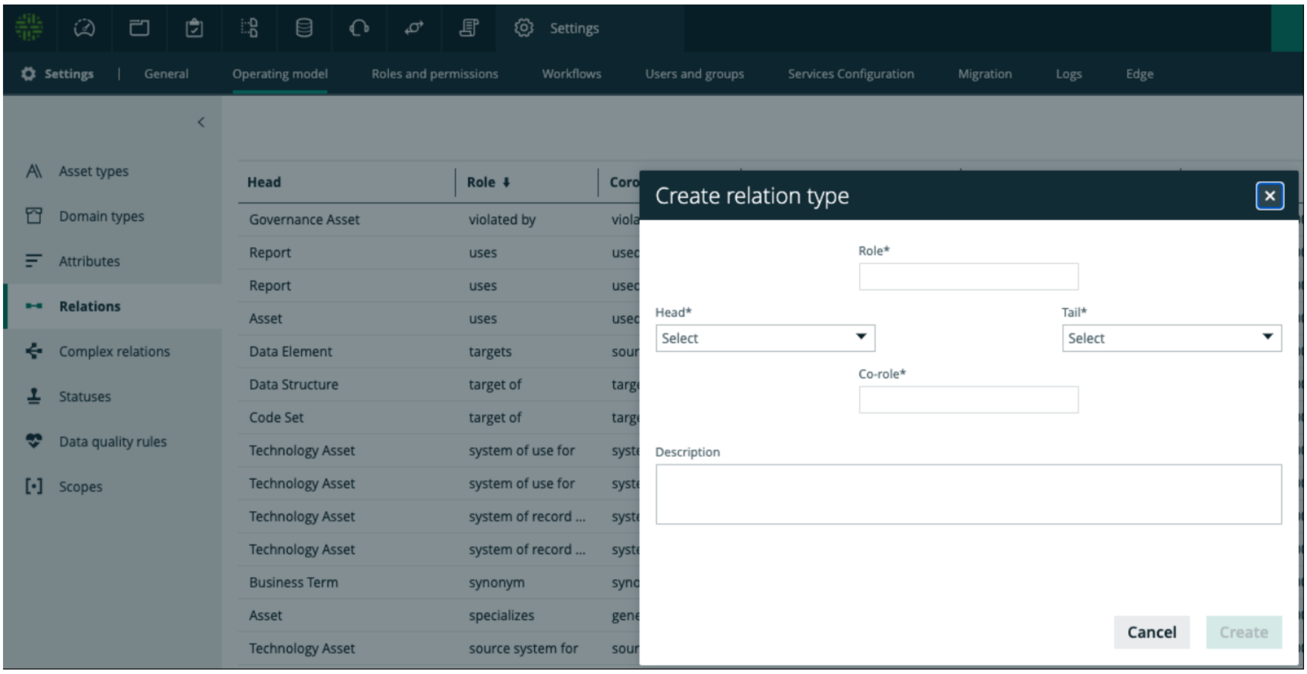
Add data quality rule

- dq-path-column
- dq-path-table

Showing 2

Q: DQ Dashboard In DGC: Why won't my DQ Dimension charts display in my Dashboard?

A: Please 1) add a new custom **Relation** 'Data Quality Metric classified by Data Quality Dimension', 2) **Global Assignment** for 'Data Quality Metric', 3) UUID of the new **Relation** into the **DQ Connector** setup in **Step 1G**, 4).



Head	Role	Coro
Governance Asset	violated by	viola
Report	uses	usec
Report	uses	usec
Asset	uses	usec
Data Element	targets	sour
Data Structure	target of	targ
Code Set	target of	targ
Technology Asset	system of use for	syste
Technology Asset	system of use for	syste
Technology Asset	system of record ...	syste
Technology Asset	system of record ...	syste
Business Term	synonym	sync
Asset	specializes	gene
Technology Asset	source system for	sour

Create relation type

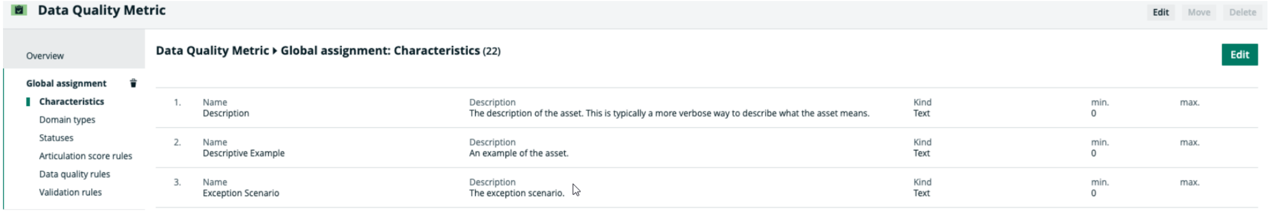
Role*

Head*: Select

Tail*: Select

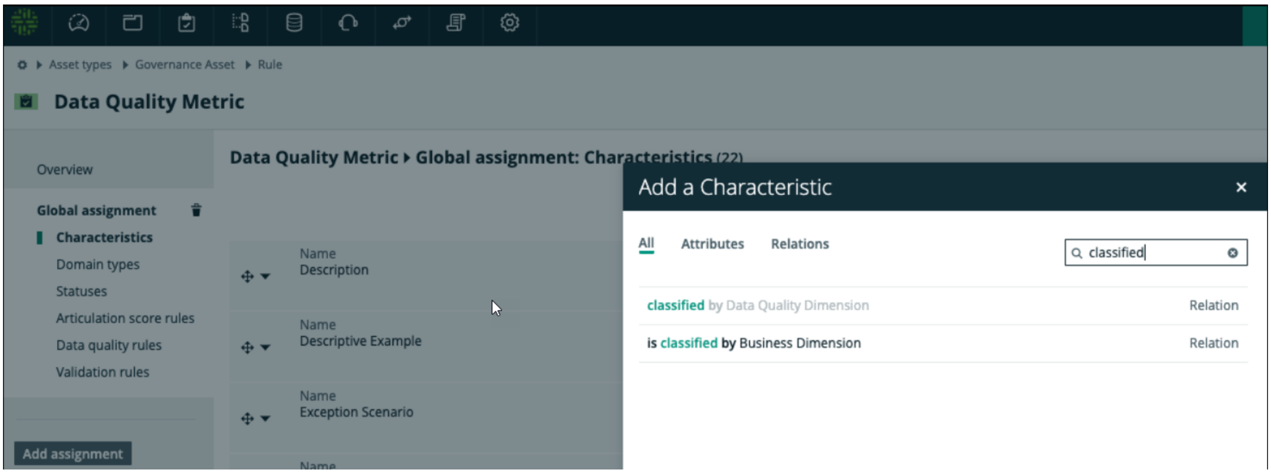
Co-role*

Description



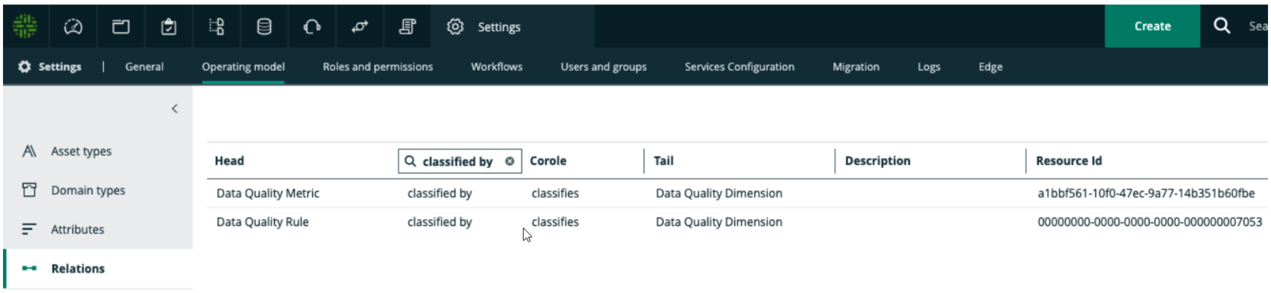
Data Quality Metric ▸ Global assignment: Characteristics (22)

	Name	Description	Kind	min.	max.
1.	Description	The description of the asset. This is typically a more verbose way to describe what the asset means.	Text	0	
2.	Descriptive Example	An example of the asset.	Text	0	
3.	Exception Scenario	The exception scenario.	Text	0	



classified

classified by Data Quality Dimension	Relation
is classified by Business Dimension	Relation



Head	classified by	Corole	Tail	Description	Resource Id
Data Quality Metric	classified by	classifies	Data Quality Dimension		a1bbf561-10f0-47ec-9a77-14b351b60fbe
Data Quality Rule	classified by	classifies	Data Quality Dimension		00000000-0000-0000-0000-000000007053

Q: I've connected and configured data sources correctly, why aren't DQ Rules and DQ Metrics being synchronized?

A: Please ensure Connection / System Names between Collibra Data Quality, Collibra, and Edge exactly match.

A: Please ensure Edge user has admin permissions to write the assets into Catalog.

A: Please ensure correct URL specified within the DQ Connector capability e.g. http://cdq.customer.com:9000/.

Q: Is DQ Connector unidirectional?

A: Yes, from Collibra DQ to Collibra Catalog in Data Intelligence Cloud.

Q: How many DQ Connectors can I run simultaneously?

A: Currently, one.

Q: Does the DQ Connector work with On-Prem Collibra DGC?

A: No, any work with on-prem Collibra DGC would be custom API development via Collibra Professional Services or a partner SI.

Q: If I delete a rule from Collibra DQ that I have already synchronized into Collibra Catalog, will it be deleted from Catalog in the next synchronization?

A: No, the DQ Connector only upserts into Catalog. If a rule is deleted from Collibra DQ, it will not be automatically deleted in Catalog.

Q: Why are my scores different in Collibra DQ and Collibra Catalog?

A: Currently, the DQ DQ Connector pulls in the most recent user-defined rules from Collibra DQ. Other components that affect score such as Behaviors, Outliers, Patterns, Dupes, Source are not yet included.

Q: Getting errors when trying to delete both domain that Edge created for DB and the Connection?

A: Please delete Edge created domain via API.

Q: I've hit the synchronize button, how can I tell if my job is complete?

A: Check the Activities circle (button on top right of menu) for the status of your DQ Synchronization.

DQ Workflows

Benefits

The DQ Workflows package listed on Collibra Marketplace allows you to 1) create and manage Data Quality Issues, 2) receive Notifications on Rule Metrics, and 3) request Rule Creation and Modification within **Collibra Data Intelligence Cloud**. Data stewards will be able to organize and prioritize all requests within DIC before they take any action within **Collibra Data Quality**.

Once deployed, the workflows will facilitate quicker data issue remediation by involving business analysts and other personas who can now participate in your data quality workstreams.

Please note: DQ Workflows are listed on Collibra Marketplace and are templates to get customers started. Collibra-provided Marketplace listings are not subject to the same SLA obligations (https://marketplace.collibra.com/marketplace-terms/) In addition, they can only be leveraged within Collibra Data Intelligence Cloud. In the future, we will work towards releasing bi-directional workflows.

Step 0: Prerequisites

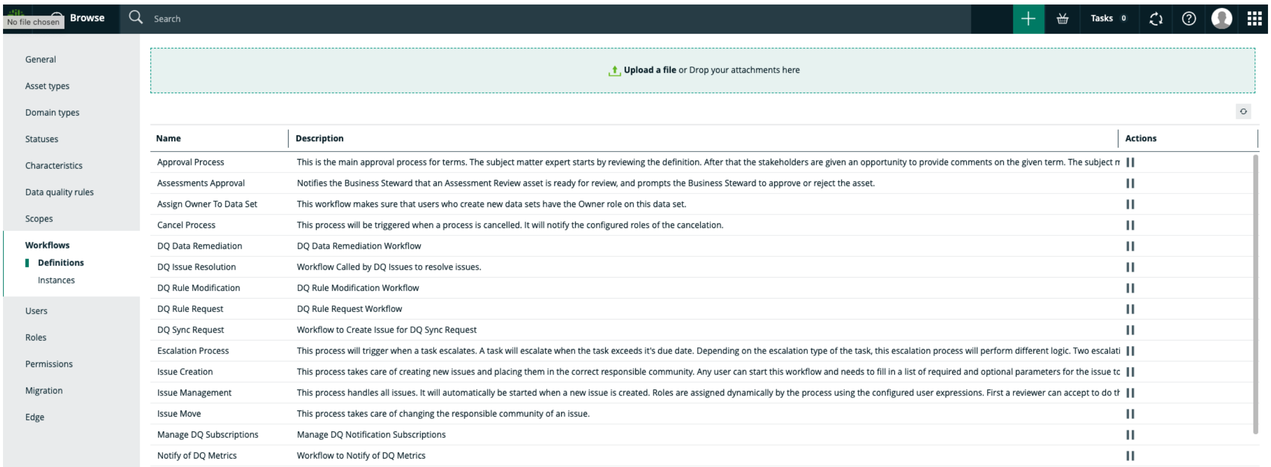
Resource	Notes
Collibra Edge Site	DQ Connector is a capability of Edge
Collibra Data Intelligence Cloud	2021.07 Release (or newer)
Collibra Data Quality	2.15 (or newer)
Collibra DQ Connector	Synchronized Rules from Data Quality to Catalog

> **Note** After gathering all the prerequisites, you can now proceed to the next step.

Step 1: Download, Deploy and Start DQ Workflows

1A. Download Package from Collibra Marketplace and Unzip Files

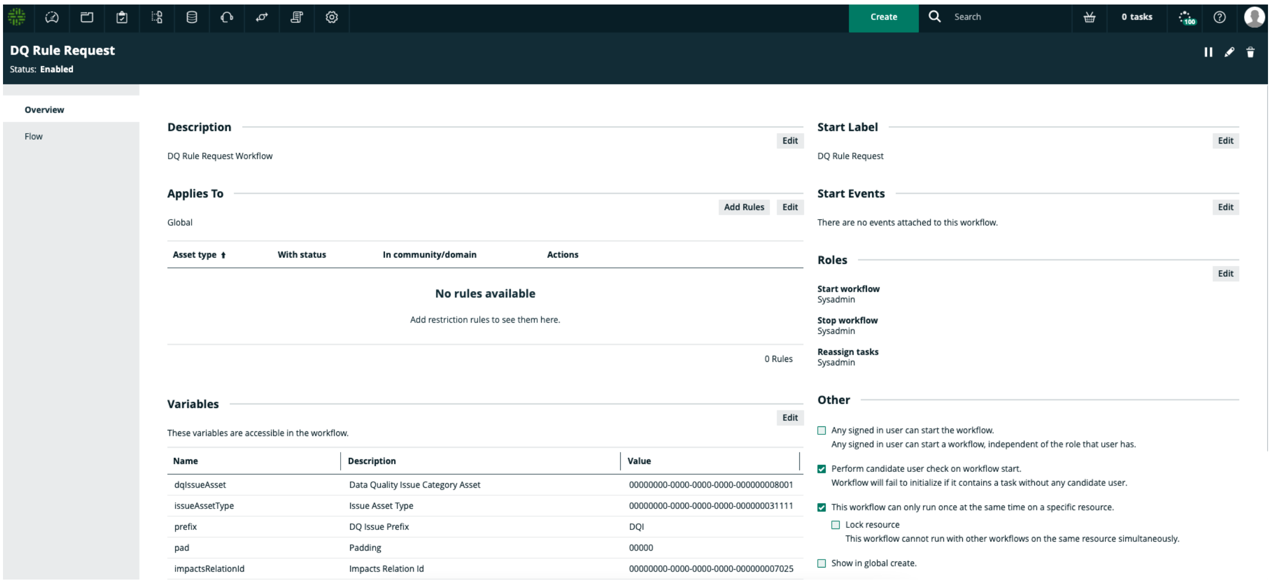
**1B. Deploy Workflows **



Name	Description	Actions
Approval Process	This is the main approval process for terms. The subject matter expert starts by reviewing the definition. After that the stakeholders are given an opportunity to provide comments on the given term. The subject n	❚❚
Assessments Approval	Notifies the Business Steward that an Assessment Review asset is ready for review, and prompts the Business Steward to approve or reject the asset.	❚❚
Assign Owner To Data Set	This workflow makes sure that users who create new data sets have the Owner role on this data set.	❚❚
Cancel Process	This process will be triggered when a process is cancelled. It will notify the configured roles of the cancelation.	❚❚
DQ Data Remediation	DQ Data Remediation Workflow	❚❚
DQ Issue Resolution	Workflow Called by DQ Issues to resolve issues.	❚❚
DQ Rule Modification	DQ Rule Modification Workflow	❚❚
DQ Rule Request	DQ Rule Request Workflow	❚❚
DQ Sync Request	Workflow to Create Issue for DQ Sync Request	❚❚
Escalation Process	This process will trigger when a task escalates. A task will escalate when the task exceeds it's due date. Depending on the escalation type of the task, this escalation process will perform different logic. Two escalati	❚❚
Issue Creation	This process takes care of creating new issues and placing them in the correct responsible community. Any user can start this workflow and needs to fill in a list of required and optional parameters for the issue tc	❚❚
Issue Management	This process handles all issues. It will automatically be started when a new issue is created. Roles are assigned dynamically by the process using the configured user expressions. First a reviewer can accept to do tł	❚❚
Issue Move	This process takes care of changing the responsible community of an issue.	❚❚
Manage DQ Subscriptions	Manage DQ Notification Subscriptions	❚❚
Notify of DQ Metrics	Workflow to Notify of DQ Metrics	❚❚

1C. Adjust Workflow Settings (One-Time Setup)

Workflow Configuration Setting	DQ Rule / DQ Sync Request	DQ Rule Modification	DQ Data Remediation	DQ Issue Resolution	Manage DQ Subscriptions	Notify of DQ Metrics
Applies To	Asset	Asset	Asset	Asset	Global	Global
Applies To Asset Type	Column, Table	Column, Table, Data Quality Rule	Column, Table	Issue		
Other: Any Signed In User Can Start Workflow	Y	Y			Y	Y
Other: Perform Candidate User Check on Workflow Start	Y	Y	Y		Y	Y
Other: This Workflow Can Only Run Once At Same Time on Specific Resource					Y	Y
Other: Show In Global Create					Y	Y
Roles: Start Workflow					Sysadmin	Sysadmin
Roles: Stop Workflow					Sysadmin	Sysadmin
Roles: Reassign Tasks					Sysadmin	Sysadmin



DQ Rule Request
Status: **Enabled**

Description
Edit
DQ Rule Request Workflow

Applies To
Add Rules Edit
Global

Asset type ⬆	With status	In community/domain	Actions

No rules available

Add restriction rules to see them here.

0 Rules

Variables
Edit
These variables are accessible in the workflow.

Name	Description	Value
dqIssueAsset	Data Quality Issue Category Asset	00000000-0000-0000-0000-000000008001
issueAssetType	Issue Asset Type	00000000-0000-0000-0000-000000031111
prefix	DQ Issue Prefix	DQI
pad	Padding	00000
impactsRelationId	Impacts Relation Id	00000000-0000-0000-0000-000000007025

Start Label
Edit
DQ Rule Request

Start Events
Edit
There are no events attached to this workflow.

Roles
Edit
Start workflow
Sysadmin
Stop workflow
Sysadmin
Reassign tasks
Sysadmin

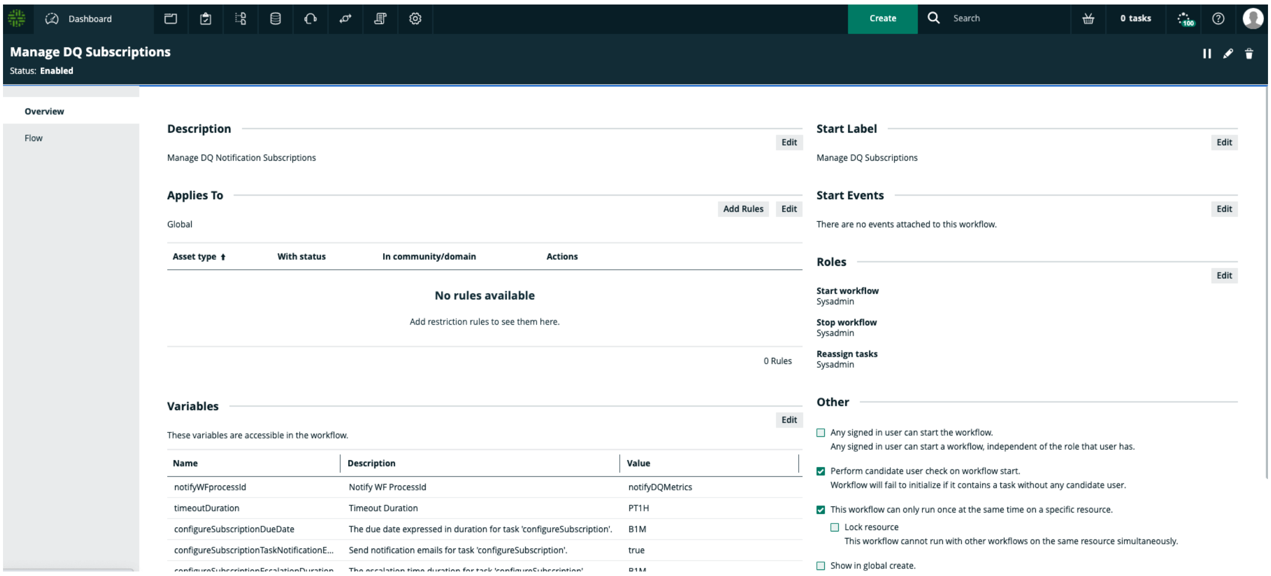
Other

□ Any signed in user can start the workflow.
Any signed in user can start a workflow, independent of the role that user has.

☑ Perform candidate user check on workflow start.
Workflow will fail to initialize if it contains a task without any candidate user.

☑ This workflow can only run once at the same time on a specific resource.
□ Lock resource
This workflow cannot run with other workflows on the same resource simultaneously.

□ Show in global create.



Manage DQ Subscriptions
Status: **Enabled**

Description
Edit
Manage DQ Notification Subscriptions

Applies To
Add Rules Edit
Global

Asset type ⬆	With status	In community/domain	Actions

No rules available

Add restriction rules to see them here.

0 Rules

Variables
Edit
These variables are accessible in the workflow.

Name	Description	Value
notifyWFprocessId	Notify WF ProcessId	notifyDQMetrics
timeoutDuration	Timeout Duration	PT1H
configureSubscriptionDueDate	The due date expressed in duration for task 'configureSubscription'.	B1M
configureSubscriptionTaskNotificationE...	Send notification emails for task 'configureSubscription'.	true
configureSubscriptionEscalationDuration	The escalation time duration for task 'configureSubscription'.	B1M

Start Label
Edit
Manage DQ Subscriptions

Start Events
Edit
There are no events attached to this workflow.

Roles
Edit
Start workflow
Sysadmin
Stop workflow
Sysadmin
Reassign tasks
Sysadmin

Other

□ Any signed in user can start the workflow.
Any signed in user can start a workflow, independent of the role that user has.

☑ Perform candidate user check on workflow start.
Workflow will fail to initialize if it contains a task without any candidate user.

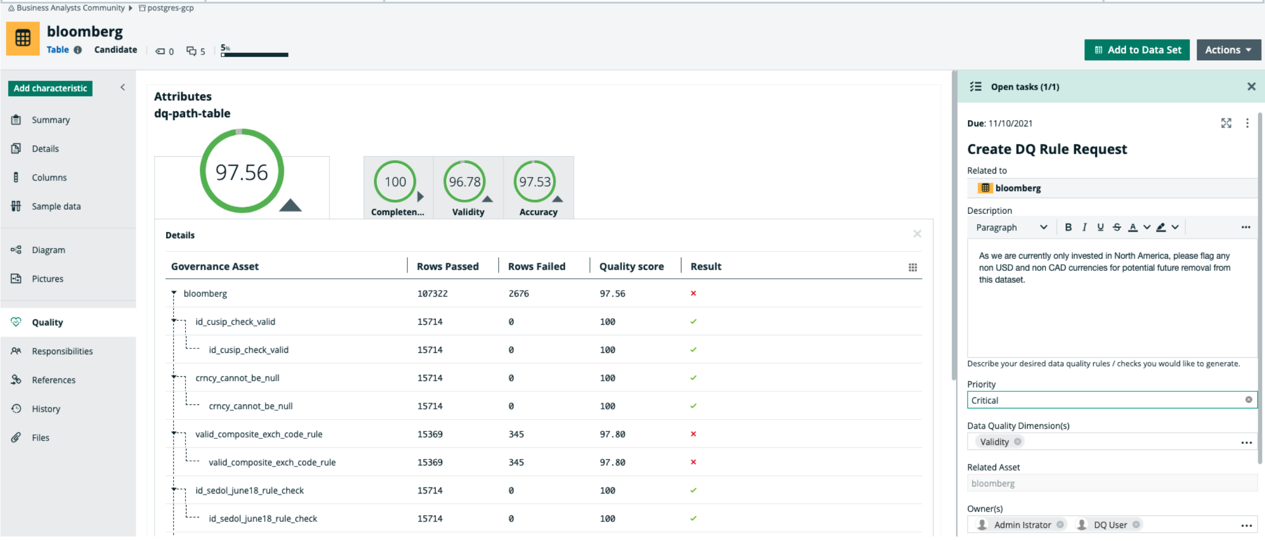
☑ This workflow can only run once at the same time on a specific resource.
□ Lock resource
This workflow cannot run with other workflows on the same resource simultaneously.

□ Show in global create.

Step 2: Create Data Quality Requests / Issues

2A. Create Data Quality Issues

Workflow	Main Requestor Persona	Description	Steward Taking Action
DQ Data Remediation	Data Steward Business Analyst	Tracking / management for confirmed data issues which may require underlying data remediation	Data Lake Admin, ETL Engineer
DQ Rule Request	Business Analyst	Proposing data quality rules in plain language e.g. "flag any German phone numbers in this dataset" or "identify customers with churn risk based on engagement time with our platform"	Data Steward
DQ Rule Modification	Business Analyst	Proposing adjustments to existing rules e.g. values, dimensions, passing thresholds	Data Steward
DQ Sync Request	Business Analyst	Request for synchronization of the DQ Connector to synchronize and/or onboarding a new dataset with pre-populated rules	Data Steward



Attributes
dq-path-table

Details

Governance Asset	Rows Passed	Rows Failed	Quality score	Result
bloomberg	107322	2676	97.56	✗
id_cusip_check_valid	15714	0	100	✓
id_cusip_check_valid	15714	0	100	✓
crncy_cannot_be_null	15714	0	100	✓
crncy_cannot_be_null	15714	0	100	✓
valid_composite_exch_code_rule	15369	345	97.80	✗
valid_composite_exch_code_rule	15369	345	97.80	✗
id_sedol_june18_rule_check	15714	0	100	✓
id_sedol_june18_rule_check	15714	0	100	✓

Due: 11/10/2021

Create DQ Rule Request

Related to
bloomberg

Description
As we are currently only invested in North America, please flag any non USD and non CAD currencies for potential future removal from this dataset.

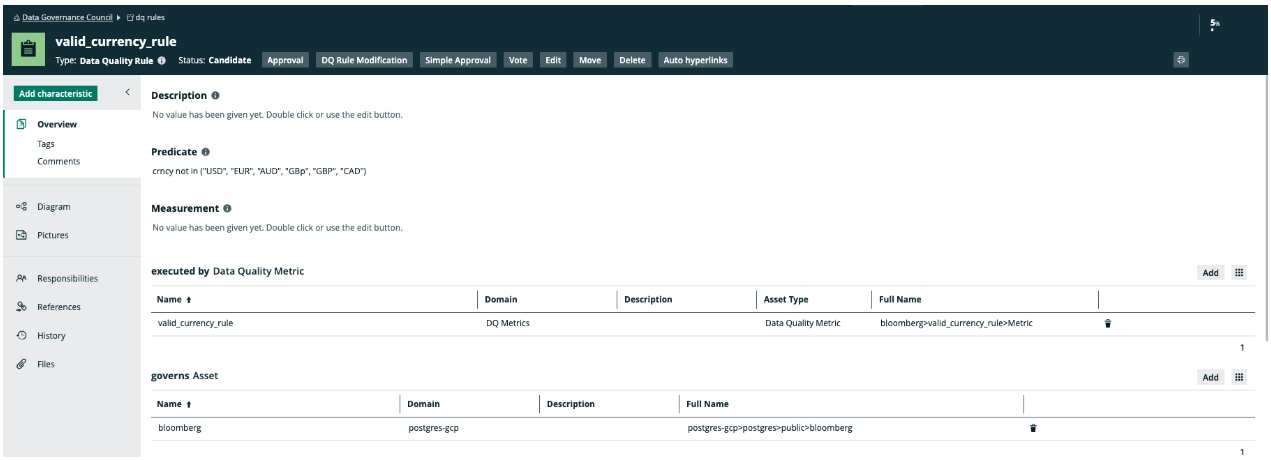
Describe your desired data quality rules / checks you would like to generate.

Priority
Critical

Data Quality Dimension(s)
Validity

Related Asset
bloomberg

Owner(s)
Admin Istrator
DQ User



valid_currency_rule

Type: **Data Quality Rule** Status: **Candidate**

Description

No value has been given yet. Double click or use the edit button.

Predicate

crncy not in ("USD", "EUR", "AUD", "GBp", "GBP", "CAD")

Measurement

No value has been given yet. Double click or use the edit button.

executed by Data Quality Metric

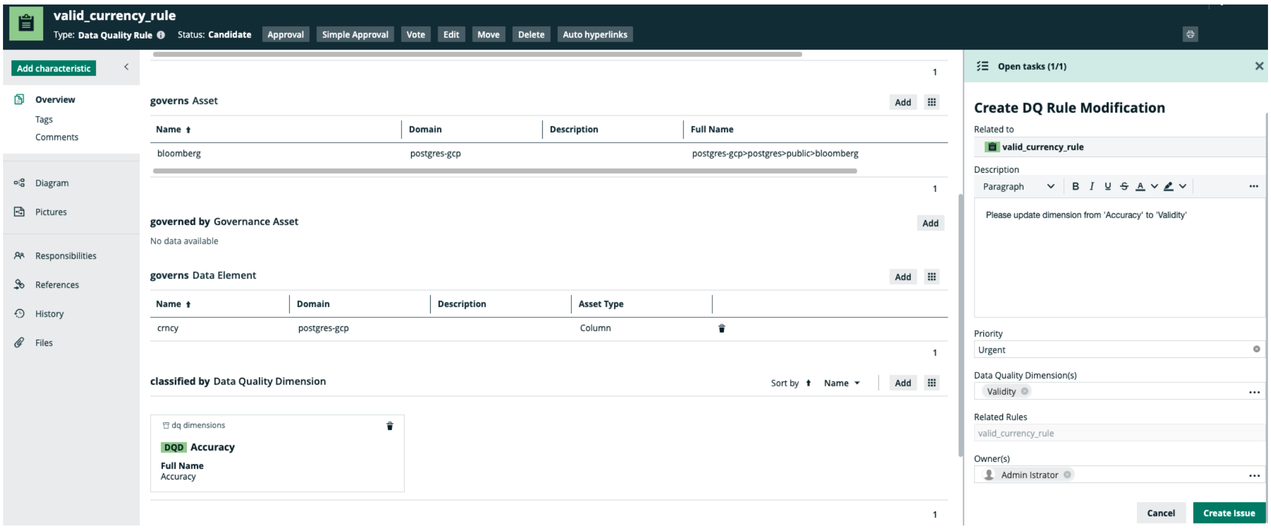
Name	Domain	Description	Asset Type	Full Name
valid_currency_rule	DQ Metrics		Data Quality Metric	bloomberg>valid_currency_rule>Metric

1

governs Asset

Name	Domain	Description	Full Name
bloomberg	postgres-gcp		postgres-gcp>postgres>public>bloomberg

1



valid_currency_rule

Type: **Data Quality Rule** Status: **Candidate**

1

governs Asset

Name	Domain	Description	Full Name
bloomberg	postgres-gcp		postgres-gcp>postgres>public>bloomberg

1

governed by Governance Asset

No data available

governs Data Element

Name	Domain	Description	Asset Type
crncy	postgres-gcp		Column

1

classified by Data Quality Dimension

dq dimensions

DQD **Accuracy**

Full Name
Accuracy

1

Create DQ Rule Modification

Related to: **valid_currency_rule**

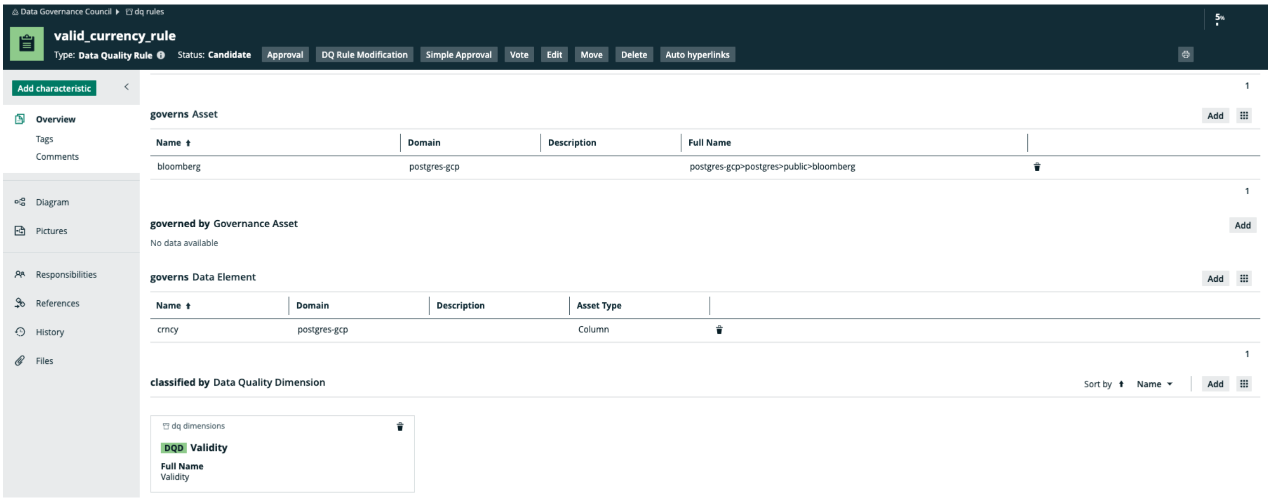
Description: Please update dimension from 'Accuracy' to 'Validity'

Priority: Urgent

Data Quality Dimension(s): Validity

Related Rules: valid_currency_rule

Owner(s): Admin Istrator



valid_currency_rule

Type: **Data Quality Rule** Status: **Candidate**

1

governs Asset

Name	Domain	Description	Full Name
bloomberg	postgres-gcp		postgres-gcp>postgres>public>bloomberg

1

governed by Governance Asset

No data available

governs Data Element

Name	Domain	Description	Asset Type
crncy	postgres-gcp		Column

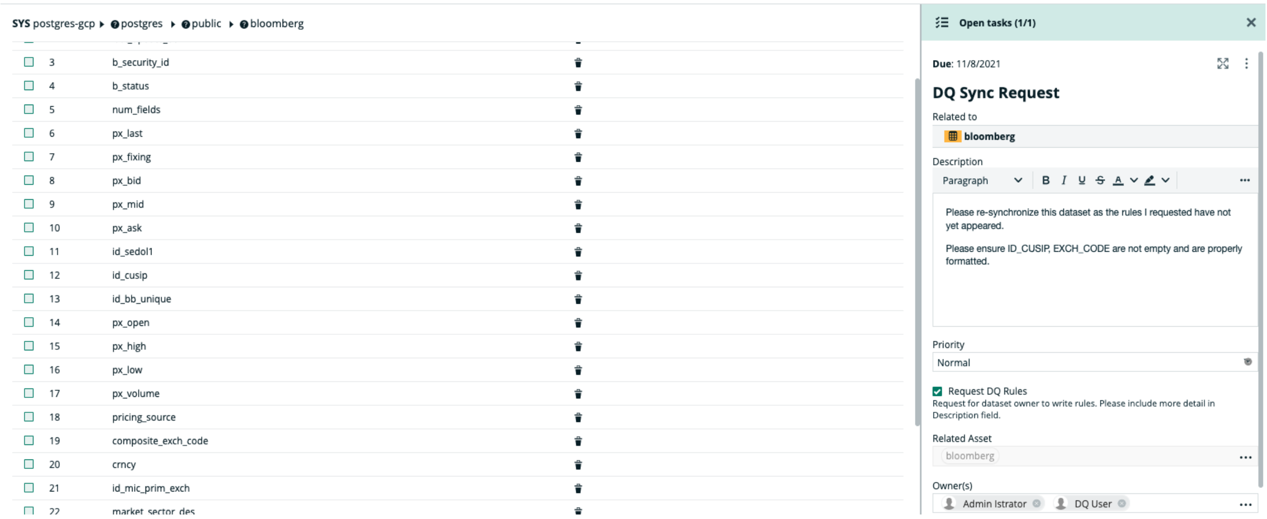
1

classified by Data Quality Dimension

dq dimensions

DQD **Validity**

Full Name
Validity



□	3	b_security_id
□	4	b_status
□	5	num_fields
□	6	px_last
□	7	px_fixing
□	8	px_bid
□	9	px_mid
□	10	px_ask
□	11	id_sedol1
□	12	id_cusip
□	13	id_bb_unique
□	14	px_open
□	15	px_high
□	16	px_low
□	17	px_volume
□	18	pricing_source
□	19	composite_exch_code
□	20	crncy
□	21	id_mic_prim_exch
□	22	market_sector_des

Due: 11/8/2021

DQ Sync Request

Related to: bloomberg

Description

Please re-synchronize this dataset as the rules I requested have not yet appeared.

Please ensure ID_CUSIP, EXCH_CODE are not empty and are properly formatted.

Priority: Normal

☑ Request DQ Rules
Request for dataset owner to write rules. Please include more detail in Description field.

Related Asset: bloomberg

Owner(s): Admin Istrator, DQ User

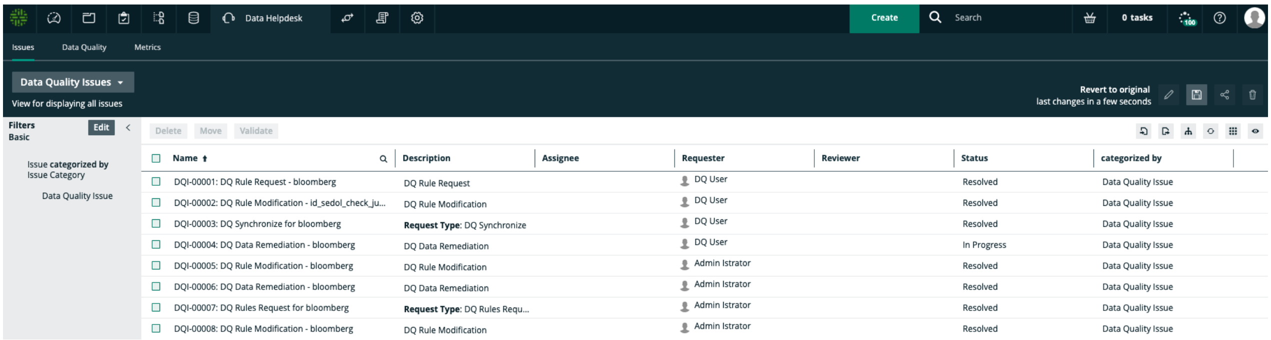
Step 3: Manage Data Quality Issues

3A. Setup Data Helpdesk Filter

Data Helpdesk

- Select Issues
- Navigate to 'Filters'
- Properties > Attributes > Relations > Issue **categorized by **Issue Category > Input 'Data Quality Issue' > Apply
- Save button > Save View as > '**Data Quality Issues**'
- Optional settings for View: Can pin, promote, make public, make default

3B. Manage Issues From Data Helpdesk View

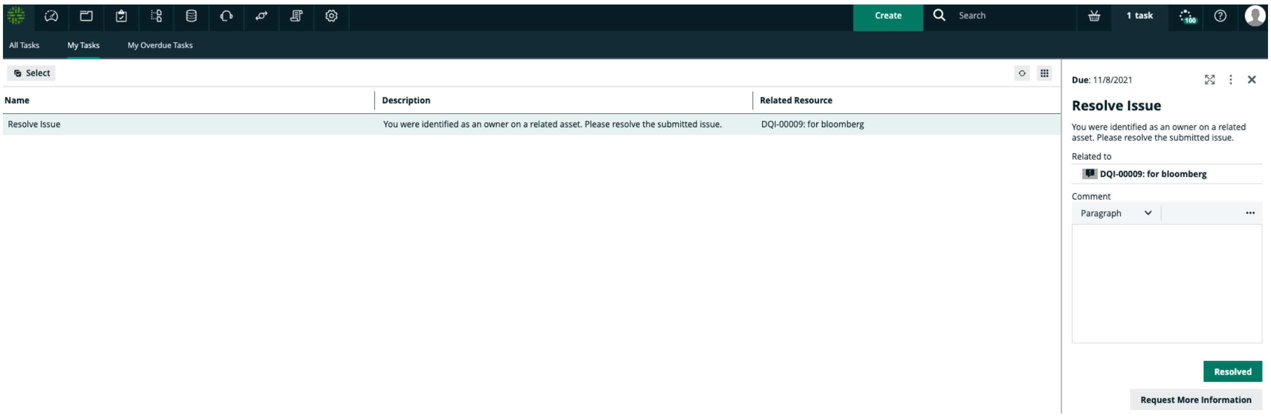


View for displaying all issues

Issue **categorized by** Issue Category: Data Quality Issue

□	Name	Description	Assignee	Requester	Reviewer	Status	categorized by
□	DQI-00001: DQ Rule Request - bloomberg	DQ Rule Request		DQ User		Resolved	Data Quality Issue
□	DQI-00002: DQ Rule Modification - id_sedol_check_ju...	DQ Rule Modification		DQ User		Resolved	Data Quality Issue
□	DQI-00003: DQ Synchronize for bloomberg	**Request Type**: DQ Synchronize		DQ User		Resolved	Data Quality Issue
□	DQI-00004: DQ Data Remediation - bloomberg	DQ Data Remediation		DQ User		In Progress	Data Quality Issue
□	DQI-00005: DQ Rule Modification - bloomberg	DQ Rule Modification		Admin Istrator		Resolved	Data Quality Issue
□	DQI-00006: DQ Data Remediation - bloomberg	DQ Data Remediation		Admin Istrator		Resolved	Data Quality Issue
□	DQI-00007: DQ Rules Request for bloomberg	**Request Type**: DQ Rules Requ...		Admin Istrator		Resolved	Data Quality Issue
□	DQI-00008: DQ Rule Modification - bloomberg	DQ Rule Modification		Admin Istrator		Resolved	Data Quality Issue

3C. Alternate: Manage Issues From Tasks



Name	Description	Related Resource
Resolve Issue	You were identified as an owner on a related asset. Please resolve the submitted issue.	DQI-00009: for bloomberg

Due: 11/8/2021

Resolve Issue

You were identified as an owner on a related asset. Please resolve the submitted issue.

Related to

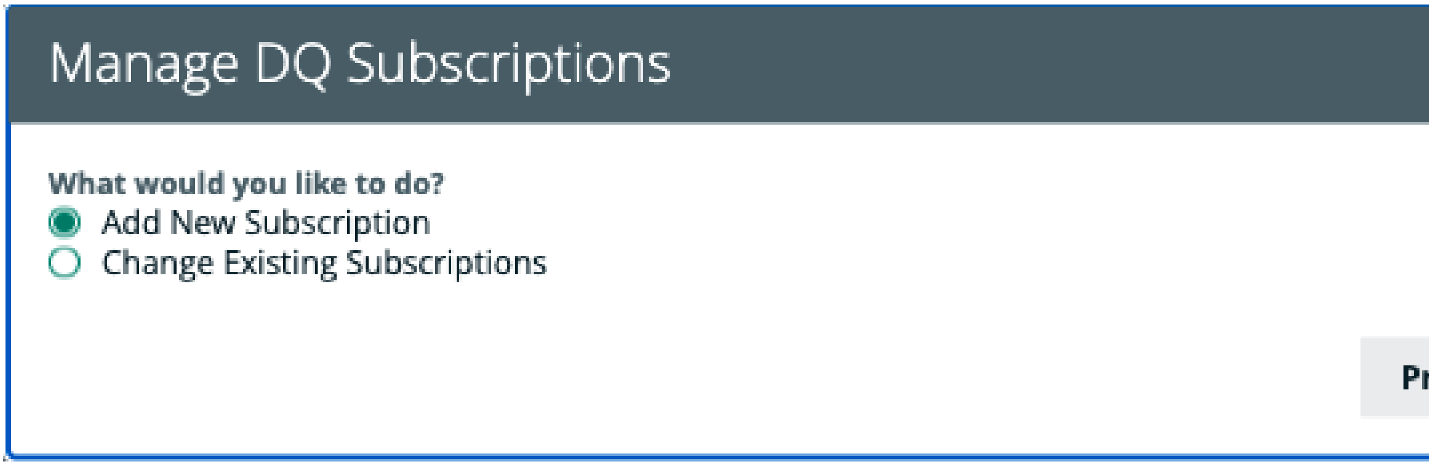
DQI-00009: for bloomberg

Comment

Step 4: Receive Notifications Of DQ Issues And Metrics

4A. Set Up DQ Metric Subscription

Who? Anyone can set up a DQ subscription, for yourself or for your teammates.



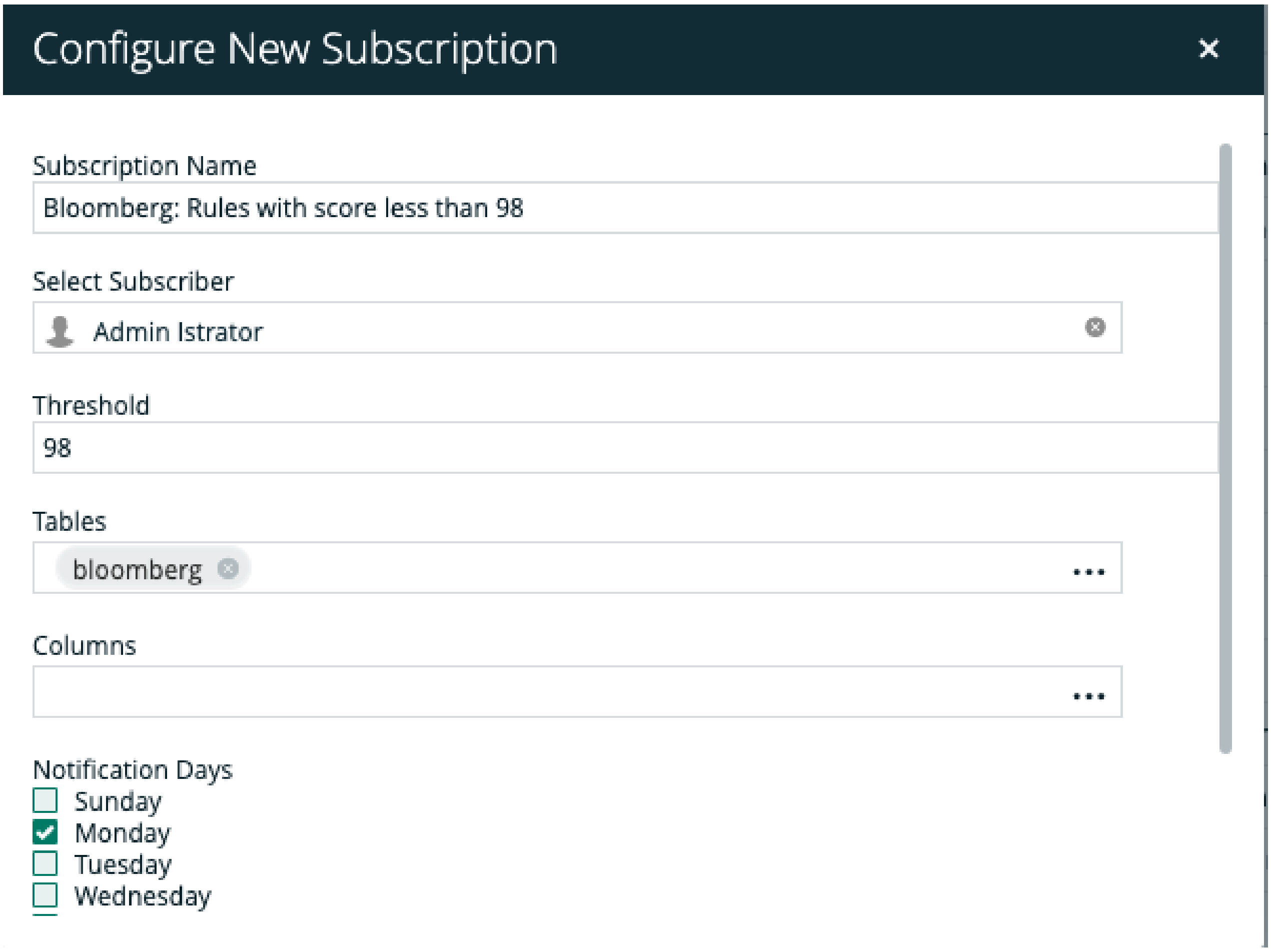
Manage DQ Subscriptions

What would you like to do?

● Add New Subscription

○ Change Existing Subscriptions

Alerts will be sent based on reviewing rules and metrics associated with **Tables** or **Columns** that violate the specified **Threshold**.



Configure New Subscription

Subscription Name: Bloomberg: Rules with score less than 98

Select Subscriber: Admin Istrator

Threshold: 98

Tables: bloomberg

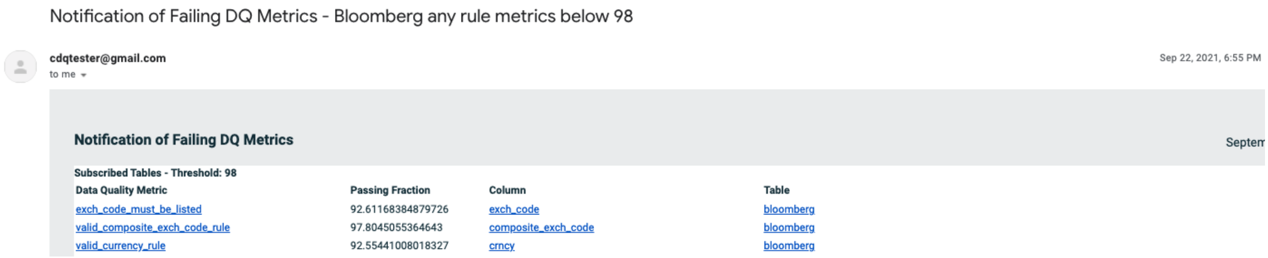
Columns:

Notification Days
□ Sunday
☑ Monday
□ Tuesday
□ Wednesday

Assuming an e-mail is associated with the Subscriber within Collibra, the Subscriber will receive e-mail notifications by default at **12pm local server time.** This, along with other settings within the provided workflow, can be **adjusted** in **Eclipse**, Collibra's recommended workflow editor.

4B. Review DQ Metric Alerts

Ensure that the DQ alerts set for you are providing helpful details.



Notification of Failing DQ Metrics - Bloomberg any rule metrics below 98

cdqtester@gmail.com
to me
Sep 22, 2021, 6:55 PM

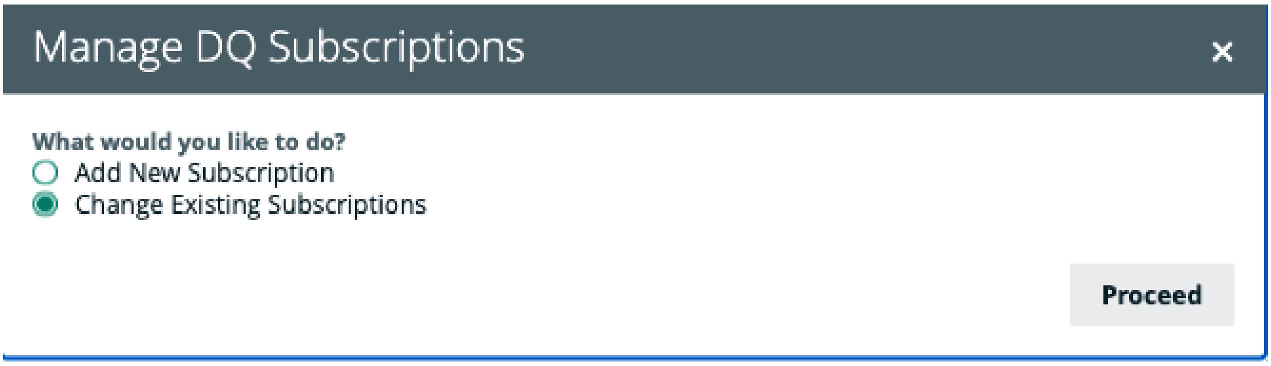
Notification of Failing DQ Metrics

Septem

Subscribed Tables - Threshold: 98

Data Quality Metric	Passing Fraction	Column	Table
exch_code_must_be_listed	92.61168384879726	exch_code	bloomberg
valid_composite_exch_code_rule	97.8045055364643	composite_exch_code	bloomberg
valid_currency_rule	92.55441008018327	crncy	bloomberg

4C. Update Subscription Settings



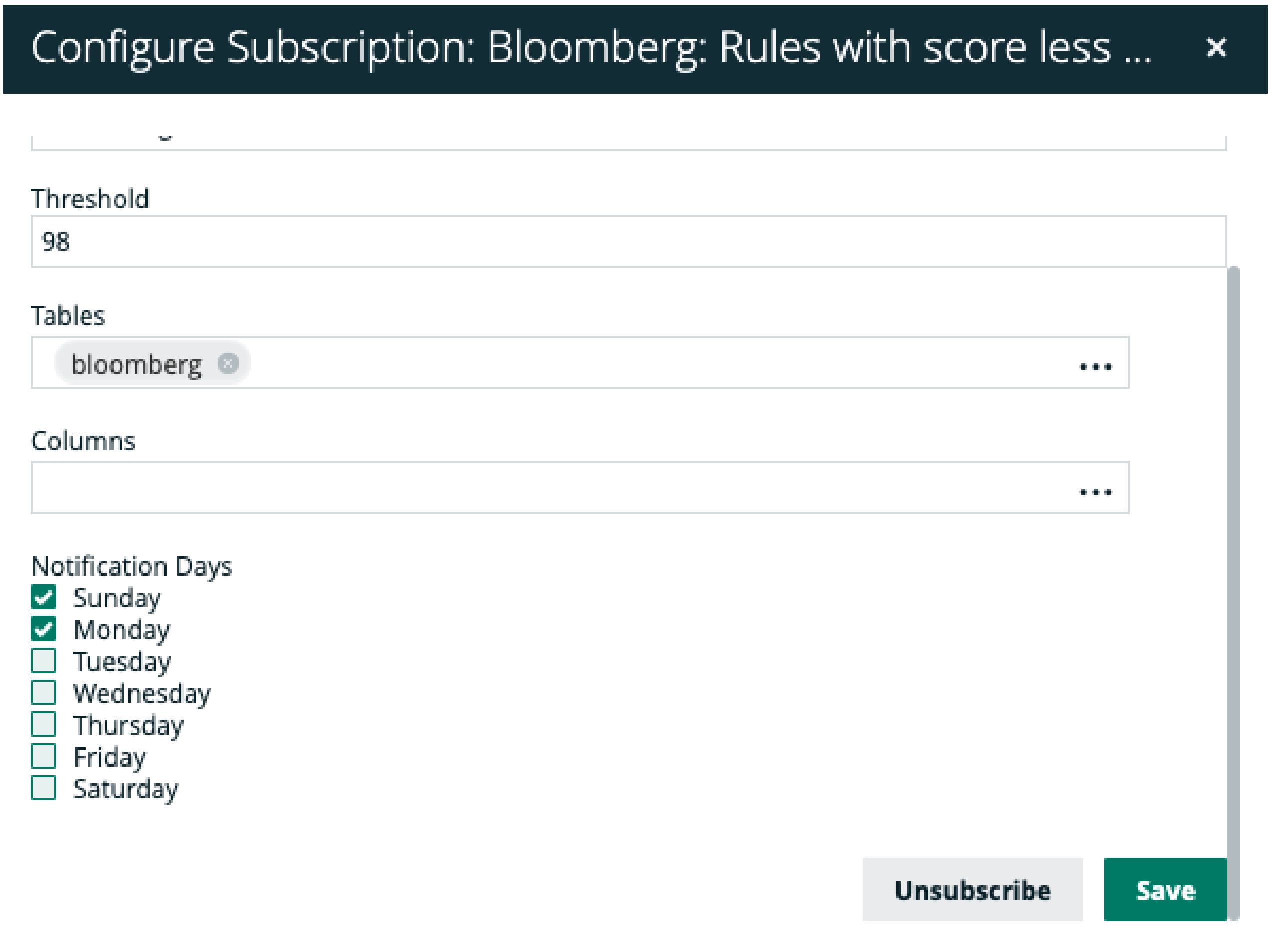
Manage DQ Subscriptions

What would you like to do?

○ Add New Subscription

● Change Existing Subscriptions

For every subscription set up for a Subscriber, the Manage DQ Subscriptions modal will cycle through for your review. You can update **Threshold**, add or delete **Notification Days**, add or delete **Tables** or **Columns**, rename the **Subscription title**, **Save the new settings**, or simply **Unsubscribe**.



Configure Subscription: Bloomberg: Rules with score less ...

Threshold: 98

Tables: bloomberg

Columns:

Notification Days

☑ Sunday

☑ Monday

□ Tuesday

□ Wednesday

□ Thursday

□ Friday

□ Saturday

Chapter 14

Collibra DQ Catalog

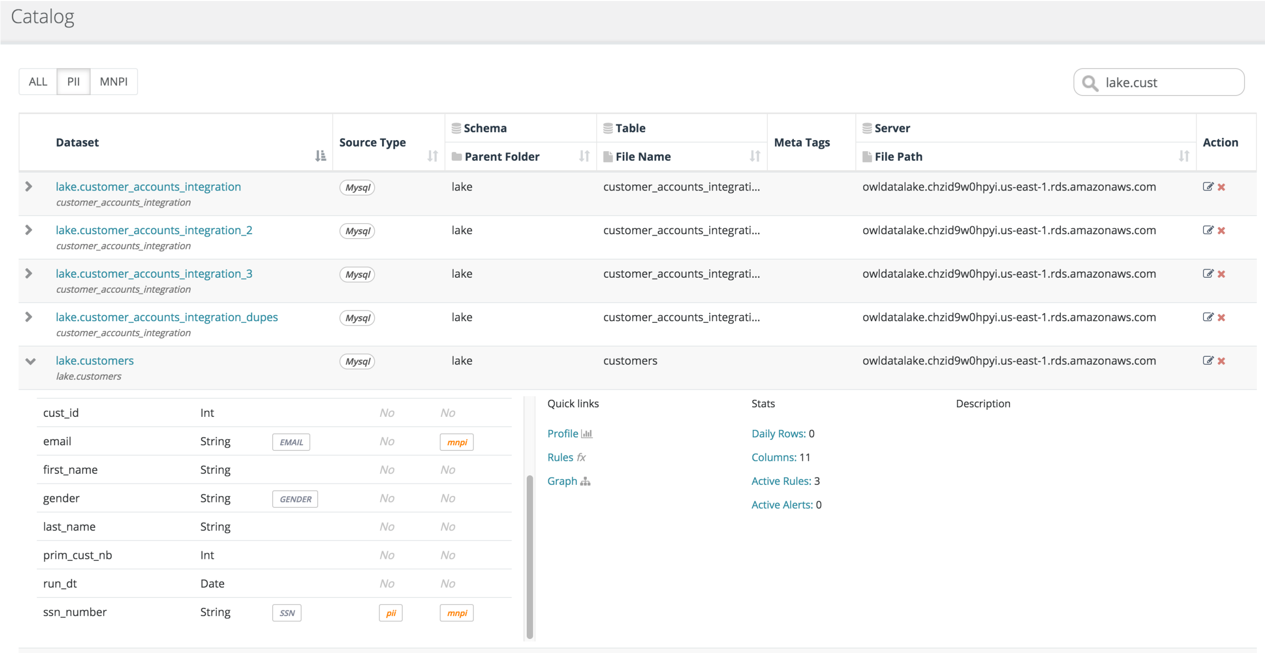
Overview

Smart Catalog - Bringing Data Science to Cataloging

While Collibra DQ does not pride itself on being a catalog tool it does automatically maintain a dataset and process catalog. It is a necessary control for DQ and helpful to the end user. Without a smart catalog a user could technically overwrite another user's OwlCheck (DQ check). For example -ds "Trade" and -ds "Trade". DQ believes a healthier habit is to store the full natural name of the dataset and allow the user to alias the name in the event that they wish to make a short-name. By doing this DQ protects users from mixing up their results and stops the constant renaming of common objects which leads to more unnecessary business level mapping. This approach makes it effortless for a user to create a new OwlCheck in the wizard because DQ will warn the user if there is a naming collision. DQ learns all the server hosts, the database schemas and table names and keeps things automatically organized. One less catalog to setup, manage and eventually untangle.

Automatic Sensitive Data (PII) Detection

DQ automatically understands the *semantic* schema of your data such as CREDIT CARD, EMAIL, SSN and much more. Additionally, DQ will label sensitive data with PII and MNPI classifications.



Catalog

ALL | PII | MNPI

lake.cust

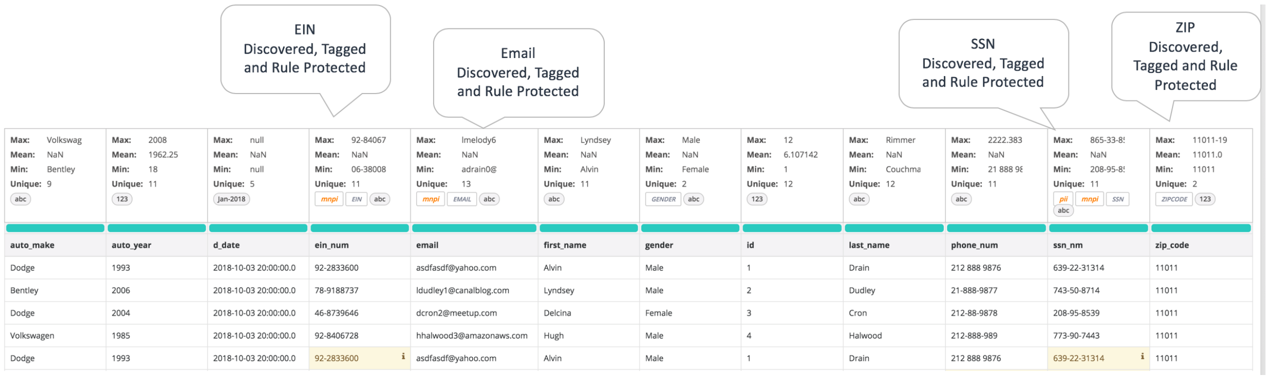
	Dataset	Source Type	Schema Parent Folder	Table File Name	Meta Tags	Server File Path	Action
›	lake.customer_accounts_integration *customer_accounts_integration*	*Mysql*	lake	customer_accounts_integrati...		owldatalake.chzid9w0hpyi.us-east-1.rds.amazonaws.com	✎ ✖
›	lake.customer_accounts_integration_2 *customer_accounts_integration*	*Mysql*	lake	customer_accounts_integrati...		owldatalake.chzid9w0hpyi.us-east-1.rds.amazonaws.com	✎ ✖
›	lake.customer_accounts_integration_3 *customer_accounts_integration*	*Mysql*	lake	customer_accounts_integrati...		owldatalake.chzid9w0hpyi.us-east-1.rds.amazonaws.com	✎ ✖
›	lake.customer_accounts_integration_dupes *customer_accounts_integration*	*Mysql*	lake	customer_accounts_integrati...		owldatalake.chzid9w0hpyi.us-east-1.rds.amazonaws.com	✎ ✖
⌄	lake.customers *lake.customers*	*Mysql*	lake	customers		owldatalake.chzid9w0hpyi.us-east-1.rds.amazonaws.com	✎ ✖

cust_id	Int		*No*	*No*
email	String	*EMAIL*	*No*	*mnpi*
first_name	String		*No*	*No*
gender	String	*GENDER*	*No*	*No*
last_name	String		*No*	*No*
prim_cust_nb	Int		*No*	*No*
run_dt	Date		*No*	*No*
ssn_number	String	*SSN*	*pii*	*mnpi*

Quick links	Stats	Description
Profile	Daily Rows: 0	
Rules *fx*	Columns: 11	
Graph	Active Rules: 3	
	Active Alerts: 0	

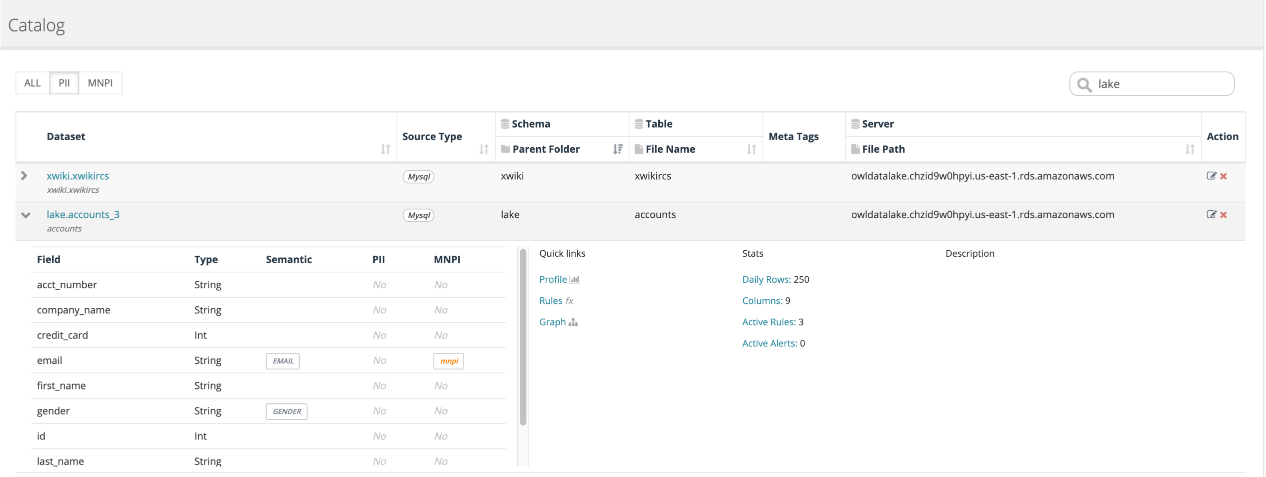
Data Table View of PII

DQ applies many labels to the header of a field / column. These labels be seen in the data preview table with highlighted errors and findings.



Max: Volkswag **Mean:** NaN **Min:** Bentley **Unique:** 9 abc	**Max:** 2008 **Mean:** 1962.25 **Min:** 18 **Unique:** 11 123	**Max:** null **Mean:** NaN **Min:** null **Unique:** 5 Jan-2018	**Max:** 92-84067 **Mean:** NaN **Min:** 06-38008 **Unique:** 11 *mnpi* *EIN* abc	**Max:** lmelody6 **Mean:** NaN **Min:** adrain0@ **Unique:** 13 *mnpi* *EMAIL* abc	**Max:** Lyndsey **Mean:** NaN **Min:** Alvin **Unique:** 11 abc	**Max:** Male **Mean:** NaN **Min:** Female **Unique:** 2 *GENDER* abc	**Max:** 12 **Mean:** 6.107142 **Min:** 1 **Unique:** 12 123	**Max:** Rimmer **Mean:** NaN **Min:** Couchma **Unique:** 12 abc	**Max:** 2222.383 **Mean:** NaN **Min:** 21 888 98 **Unique:** 11 abc	**Max:** 865-33-8! **Mean:** NaN **Min:** 208-95-8! **Unique:** 11 *pii* *mnpi* *SSN* abc	**Max:** 11011-19 **Mean:** 11011.0 **Min:** 11011 **Unique:** 2 *ZIPCODE* 123
auto_make	**auto_year**	**d_date**	**ein_num**	**email**	**first_name**	**gender**	**id**	**last_name**	**phone_num**	**ssn_nm**	**zip_code**
Dodge	1993	2018-10-03 20:00:00.0	92-2833600	asdfasdf@yahoo.com	Alvin	Male	1	Drain	212 888 9876	639-22-31314	11011
Bentley	2006	2018-10-03 20:00:00.0	78-9188737	ldudley1@canalblog.com	Lyndsey	Male	2	Dudley	21-888-9877	743-50-8714	11011
Dodge	2004	2018-10-03 20:00:00.0	46-8739646	dcron2@meetup.com	Delcina	Female	3	Cron	212-88-9878	208-95-8539	11011
Volkswagen	1985	2018-10-03 20:00:00.0	92-8406728	hhalwood3@amazonaws.com	Hugh	Male	4	Halwood	212-888-989	773-90-7443	11011
Dodge	1993	2018-10-03 20:00:00.0	92-2833600 ℹ	asdfasdf@yahoo.com	Alvin	Male	1	Drain	212 888 9876	639-22-31314 ℹ	11011

The catalog offers a global view and filtering to see where PII exists



Catalog

ALL | PII | MNPI

lake

Dataset	Source Type	Schema Parent Folder	Table File Name	Meta Tags	Server File Path	Action
xwiki.xwikircs *xwiki.xwikircs*	*Mysql*	xwiki	xwikircs		owldatalake.chzid9w0hpyi.us-east-1.rds.amazonaws.com	
lake.accounts_3 *accounts*	*Mysql*	lake	accounts		owldatalake.chzid9w0hpyi.us-east-1.rds.amazonaws.com	

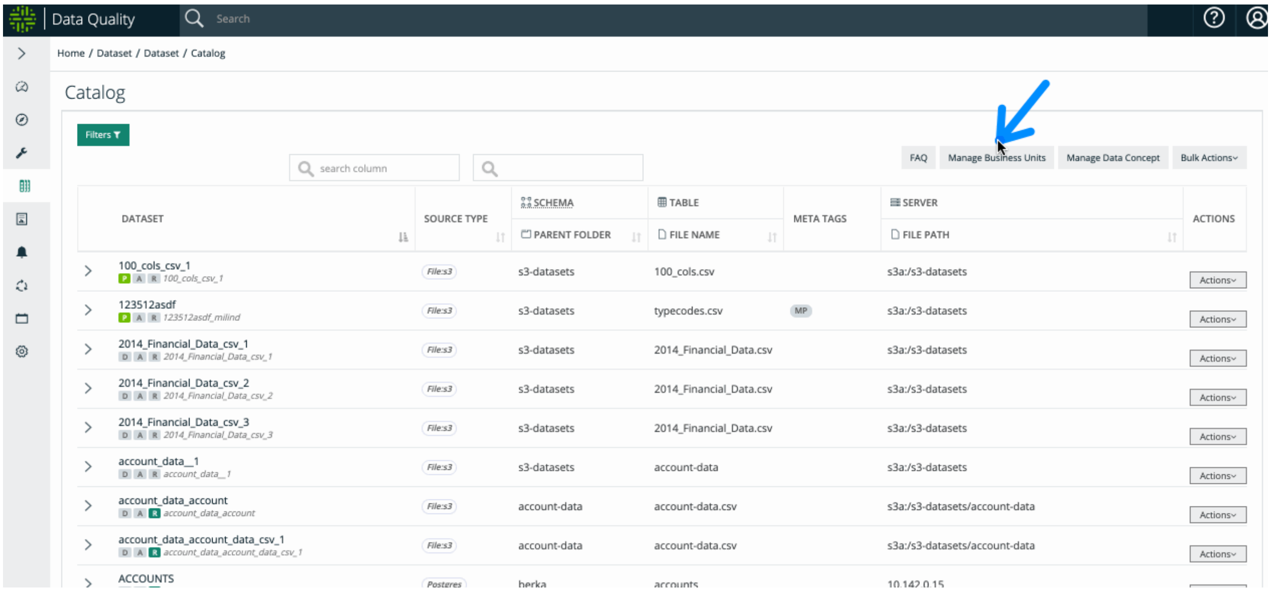
Field	Type	Semantic	PII	MNPI
acct_number	String		No	No
company_name	String		No	No
credit_card	Int		No	No
email	String	EMAIL	No	mnpi
first_name	String		No	No
gender	String	GENDER	No	No
id	Int		No	No
last_name	String		No	No

Quick links
Profile
Rules *fx*
Graph

Stats
Daily Rows: 250
Columns: 9
Active Rules: 3
Active Alerts: 0

Description

Business Units



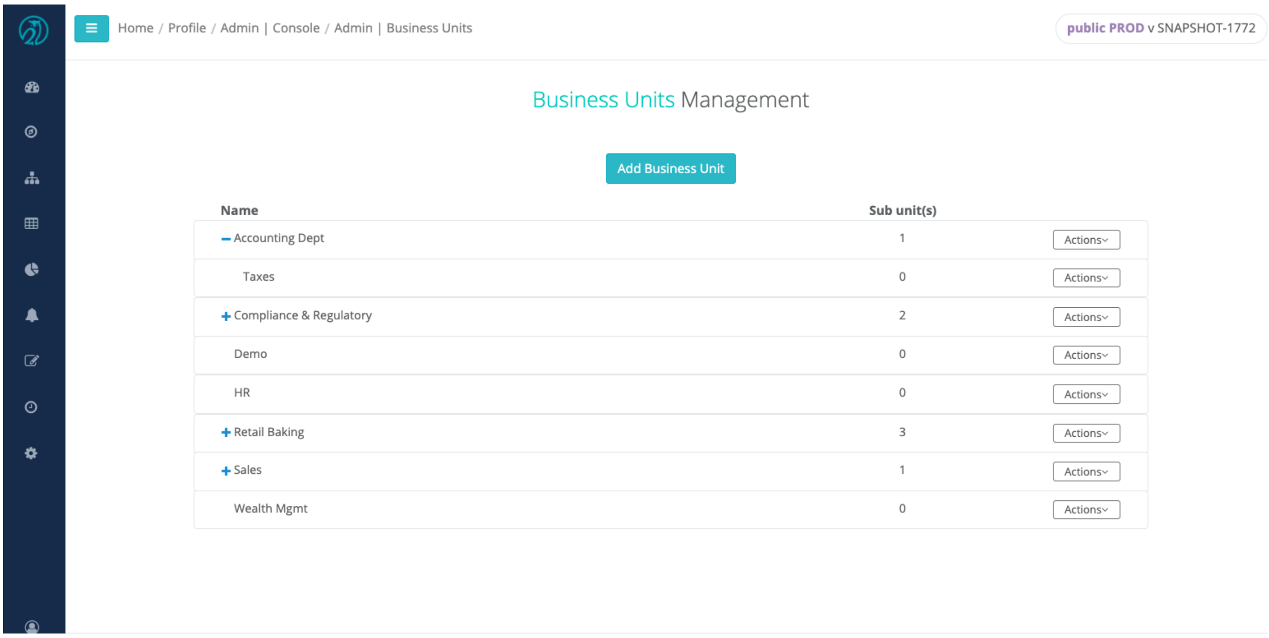
Home / Dataset / Dataset / Catalog

Catalog

DATASET	SOURCE TYPE	SCHEMA PARENT FOLDER	TABLE FILE NAME	META TAGS	SERVER FILE PATH	ACTIONS
100_cols_csv_1 P A R *100_cols_csv_1*	*File:s3*	s3-datasets	100_cols.csv		s3a:/s3-datasets	Actions
123512asdf P A R *123512asdf_milind*	*File:s3*	s3-datasets	typecodes.csv	MP	s3a:/s3-datasets	Actions
2014_Financial_Data_csv_1 D A R *2014_Financial_Data_csv_1*	*File:s3*	s3-datasets	2014_Financial_Data.csv		s3a:/s3-datasets	Actions
2014_Financial_Data_csv_2 D A R *2014_Financial_Data_csv_2*	*File:s3*	s3-datasets	2014_Financial_Data.csv		s3a:/s3-datasets	Actions
2014_Financial_Data_csv_3 D A R *2014_Financial_Data_csv_3*	*File:s3*	s3-datasets	2014_Financial_Data.csv		s3a:/s3-datasets	Actions
account_data__1 D A R *account_data__1*	*File:s3*	s3-datasets	account-data		s3a:/s3-datasets	Actions
account_data_account D A R *account_data_account*	*File:s3*	account-data	account-data.csv		s3a:/s3-datasets/account-data	Actions
account_data_account_data_csv_1 D A R *account_data_account_data_csv_1*	*File:s3*	account-data	account-data.csv		s3a:/s3-datasets/account-data	Actions
ACCOUNTS	*Postgres*	berka	accounts		10.142.0.15	

Collibra DQ allows its users to run large sets of DQ jobs. Business units provide a way to categorize and group these.

Through the admin console the user can navigate to the business units management page. This page will contain a table of your business units and a button to create new units.



Home / Profile / Admin | Console / Admin | Business Units

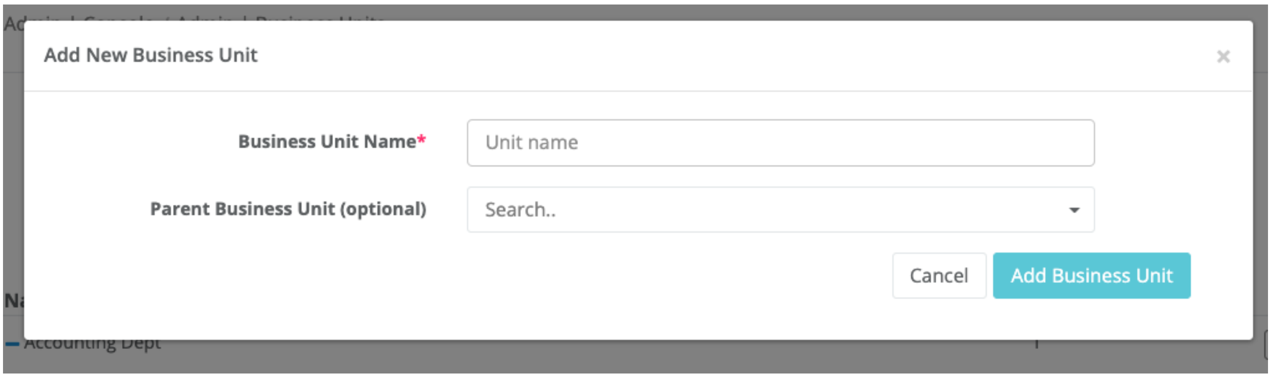
public PROD v SNAPSHOT-1772

Business Units Management

Add Business Unit

Name	Sub unit(s)	
− Accounting Dept	1	Actions
Taxes	0	Actions
+ Compliance & Regulatory	2	Actions
Demo	0	Actions
HR	0	Actions
+ Retail Baking	3	Actions
+ Sales	1	Actions
Wealth Mgmt	0	Actions

By clicking the Add Business Unit button the user will be able to fill out the business unit form. A unique name is required and a parent business unit can be optionally selected. Each unit can have one parent and many children. On the business units table you can click the blue plus icon to expand all children for that unit. If any children have children unit they will also have a plus sign to indicate the children rows can be expanded.

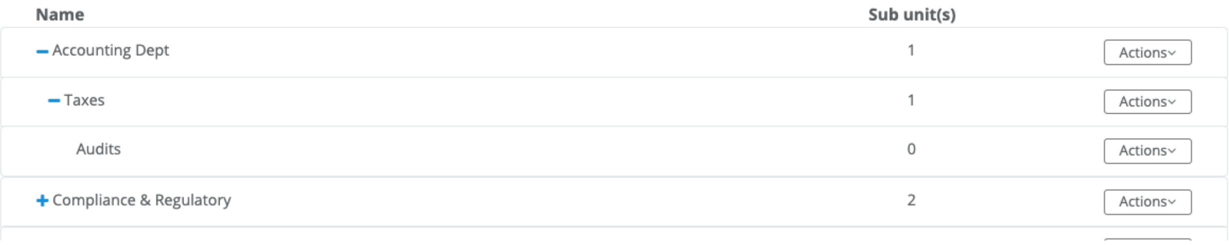


Add New Business Unit

Business Unit Name*: Unit name

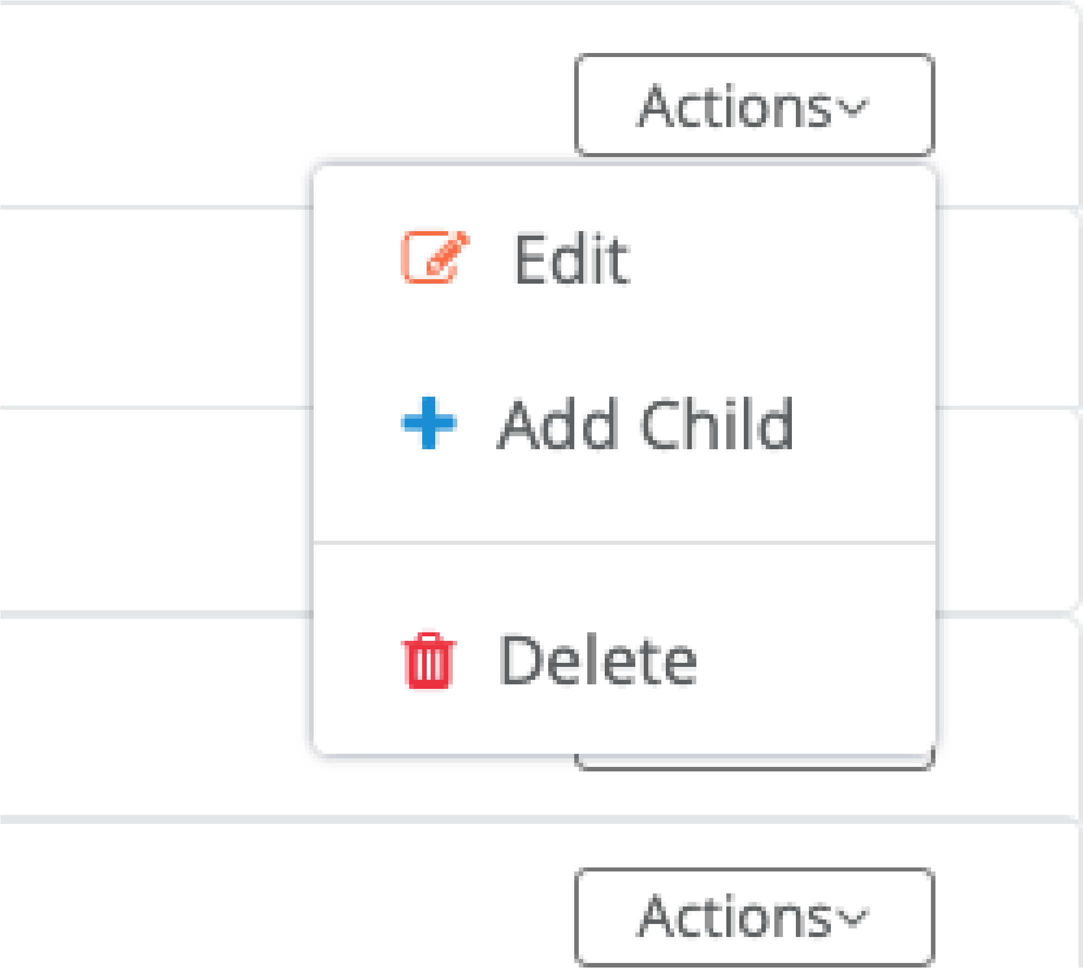
Parent Business Unit (optional): Search..

Cancel | Add Business Unit

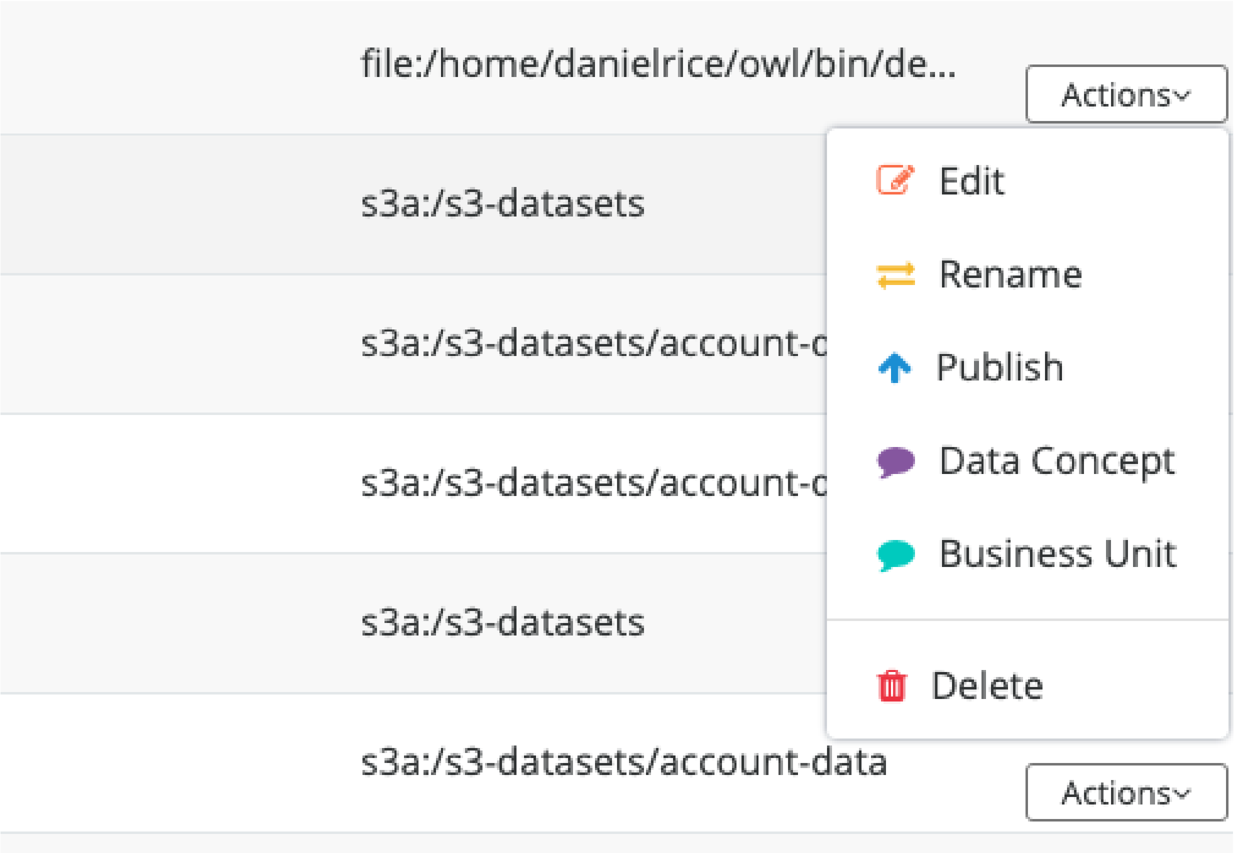


Name	Sub unit(s)	
− Accounting Dept	1	Actions
− Taxes	1	Actions
Audits	0	Actions
+ Compliance & Regulatory	2	Actions

Each business unit has actions. The business unit can be edited or deleted. If the unit is assigned to at least one data set, it cannot be deleted. If the user wishes to create children of a unit they can choose the Add Child action to have the new business unit form pre-populated with the selected unit as the parent.



There are two different ways to assign a business unit to a data set. On the Catalog page there is an action option to manage the business unit. One the profile page the user can click the add/edit business units icon to open a control to manage the assigned business unit.



file:/home/danielrice/owl/bin/de...

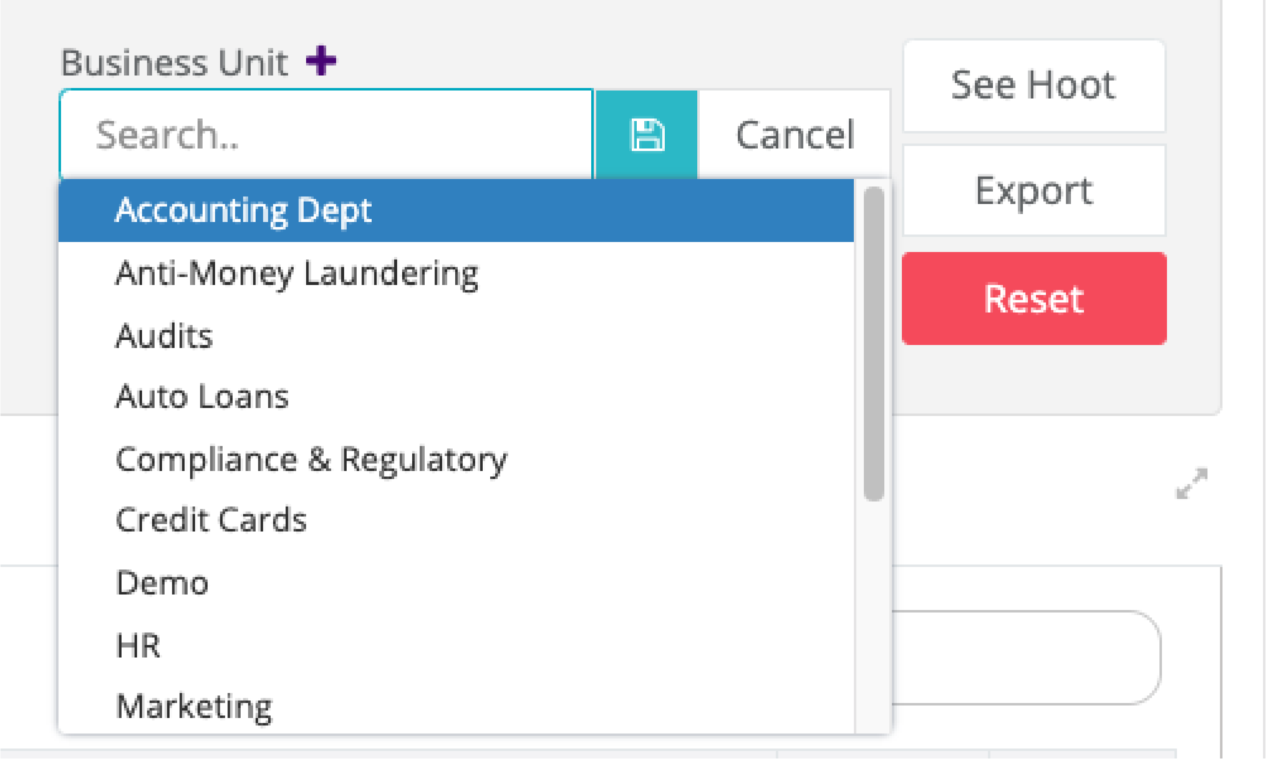
s3a:/s3-datasets

s3a:/s3-datasets/account-c

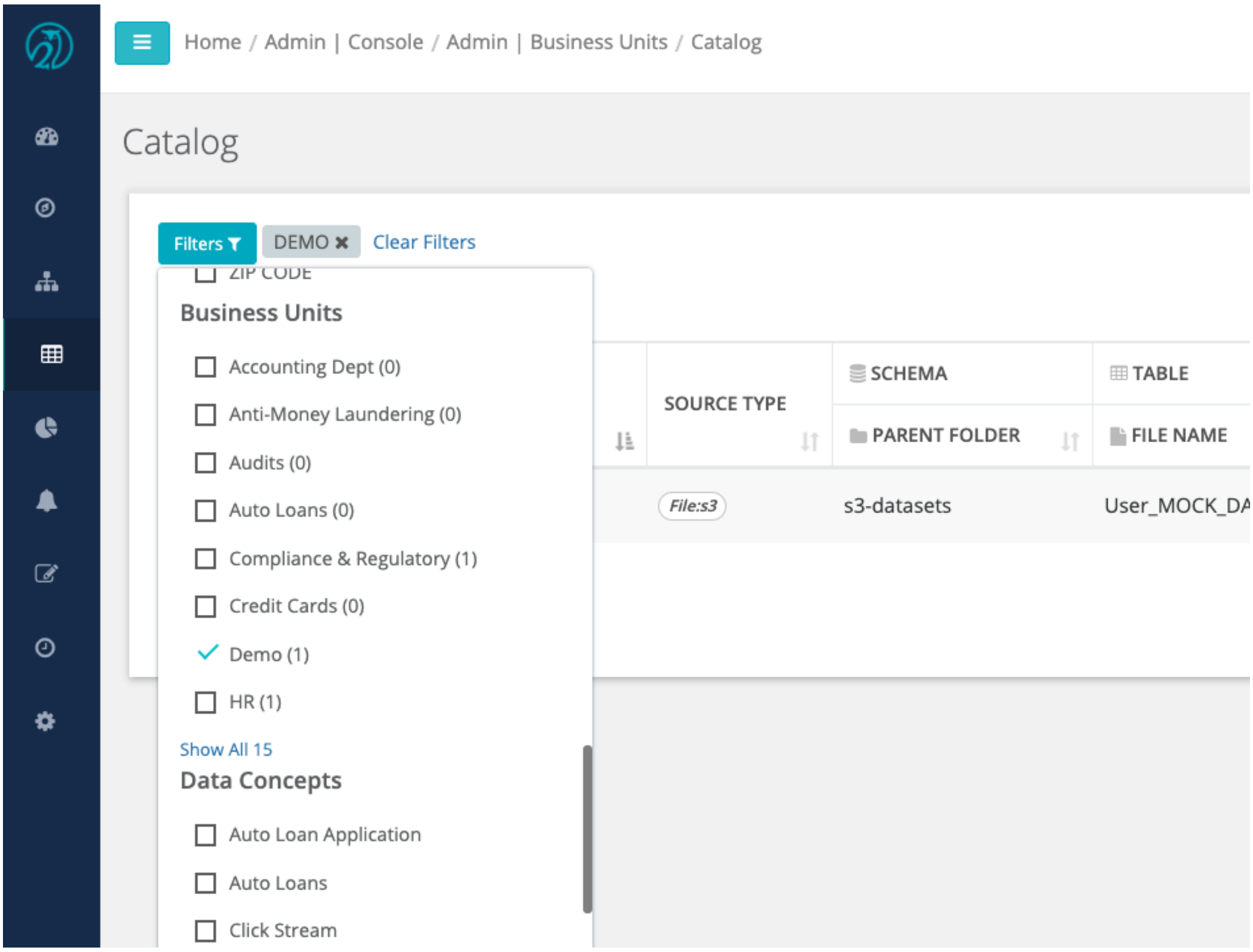
s3a:/s3-datasets/account-c

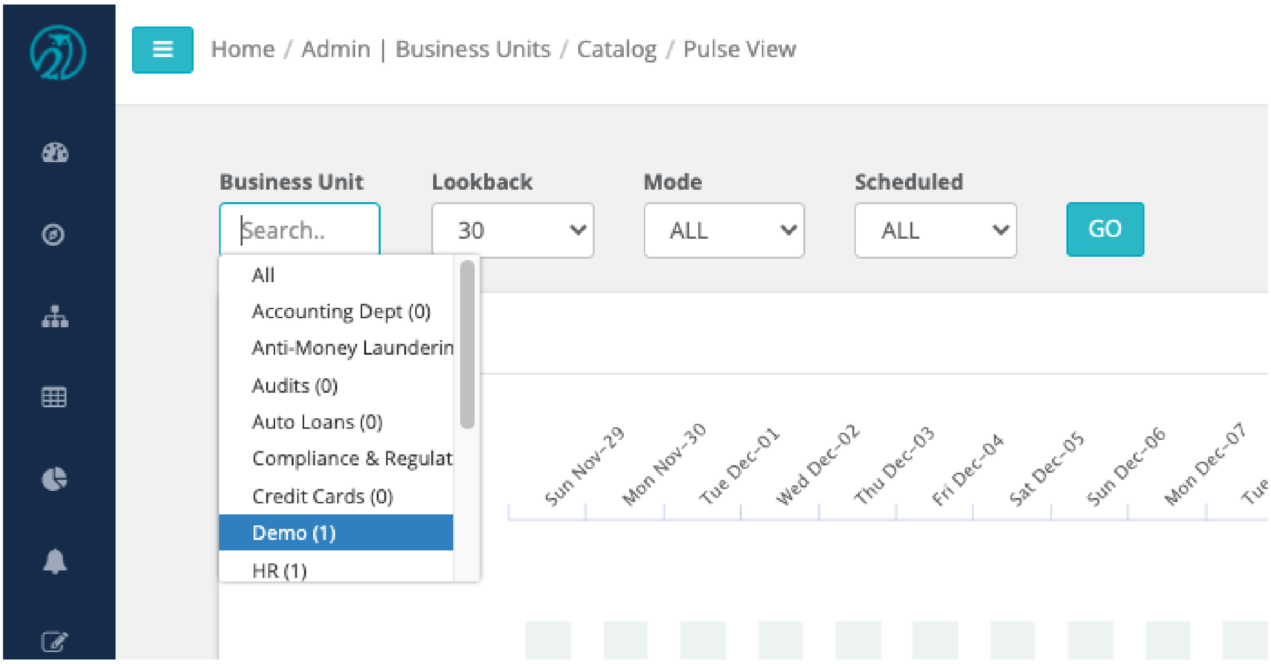
s3a:/s3-datasets

s3a:/s3-datasets/account-data



Once a business unit has been assigned to a data set the user can filter by that business unit on the Catalog and Pulse View.

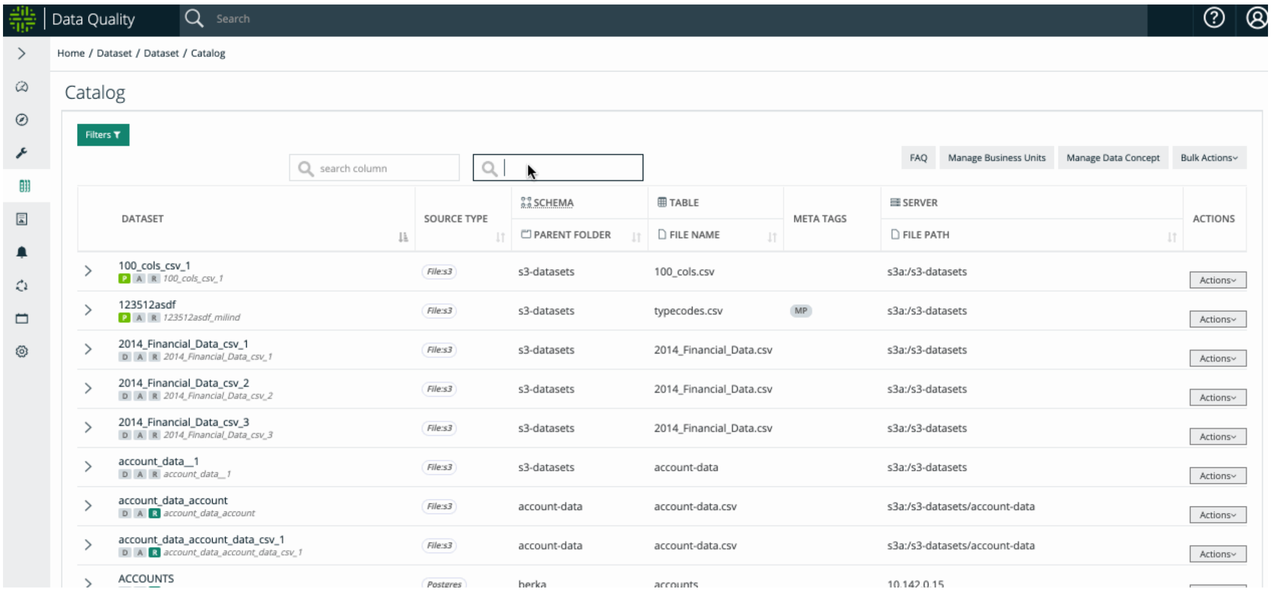




Home / Admin | Business Units / Catalog / Pulse View

Business Unit: Search..
Lookback: 30
Mode: ALL
Scheduled: ALL

Catalog Bulk Actions



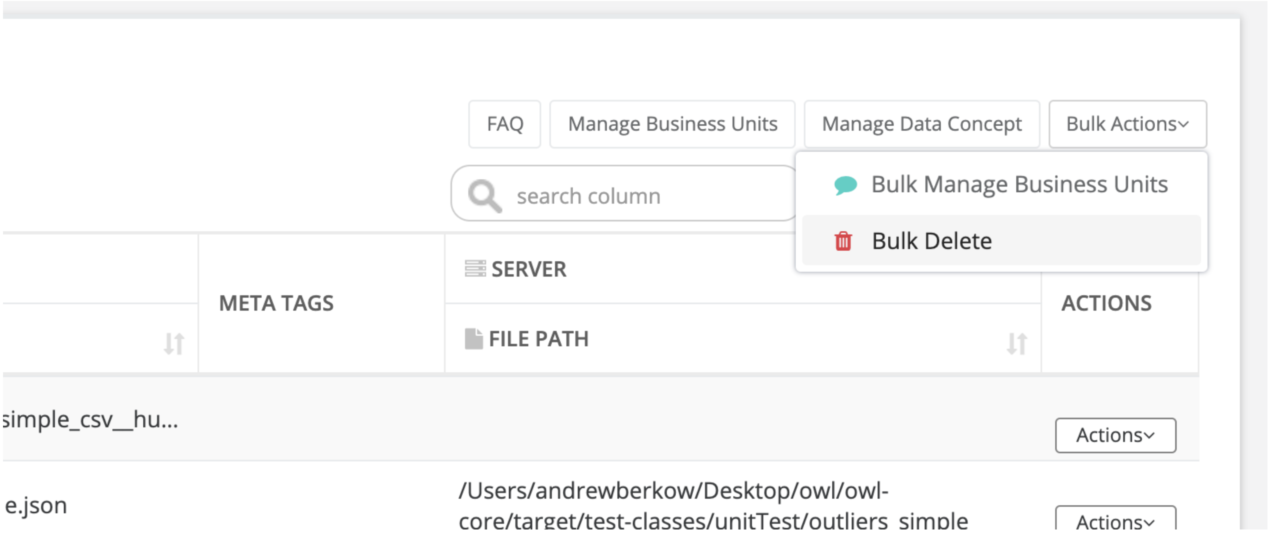
Home / Dataset / Dataset / Catalog

Catalog

DATASET	SOURCE TYPE	SCHEMA	TABLE	META TAGS	SERVER	ACTIONS
		PARENT FOLDER	FILE NAME		FILE PATH	
100_cols_csv_1 P A R 100_cols_csv_1	File:s3	s3-datasets	100_cols.csv		s3a:/s3-datasets	Actions
123512asdf P A R 123512asdf_milind	File:s3	s3-datasets	typecodes.csv	MP	s3a:/s3-datasets	Actions
2014_Financial_Data_csv_1 D A R 2014_Financial_Data_csv_1	File:s3	s3-datasets	2014_Financial_Data.csv		s3a:/s3-datasets	Actions
2014_Financial_Data_csv_2 D A R 2014_Financial_Data_csv_2	File:s3	s3-datasets	2014_Financial_Data.csv		s3a:/s3-datasets	Actions
2014_Financial_Data_csv_3 D A R 2014_Financial_Data_csv_3	File:s3	s3-datasets	2014_Financial_Data.csv		s3a:/s3-datasets	Actions
account_data__1 D A R account_data__1	File:s3	s3-datasets	account-data		s3a:/s3-datasets	Actions
account_data_account D A R account_data_account	File:s3	account-data	account-data.csv		s3a:/s3-datasets/account-data	Actions
account_data_account_data_csv_1 D A R account_data_account_data_csv_1	File:s3	account-data	account-data.csv		s3a:/s3-datasets/account-data	Actions
ACCOUNTS	Postgres	berka	accounts		10.142.0.15	

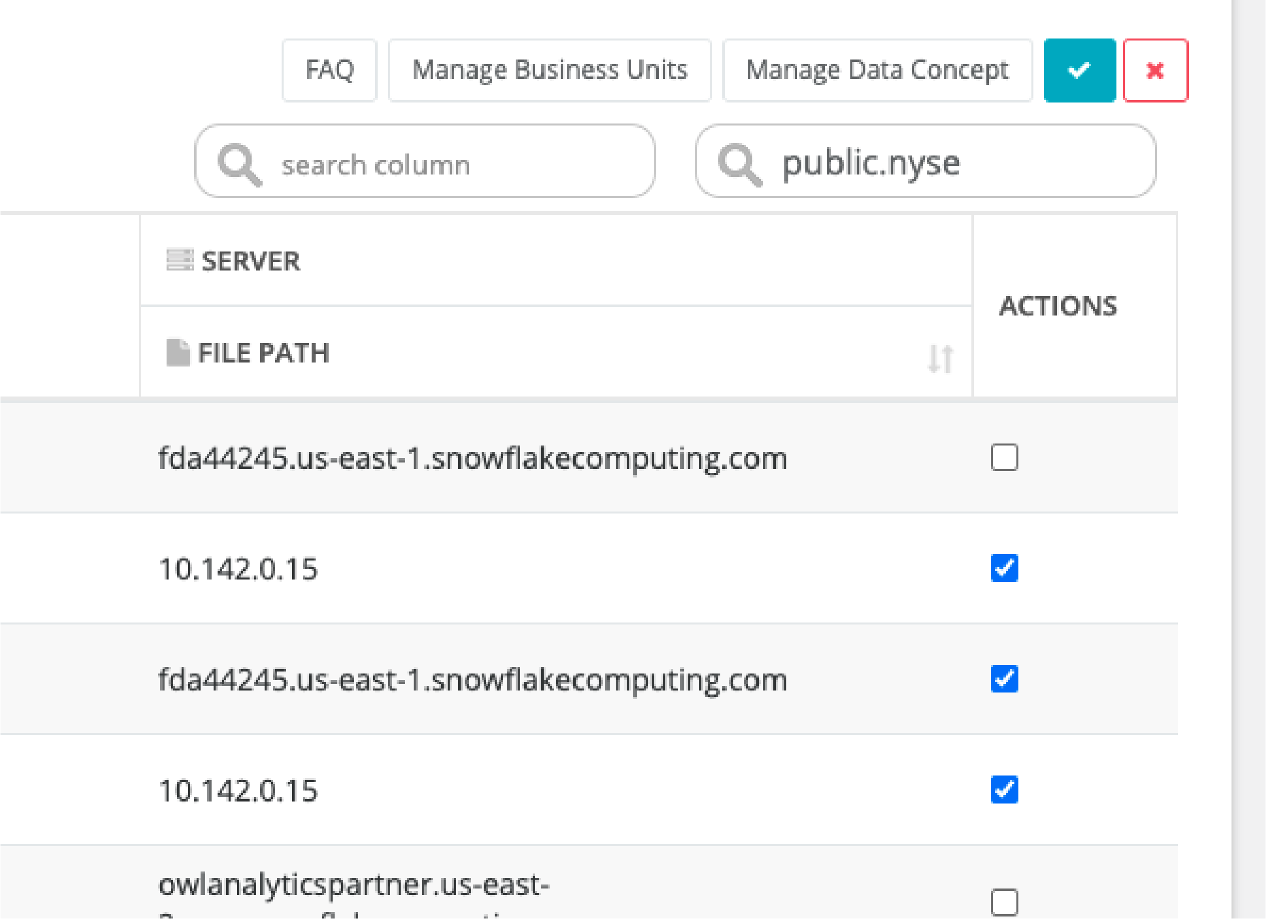
Bulk Delete

The catalog allows user to delete multiple datasets in one action through the catalog. Click the Bulk Actions button dropdown in the top right corner. Select Bulk Delete.



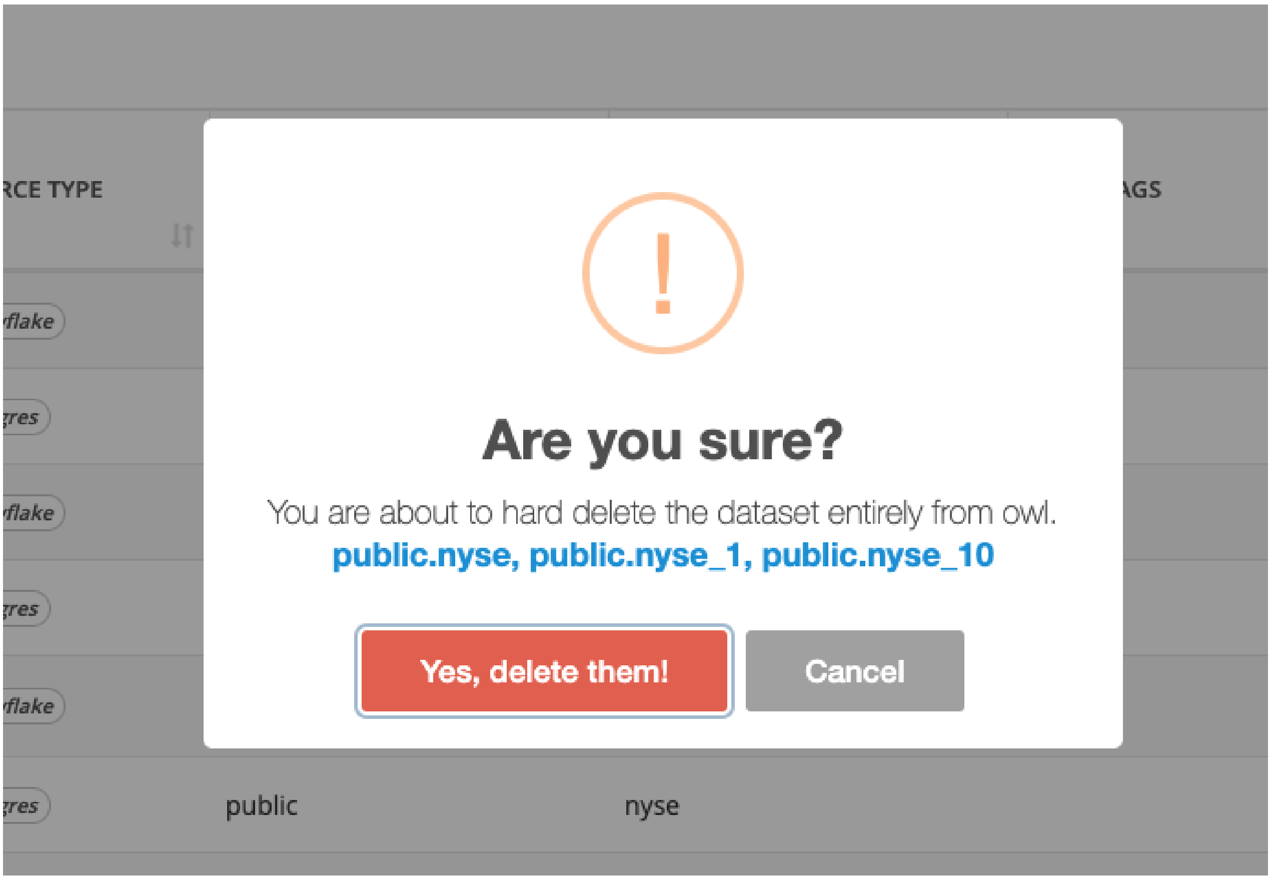
	META TAGS	SERVER FILE PATH	ACTIONS
simple_csv__hu...			Actions
e.json		/Users/andrewberkow/Desktop/owl/owl-core/target/test-classes/unitTest/outliers_simple	Actions

Each data set row will now have a checkbox in the Actions column. All filters can be applied now and the user can check all data sets they wish to delete. Once desired data sets are selected, the checkbox can be clicked. The user will be prompted to confirm they wish to delete data sets. The user can also click the X button to cancel.



public.nyse

SERVER FILE PATH	ACTIONS
fda44245.us-east-1.snowflakecomputing.com	□
10.142.0.15	☑
fda44245.us-east-1.snowflakecomputing.com	☑
10.142.0.15	☑
owlanalyticspartner.us-east-	□

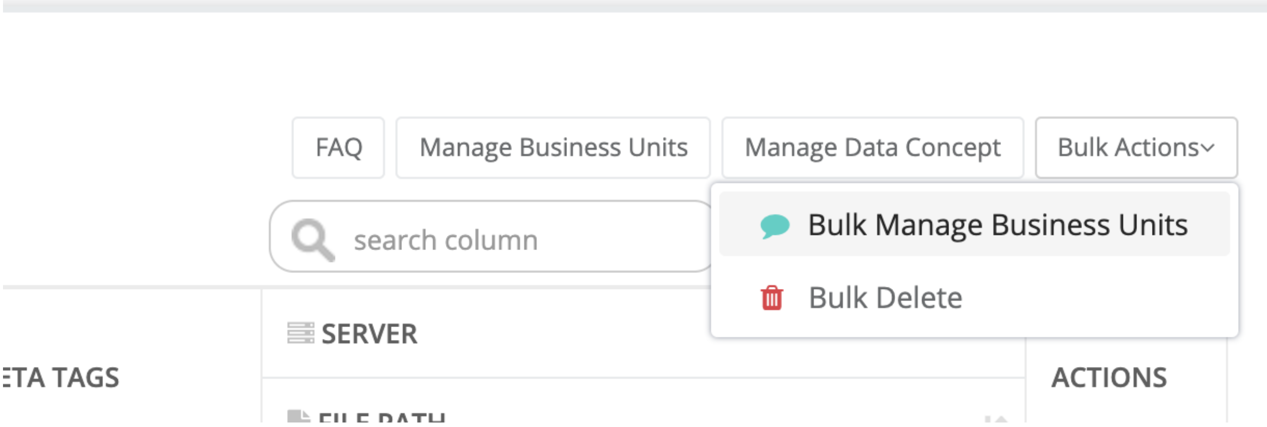


Are you sure?

You are about to hard delete the dataset entirely from owl.
public.nyse, public.nyse_1, public.nyse_10

Bulk Manage Business Units

Another bulk feature allows the user to manage the assigned business unit to multiple datasets. Click the Bulk Actions button dropdown in the top right corner. Select Bulk Manage Business Units.



Each data set row will now have a checkbox in the Actions column. All filters can be applied now and the user can check all data sets they wish to delete. Once desired datasets are selected, the user can select a business unit from the business unit dropdown control in the top right corner and click the checkbox. The user will be prompted to confirm they wish to change the assigned business unit to the data sets.

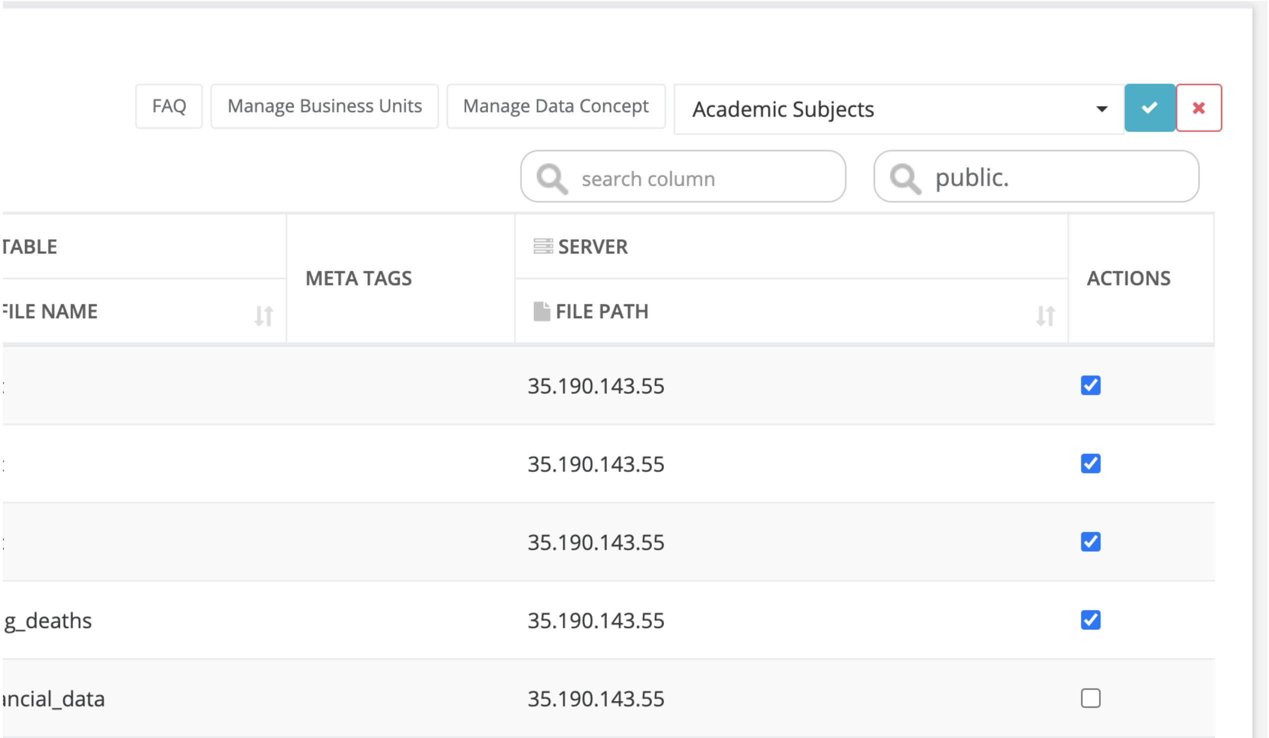
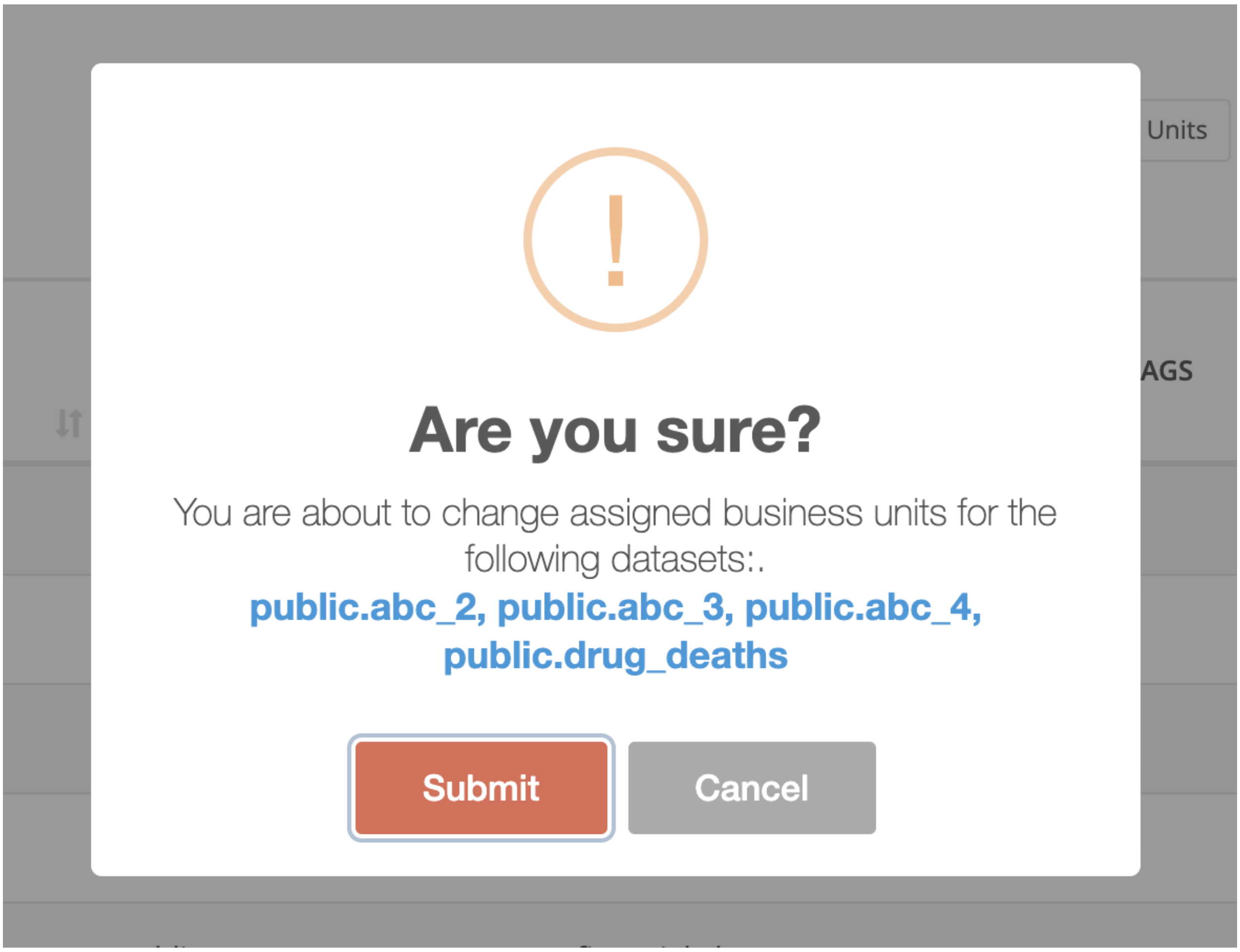


TABLE FILE NAME	META TAGS	SERVER FILE PATH	ACTIONS
:		35.190.143.55	☑
:		35.190.143.55	☑
:		35.190.143.55	☑
g_deaths		35.190.143.55	☑
ncial_data		35.190.143.55	☐



Are you sure?

You are about to change assigned business units for the following datasets:.

public.abc_2, public.abc_3, public.abc_4, public.drug_deaths

Chapter 15

Collibra DQ Solutions

Use Cases

Data Projects

Here are the articles in this section:

- Builds a Better DQ Dashboard
- Ensures CCPA & GDPR
- Makes your Data Lake better
- Speeds Migrations/Enables Replications

Builds a Better DQ Dashboard

- **DQ Dashboards.** Many DQ problems result from an improper or a too slow observation of business rules related to the data. What is not caught by handmade visual inspection or a potentially outdated man-made rule can only be flagged by AI Machine Learning. Conversely, what does get flagged should also be easily triaged and then immediately fixed with the aid of AI. The most important metric for a DQ Dashboard is the time to fix, not simply the overall DQ score.

Ensures CCPA & GDPR

Aggregation from hundreds of locations: The dashboard for what is within spec based on AI observation – not handmade rules.

Then push-down fix: The rules are created and then immediately applied via self-service. The problem is immediately identified and a fix (recommendation engine) is applied.

The value of this for both companies: The DQ problem never corrupts the whole. The longer the bad quality exists the bigger problem it can create.

Makes your Data Lake better.

Data Lakes support analytics, which will ultimately drive actions that increase revenue, support compliance, prevent churn, etc. However, whether that action is near to real-time or not, none of those can be performed without first performing a DQ check. For example, can you trigger an action before first checking the “GDPR Remove” list? A Data Quality check must always be the first step in any action. OwlDQ with Schema Learned can perform 100+ owl checks. However beyond simply those checks, it is OwlDQ's unique Spark-based architecture listed below that enables innovation. Churn, credit check, AML, infosec checks developed in the Data Lake could be added as part of Owlcheck on the streaming data.

- **Data and Privacy in Place.** Data never has to move for a DQ OwlCheck. The latency saved from operating in place, the added hybrid flexibility, the privacy maintained serves many new use cases that were not possible before. It also removes any unnecessary consolidation for the sake of simply consolidation. DQ doesn't have to start by first moving it into a Data Lake.
- **DQ or Any Rules applied in the Stream.** The DQ rules learned by DQ can be applied back to the source on data in the stream. However, other non-DQ rules learned in the Data Lake can also be added to the OwlDQ check.
- **Self-Service and DQ push-down fix.** DQ can enable a self-service push-down fix (recommendation engine) to anything flagged at the source. The best time to fix DQ is when and where the problem started. This enables tighter integration with Data Governance tools since DQ is maintained at the source once, not downstream where corruption beyond just the data can occur.
- **Multi-cloud/On-prem/Hybrid.** OwlDQ can scan/alert/report at the source or can operate natively on the target Data Lake such as Databricks Delta in Azure or Snowflake on AWS, or Qubole on GCP. Why compromise DQ just because your data is not in one place? Why settle on a DQ strategy that only works if the data is first migrated or moved?
- **DQ Dashboards.** Many DQ problems result from an improper or a too slow observation of business rules related to the data. What is not caught by handmade visual inspection or a potentially outdated man-made rule can only be flagged by AI Machine Learning. Conversely, what does get flagged should also be easily triaged and then immediately fixed with the aid of AI. The most important metric for a DQ Dashboard is the time to fix, not simply the overall DQ score.

Speeds Migrations/Enables Replications

- **Speed Migrations/Enable Replications.** Batch collection with subsequent excel compare is very problematic. Instead, rules are generated by the data itself, and anomalies are triggered on the fly at the source system. This type of schema learned approach will speed migration and enable replications with much less overhead.

Assists Data Aggregation

- **Greatly Reduce Support Costs.** Apply AI-generated rules to maintain consistency across all accounts, rather than apply hand-made rules per every account. You are not managing 100+ variations of rules, but a consistent set that is learned from all.
- **Capitalize on Real-time.** Batch collection with excel compare will never support real-time. Instead, rules are generated by the data itself, and anomalies are triggered on the fly at the source system.
- **Rapid Onboarding.** Universal and already tested scans are applied quickly.
- **Improve Customer Satisfaction.** Monitor the real-time speed of the DQ pushdown fix, not just the overall DQ score over time.
- **Improved SLAs.** When DQ is fixed immediately, all SLAs can be improved not just DQ SLAs.

Creating a Data Quality Pipeline

Organizations that leverage data as an asset to make decisions into their future must entrust the data, from which important business decisions are derived. While almost all businesses leverage their own collected or generated data (or plan to) for internal use, how many actually scrutinize their data? Companies that sell a product must ensure that it is run through some sort of quality assurance suite of tests/runs before it is available to a customer. So organizations that use data internally as their own asset/product should have the same or more confidence in the quality of their data. Owl-Analytics is a data quality product that observes the data to surface behaviors, patterns, outliers, schema changes, record changes, and more.

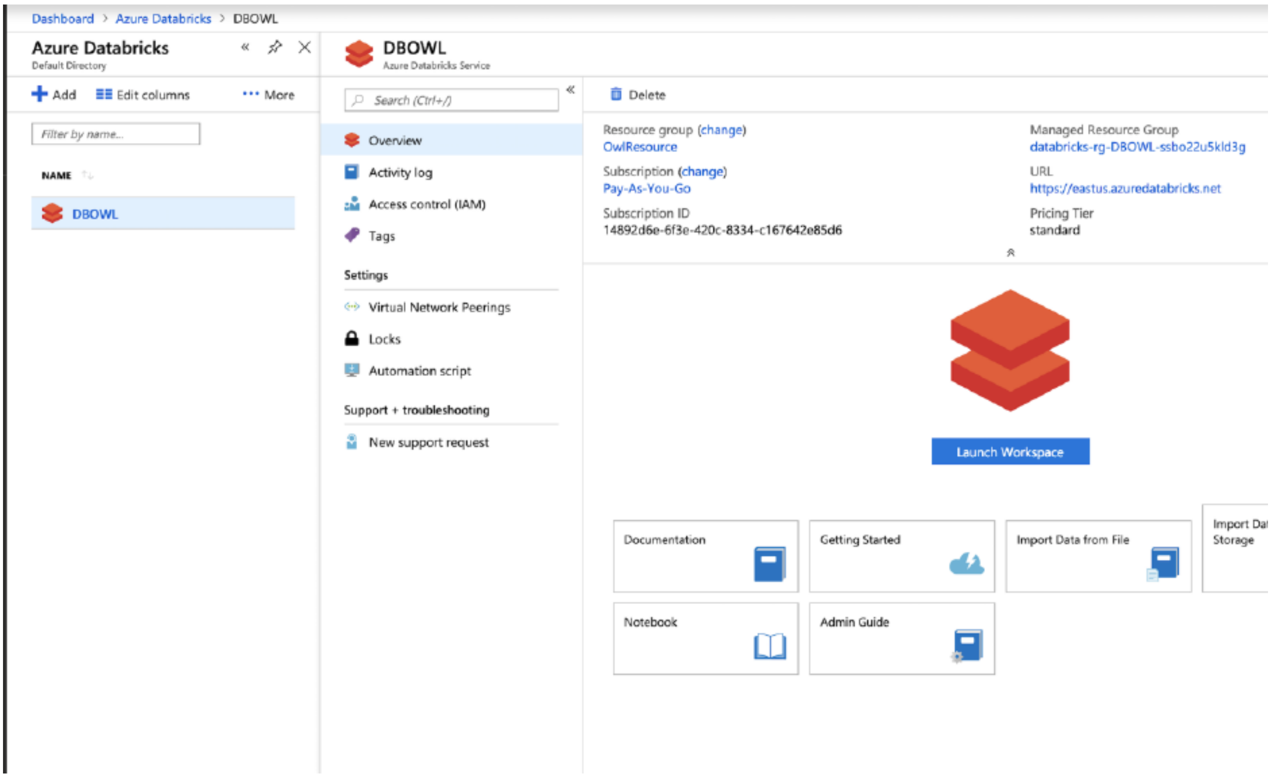
Data Scientists are trying to find insights in data to solve complex problems for their business. However, 80 percent of their time is spent discovering the data to cleanse it to make it ready for the model. Over time, models deteriorate as data underneath changes or new trends/ patterns arise. Leveraging Owl-Analytics to validate the quality of the data during the data pipeline and before the data is presented to the Data Scientist reduces time to value for business insights as Data Scientists get time back, not cleaning / prepping the data, and helping the model maintain a longer life.

Azure Databricks allows the ability for Scala code to be written in a Jupyter Notebook against an Azure backed Databricks cluster to scale the work out to more nodes. This is to support the model and the amount of data being crunched by a business's Data Scientists. The simplistic nature of Azure and Databricks and the unification of Spark and Jupyter Notebooks, on top of a robust infrastructure (from storage to compute), allow for Owl-Analytics Data Qualified pipelines to be built and executed seamlessly. This reduces the time it usually takes to obtain valuable insights.

Here is how you can build such great DQ pipelines.

Step 1: Build a Databricks Cluster in Azure.

Within the Azure portal find Azure Databricks Service and create a cluster, after the cluster is built you should be able to launch the Workspace as shown below.



Resource group (change)
OwlResource

Subscription (change)
Pay-As-You-Go

Subscription ID
14892d6e-6f3e-420c-8334-c167642e85d6

Managed Resource Group
databricks-rg-DBOWL-ssbo22u5kld3g

URL
https://eastus.azuredatabricks.net

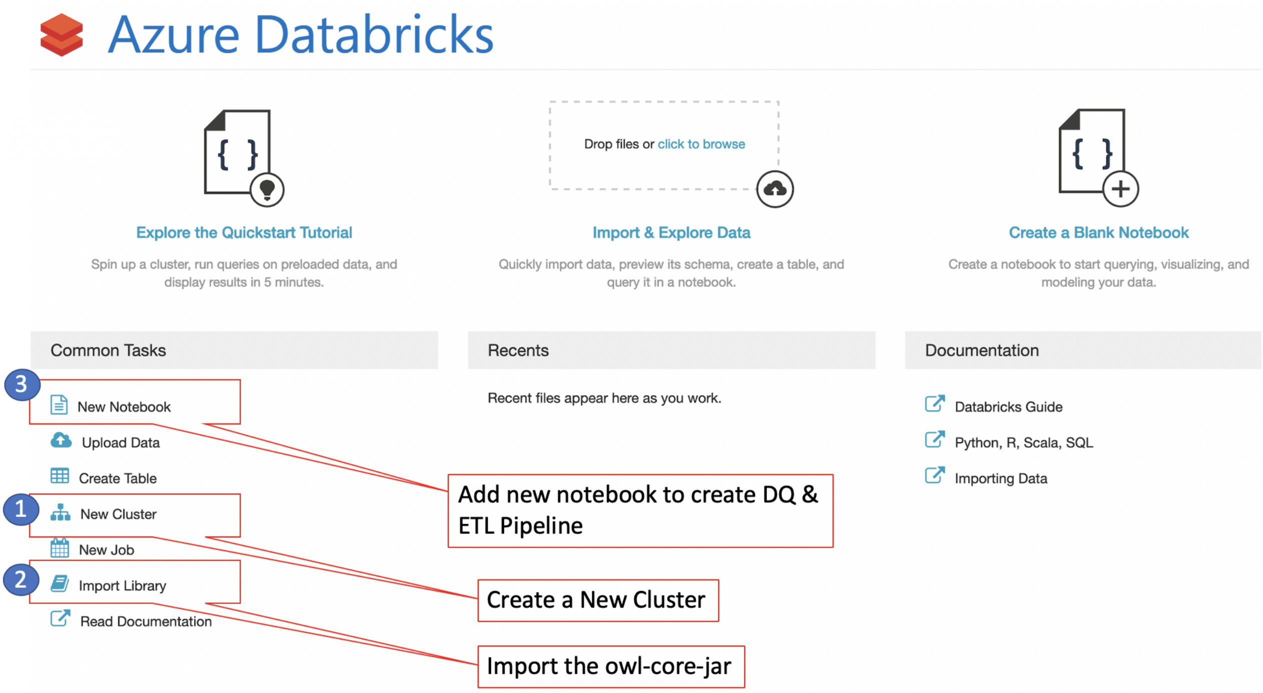
Pricing Tier
standard

Step 2: Create a Cluster, add the Owl jar and create a Notebook.

1.) Inside the Azure Databricks UI, create a cluster, provide a cluster name (in this example we will be using DBOWL2 as the cluster name) and select the Databricks Runtime Version that DQ currently supports (as of this blog post), which is Runtime: 5.2(Scala 2.11, Spark 2.4.0).

2.) After the cluster is created, make sure to import DQ's jar file onto the cluster so that the Notebook can access the methods exposed in the jar file.

3.) Now that the Jar file has been added, create the Notebook and attach it to the cluster.



Spin up a cluster, run queries on preloaded data, and display results in 5 minutes.

Quickly import data, preview its schema, create a table, and query it in a notebook.

Create a notebook to start querying, visualizing, and modeling your data.

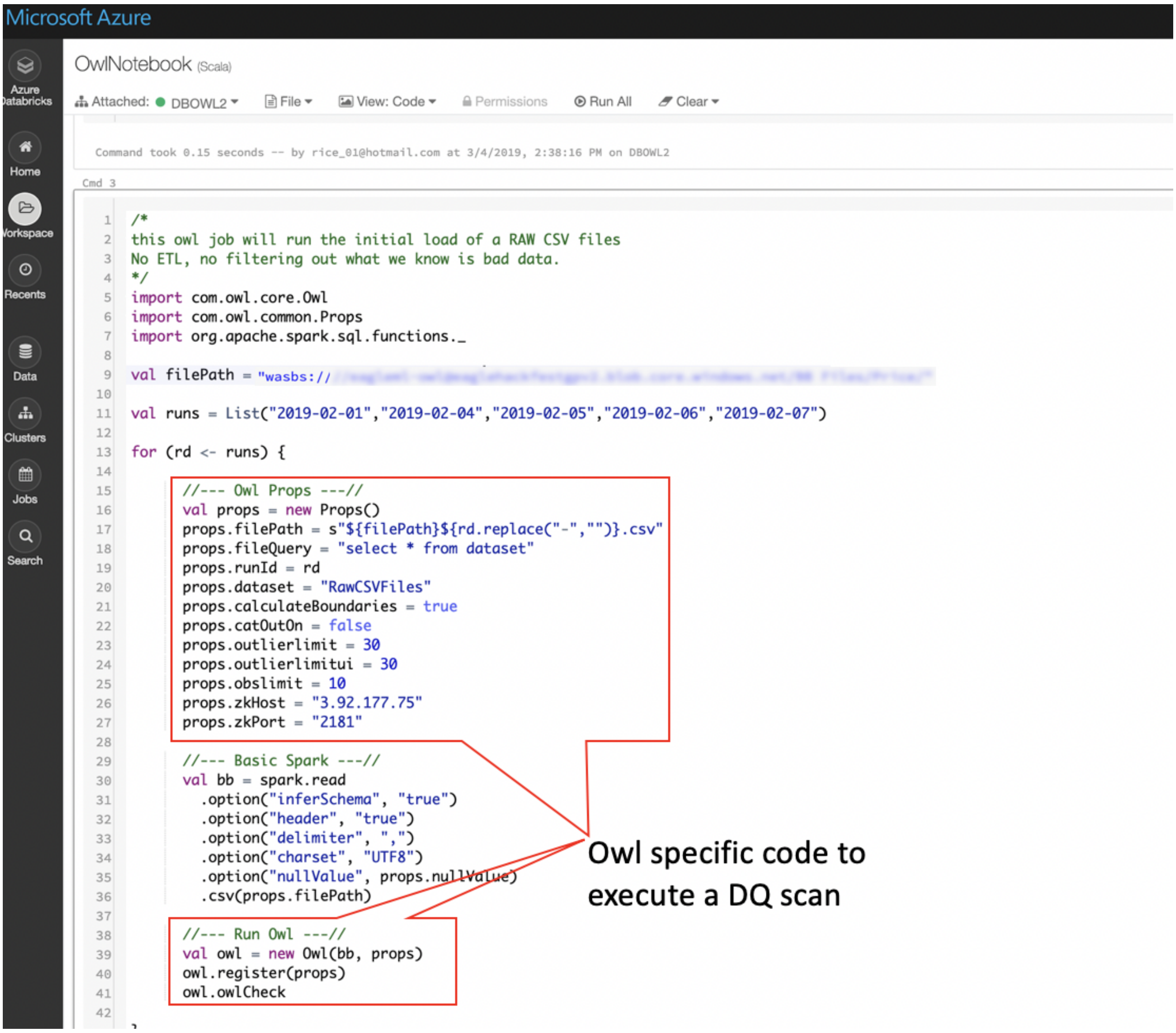
Recent files appear here as you work.

Add new notebook to create DQ & ETL Pipeline

Create a New Cluster

Import the owl-core-jar

Now the cluster is running with the DQ jar loaded on the cluster. Open the Jupyter notebook attached to the cluster and begin looking at a data set as a Data Engineer would, prepping the data for use by a Data Scientist by leveraging a DQ Pipeline as shown in the below screen shot.

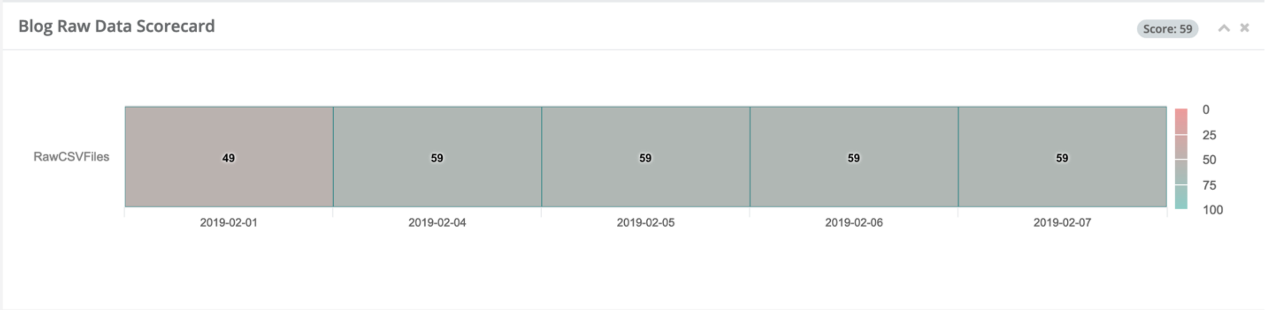


```
Command took 0.15 seconds -- by rice_01@hotmail.com at 3/4/2019, 2:38:16 PM on DBOWL2
```

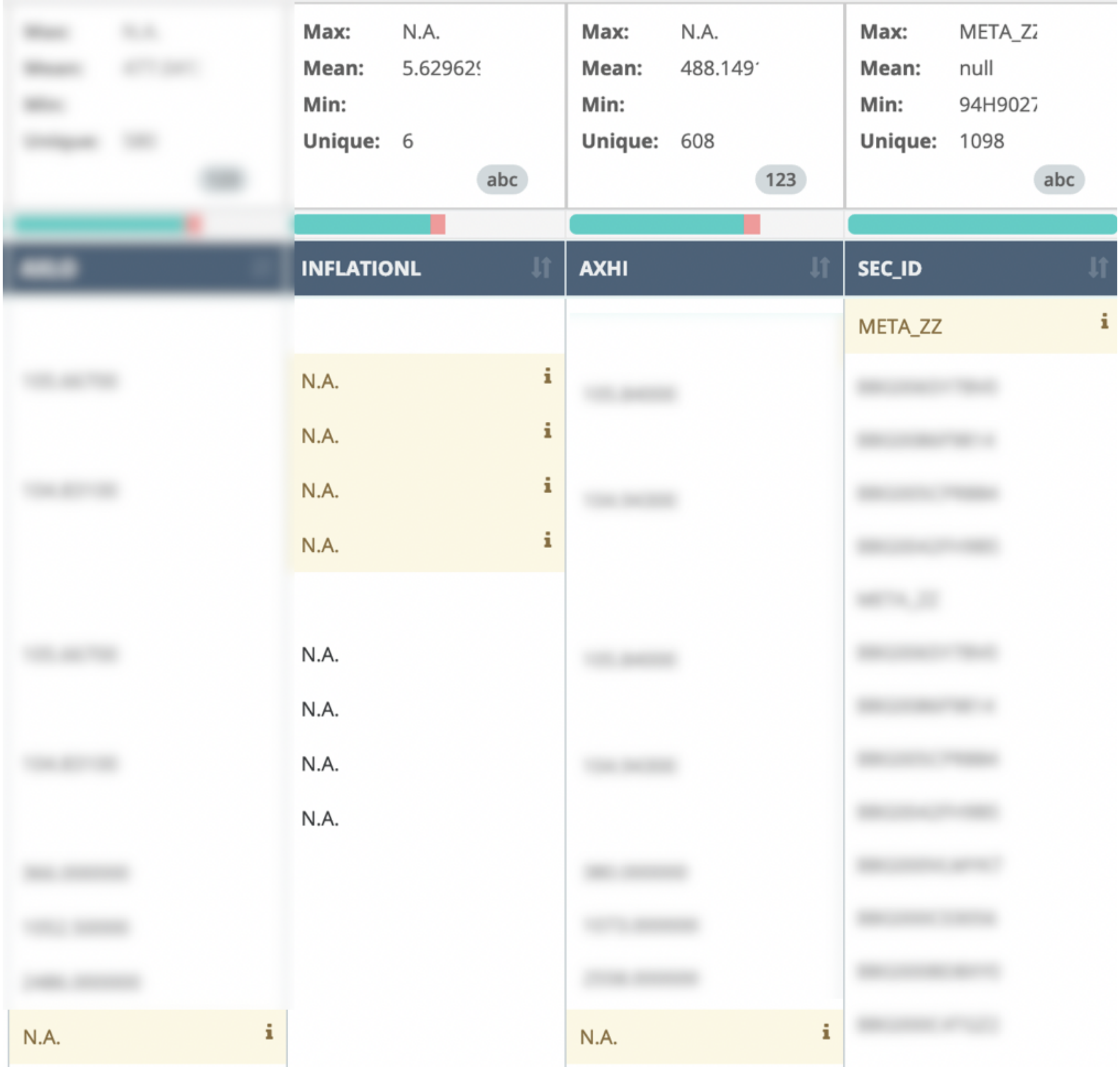
```
/*
this owl job will run the initial load of a RAW CSV files
No ETL, no filtering out what we know is bad data.
*/
import com.owl.core.Owl
import com.owl.common.Props
import org.apache.spark.sql.functions._

val filePath = "wasbs://[redacted]"

val runs = List("2019-02-01","2019-02-04","2019-02-05","2019-02-06","2019-02-07")

for (rd <- runs) {

    //--- Owl Props ---//
    val props = new Props()
    props.filePath = s"${filePath}${rd.replace("-","")}.csv"
    props.fileQuery = "select * from dataset"
    props.runId = rd
    props.dataset = "RawCSVFiles"
    props.calculateBoundaries = true
    props.catOutOn = false
    props.outlierlimit = 30
    props.outlierlimitui = 30
    props.obslimit = 10
    props.zkHost = "3.92.177.75"
    props.zkPort = "2181"

    //--- Basic Spark ---//
    val bb = spark.read
      .option("inferSchema", "true")
      .option("header", "true")
      .option("delimiter", ",")
      .option("charset", "UTF8")
      .option("nullValue", props.nullValue)
      .csv(props.filePath)

    //--- Run Owl ---//
    val owl = new Owl(bb, props)
    owl.register(props)
    owl.owlCheck

}
```

Owl specific code to execute a DQ scan

This Scala code imports the DQ jar and loops through the dates residing in files on Azure blob storage, pulls them into a Spark Data Frame (DF), and executes a DQ job to scan for the quality issues on the Spark DF. Once the scan is completed, the results are stored into the metadata repository under DQ's web application and visible through your browser, as shown in Figure 4 below.

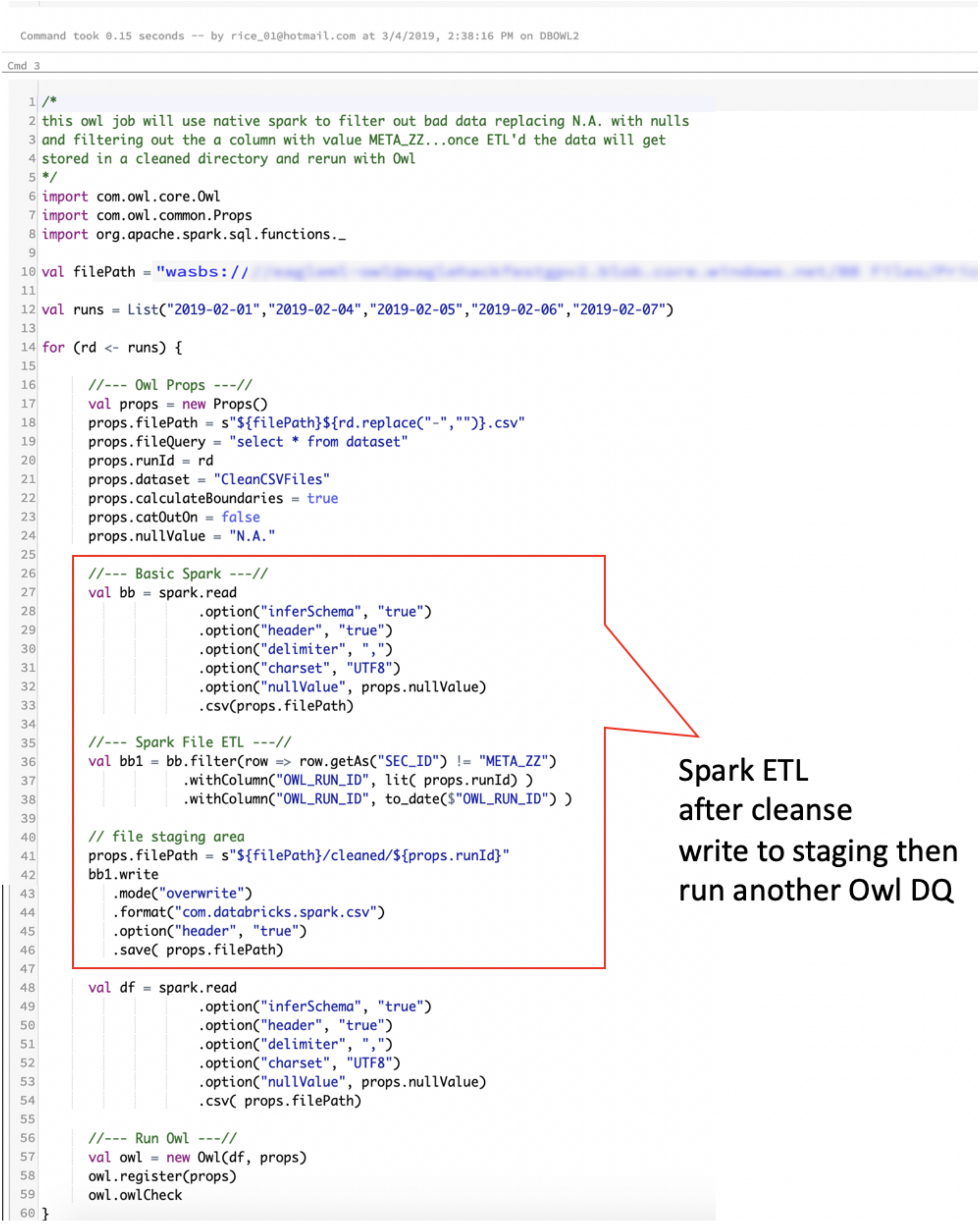


The reason for a score of 49 on the raw data (as shown below in Figure 5) is due to the file having string values sprinkled in the file when something is Not Applicable (N.A.). When reading data in a column of a file that has a mix of numeric and string values the column will automatically conform to a string regardless if the majority class are integers. Also, within the files there is a single record in this file that has meta data information about the file "META_ZZ" this is also adding empty strings for all other columns. This record will also cause all columns to conform to strings.



INFLATIONL	AXHI	SEC_ID
Max: N.A. Mean: 5.62962‹ Min: Unique: 6 abc	Max: N.A. Mean: 488.149‹ Min: Unique: 608 123	Max: META_Z‹ Mean: null Min: 94H902‹ Unique: 1098 abc
		META_ZZ ℹ
N.A. ℹ		
N.A. ℹ		
N.A. ℹ		
N.A. ℹ		
N.A.		
N.A.		
N.A.		
N.A.		
	N.A. ℹ	

You should now have an understanding of the raw file and how you need to conform it before analysts can start to glean business value from the contents itself. First, ETL or cleanse the data that you discovered as being in error by filtering out the erroneous record and flipping all the N.A. values to null as the next step in our ETL and DQ pipeline.



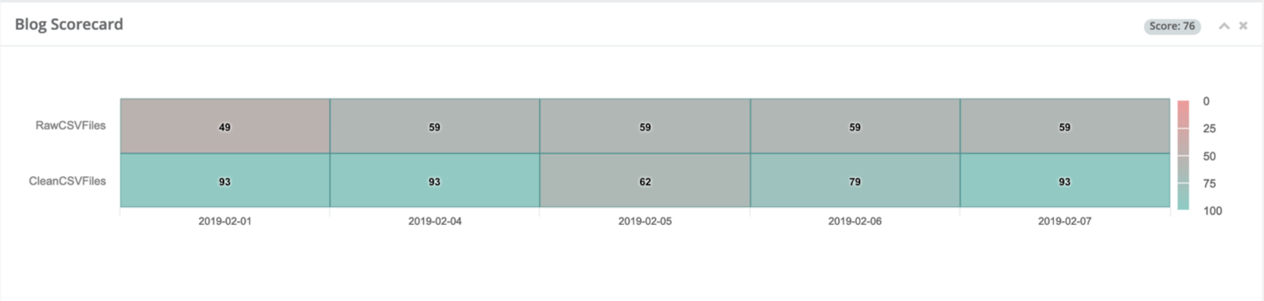
```
Command took 0.15 seconds -- by rice_01@hotmail.com at 3/4/2019, 2:38:16 PM on DBOWL2
```

Cmd 3

```
/*
this owl job will use native spark to filter out bad data replacing N.A. with nulls
and filtering out the a column with value META_ZZ...once ETL'd the data will get
stored in a cleaned directory and rerun with Owl
*/
import com.owl.core.Owl
import com.owl.common.Props
import org.apache.spark.sql.functions._

val filePath = "wasbs://[redacted]

val runs = List("2019-02-01","2019-02-04","2019-02-05","2019-02-06","2019-02-07")

for (rd <- runs) {

    //--- Owl Props ---//
    val props = new Props()
    props.filePath = s"${filePath}${rd.replace("-","")}.csv"
    props.fileQuery = "select * from dataset"
    props.runId = rd
    props.dataset = "CleanCSVFiles"
    props.calculateBoundaries = true
    props.catOutOn = false
    props.nullValue = "N.A."

    //--- Basic Spark ---//
    val bb = spark.read
                .option("inferSchema", "true")
                .option("header", "true")
                .option("delimiter", ",")
                .option("charset", "UTF8")
                .option("nullValue", props.nullValue)
                .csv(props.filePath)

    //--- Spark File ETL ---//
    val bb1 = bb.filter(row => row.getAs("SEC_ID") != "META_ZZ")
              .withColumn("OWL_RUN_ID", lit( props.runId) )
              .withColumn("OWL_RUN_ID", to_date($"OWL_RUN_ID") )

    // file staging area
    props.filePath = s"${filePath}/cleaned/${props.runId}"
    bb1.write
       .mode("overwrite")
       .format("com.databricks.spark.csv")
       .option("header", "true")
       .save( props.filePath)

    val df = spark.read
                .option("inferSchema", "true")
                .option("header", "true")
                .option("delimiter", ",")
                .option("charset", "UTF8")
                .option("nullValue", props.nullValue)
                .csv( props.filePath)

    //--- Run Owl ---//
    val owl = new Owl(df, props)
    owl.register(props)
    owl.owlCheck
}
```

Spark ETL
after cleanse
write to staging then
run another Owl DQ

The DQ block of code is essentially the same, however, there is a new DQ property added to auto filter values “props.nullValue = ‘N.A’”. This finds every cell that has the value of N.A. and conforms it to a “null”. Once the file is read into a Spark DF, you use Spark to “Filter” out the erroneous record on line 36 in the code snippet above. Notice we are also adding an Owl_Run_ID date as this data set did not have a date that conforms easily. After the ETL process cleanses the data, you then have DQ’s Data Quality engine scan the newly processed Spark DF, storing the results into a data set called CleanCSVFiles (as shown in Figure 7 below).



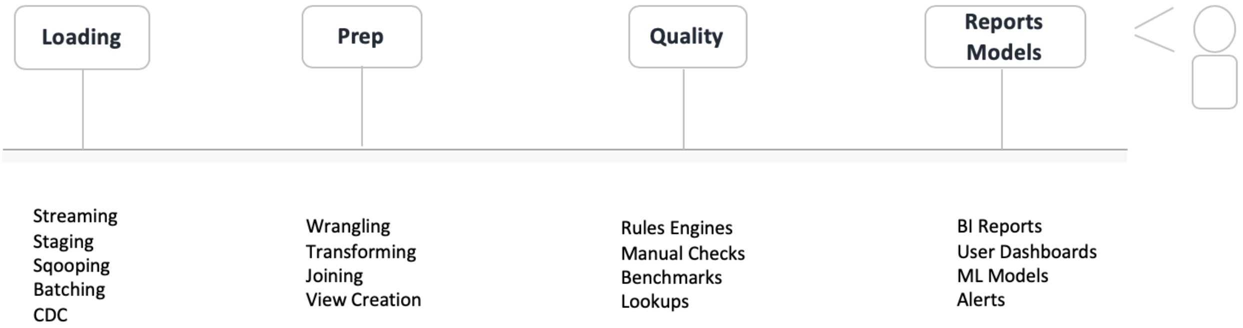
Notice the composite scores in the boxes are substantially better for the CleanCSVFiles data set than what they are for the original RawCSVFiles. In the next article, we will look deeper at the intelligence a DQ scan garners on a data set when run over several days and how DQ surfaces different patterns, behaviors, trends and more in the data itself.

Our Approach

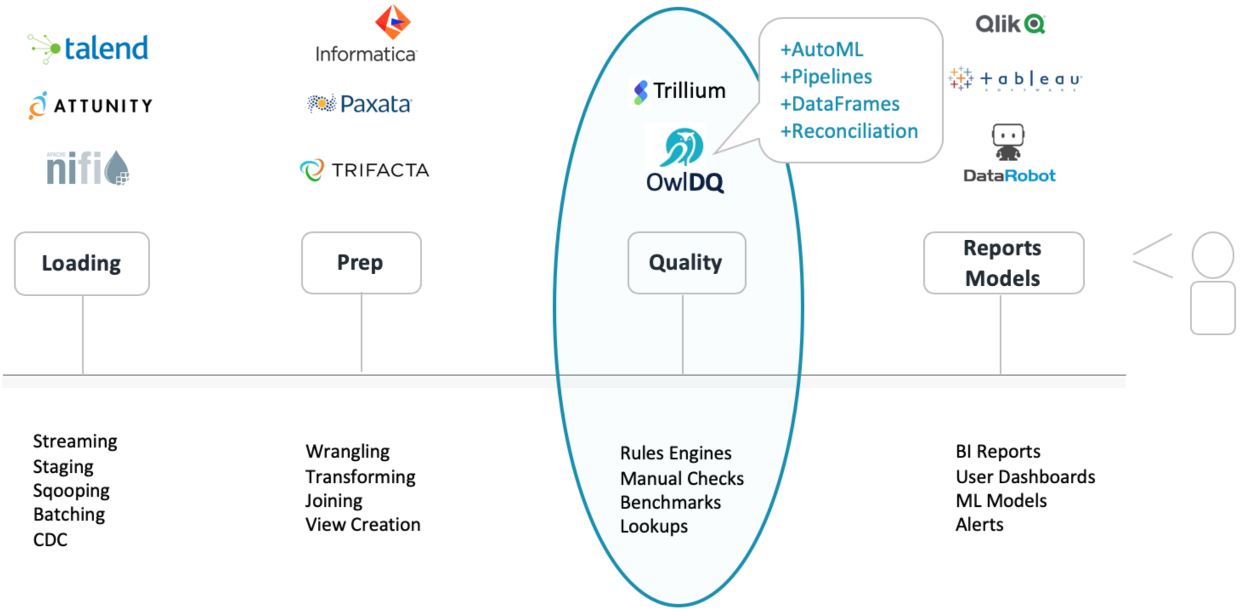
Because: Using raw data to drive key decisions, leads to incorrect answers and end-user distrust.

Collibra Data Quality is singularly focused on providing your end-users with the highest standards of data quality. We are purpose-built to solve the problem of data quality and to ensure end-user trust.

Whether you use a BI tool to visualize data or you are responsible for serving data to downstream subscribers, you always want to trust that your data is accurate. Showing inaccurate data in a bar chart or PDF report leads to a lack of confidence in the data provider. For example, see the data pipeline below. There are four main stages: Data Loading, Data Preparation, Data Verification (DQ), and Data Reporting, which covers a broad category of all ways to see and deliver data.

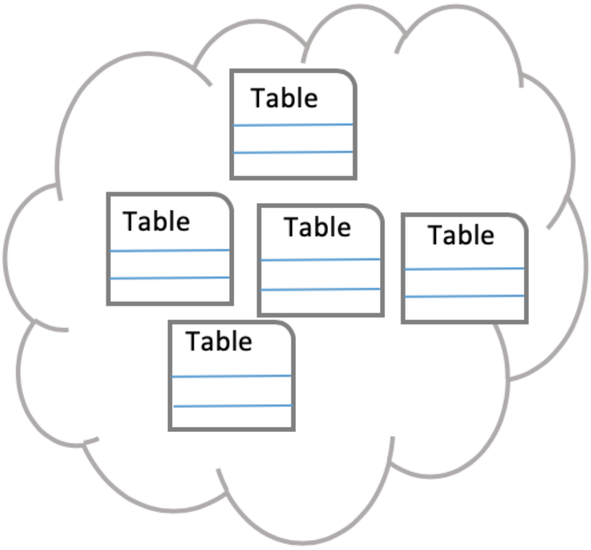


To avoid getting lost in the latest marketing jargon, a fundamental description is provided under each of the four stages. There are many ways to ingest and transform data; the descriptions are not meant to be exhaustive. Imagine a scenario where data is loaded in either a batch or stream, then joined to another dataset with some column transformations, and finally made viewable in a BI tool for consumption. But what about quality? What checks and verifications are in place to guarantee data accuracy and completeness? After all, showing someone a housing report with incorrect estimated housing values or a stock report with the wrong stock prices won't go over well. Figure 2 below shows popular company logos overlaid in each stage to bring more context to the discussion. There are easily 30+ software companies in each of the four stages, DQ chose three popular companies in each sector at random. DQ is not ranking companies. Gartner is of course an obvious choice if you are looking for companies rankings per sector.



So, What's the Problem?

Detecting data issues is nuanced, manual and time consuming. The traditional solution is to write bespoke code or use a rules engine to validate specific columns in a data set. If missing data is a concern, a common remedy is to write a *nullcheck*. Another common example is a *row count check;* a piece of logic that checks if the number of rows in a data set is greater than a specified number. Of course, DQ and business rules can get much more complicated. Scale becomes a huge issue, because it is nearly impossible to write all the rules that a business truly needs to be confident in their data. Often times, the math is *f(x) = columns * dbTables*. 100 columns on average and 500 tables in a single warehouse equals 50,000 rules if you only wrote 1 rule per column. The reality is you need many rules per column, and your business has more than 500 tables and files. But there are even bigger problems with this strategy. Rules are a reactive approach to solving the problem; they are manually written and don't adapt (they are static). With a rules-only approach, you can measure your franchise risk by the number of rules you can write. This requires coders, domain experts and a tool to write and then manage the rules.



500 tables

x

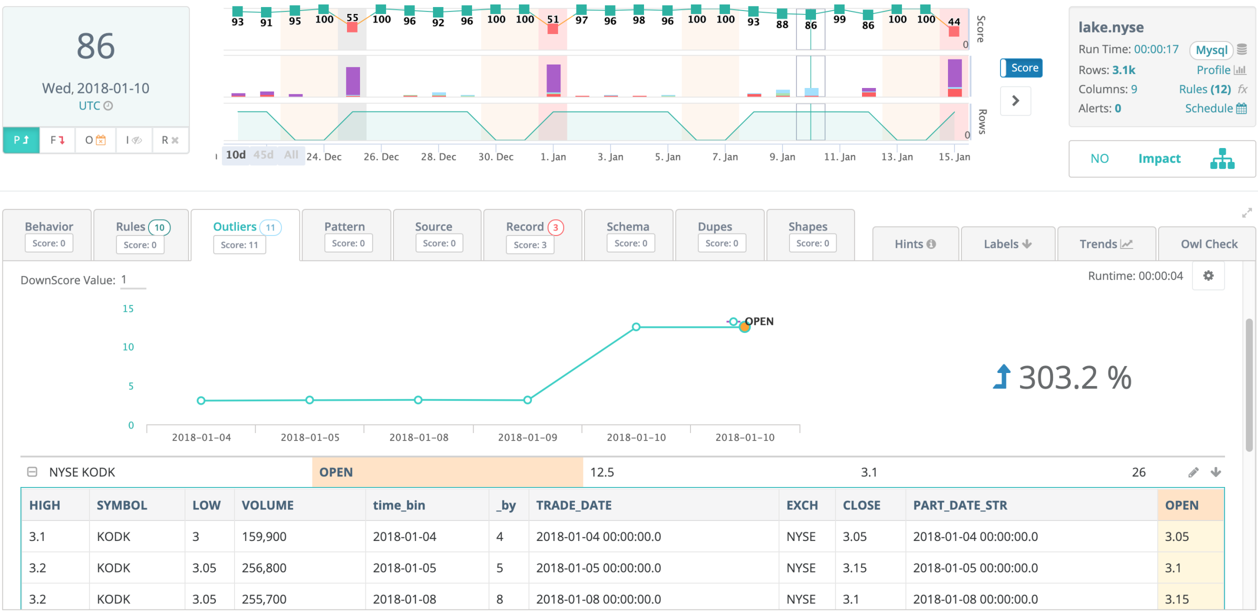
100 columns

=

50,000 Rules

How Can Predictive DQ Help?

DQ intentionally solves the problem using a machine learning first, rules second based approach. DQ automatically puts all columns under quality control. This includes *nullchecks, emptychecks, statistical profiles, and sketches.* DQ creates snapshots and baselines to benchmark past data and discover *drift*. DQ automatically creates an ML labeling system for users to collaborate and down-train items with a click of a button. The reason for this approach is to maximize coverage while reducing the dependency of manual rule building. The greater technical benefit is that all of DQ's generated checks and rules are adaptive. DQ is constantly learning from new data and will make predictions in many cases for typos, formatting issues, outliers and relationships. This is a paradigm shift **from**, *risk being a measure of how many rules one can dream up and write*, **to** *simply click the DQ [RUN] button*.



Run Time: 00:00:17

Rows: 3.1k

Columns: 9

Alerts: 0

DownScore Value: 1

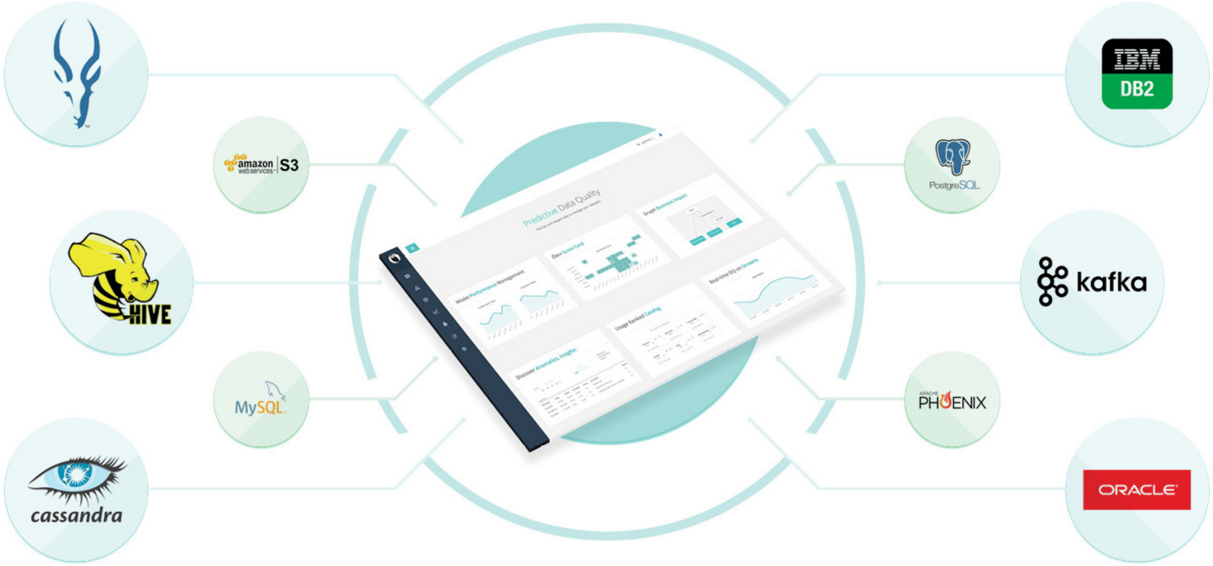
Runtime: 00:00:04

NYSE KODK | OPEN | 12.5 | 3.1 | 26

HIGH	SYMBOL	LOW	VOLUME	time_bin	_by	TRADE_DATE	EXCH	CLOSE	PART_DATE_STR	OPEN
3.1	KODK	3	159,900	2018-01-04	4	2018-01-04 00:00:00.0	NYSE	3.05	2018-01-04 00:00:00.0	3.05
3.2	KODK	3.05	256,800	2018-01-05	5	2018-01-05 00:00:00.0	NYSE	3.15	2018-01-05 00:00:00.0	3.1
3.2	KODK	3.05	255,700	2018-01-08	8	2018-01-08 00:00:00.0	NYSE	3.1	2018-01-08 00:00:00.0	3.15

Why a Unified DQ Solution?

Aren't their other DQ companies and solutions on the market? Yes, absolutely. The challenge lies in the vast number of ways IT groups consume and process data. You need to find a product that can plug into Files the same way it plugs into DB Tables, Cloud File Systems, Data Frames and Kafka Topics, etc. You need a product that offers a consistent feature set and covers all nine dimensions of DQ. For most companies, DQ is an after thought, they will add-on a single dimension of DQ, such as *rules* or *data drift.*DQ offers a full data quality suite to cover the unique challenges of each data set. Complete coverage and consistency drives trust. A single scoring and reporting framework with nine pluggable features that can be activated in a tailorable DQ pipeline. DQ is horizontally scaleable, it can scan data from any location with infinity scale. Data quality needs to be abstracted from data ingestion for management to have a single normalized view of data health.



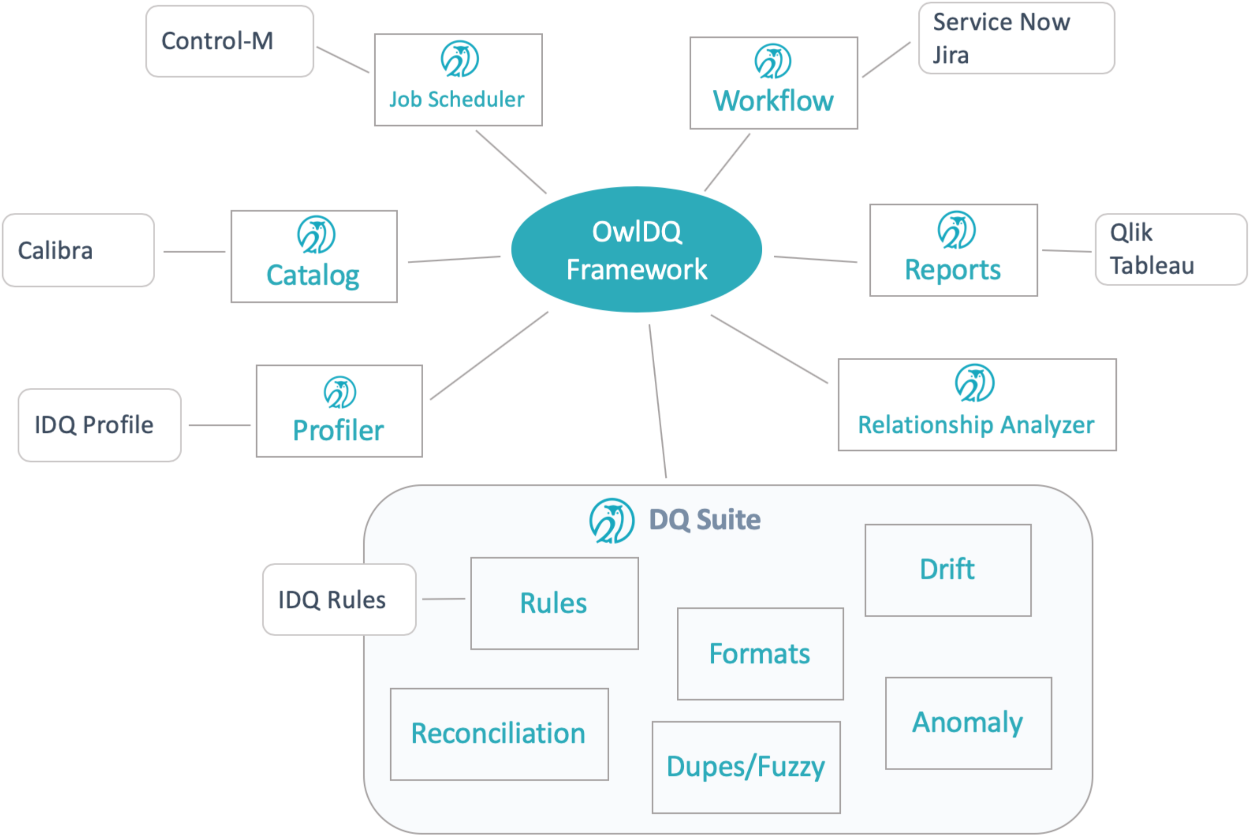
Do One Thing Extremely Well

DQ believes that data quality is such an important part of the data lifecycle that it requires a company that is solely committed to revolutionizing the way enterprises manage data quality. This is why DQ has a prescriptive approach to data quality (ML first, Rules second). The DQ software is purpose built for predicting and detecting data quality issues. Much like how Jira is used as the standard for software project management, even though it is absolutely possible to manage project line items in an excel sheet. Businesses that manage a lot of data require Score Cards, Alerts, Reports, List Views, Collaboration, Down Training, Cataloging, Scheduling and much more.

Get Started

Email us: info@collibra.com

Does your DQ Solution Have?



Unified DQ	The ability to score and manage and report on all datasets (files, tables, topics) agnostically. Providing a single pane of glass for DQ across all data sources.
Collaboration	The ability for end-users to down-train, annotate and audit each DQ item
Auto Discovery	The ability to figure out issues in your data without requiring domain experts and rule writers
Anomaly Detection	The ability to detect numeric and categorical outliers in a dataset
Correlation Analysis	The ability to measure the lift or relationship between numeric columns

Relationship Analysis	The ability to discover and make predictions on hidden relationships in your data
Alerting	The ability to send out alerts when DQ scores drop
Scheduling	The ability to schedule DQ jobs with a click of a button in the UI
Profiling	The ability to provide descriptive statistics about the current run overlaid with the past runs for trend analysis
Reconciliation	The ability to validate the source and target dataset in timeline snapshots
Duplicate Detection	The ability to find exact and similar matches in data records
Lineage Graphs	The ability to asses business impact via a business impact score by understanding how connected each dataset is
Schema Evolution	The ability to detect changes in data types, additions and removals
Rules	The ability to write custom rules for simple and complex scenarios

Our Story

Background

The Collibra DQ team comes from a variety of backgrounds. While some spent a decade building technology to detect financial crimes, others were architecting data fabrics at fortune 100 companies.

> *Regardless of the industry or experience, we all faced similar challenges as it related to data quality.*

These unique vantage points have allowed us to understand the most common data quality challenges organizations are facing.

What Did We Notice?

We tried many of the traditional tools and techniques. The biggest problem was always the amount of time it took to do everything needed to implement and maintain data quality controls.

You get left with half-baked data quality coverage and the right controls are added only after issues occur.

It turned out teams were doing the same tasks for every data set and for each department, building the exact same tools over and over again.

> **Note** The result was a never-ending cycle of data issues, fire drills, and a mad scramble to fix it fast. All within the context of real-time business operations.

Traditional Approach

Traditional approaches are very manual.

Start by opening a sample or spreadsheet and conduct analysis (table-by-table, column-by-column, query-by-query, and item-by-item).

Next, manually craft the rules, conditions, tolerances, and thresholds.

Then stitch together the dashboards, scoring, workflows, alerts, and reporting. And you wonder why bare-minimum coverage is common.

> **Note** You're only as good as the rules you thought to write.

Fast Forward

Now that the surface area of the data in an organization is so much larger, these traditional techniques don't hold up.

What Did We Need?

What we needed didn't exist. As lifelong data enthusiasts, we wanted a tool that could alert us when data changes occurred without complicated setup and lengthy analysis. We sought something that could work on big, medium, and small data and across all storage formats. Upon evaluating all the commercially available tools, and assessing costs and time of homegrown solutions, there were no great options.

DQ is the difference

Lake vs Swamp

The difference between a business-critical lake and a swamp is **data _quality_.** One organization’s data lake may be another's data swamp. The difference lies in how data is curated. A data lake describes a vast amount of data that can be stored, assessed, and analyzed. A data swamp has little data governance, DQ automation, or contextual metadata.

The accuracy and cleanliness of data is directly proportional to the quality of insights end-users will derive. Data lakes that gain broad adoption have strong governance programs. The challenge is, adding a DQ program typically takes 6-12 months but the project never really ends due to the volume, variety and velocity of incoming data. OwlDQ uses autoML so solve this problem. OwlDQ constantly monitors the lake with native integration and unlimited scale. Use OwlDQ to generate the equivalent of 10K rules, while continuously adapting to the natural variance in your data. When erroneous data enters your lake OwlDQ will alert the data steward and provide a rich visual displaying the break records and explainable AI describing the issue. OwlDQ's approach is to learn from data and become incrementally smarter each day to ensure a statistically defensible DQ program.

What is CDQ

CDQ is an intelligent data validation tool.

8 Ways to Add Value Using CDQ

1. **Crowdsourcing**

   “People that have never written SQL are now helping with data quality”

2. **Rule Coverage**

   “Did in 20 days what took 2 years with our legacy tool”

3. **Audit & Identify Gaps**

   “Audited our existing checks and could not imagine the gaps we uncovered.”

4. **Automate Repeatable Processes**

   “DQ cut 60% of our manual workloads”

5. **Technology Limitations**

   “We now scan files and Kafka, avoiding downstream issues”

6. **Getting standard**

   “No more piecemeal reports. Files, Warehouse, Lake. All metrics in one, transparent place.”

7. **Building Reports, Visuals, Workflows**

   “This takes the place of 3 tools”

8. **Prioritized Efforts**

   “Easy to see top priorities for improvement”

What Savings Does CDQ Provide?

Save Hours of Effort with Auto-generated Data Validation Checks

- **Top 10 Bank**
  Reduced 60% of their manual Data quality workload + $1.7M cost savings
- **Top 3 Healthcare Organization**
  Saved 2,000 hours during a cloud migration requirement
- **Top Insurance Organization**
  Satisfied Regulatory Second Line Controls in a 4 weeks (what originally took 2 years using their previous tool)

While Reducing System-Wide Pain Points

- Overwhelmed with tickets
- Business users find issues first
- Touchy pipelines break with minor updates
- Too busy responding to fire drills to implement new projects {% endhint %}

How Can CDQ Help?

Click a button and smile - knowing baseline validation checks are applied - instead of spending hours manually digging through data & stitching together scripts

- ☑ **Implementing Checks**
  - Autodiscovery
  - Generates SQL validations, parameters & thresholds
  - Rule suggestions

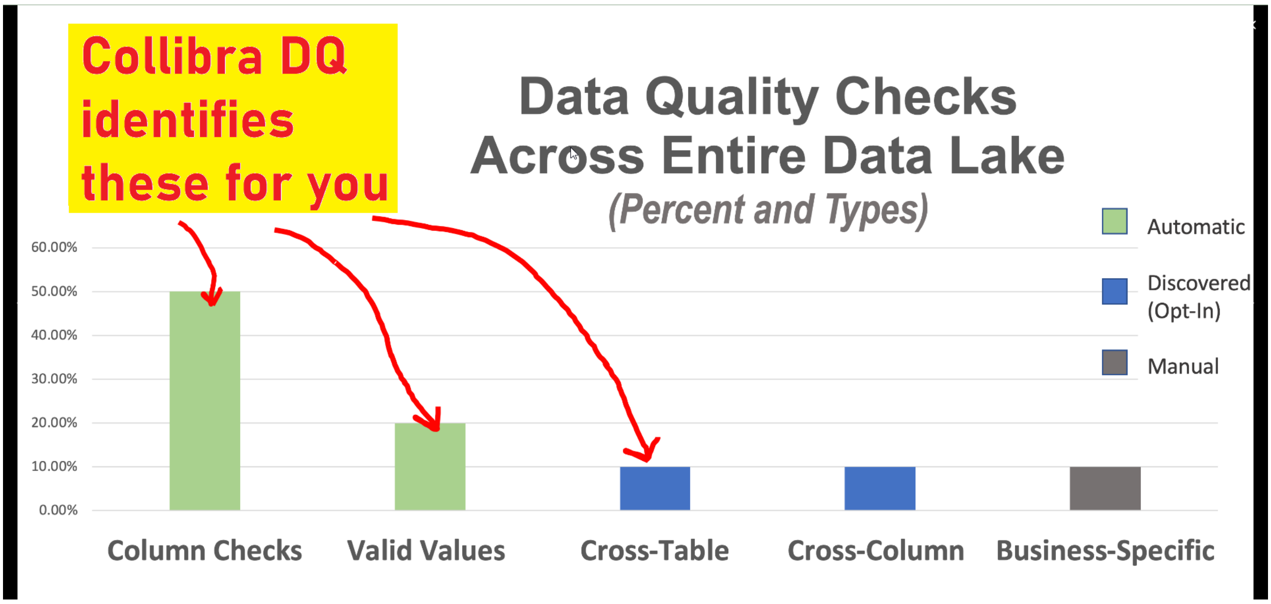
- ☑ **Taking Inventory**
  - Bulk Profiling & Metadata Collection
  - Data Mapping with Column Identification
  - Map Column Fingerprints, Cross-Table Matches & PII Checks
- ☑ **Consolidating Systems**
  - No more closed-systems or confusing scripts
  - Macro & micro views for measuring effectiveness over time
  - Global management Across Sources / Platforms / Environments
- ☑ **Enabling More Users**
  - Self-Service, Easy to use Rule Editor
  - Pre-Built Analytics and Charts
  - Extensible APIs, Open Architecture

Boost productivity. 80% faster than manual coding. Minimize development costs. Get faster, easier access to data quality metrics. Show line of business users how to self-service.

What **makes CDQ unique?**

CDQ is The Only Tool Business & Technical Users Will Love

Every feature, visual, and component within Collibra DQ is intended to make the analysis and implementation of data checks easier.



Why?

Because Humans Can’t Predict Every Which Way Data Can Go Wrong.

{% tabs %} {% tab title="Billing Issue Example" %}

{% endtab %}

{% tab title="Financial Data Example" %}

{% endtab %}

{% tab title="API Example" %}

{% endtab %}

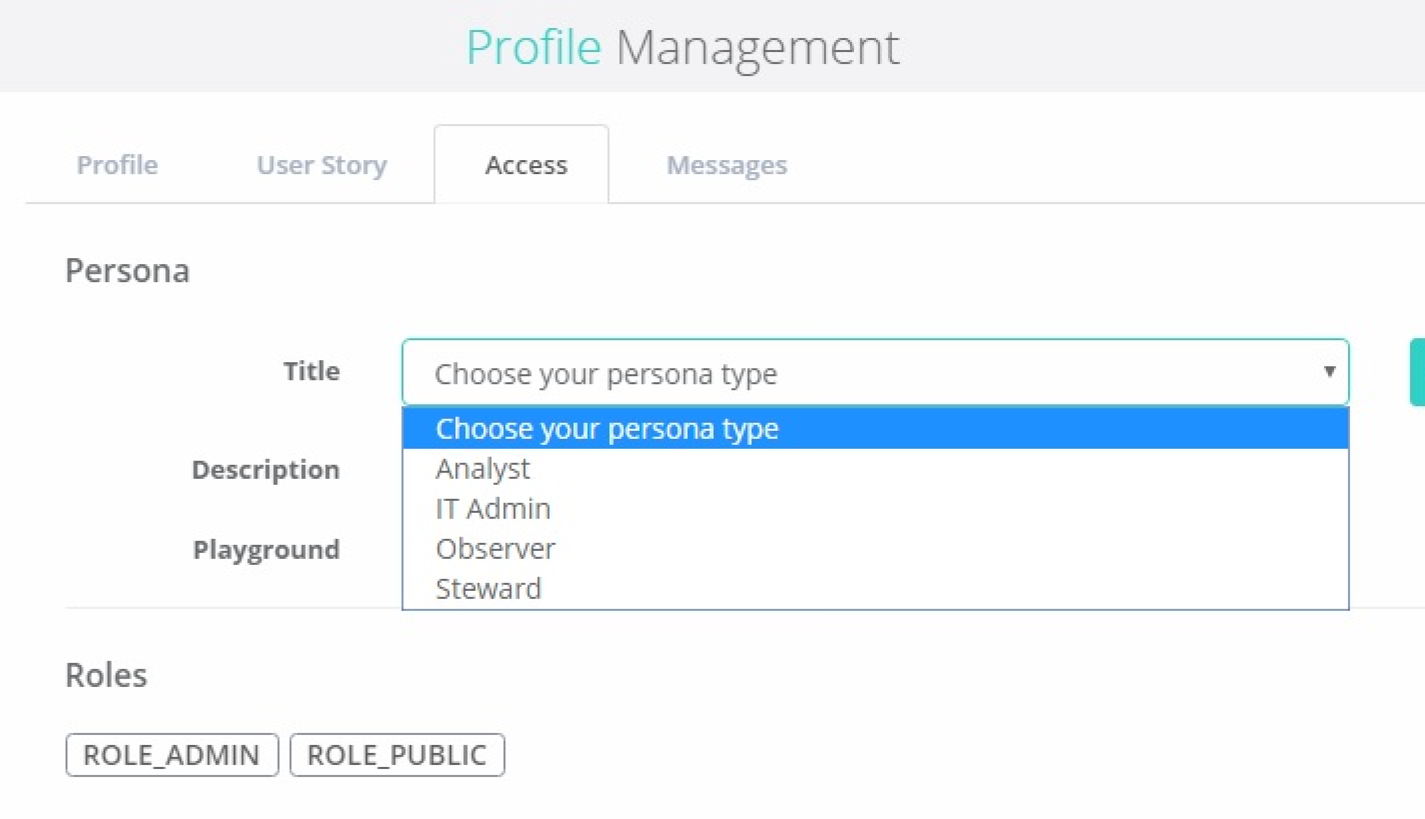
{% tab title="IoT / Meter Example" %}

{% endtab %} {% endtabs %}

****

Prescriptive Personas

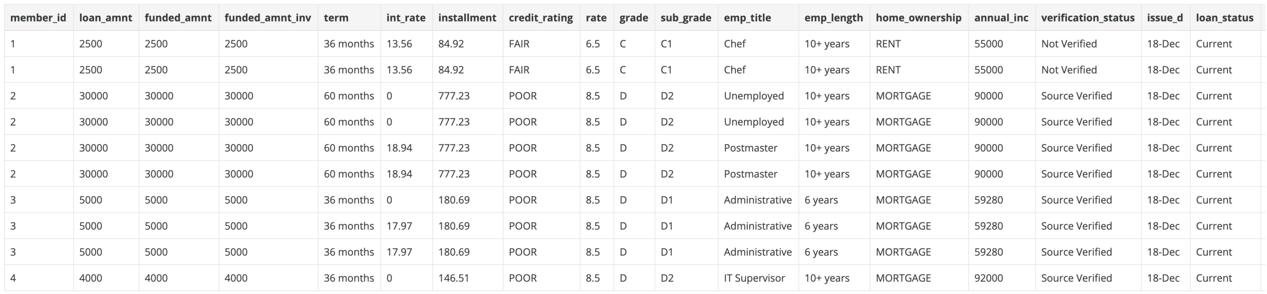
Collibra DQ has four prescriptive personas to manage user permissions: Analyst, IT Admin, Observer, and Steward. Click the user icon located on the bottom left of the blue DQ Menu bar and select **User Profile**. The persona type can be assigned under the access tab in Profile Management.



Bank Loans

It is common for banks to lend money in return for monthly payments with interest. However, to do so a bank must make sure that the applications are valid and well formed to begin the underwriting and approval process. The following list comprises some basic lending concepts to Collibra DQ.

1. Credit Score Validation
2. SSN Validation
3. Loan to Value Validation
4. Interest Rate Validation
5. Duplicate Loan Applications
6. Loan Amount Validation
7. Loan Completeness Validation



member_id	loan_amnt	funded_amnt	funded_amnt_inv	term	int_rate	installment	credit_rating	rate	grade	sub_grade	emp_title	emp_length	home_ownership	annual_inc	verification_status	issue_d	loan_status
1	2500	2500	2500	36 months	13.56	84.92	FAIR	6.5	C	C1	Chef	10+ years	RENT	55000	Not Verified	18-Dec	Current
1	2500	2500	2500	36 months	13.56	84.92	FAIR	6.5	C	C1	Chef	10+ years	RENT	55000	Not Verified	18-Dec	Current
2	30000	30000	30000	60 months	0	777.23	POOR	8.5	D	D2	Unemployed	10+ years	MORTGAGE	90000	Source Verified	18-Dec	Current
2	30000	30000	30000	60 months	0	777.23	POOR	8.5	D	D2	Unemployed	10+ years	MORTGAGE	90000	Source Verified	18-Dec	Current
2	30000	30000	30000	60 months	18.94	777.23	POOR	8.5	D	D2	Postmaster	10+ years	MORTGAGE	90000	Source Verified	18-Dec	Current
2	30000	30000	30000	60 months	18.94	777.23	POOR	8.5	D	D2	Postmaster	10+ years	MORTGAGE	90000	Source Verified	18-Dec	Current
3	5000	5000	5000	36 months	0	180.69	POOR	8.5	D	D1	Administrative	6 years	MORTGAGE	59280	Source Verified	18-Dec	Current
3	5000	5000	5000	36 months	17.97	180.69	POOR	8.5	D	D1	Administrative	6 years	MORTGAGE	59280	Source Verified	18-Dec	Current
3	5000	5000	5000	36 months	17.97	180.69	POOR	8.5	D	D1	Administrative	6 years	MORTGAGE	59280	Source Verified	18-Dec	Current
4	4000	4000	4000	36 months	0	146.51	POOR	8.5	D	D2	IT Supervisor	10+ years	MORTGAGE	92000	Source Verified	18-Dec	Current

1. Credit Score

Business Check	OwlDQ Feature	Manual vs Auto
Is the credit score a whole number?	BEHAVIOR	AUTO

Business Check	OwlDQ Feature	Manual vs Auto
Is the credit score within a valid range? (between 300 - 850)	RULE	credit_ score between 300 and 850
Is the credit score NULL or Missing?	BEHAVIOR	AUTO

2. SSN Validation

Business Check	Collibra DQ Feature	Text
Is the SSN format valid?	RULE	AUTO-SSN detection
SSN is PII.	SENSITIVITY	AUTO-SSN labeled
Is the SSN NULL or Missing?	BEHAVIOR	AUTO
Does the SSN belong to the Applicant?	PATTERN	SSN -> first_name, last_name

3. Loan to Value

Business Check	Collibra DQ Feature	Text
Are loan amount and asset value (home or auto) valid numbers?	BEHAVIOR	AUTO
95% loan to value ratio to approve?	RULE	loan / asset_value < .95

4. Interest Rate

Business Check	OwlDQ Feature	Text
Interest rate between min and max allowable range for the loans credit rating.	RULE COMPLEX	loan l join rates r on l.credit_rating = r.credit_rating where l.rate between r.min_rate and r.max_rate

5. Duplicate Loan Applications

Business Check	OwlDQ Feature	Manual vs Auto
Ensure we don't issue the same loan twice.	DUPE	first_n, last_n, SSN, Address

6. Loan Amount

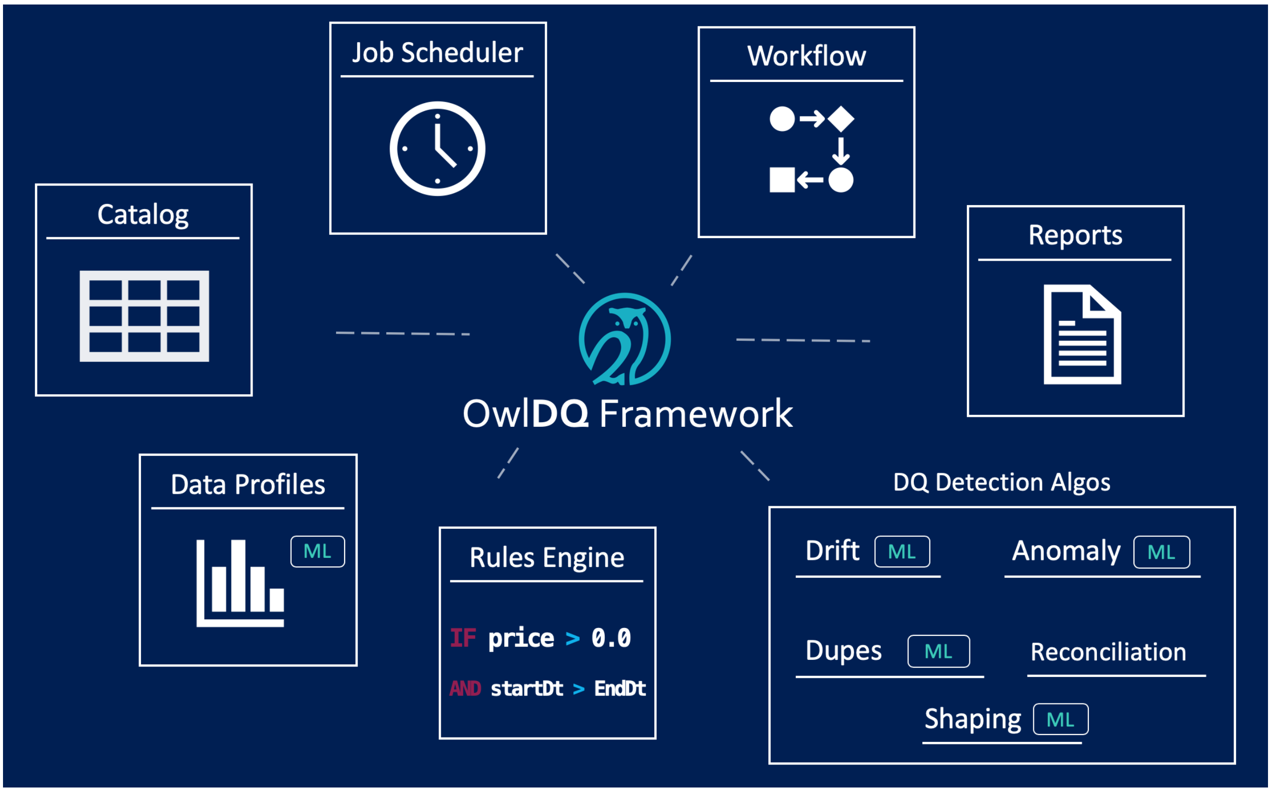
Business Check	OwlDQ Feature	Manual vs Auto
Loan amount within lendable range	OUTLIER	AUTO
Loan amount within lendable range. Only lend money between 50K and 3M.	RULE	loan_amount between 50000 and 3000000

Resulting OwlCheck

```
-lib "/home/opt/owl/drivers/postgres" \
-cxn postgres-gcp \
-q "select * from public.loan_risk_grade where last_pymnt_d =
'2019-04-01'" \
-key member_id -alias loan_risk \
-ds public.loan \
-rd "2019-04-01" \
-dl -loglevel INFO \
-h 10.142.0.29:5432/owltrunk \
-numexecutors 10 -executormemory 1g -drivermemory 4g \
-master yarn -deploymode cluster \
-sparkprinc user2@CW.COM \
-sparkkeytab /tmp/user2.keytab -tbin MONTH \
-dupe -dupeinc purpose -fpgon -fpgkey grade \
-fpginc grade,sub_grade -fpglb 365 -fpgdc last_pymnt_d \
-record member_id -dupecutoff 60 -dupepermatchupperlimit 99
```

Which components did we use?

We made use of Profiles, Duplicates, Outliers and Rules in this example. The experiments were automatically cataloged and put on a job scheduler. The next time a loan issue arises, we will be able to take remediation action using the workflow Q. Over time we can see how the bank loan program is running via the report section.



Files that can be used to replicate this example

interest_rates.csv

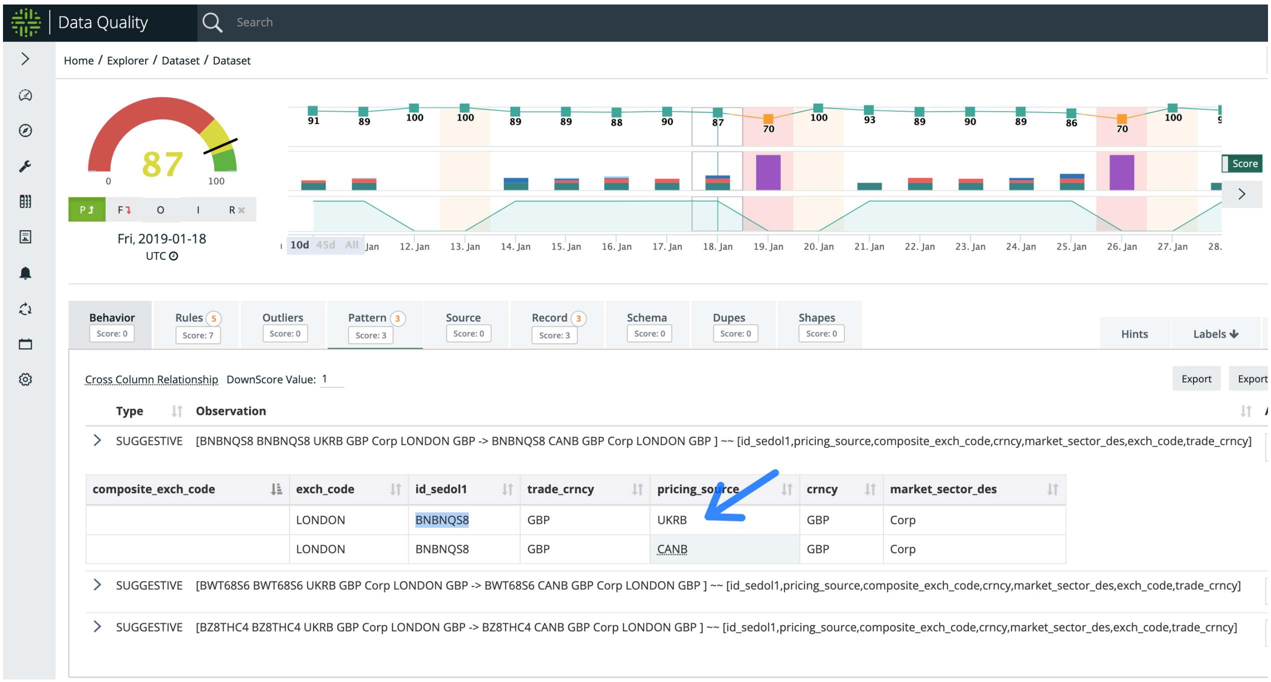
Binary

Owl Dataset (2).csv

Binary

Bloomberg Data

Collibra DQ finds over 50 data quality issues per day in common market data through pattern mining. Sequential pattern mining is a tool that finds statistically relevant patterns between data examples where the values are delivered in a sequence.



Cross Column Relationship DownScore Value: 1

Type	Observation
SUGGESTIVE	[BNBNQS8 BNBNQS8 UKRB GBP Corp LONDON GBP -> BNBNQS8 CANB GBP Corp LONDON GBP] ~~ [id_sedol1,pricing_source,composite_exch_code,crncy,market_sector_des,exch_code,trade_crncy]

composite_exch_code	exch_code	id_sedol1	trade_crncy	pricing_source	crncy	market_sector_des
	LONDON	BNBNQS8	GBP	UKRB	GBP	Corp
	LONDON	BNBNQS8	GBP	CANB	GBP	Corp

Type	Observation
SUGGESTIVE	[BWT68S6 BWT68S6 UKRB GBP Corp LONDON GBP -> BWT68S6 CANB GBP Corp LONDON GBP] ~~ [id_sedol1,pricing_source,composite_exch_code,crncy,market_sector_des,exch_code,trade_crncy]
SUGGESTIVE	[BZ8THC4 BZ8THC4 UKRB GBP Corp LONDON GBP -> BZ8THC4 CANB GBP Corp LONDON GBP] ~~ [id_sedol1,pricing_source,composite_exch_code,crncy,market_sector_des,exch_code,trade_crncy]

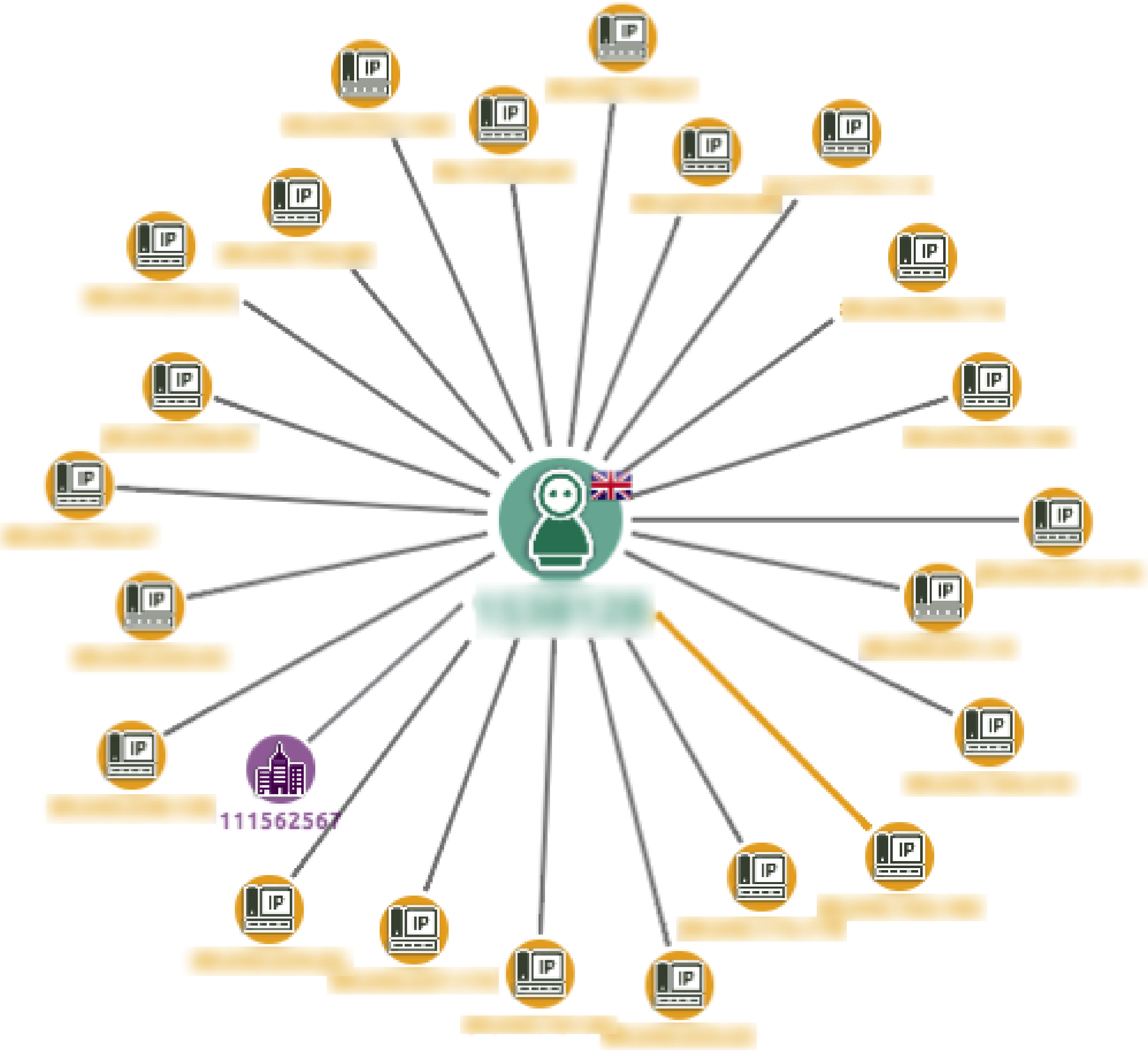
Cyber Anomalies in Real-Time

With an increasing number of cyber threats, most of the cyber security team doesn't have the capacity to manually detect, monitor, and defend against all of them. Effective cyber threat management requires leveraging automation to inform decisions.

The Collibra DQ framework, provides organizations the ability to load and process diverse security data feeds at scale to detect network data anomalies. The DQ alerts enable network admins to respond to these events in timely manner.

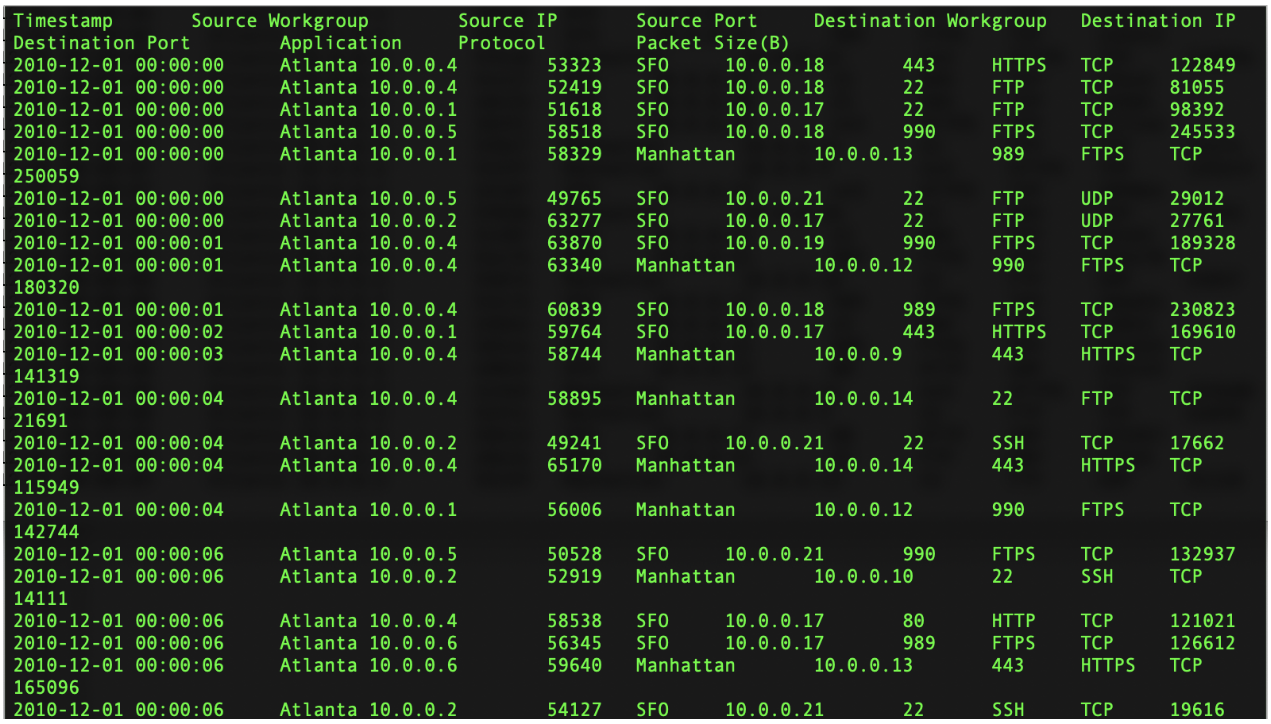
The following scenario demonstrates how to detect anomalies with network traffic data sets.

1. Perform IP address validation.
2. Detect the unusual network traffic patterns based on locations.
3. Identify the suspicious packets based on size.
4. Detect the malicious activity based on source and destination IP addresses.



Infosec data set preview

Data set contains Timestamp, Source Workgroup, Source IP, Source Port, Destination Workgroup, Destination IP, Destination Port, Application, Protocol and Packet size information.



```
Timestamp       Source Workgroup        Source IP       Source Port     Destination Workgroup   Destination IP
Destination Port        Application     Protocol        Packet Size(B)
2010-12-01 00:00:00     Atlanta 10.0.0.4        53323   SFO     10.0.0.18       443     HTTPS   TCP     122849
2010-12-01 00:00:00     Atlanta 10.0.0.4        52419   SFO     10.0.0.18       22      FTP     TCP     81055
2010-12-01 00:00:00     Atlanta 10.0.0.1        51618   SFO     10.0.0.17       22      FTP     TCP     98392
2010-12-01 00:00:00     Atlanta 10.0.0.5        58518   SFO     10.0.0.18       990     FTPS    TCP     245533
2010-12-01 00:00:00     Atlanta 10.0.0.1        58329   Manhattan       10.0.0.13       989     FTPS    TCP
250059
2010-12-01 00:00:00     Atlanta 10.0.0.5        49765   SFO     10.0.0.21       22      FTP     UDP     29012
2010-12-01 00:00:00     Atlanta 10.0.0.2        63277   SFO     10.0.0.17       22      FTP     UDP     27761
2010-12-01 00:00:01     Atlanta 10.0.0.4        63870   SFO     10.0.0.19       990     FTPS    TCP     189328
2010-12-01 00:00:01     Atlanta 10.0.0.4        63340   Manhattan       10.0.0.12       990     FTPS    TCP
180320
2010-12-01 00:00:01     Atlanta 10.0.0.4        60839   SFO     10.0.0.18       989     FTPS    TCP     230823
2010-12-01 00:00:02     Atlanta 10.0.0.1        59764   SFO     10.0.0.17       443     HTTPS   TCP     169610
2010-12-01 00:00:03     Atlanta 10.0.0.4        58744   Manhattan       10.0.0.9        443     HTTPS   TCP
141319
2010-12-01 00:00:04     Atlanta 10.0.0.4        58895   Manhattan       10.0.0.14       22      FTP     TCP
21691
2010-12-01 00:00:04     Atlanta 10.0.0.2        49241   SFO     10.0.0.21       22      SSH     TCP     17662
2010-12-01 00:00:04     Atlanta 10.0.0.4        65170   Manhattan       10.0.0.14       443     HTTPS   TCP
115949
2010-12-01 00:00:04     Atlanta 10.0.0.1        56006   Manhattan       10.0.0.12       990     FTPS    TCP
142744
2010-12-01 00:00:06     Atlanta 10.0.0.5        50528   SFO     10.0.0.21       990     FTPS    TCP     132937
2010-12-01 00:00:06     Atlanta 10.0.0.2        52919   Manhattan       10.0.0.10       22      SSH     TCP
14111
2010-12-01 00:00:06     Atlanta 10.0.0.4        58538   SFO     10.0.0.17       80      HTTP    TCP     121021
2010-12-01 00:00:06     Atlanta 10.0.0.6        56345   SFO     10.0.0.17       989     FTPS    TCP     126612
2010-12-01 00:00:06     Atlanta 10.0.0.6        59640   Manhattan       10.0.0.13       443     HTTPS   TCP
165096
2010-12-01 00:00:06     Atlanta 10.0.0.2        54127   SFO     10.0.0.21       22      SSH     TCP     19616
```

IP Address format validation

Business Check	Collibra DQ Feature	Text
Is IP a valid format?	RULE	AUTO-IP detection
Is the IP address NULL or Missing?	BEHAVIOR	AUTO

Source and destination workgroups

Business Check	OwlDQ Feature	Text
Is it usual network traffic based on locations?	PATTERN	Source_Workgroup -> Destination_Workgroup

Source and Destination IP Address validation

Business Check	Collibra DQ Feature	Text
Is it usual network traffic based on source and destination IP?	PATTERN	Source_IP -> Destination_IP

Packet Size

Business Check	Collibra DQ Feature	Text
Is the Packet Size NULL or Missing?	BEHAVIOR	AUTO
Packet Size within normal range?	PATTERN	Source_IP -> Packet_SizeB

Resulting OwlCheck

```
-f file:///home/danielrice/owl/bin/demos/infosec/ -d tab \
-fullfile -fq "select * from dataset" -encoding UTF-8 -ds
infosecv2 \
-rd "2020-04-04" -dl -dlinc Destination_IP,Packet_SizeB,Source_
IP \
-dlkey Source_IP -fpgon -fpginc Destination_Workgroup -fpgkey
Source_Workgroup \
-df "yyyy-MM-dd" -loglevel INFO -h 10.142.0.29:5432/owltrunk -
owluser admin \
-fpgsupport .000000001 -fpgconfidence 0.4
```

Which components did we use?

DQ addresses the issue of efficient network traffic classification by performing unsupervised anomaly detection and uses this information to create dynamic rules that classify huge amounts of Infosec data in real time.

By providing Infosec data sets, along with anomaly records DQ outlier and pattern algorithms found the anomaly in the network traffic. It mainly detects the following anomalies:

1. Traffic between Atlanta->Texas.
2. The packet size extremely low between Atlanta->Texas.
3. Atlanta source IP and Texas Destination IP.

Realtime DQ provides the alerts on network traffic anomalies, which can help network admins to do further deep analysis and takes preventative measure, which is a daunting task with huge amount of data.

Sample Data set

infosec-anomaly.csv

Binary

Financial FxRate Data

Collibra DQ Automatically Alerts to Incorrect Foreign Exchange (FX) Rate Data without a Single Rule

FX Rate data commonly looks like the below table. Often you have a TO currency and a FROM currency with the RATE being the multiplier column for conversion. For example, in March you would need to spend $1 US Dollar and 18 US cents to receive $1 Euro. "In exchange for":

TO_CURR	FROM_CURR	RATE	DATE
USD	EUR	0.82	2019-03-12
EUR	USD	1.18	2019-03-12
USD	YEN	111.0	2019-03-12

28,000 Currency Pairs

There are roughly 28,000 currency pairs and the exchange rates change throughout the day but at a minimum most banks are concerned with the daily close of the FX Rate. Now imagine trying to write a rule for each currency pair. You'd have to know the relationship and adjust a static threshold for each of the 28K pairs every couple of days to keep the rule intact. Our minds quickly jump to a conclusion that we might be able to solve this with simple math. We can get closer using averages or percent change formulas but these formulas quickly come up short when some currencies commonly fluctuate more than others. Our minds then quickly graduate from stats 101 to 201 and we could consider the individual variance of every combination. But even this only gets us so far as time is an important dimension, the length of time or window can often be tricky to calculate. The problem gets harder when you run your basic stat model and receive multiple false positive alerts. Signal-to-noise ratio is important, confidence factors are important and down-training individual foreign currencies that don't seem to fit your statical model are important. Knowing if you copied the data incorrectly, truncated nine levels of precision on the decimal, or if the source provider sent the wrong information is important. Needing the ability to flag exceptions in production on a single currency pair while *not* flagging the other 27,445 pairs. Using a feedback loop so that the data steward interactions are captured and learned from vs having to take the same corrective action over and over. What happens when there is a typo in the currency pair or a single pair goes missing? The answer is that rules don't scale and we need much more than just one off statistical metrics to have a robust and trust worthy data quality program.

Consistency

Even when it is possible to deploy a team of smart people to build a solution to handle this use case, the question then becomes "but what about all my other data, don't I want similar yet different controls on everything?" Especially since FX Rate data by itself doesn't mean that much and is often combined with a number of other data sets to produce value. What if those data sets aren't accurate either? But those data sets have very different columns, different relationships and different time windows. DQ takes an auto-learning approach whereby it interrogates and runs fitness tests against each data set individually to devise the best statistical and learning approach. The goal being to provide an automated and elegant way to have consistent controls across all your data sets.

Auto Adapting OwlCheck for FxRate Data

```
-ds fx_rate \
-rd $rd \
-dl \
-dlkey TO_CURR,FROM_CURR \
-q "select * from FX_RATE where date = '${rd}'" \
-cxn dbConnName \
-dupe -dupeinc TO_CURR,FROM_CURR -depth 0
```

What this OwlCheck Does

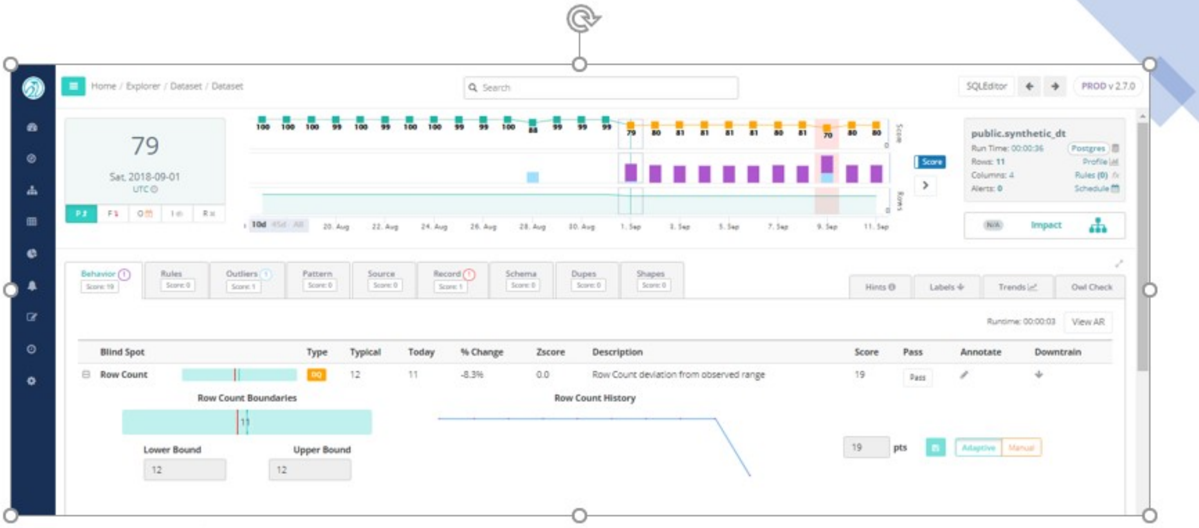
- Automatic correlation and relationship analysis
- Histograming and segmentation analysis
- Anomaly detection
- Currency pair tracking
- Schema evolution
- Removes 28K static rules
- Duplicate detection for redundant currency pairs

Healthcare Data Quality

Collibra DQ connects all members of the healthcare continuum with trustworthy, timely, and meaningful patient data, while reducing the time, expense, and effort required by 70 percent.

Poor data quality in healthcare is the leading problem that maligns patient outcomes. Hospitals and health information exchanges (HIEs) still struggle with patient matching issues, with most citing data quality problems and poor algorithms as top barriers to patient matching. Correctly linking patient data across organizations is a key element of value-based care, patient safety, and care coordination. Duplicate or mismatched records can result in privacy risks, claim denials, redundant medical tests or procedures, and reporting errors.

The lack of accurate and reliable data quality in healthcare leads to dire consequences that are completely preventable, as shown in DQ's troponin example below. Complete and accurate data is a vital component of our complex health system, and anything less is an unacceptable risk. DQ provides the predictable data quality that healthcare organizations need to deliver high-quality care that we all strive to achieve.



public.synthetic_dt
Run Time: 00:00:36 Postgres
Rows: 11 Profile
Columns: 4 Rules (0)
Alerts: 0 Schedule

Behavior Score: 19 | Rules Score: 0 | Outliers Score: 1 | Pattern Score: 0 | Source Score: 0 | Record Score: 1 | Schema Score: 0 | Dupes Score: 0 | Shapes Score: 0

Runtime: 00:00:03

Blind Spot	Type	Typical	Today	% Change	Zscore	Description	Score	Pass	Annotate	Downtrain
Row Count	DQ	12	11	-8.3%	0.0	Row Count deviation from observed range	19	Pass		

Lower Bound: 12
Upper Bound: 12
19 pts

Health Insurance Claims Data

Poor data quality is the primary cause for diagnostic providers receiving incomplete health care payments during Revenue Cycle Management (RCM).

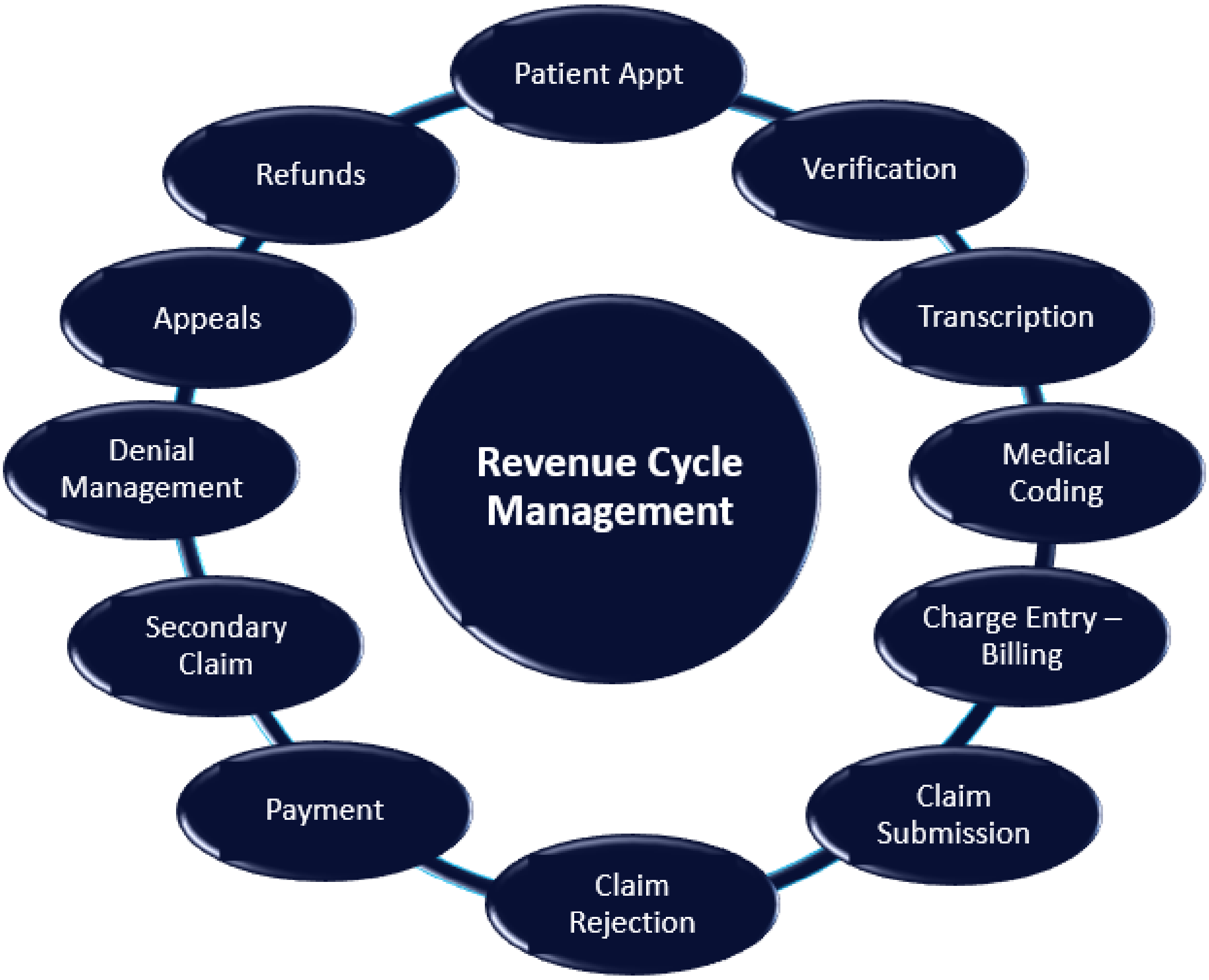
Revenue Cycle Management is the process of identifying, collecting and managing the practice's revenue from payers based on the services provided. A complete RCM process is critical for a healthcare practice to maintain financial viability and continue to provide quality care for their patients.

Inaccurate claims data, is the primary cause for diagnostic providers receiving incorrect payments for their services. Most providers struggle with the quality of the data that they receive, and without direct access to the patients, it can be an expensive, laborious process to correct incomplete, or missing data that is required for claim reimbursement.

Cleaning up or correcting incomplete data is not a step in the claims process that can be skipped. It must be done to assure the reimbursement process is accurate, and complete in the agreed time frame. Automating the data quality during intake is the key to the timely completion of the reimbursement process, and saving the cost and effort of correcting the data down stream.

```
Increase revenue from insurance and patient payments
Spend less time tracking down missing patient information
Lower error processing rates
Reduce operating costs
Improve claim processing speed
```

The revenue cycle includes all the administrative and clinical functions that contribute to the capture, management and collection of patient service revenue, according to the Healthcare Financial Management Association.



```
Preregistration - Collecting preregistration information
Verification - Patient eligibility and benefit is verified
Transcription - recording the diagnoses and procedure
Medical Coding - Properly coding diagnoses and procedures.
Charge capture - Medical services into billable charges.
Claim submission - Submitting claims to insurance companies.
Claim Rejection - when necessary
Payment Posting - Determining patient balances, collection
Secondary Claim Submission
Denial Management - Applying or rejecting payments remittance
Medical Appeals - Examining the necessity of medical services.
Refund - where aplicable
```

Intraday Positions

It is common for financial organizations to receive a steady stream of files that have hourly or minutely data. The files might trail the market in a near real-time fashion. Below is an example:

```
--positions/
   |--2019/
     |--01/
       |--22/
         position_2019_01_22_09.csv
         position_2019_01_22_10.csv
         position_2019_01_22_11.csv
         position_2019_01_22_12.csv
```

File Contents @ 9am

TIME	COMPANY	TICK	SIDE	QTY
2019-01-22 09:00	T&G	xyz	LONG	300
2019-01-22 09:00	Fisher	abc	SHORT	20
2019-01-22 09:00	TradeServ	def	LONG	120

File Contents @ 10am

TIME	COMPANY	TICK	SIDE	QTY
2019-01-22 10:00	T&G	xyz	LONG	280
2019-01-22 10:00	BlackTR	ghi	SHORT	45

Notice that during the day you may or may not have a position for every company recorded. We need a way to link the "company" to its position throughout the day but not alert in cases where they simply did not trade or adjust their position. Collibra DQ offers real-time outlier detection for this scenario (see code snippet below). We also need to ensure that each company's position is only represented once per file (per hour in this case) because positions are already the aggregate view of the trades, so they should be unique. DQ offers duplicate detection (see code snippet below).

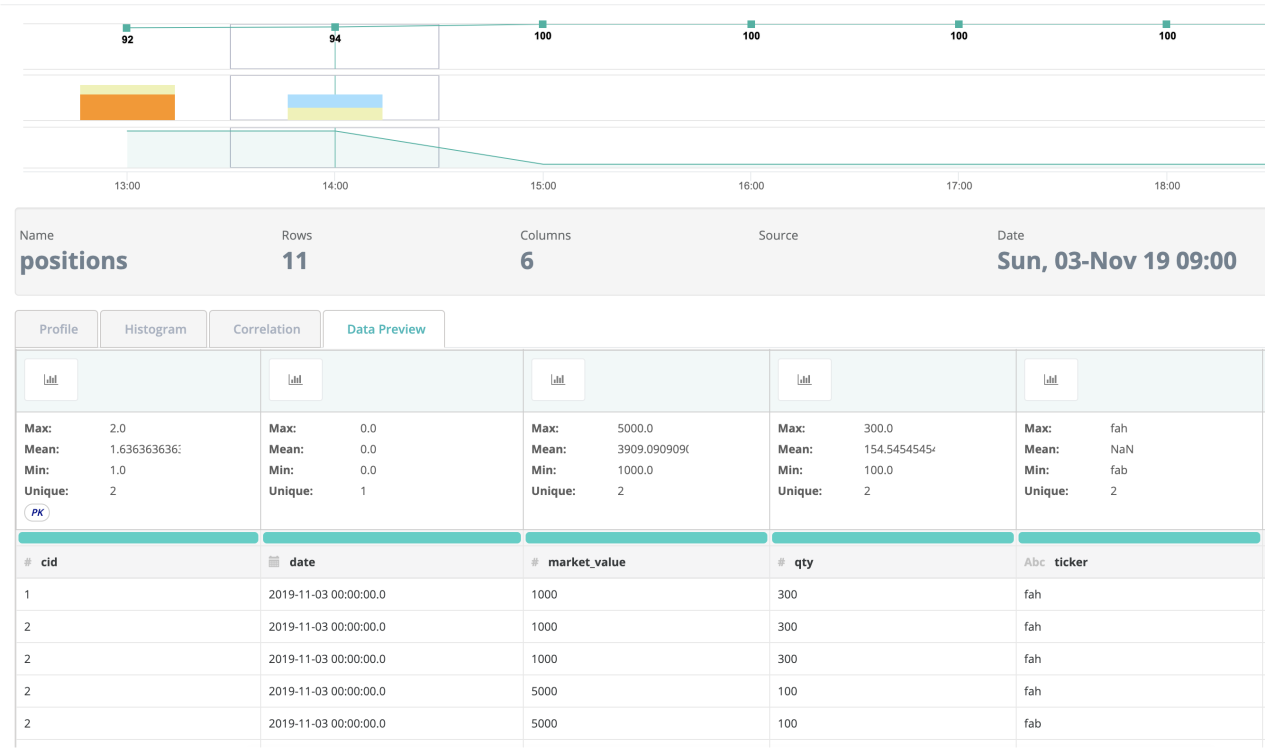
Chapter 15

Collibra DQ Pipeline

```
// Part of your pipeline includes the ingestion of files that
have the date
// and hour encoded in the file name. How do you process those
files using Owl?
//
// Format: <name>_<year>_<month>_<day>.csv

val filePath = // <set this> positions/2019/01/22/positions_
2019-01-22_09.csv

// Configure Owl.
val opt = new OwlOptions
opt.dataset = "positions"
opt.load.delimiter = ","
opt.load.fileQuery = "select * from dataset"
opt.load.filePath = file.getPath

opt.outlier.on = true
opt.outlier.key = Array("COMPANY")
opt.outlier.timeBin = TimeBin.HOUR

opt.dupe.on = true
opt.dupe.include = Array("COMPANY", "TICK")
opt.dupe.exactMatch = true

// Parse the filename to construct the run date (-rd) that will
be passed
// to Owl.
val name = file.getName.split('.').head
val parts = name.split("_")
val date = parts.slice(2, 5).mkString("-")
val hour = parts.takeRight(1).head

// Must be in format 'yyyy-MM-dd' or 'yyyy-MM-dd HH:mm'.
val rd = s"${date} ${hour}"

// Tell Owl to process data
opt.runId = rd

// Create a DataFrame from the file.
val df = OwlUtils.load(opt.load.filePath, opt.load.delimiter,
spark)

// Instantiate an OwlContext with the dataframe and our custom
configuration.
val owl = OwlUtils.OwlContext(df, spark, opt)

// Make sure Owl has catalogued the dataset.
```

```
owl.register(opt)

// Let Owl do the rest!
owl.owlCheck
```

DQ Web



Name	Rows	Columns	Source	Date
positions	11	6		Sun, 03-Nov 19 09:00

Max: 2.0	Max: 0.0	Max: 5000.0	Max: 300.0	Max: fah
Mean: 1.6363636363	Mean: 0.0	Mean: 3909.0909090	Mean: 154.54545454	Mean: NaN
Min: 1.0	Min: 0.0	Min: 1000.0	Min: 100.0	Min: fab
Unique: 2	Unique: 1	Unique: 2	Unique: 2	Unique: 2

# cid	date	# market_value	# qty	Abc ticker
1	2019-11-03 00:00:00.0	1000	300	fah
2	2019-11-03 00:00:00.0	1000	300	fah
2	2019-11-03 00:00:00.0	1000	300	fah
2	2019-11-03 00:00:00.0	5000	100	fah
2	2019-11-03 00:00:00.0	5000	100	fab

DQ Coverage for Position data

- Schema evolution
- Profiling
- Correlation analysis
- Segmentation
- Outlier detection
- Duplicate detection
- Pattern mining

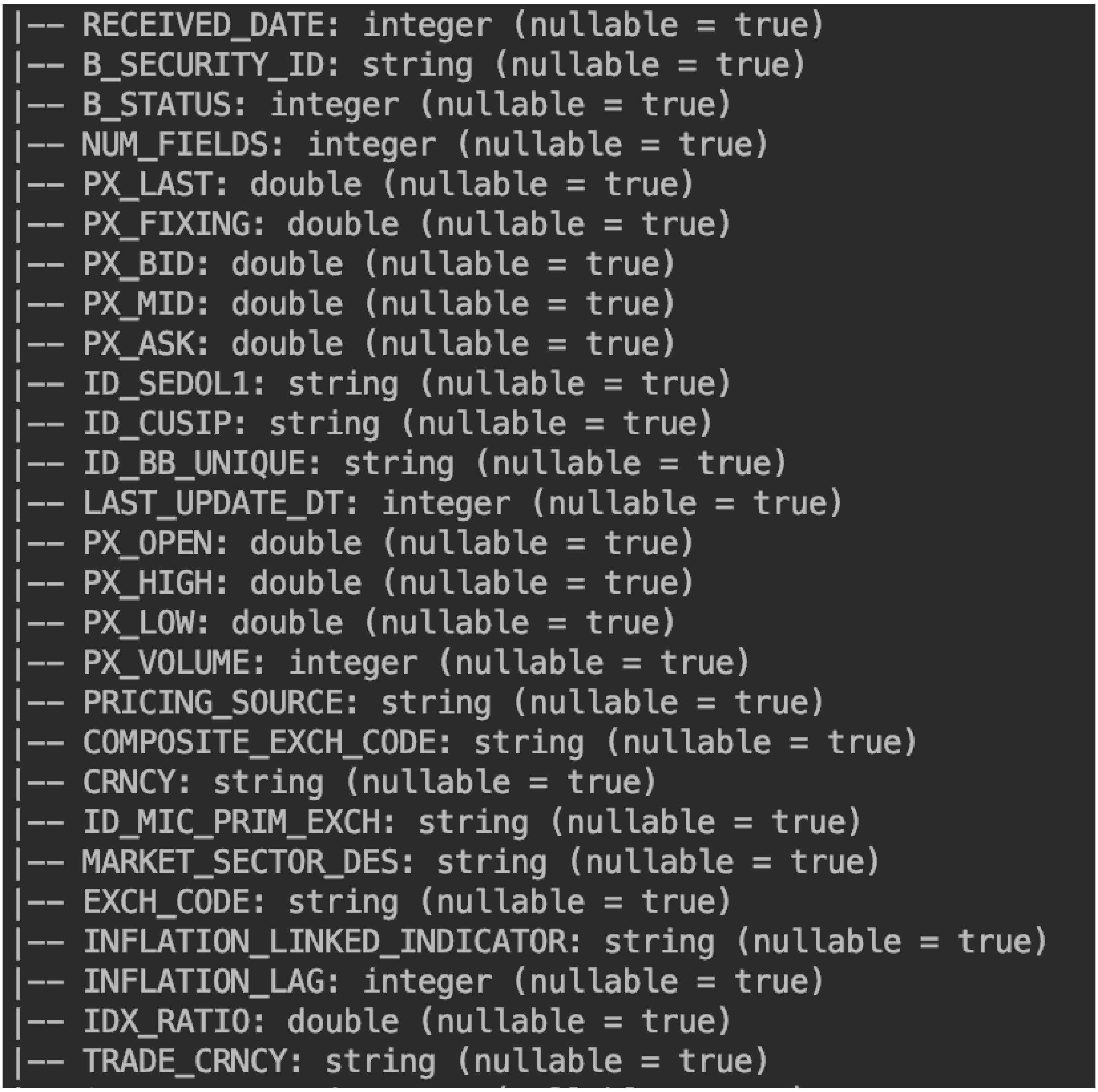
Security Reference Data

Pattern recognition for cross column, categorical, and conditional relationships.

Given the interconnected, automated nature of the data generated by reporting, exchanges, and source systems - hidden patterns go unnoticed.

Financial firms of all shapes and sizes ingest financial data for a variety of reasons. A few vendors include Bloomberg, Thomson Reuters, ICE Data Services or SIX Financial Information.

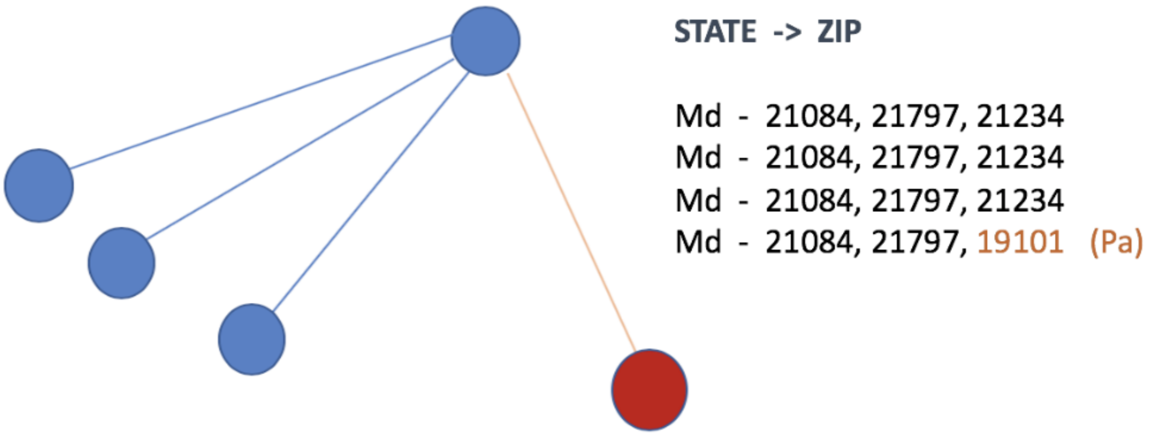
> **Note** **In no uncertain terms, critical business decisions rely on the accuracy of this data.**



```
|-- RECEIVED_DATE: integer (nullable = true)
|-- B_SECURITY_ID: string (nullable = true)
|-- B_STATUS: integer (nullable = true)
|-- NUM_FIELDS: integer (nullable = true)
|-- PX_LAST: double (nullable = true)
|-- PX_FIXING: double (nullable = true)
|-- PX_BID: double (nullable = true)
|-- PX_MID: double (nullable = true)
|-- PX_ASK: double (nullable = true)
|-- ID_SEDOL1: string (nullable = true)
|-- ID_CUSIP: string (nullable = true)
|-- ID_BB_UNIQUE: string (nullable = true)
|-- LAST_UPDATE_DT: integer (nullable = true)
|-- PX_OPEN: double (nullable = true)
|-- PX_HIGH: double (nullable = true)
|-- PX_LOW: double (nullable = true)
|-- PX_VOLUME: integer (nullable = true)
|-- PRICING_SOURCE: string (nullable = true)
|-- COMPOSITE_EXCH_CODE: string (nullable = true)
|-- CRNCY: string (nullable = true)
|-- ID_MIC_PRIM_EXCH: string (nullable = true)
|-- MARKET_SECTOR_DES: string (nullable = true)
|-- EXCH_CODE: string (nullable = true)
|-- INFLATION_LINKED_INDICATOR: string (nullable = true)
|-- INFLATION_LAG: integer (nullable = true)
|-- IDX_RATIO: double (nullable = true)
|-- TRADE_CRNCY: string (nullable = true)
```

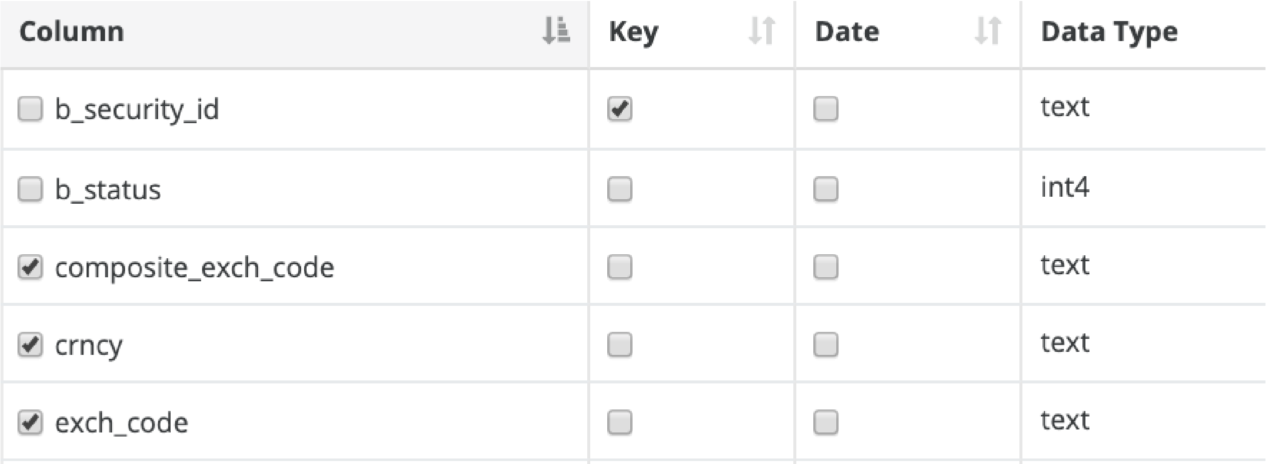
This data is not monolithic and most real-world data easily consists of over 100 columns. Maintaining the quality can be challenging, given the variety of sources feeding into just a single feed. Even the most simple quality checks can snowball into a daunting task. Everything from tickers, sedols, cusips, products, sub-products, issuers, and issuing countries can further complicate the problem. Identifying anomaly values earlier in the data ingestion process can significantly reduce downstream complexity. Furthermore, finding improbable patterns before they're used for making decisions can save costly remediation efforts.

An easy way to think about Pattern Analysis. Columns that belong 'together'.



A common application of Collibra DQ is to identify securities that are violating historical patterns. Conditional dependencies can be discovered and used as a guide to highlight misreporting. Rather than defining look-up tables, reference data sets, and predefining exact conditions - security specific patterns can be derived using probabilistic inferences.

By clicking columns that belong together, a robust framework for cross-column pattern analysis can be generated. The equivalent of dozens of multi-column, conditional rule checks can be applied with just a few clicks. In creating a confidence and probability weighted classification algorithm, this is both adaptive and granular.



Column	Key	Date	Data Type
□ b_security_id	☑	□	text
□ b_status	□	□	int4
☑ composite_exch_code	□	□	text
☑ crncy	□	□	text
☑ exch_code	□	□	text

Using this technique, DQ reduces false positives, scales coverage, and quickly models a more complex series of checks than domain experts would want to develop.

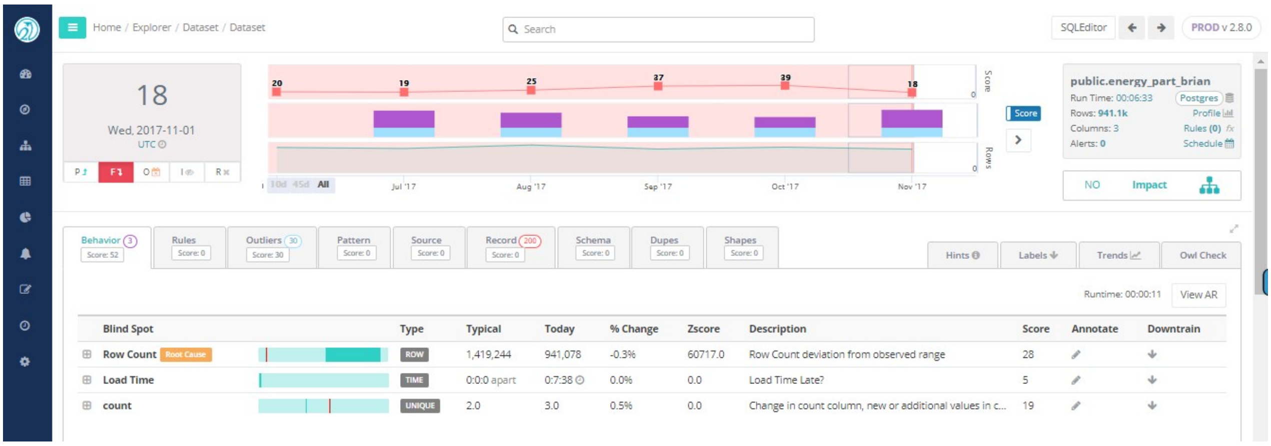
Smart Meter Data

Colliba DQ uncovered $10 million dollars in unbilled revenue for a leading U.S. energy company.

DQ's Smart Meter Data Analytics provides accurate and predictable data quality to companies often inundated with massive amounts of data and aging enterprise systems.

The U.S. smart meter data management market forecast is projected to reach $556.94 million by 2026. In 2018, U.S. electric utilities had about 86.8 million advanced (smart) metering installations. DQ provides an automated process to manage the mountain of data collected and glean critical business insights. By applying our ML algorithms during the normal data ingestion cycles, DQ uncovered $10 million dollars in unbilled revenue for a leading U.S. energy company.

In the example below, DQ detected 200 records missing from the previous run.



public.energy_part_brian
Run Time: 00:06:33 Postgres
Rows: 941.1k Profile
Columns: 3 Rules (0)
Alerts: 0 Schedule

Behavior Score: 52 | Rules Score: 0 | Outliers Score: 30 | Pattern Score: 0 | Source Score: 0 | Record Score: 0 | Schema Score: 0 | Dupes Score: 0 | Shapes Score: 0

Runtime: 00:00:11

Blind Spot	Type	Typical	Today	% Change	Zscore	Description	Score	Annotate	Downtrain
Row Count Root Cause	ROW	1,419,244	941,078	-0.3%	60717.0	Row Count deviation from observed range	28		
Load Time	TIME	0:0:0 apart	0:7:38	0.0%	0.0	Load Time Late?	5		
count	UNIQUE	2.0	3.0	0.5%	0.0	Change in count column, new or additional values in c...	19		

Consider the following opportunities that smart meter data analytics provide:

- Generate new customer insights
- Manage and prevent outages
- Improve maintenance techniques
- Build predictive models for program planning
- Develop new services and rate plans based on customer requirements

Identification of unbilled revenue: Meter events and usage information helps illustrate a picture of the customer’s energy usage over time. This helps detect energy theft, meter tampering, and equipment issues that may be affecting service levels.

Outage event analysis and prevention: Today, some utilities are still unable to verify an outage unless personnel physically visit the suspected problem area to confirm. With outage event analysis, however, the utility knows the exact piece of equipment causing the problem, along with the customers directly impacted by it.

Meter quality assurance: Focusing on meter reading performance enables utilities to ensure reliability. When meter readings are expected but not delivered, the system provides an alert, and calculates overall data score from previous runs . Utilities are notified to potential data quality issues they never would have identified in the past.

It is meter data analytics that will enable utilities to tackle the problems of the future.

Validating Data Movement

Validate Data Integrity between distinct storage systems.

Record-for-Record Reconciliation

When you're copying or moving data between distinct storage systems, such as multiple HDFS clusters or between non-HDFS storage and cloud storage, it's a good idea to perform some type of validation to guarantee data integrity. This validation is essential to be sure data wasn't altered during transfer.

Detect potential data corruption caused, for example, by older versions of drivers, parsing errors, connection limits, noisy network links, memory errors on server computers and routers along the path, or software bugs (such as in a library that customers use).

Common Data Copying/Movement Scenarios

- Landing, Loading, Persisting third-party files
    - Landing daily files.
    - Loading daily files into staging location.
    - Finally, persisting data in lake or warehouse.
- Cloud Migrations
    - Between existing database storage to optimized cloud storage formats.
    - Between local file systems and cloud relational database.

- Data Lake or Data Warehouse
    - Migrating data from single storage system to distributed storage.
    - Consolidating storage systems to a single lake or warehouse.
- Same Storage, Different Environments
    - Copying same data between Dev, QA, and Prod environments.

> **Warning** *How do you easily validate that the same data exists in distinct locations?*

Shortcomings of Existing Validation Checks

- Low-level integrity checks like row counts and column counts may not be sufficient.
- No easy way to reconcile between across non-HDFS files and database.
- Chunk verification requires storage size, format, and metadata to be exactly equal.
- Different data types in two distinct databases (Oracle and Teradata) will not reconcile.
- Two different copies of the same files in HDFS, but with different per-file block sizes configured.
- Two different instances of HDFS with different block or chunk sizes configured.
- Copying across non-HDFS Hadoop-compatible file systems
- https://wiki.apache.org/hadoop/HCFS
- (HCFS) such as Cloud Storage.

Explicit end-to-end data integrity validation adds protection for cases that may go undetected by typical in-transit mechanisms.

Enter, Collibra DQ Integrity Validation!

To ensure and protect against target systems getting out of sync or not matching the originating source, turn on `-vs` to validate that the source matches the target. Read More

https://docs.owl-analytics.com/dq-visuals/validate-source
docs.owl-analytics.com

Complete row, column, conformity, and value checks between any two distinct storage systems can be run against high-dimension or low-dimension datasets. Works between Files and/or Database storage, On-premise, or across Cloud environments.

Get Started Today

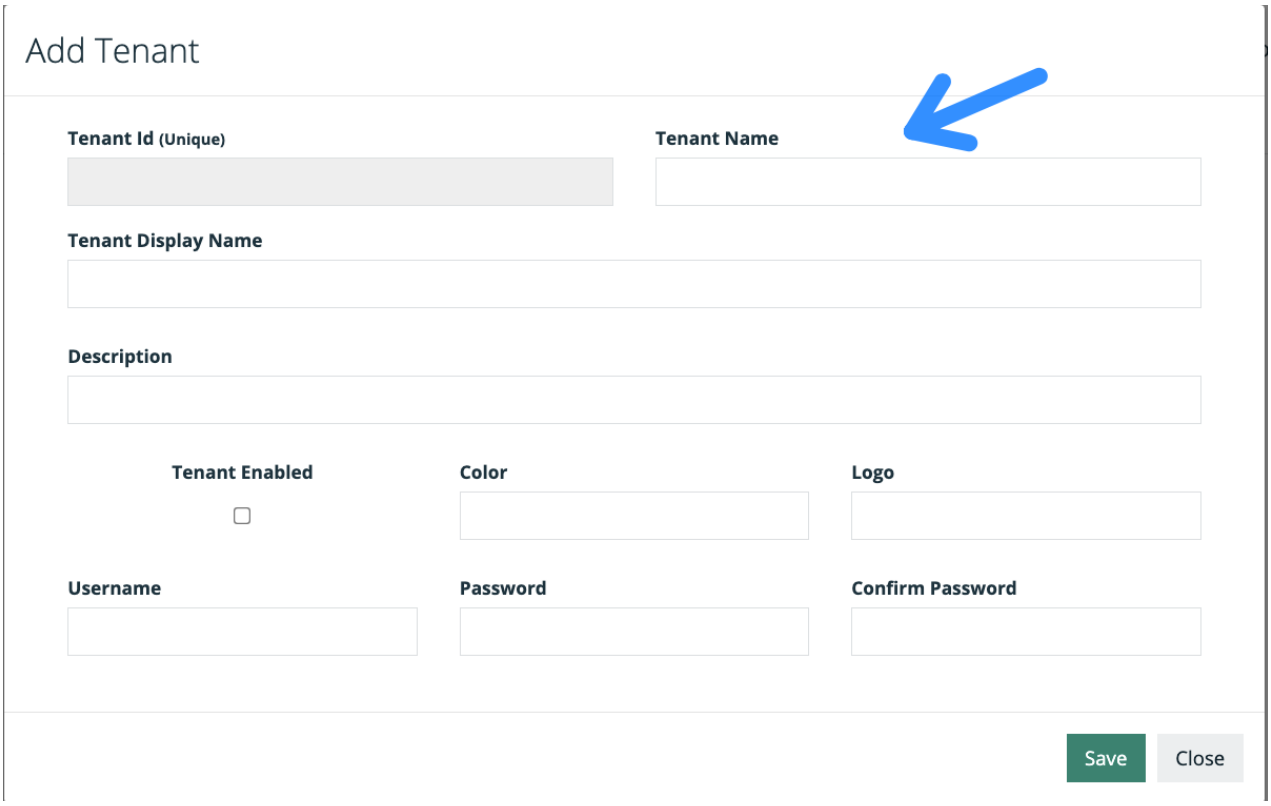
We don't want you to get stuck writing a lot of reconciliation checks we've already written. Focus on other things that actually move your project forward.

For more information, please contact **info@owl-analytics.com** or **schedule a demo at** www.owldq.com ****

Best Practices

Multi Tenant Names

> **Note** Tenant names should be lower case only.



Add Tenant

Tenant Id (Unique)	Tenant Name

Tenant Display Name
Description

Tenant Enabled	Color	Logo
□		
Username	Password	Confirm Password

Understanding Collibra DQ activities and what the key/date columns mean for each

- Starting with profile and expanding to rules and then other advanced capabilities.
    - https://dq-docs.collibra.com/dq-visuals/profile
- Training with DQ-team Zoom/Onsite support.
- Running with sample data.
- Introducing anomalies on sample data and running an owlcheck to see the anomalies.

Using the tool with practical scenarios

- Having Well Defined Use Cases
    - Determine a single table (dataset) that you would like to scan.
    - Have an expectation of what you would expect DQ to find in this dataset.
    - Understand which activities would capture the expected findings.
- Target internal datasets with known data issues.
- Historical Comparisons:
    - If pre-cleaned data is available with data findings that have been cleaned via legacy methods such as internal rules, run these datasets and compare the results from DQ to Internal findings.
- Work with data owners to understand findings or review expected findings.

Explorer

- The date selected with the calendar widget in the Scope (home) tab should align with the calendar widget assigned on the final (Save/Run) tab.
- If you elect to Unlock the cmd line and override the final parameters, do not re-lock or the changes will be overwritten. In general, only advanced users should override the guided settings.
- Pushdown and parallel JDBC cannot be used together. If you are using pushdown, do not select the parallel JDBC option.

Files

- File paths should not contain spaces or special characters.
- Backrun (replay) and advanced features are best suited for JDBC connections. Some features are unavailable if file and storage naming conventions do not consistently contain a date signature.

Connection Pool

If you see this message, update the agent configs in owl-env.sh or agent confg map for k8 deployments.

```
Failed to obtain JDBC Connection; nested exception is org.a-
pache.tomcat.jdbc.pool.PoolExhaustedException: [pool-29-thread-
2] Timeout: Pool empty. Unable to fetch a connection in 0
seconds, none available[size:2; busy:1; idle:0; lastwait:200].
```

Adjust these configs to modify the connection pool available.

```
export SPRING_DATASOURCE_POOL_MAX_WAIT=500
export SPRING_DATASOURCE_POOL_MAX_SIZE=10
export SPRING_DATASOURCE_POOL_INITIAL_SIZE=5
```

Freeform Agent Configs

When configuring the DQ Agent and using the Free Form Parameters at the bottom of the dialogue, you need to comma separate multiple -conf key/value pairs. I am going to write this as a forum post but use this format: "-conf some.key=x, some.other.key=y".

K8 Secrets

The following Env Vars are now managed as a Secret instead of as a Configmap:

LICENSE_KEY LIVY_SSL_KEY_PASS SERVER_SSL_KEY_PASS SPRING_AGENT_DATASOURCE_PASSWORD SPRING_AGENT_DATASOURCE_USERNAME SPRING_DATASOURCE_PASSWORD SPRING_DATASOURCE_USERNAME

DQ Job Stages

DQ job failure is one of the most frequently asked. This outlines the DQ Job Lifecycle and where to find logs for each phase. Every DQ Job goes through a three stage Lifecycle:

Stage 1

Agent picks up job from the Metastore and translates it into a valid Spark Submit request. This includes credential acquisition and injection for Cloud and Kerberos. If a job never makes it out of STAGING, the first thing to do is to check the Agent logs (<INSTALL_HOME>/log/agent.log or on K8s kubectl logs -n .

Stage 2

Agent hands off the DQ check to Spark via Spark Submit, maintaining a handle on the Spark Submit request. At this point the Job is in Spark's custody but not yet running (Spark Submit creates its own JVM to manage the submission of the Spark Job to the cluster/runtime). If the job fails with a message saying something like "Failed with reason NULL" on the Jobs page, check the Stage 2 logs (there will be a separate log for each Job). These can be found either on the Agent itself (<INSTALL_HOME>/log/.log) or whenever possible on the Jobs page Action Dropdown on the job entry. Stage 3: Spark Submit instantiates the Job in the target Spark Runtime (Hadoop/K8s/Spark-Master). At this point, the DQ core code is active and DQ is back in control of the job. Typically, if a job makes it to this stage, it will no longer be in STAGING status and you should see an error message on the Jobs Page. Typically, the full Stage 3 log is required to trouble shoot a problem that happens in Core.

Stage 3

logs can be obtained from the Actions drop down for the job entry. If log extraction failed, job logs will need to be gathered from the Spark Runtime directly (Hadoop Resource Manager, K8s API via Kubectl or vendor provided UI, Spark Master UI or directly from the Spark Master Host).

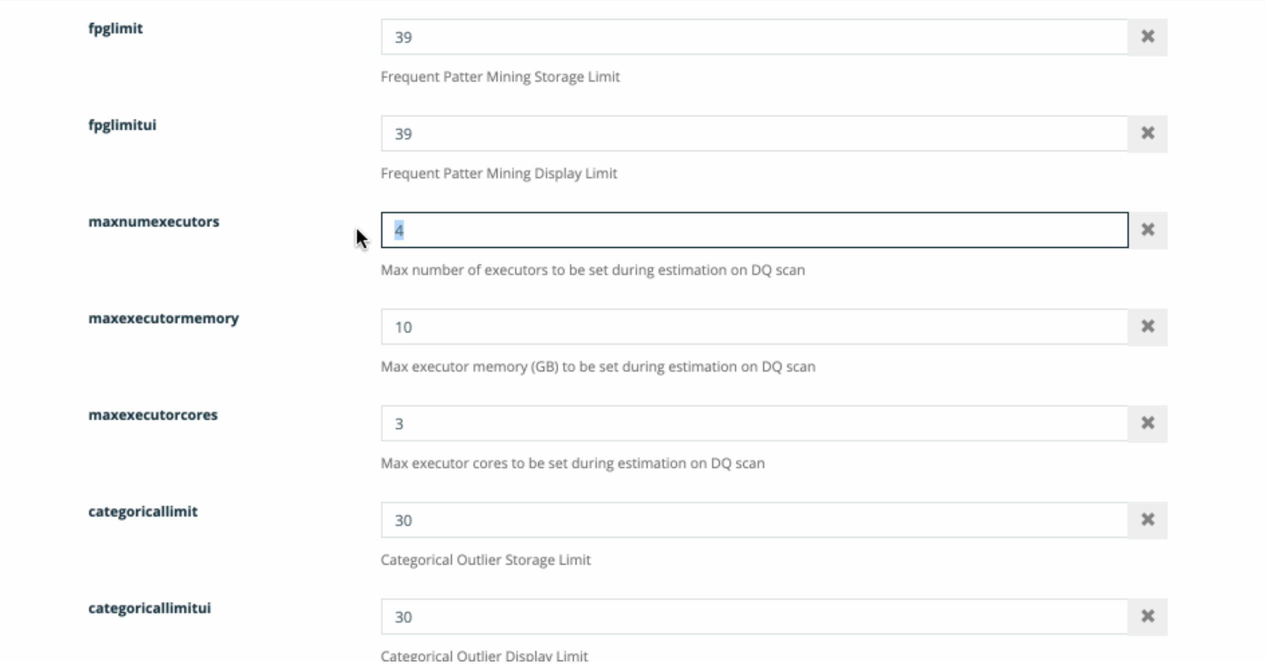
Chapter 16

Collibra DQ Benchmarks

Performance Settings

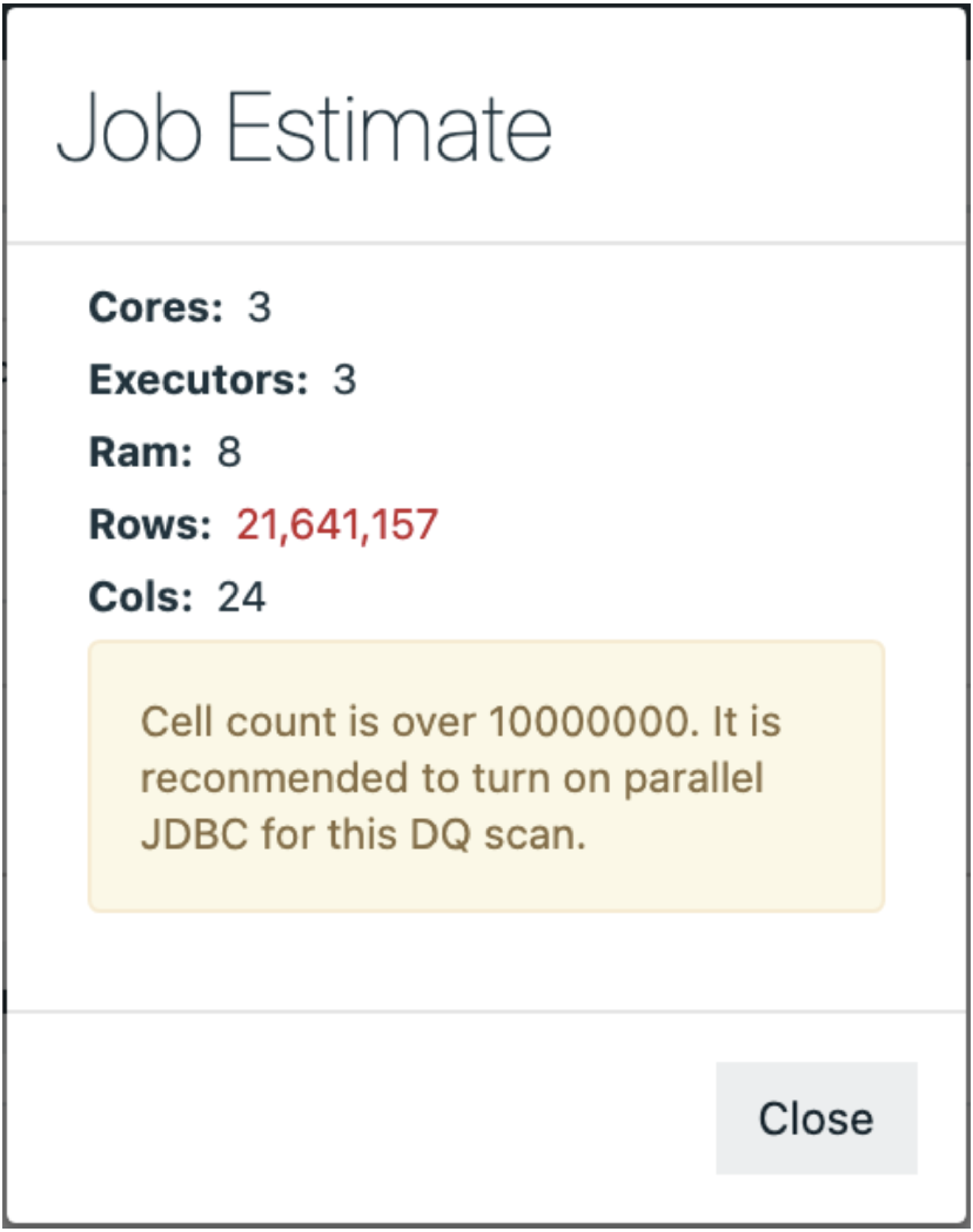
Job Limits

Limits can be set to limit resources that are requested. There are options for cores, memory, executors, and cells (maxexecutorcores, maxexecutormemory, maxnumexecutors and maxcellcountforparalleljdbc).



fpglimit	39	Frequent Patter Mining Storage Limit
fpglimitui	39	Frequent Patter Mining Display Limit
maxnumexecutors	4	Max number of executors to be set during estimation on DQ scan
maxexecutormemory	10	Max executor memory (GB) to be set during estimation on DQ scan
maxexecutorcores	3	Max executor cores to be set during estimation on DQ scan
categoricallimit	30	Categorical Outlier Storage Limit
categoricallimitui	30	Categorical Outlier Display Limit

If you request more cells than the limit, you should see a warning message before hitting run.



Job Estimate

Cores: 3

Executors: 3

Ram: 8

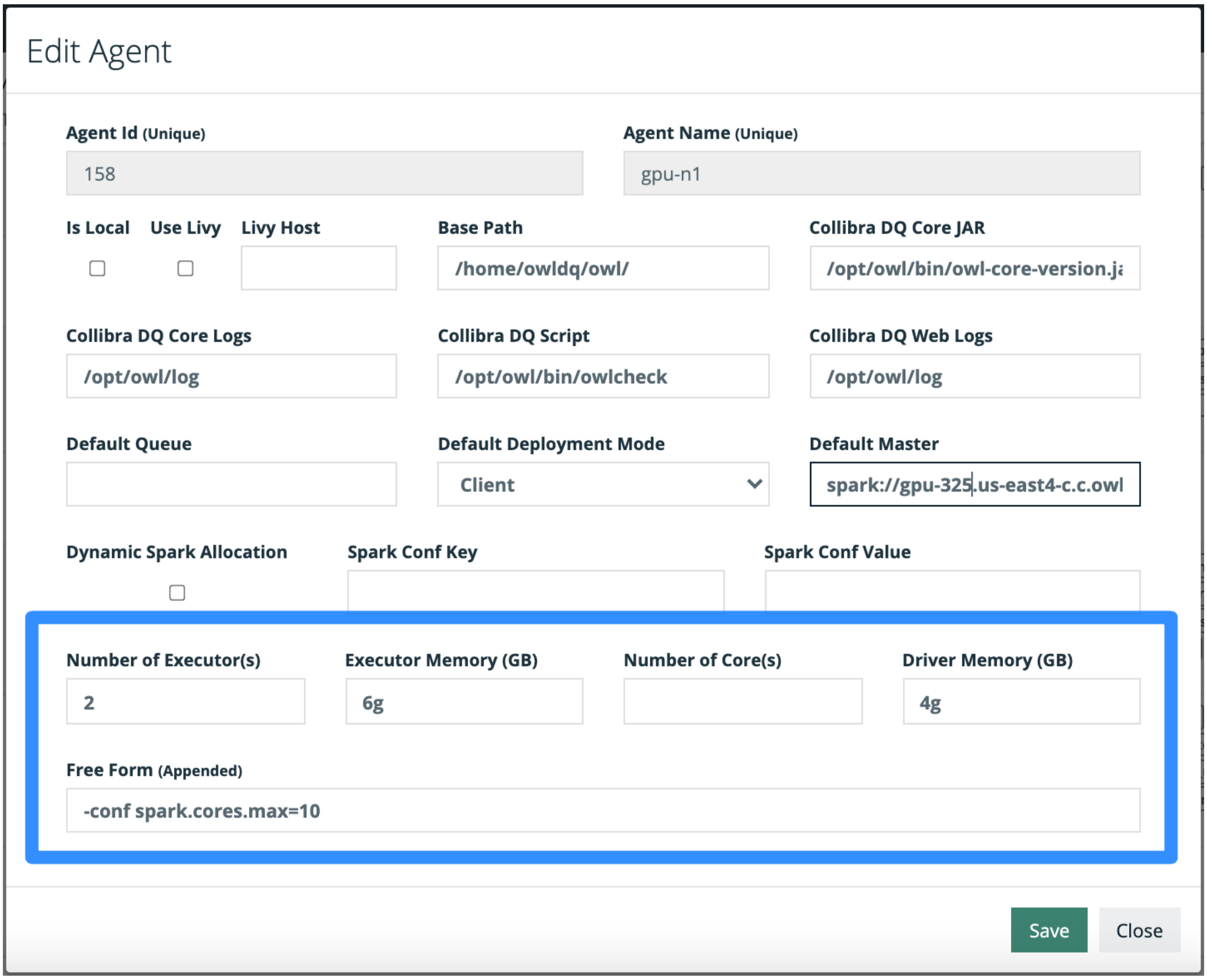
Rows: 21,641,157

Cols: 24

Cell count is over 10000000. It is reconmended to turn on parallel JDBC for this DQ scan.

Agent Defaults

Set defaults at the agent level. These should be right-sized to your environment and be used as defaults for jobs with when estimate is not available (primarily local files and remote files).



Edit Agent

Agent Id (Unique): 158

Agent Name (Unique): gpu-n1

Is Local: □

Use Livy: □

Livy Host:

Base Path: /home/owldq/owl/

Collibra DQ Core JAR: /opt/owl/bin/owl-core-version.já

Collibra DQ Core Logs: /opt/owl/log

Collibra DQ Script: /opt/owl/bin/owlcheck

Collibra DQ Web Logs: /opt/owl/log

Default Queue:

Default Deployment Mode: Client

Default Master: spark://gpu-325.us-east4-c.c.owl

Dynamic Spark Allocation: □

Spark Conf Key:

Spark Conf Value:

Number of Executor(s): 2

Executor Memory (GB): 6g

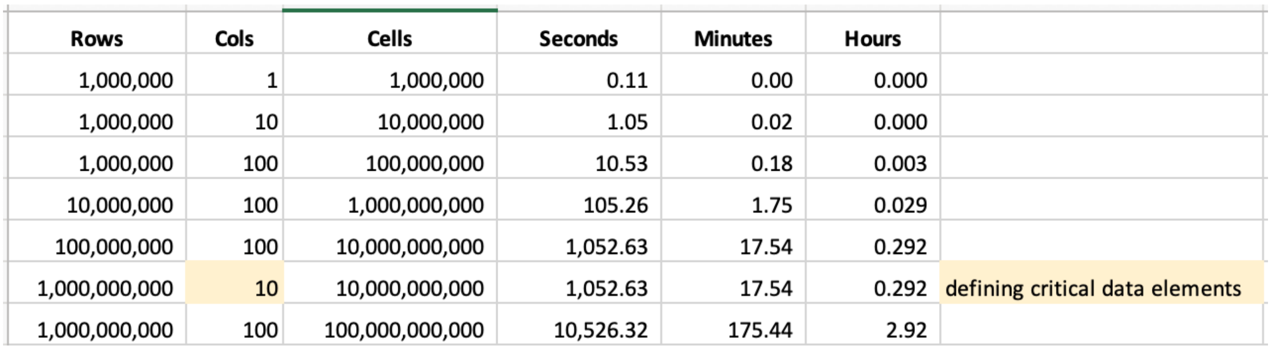
Number of Core(s):

Driver Memory (GB): 4g

Free Form (Appended): -conf spark.cores.max=10

Performance Tests

Cells Per Second Performance Theory (9.5M CPS)



Rows	Cols	Cells	Seconds	Minutes	Hours	
1,000,000	1	1,000,000	0.11	0.00	0.000	
1,000,000	10	10,000,000	1.05	0.02	0.000	
1,000,000	100	100,000,000	10.53	0.18	0.003	
10,000,000	100	1,000,000,000	105.26	1.75	0.029	
100,000,000	100	10,000,000,000	1,052.63	17.54	0.292	
1,000,000,000	10	10,000,000,000	1,052.63	17.54	0.292	defining critical data elements
1,000,000,000	100	100,000,000,000	10,526.32	175.44	2.92	

Load and Profile

Dataset Name	GBs in Memory	Rows	Cols	Cells	Num Execs	Num Cores	Exec Memory	Network Time	Total Time
NYSE	0.1G	103K	9	816K	1	1	1G	00:00:15	00:00:48
AUM	14G	9M	48	432M	5	1	4G	00:01:20	00:03:50
ENERGY	5G	43M	6	258M	8	3	3G	00:00:00	00:04:35
INVEST_ DATA	20G	3.8M	158	590M	3	2	3G	00:00:40	00:03:32

NYSE

Postgres database call, no concurrent processing, simple case, small data.

```
-bhtimeoff -numexecutors 1
-lib "/opt/owl/drivers/postgres"
-executormemory 1g
-h metastore01.us-east1-b.c.owl-hadoop-
cdh.internal:5432/dev?currentSchema=public
-drivermemory 1g -master k8s:// -ds public.nyse_128 -deploymode
cluster
-q "select * from public.nyse" -bhlb 10 -rd "2020-10-26"
-driver "org.postgresql.Driver" -bhminoff
-loglevel INFO -cxn postgres-gcp -bhmaxoff
```

AUM

Postgres database call uses parallel JDBC, split on aum_id serial id.

```
-owluser kirk
-lib "/opt/owl/drivers/postgres" -datashapeoff
-numpartitions 6 -ds public.aum_dt2_50
-deploymode cluster -bhlb 10 -bhminoff
-cxn postgres-gcp -bhmaxoff -bhtimeoff
-numexecutors 6
-executormemory 4g -semanticoff
-h metastore01.us-east1-b.c.owl-hadoop-
cdh.internal:5432/dev?currentSchema=public
-columnname aum_id -corroff -drivermemory 4g -master k8s://
-q "select * from public.aum_dt2" -histoff -rd "2020-10-27"
-driver "org.postgresql.Driver" -loglevel INFO -agentjobid 7664
```

ENERGY

HDFS file with 43 million rows, converting a string date to date type, deploy mode client.

```
-f "hdfs:///demo/owl_usage_all.csv" \
-rd "2019-02-02" \
-ds energy_file \
-loglevel DEBUG -readonly \
-d "," -df dd-MMM-yy \
-master yarn \
-deploymode client  \
-numexecutors 3 \
-executormemory 10g
```

Load Profile Outliers

NYSE - 1:10 total runtime. 20 seconds for outliers

```
-bhtimeoff -owluser kirk -numexecutors 1
-lib "/opt/owl/drivers/postgres" -executormemory 1g
-dl -h metastore01.us-east1-b.c.owl-hadoop-
cdh.internal:5432/dev?currentSchema=public
-drivermemory 1g -master k8s:// -ds public.nyse_128 -deploymode
cluster
-q "select * from public.nyse" -bhlb 10
-rd "2020-10-27" -driver "org.postgresql.Driver"
-bhminoff -loglevel INFO -cxn postgres-gcp -bhmaxoff -agentjobid
7721
```

Performance Tuning

Storage Format	Num Rows	Num Columns	Bytes Disk	Num Executors	Executor Memory	Total RAM	Transfer Time	Process Time
Local File	1M	50	1G	1	3G	3G	0 mins	2 mins
HDFS File	10M	50	5G	3	8G	24G	0 mins	4 mins
Hive Table	10M	50	5G	3	8G	24G	0 mins	4 mins
JDBC Table	50M	50	25G	8	10G	80G	3 mins	8 mins
JDBC Table	10M	100	10G	3	12G	36G	3 mins	6 mins
JDBC Table	250M	9	10G	5	7G	35G	14 mins	15 mins
JDBC Table	250M	145	70G	17	12G	204G	28 mins	30 mins

Using a 10/1 ratio of RAM to Executors is often a good rule of thumb, another and more simple option is to turn on dynamic.allocation and allow the resources to be provided as needed on demand.

Limit Columns

In most cased there are a large number of columns that go unused by the business or columns that don't require checking. One of the most efficient things you can do is limit the cols using the below cmds. As a best practice Collibra DQ strongly recommends using less than 80 columns per dataset.

```
-q "select colA, colB, colC, datCol, colD from table"
// vs
-q "select * from * from table"
```

How to limit columns when using a file

```
-fq "select colA, colB, colC from dataset"
// file query using keyword dataset
```

JDBC vs Local Data

Co-Located data (local data)

It is always a good performance practice to colocate data and processing. That doesn't mean that you tech organization chooses to do this in it's architecture and design which is why DQ accounts for both. If the data is located on the cluster that is doing the processing use options like -hive for non JDBC and native file access. Skip tuning for JDBC as moving data to the cluster first will routinely reduce 50 percent of the performance bottleneck.

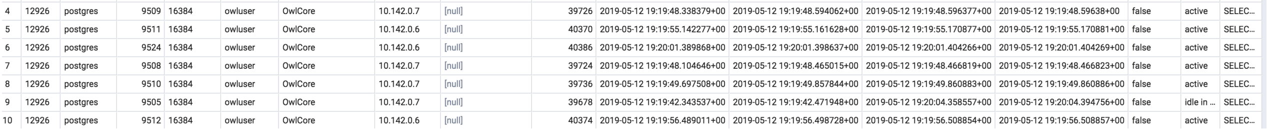
JDBC

Set fetchsize 1M rows -connectionprops fetchsize=1000 5M rows -connectionprops fetchsize=5000 10M rows -connectionprops fetchsize=10000

Set DriverMemory add more memory to the driver node as it will be responsible for the initial landing of data.

```
--driver-memory 7g
```

Add Parallel JDBC



4	12926	postgres	9509	16384	owluser	OwlCore	10.142.0.7	[null]		39726	2019-05-12 19:19:48.338379+00	2019-05-12 19:19:48.594062+00	2019-05-12 19:19:48.596377+00	2019-05-12 19:19:48.59638+00	false	active	SELEC...
5	12926	postgres	9511	16384	owluser	OwlCore	10.142.0.6	[null]		40370	2019-05-12 19:19:55.142277+00	2019-05-12 19:19:55.161628+00	2019-05-12 19:19:55.170877+00	2019-05-12 19:19:55.170881+00	false	active	SELEC...
6	12926	postgres	9524	16384	owluser	OwlCore	10.142.0.6	[null]		40386	2019-05-12 19:20:01.389868+00	2019-05-12 19:20:01.398637+00	2019-05-12 19:20:01.404266+00	2019-05-12 19:20:01.404269+00	false	active	SELEC...
7	12926	postgres	9508	16384	owluser	OwlCore	10.142.0.7	[null]		39724	2019-05-12 19:19:48.104646+00	2019-05-12 19:19:48.465015+00	2019-05-12 19:19:48.466819+00	2019-05-12 19:19:48.466823+00	false	active	SELEC...
8	12926	postgres	9510	16384	owluser	OwlCore	10.142.0.7	[null]		39736	2019-05-12 19:19:49.697508+00	2019-05-12 19:19:49.857844+00	2019-05-12 19:19:49.860883+00	2019-05-12 19:19:49.860886+00	false	active	SELEC...
9	12926	postgres	9505	16384	owluser	OwlCore	10.142.0.7	[null]		39678	2019-05-12 19:19:42.343537+00	2019-05-12 19:19:42.471948+00	2019-05-12 19:20:04.358557+00	2019-05-12 19:20:04.394756+00	false	idle in ...	SELEC...
10	12926	postgres	9512	16384	owluser	OwlCore	10.142.0.6	[null]		40374	2019-05-12 19:19:56.489011+00	2019-05-12 19:19:56.498728+00	2019-05-12 19:19:56.508854+00	2019-05-12 19:19:56.508857+00	false	active	SELEC...

Limit Features, Turn Flags Off

```
-corroff    //only losing visuals, 5% speed gain
-histoff    //only losing visuals, 4% speed gain
-hootonly   //speeds up 1% based on less logging
-readonly   //remove owl webapp read writes, 1% gain
-datashapeoff //removes Shape Detection 3% speed gain
```

Real World Scenario

Nine million rows with 46 columns on a daily basis for just 1 dataset. The data lives in Greenplum and we want to process it on a cluster platform where DQ runs. The first run results in a 12 minute runtime. While acceptable it's not ideal, here is what you should do:

1. Add Parallel JDBC for faster network.
2. Limit columns to the 18 that are of use in the downstream processing.
3. Turn off unneeded features.
4. Find out of the job is memory bound or CPU bound.

By setting the below configs this same job ran in six minutes.

```
# parallel functions
-columnname run_date -numpartitions 4 \
-lowerbound "2019-02-23 00:00:00" \
-upperbound "2019-02-24 00:00:00"
# driver optimization
-connectionprops fetchsize=6000
# analyst functions
-corroff \
-histoff
# hardware
-executormemory 4g
-numexecutors 3
```

The Full OwlCheck

```
./owlcheck  \
-u u -p pass  \
-c jdbc:postgresql://$host/postgres \                   # jdbc
url
-ds aumdt  -rd 2019-05-05  \
-q "select * from aum_dt"  \
-driver org.postgresql.Driver \                         # driver
-lib /home/owl/drivers/postgres  \                      # driver
jar
-connectionprops fetchsize=6000 \                       # driver
performance setting
-master yarn -deploymode client \
-executormemory 2G -numexecutors 2 -drivermemory 3g \   # hard-
ware sizing
-h cdh-edge.us-east1-b.c.owl-hadoop-cdh.internal:2181 \ # owl
metastore
-corroff -histoff -statsoff \                           # owl
features
-loglevel INFO \                                        # log
level
-columnname updt_ts -numpartitions 12 \                 # par-
allel jdbc
-lowerbound 1557623033193 -upperbound 1557623051585
```

```
{
  "dataset": "aumdt",
  "runId": "2019-05-05",
  "score": 100,
  "behaviorScore": 0,
  "rows": 9000000,
  "passFail": 0,
  "peak": 0,
  "avgRows": 0,
  "cols": 46,
  "runTime": "00:05:23",
  }
```

Performance Considerations

Performance Recommendations

Performance is a function of available hardware.

When running Collibra DQ Scans on a Hadoop distribution:

- Check YARN resource manager.
- Check limits on queue size.
- Contact Platform Administration team on any limitations.

When running DQ Scans on Spark standalone (single node):

- Check Spark endpoint (example: http://<IP>:<PORT>).
- Suggested maximum size on 16 core x 64GB machine: 100 million rows * 200 columns = 2 billion cells.
- If exceeding 2 billion cells, limit the width by selecting certain columns or limit depth with a WHERE clause or a FILTER condition.

When running DQ Scans on EKS:

- Check your compute pool for available pods.
- Check your worker configuration and your Spark operator configuration.
- Check minimum and maximum of allowed workers.

How-To

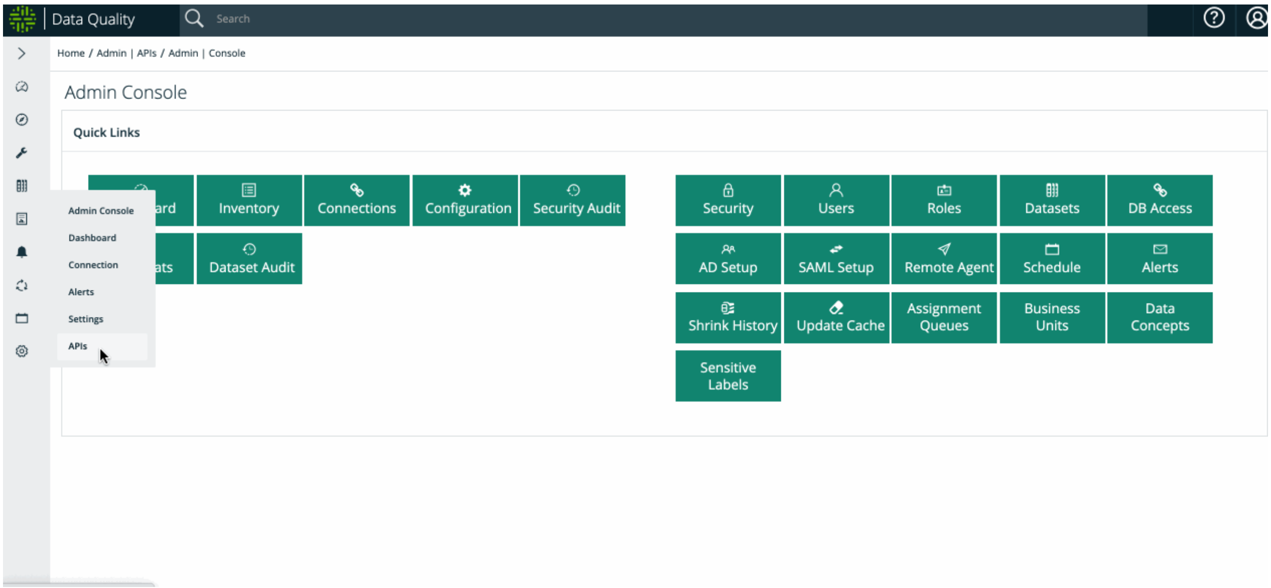
Increment DQ Scans with gradually increasing limits. Starting with a low level allows you to confirm whether database has proper indexing, skip scanning, or partitioning. Incrementing also allows you to validate security and connectivity quickly.

- Test 1: Limit 1k rows.
- Test 2: Limit 1mm rows.
- Test 3: Limit 10mm rows.

Chapter 17

Collibra DQ APIs

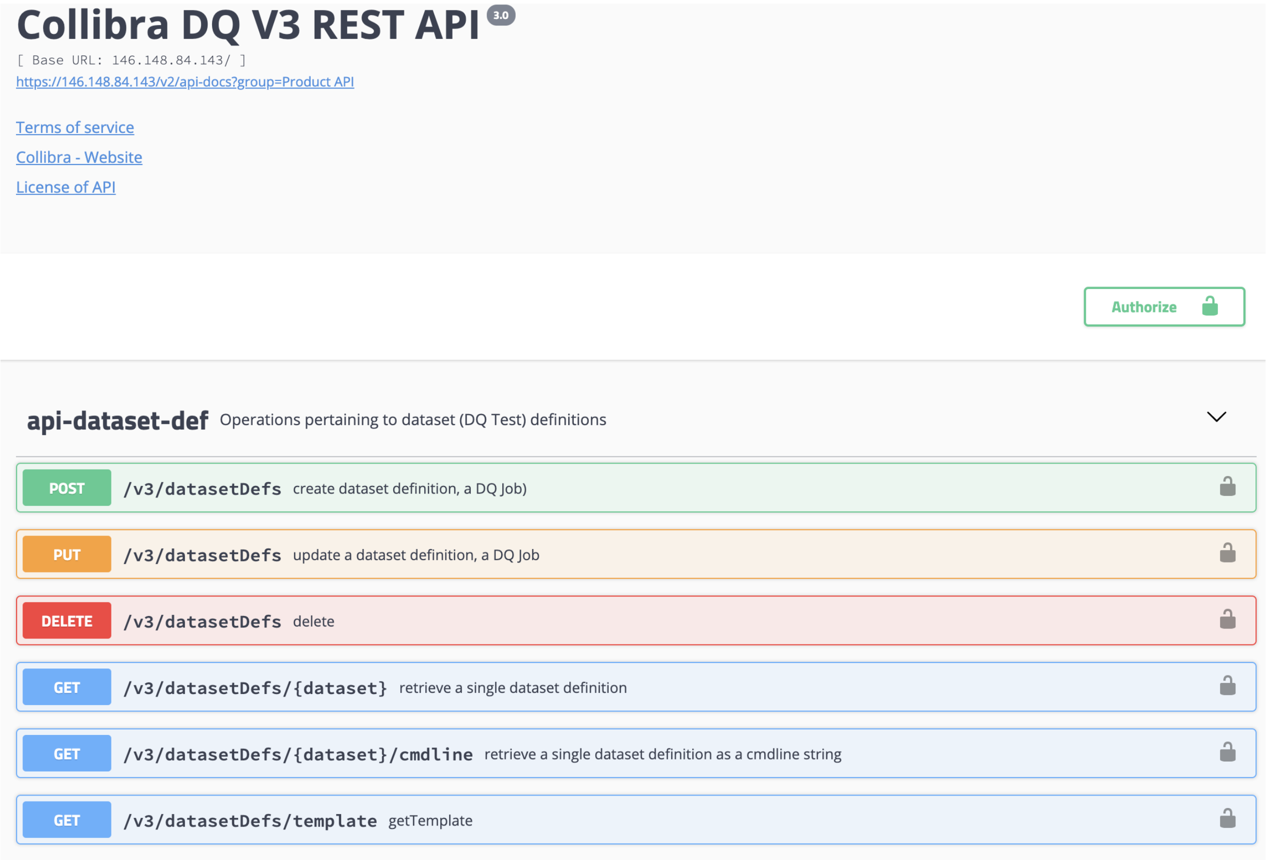
Rest



All REST APIs are available inside the application under admin section. The APIs can be used against the application in live working mode, which is preferred over documentation of APIs because it means the API works and was tested at compile time versus documentation time.

Product API

The product API is for end-users who want to interact with the official and supported API. You can also generate a client side SDK from the API with four steps below.



Collibra DQ V3 REST API 3.0

[Base URL: 146.148.84.143/]

https://146.148.84.143/v2/api-docs?group=Product API

Terms of service

Collibra - Website

License of API

api-dataset-def Operations pertaining to dataset (DQ Test) definitions

POST /v3/datasetDefs create dataset definition, a DQ Job)

PUT /v3/datasetDefs update a dataset definition, a DQ Job

DELETE /v3/datasetDefs delete

GET /v3/datasetDefs/{dataset} retrieve a single dataset definition

GET /v3/datasetDefs/{dataset}/cmdline retrieve a single dataset definition as a cmdline string

GET /v3/datasetDefs/template getTemplate

```
#psuedo code example REST API

dataset = 'public.nyse'
runId = '2021-03-05'

#SAVE datasetDef
dataset = POST /v3/datasetDefs/ {json_datasetDef}

#UPDATE datasetDef
dataset = PUT /v3/datasetDefs/ {json_datasetDef}

#RUN JOB
jobId = POST /v3/jobs/run/{dataset},{runDate}

#CHECK STATUS
status = /v3/jobs{jobId}/status

#GET DQ FINDINGS
findings = /v3/jobs/{jobId}/findings
```

JWT Token For Auth

```
import requests
import json
url = "http://localhost:9000/auth/signin"
payload = json.dumps({
    "username": "<user>",
    "password": "<pass>",
    "iss": "public"
})
headers = {
    'Content-Type': 'application/json'
}
response = requests.request("POST", url, headers=headers, data=payload)
print(response.text)
```

```
curl --location --request POST 'http://localhost:9000/auth/signin' \
--header 'Content-Type: application/json' \
--data-raw '{
    "username": "<user>",
    "password": "<pass>",
    "iss": "public"
    }'
```

Python Example

Alternatively, you can use the rest endpoints directly. This example shows how it can be done with Python.

1. Create a dataset def:
    a. Using the UI (Explorer) or
    b. Using the dataset-def-api (https://<ip>/swagger-ui.html#/dataset-def-api)
2. Confirm your Python environment has the appropriate modules and imports.
3. Fill-in the variables and customize to your preference:
    a. url, user and pass
    b. dataset, runDate, and agentName

```
import requests
import json

# Authenticate
owl = "https://<url>"
url = "https://<url>/auth/signin"
payload = json.dumps({
  "username": "<user>", # Edit Here
  "password": "<pass>", # Edit Here
  "iss": "public"       # Edit Here
})
headers = {
  'Content-Type': 'application/json'
}
response = requests.request("POST", url, headers=headers, data-
a=payload, verify=False)
owl_header = {'Authorization': 'Bearer ' + response.json()
['token']}


# Run
dataset = '<your_dataset_name>'    # Edit Here
runDate = '2021-08-08'             # Edit Here
agentName = '<your_agent_name'     # Edit Here

response = requests.post(
    url = owl +
'/v3/jobs/run?agentName='+agentName+'&dataset='+dataset+'&run-
Date='+runDate,
    headers=owl_header,
    verify=False
)

jobId = str(response.json()['jobId'])


# Status
for stat in range(100):
    time.sleep(1)

    response = requests.get(
        url = owl + '/v3/jobs/'+jobId,
        headers=owl_header,
        verify=False
    )

    job = response.json()
    if job['status'] == 'FINISHED':
        break


# Results
response = requests.get(
    url = owl + '/v3/jobs/'+jobId+'/findings',
    headers=owl_header,
    verify=False
)

print(response.json())
```

This assumes you have created a data set definition using the UI or from the template.

Command Line instead of JSON dataset def

You can run a similar job submission using the cmd line. Please note it is easiest to get the saved command line from the dataset-def-api **/v3/datasetDefs//cmdline** (with proper escaping) and passed to the **/v3/jobs/runCmdLine**.

Breaking Down The Sections

Submit the Job

Send in a data set name, date and agent to submit the job. This kicks off the engine to go do the work.

```
# Run
dataset = 'API_V3'
runDate = '2021-08-08'
agentName = 'owldq-owl-agent-owldq-dev-0'

response = requests.post(
    url = owl +
'/v3/jobs/run?agentName='+agentName+'&dataset='+dataset+'&run-
Date='+runDate,
    headers=owl_header
)

jobId = str(response.json()['jobId'])
```

Get the Status

Using the jobId returned from the job submission, you can check the status. In the example above, there is an interval to wait for the job to complete. You can create your own logic and orchestrate more precisely.

```
response = requests.get(
    url = owl + '/v3/jobs/'+jobId,
    headers=owl_header
)
```

Get the Results

Using the same jobId returned from the job submission, you can check the results. You will get a detailed json object with all the capabilities and detections in one payload. This is where you would decision, based on your organization and process.

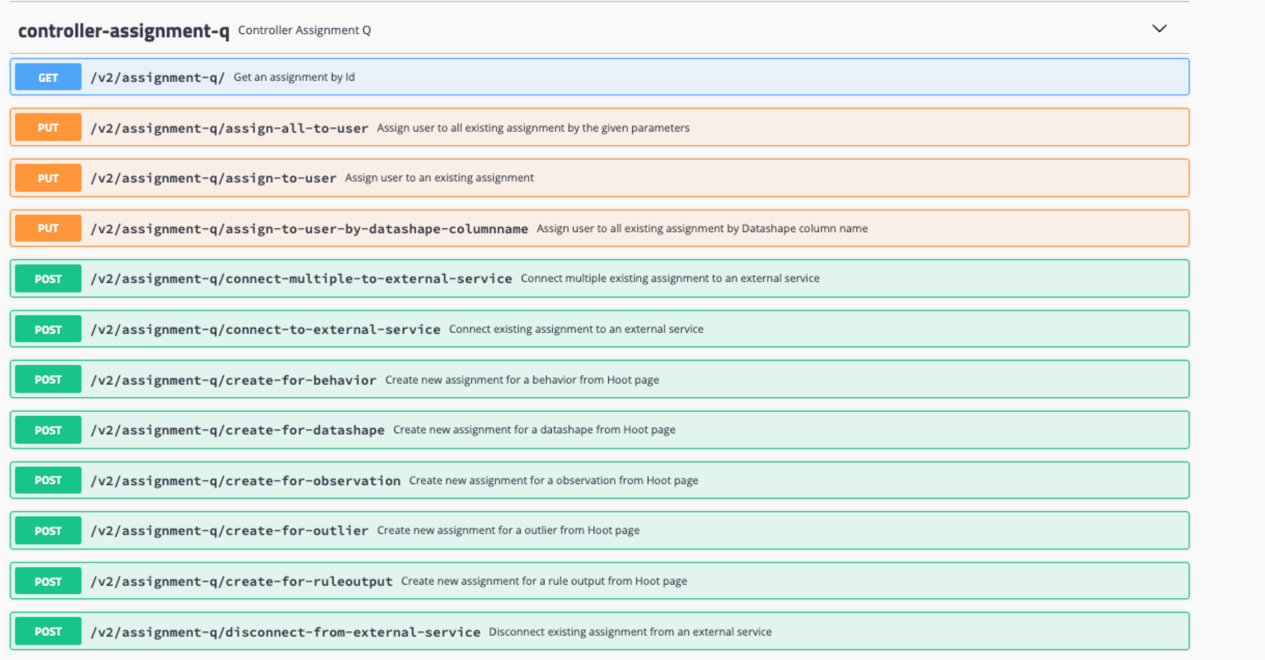
```
response = requests.get(
    url = owl + '/v3/jobs/'+jobId,
    headers=owl_header
)
```

Python Example Raw

```
import requests
import json

# Variables
owl = 'https://<ip_address>'                      #Edit
user = '<user>'                                   #Edit
password = '<password>'                           #Edit
tenant = 'public'                                 #Edit
dataset = '<your_dataset_name>'                   #Edit
runDate = '2021-08-08'                            #Edit
agentName = 'your_agent_name'                     #Edit

# Authenticate
url = owl+'/auth/signin'
payload = json.dumps({"username": user, "password": password, "iss": tenant })
headers = {'Content-Type': 'application/json'}
response = requests.request("POST", url, headers=headers, data=payload, verify=False)
owl_header = {'Authorization': 'Bearer ' + response.json()['token']}

# Run
response = requests.post(url = owl + '/v3/jobs/run?agentName='+agentName+'&dataset='+dataset+'&runDate='+runDate, headers=owl_header, verify=False)
jobId = str(response.json()['jobId'])

# Status
for stat in range(100):
    time.sleep(1)

    response = requests.get(url = owl + '/v3/jobs/'+jobId, headers=owl_header, verify=False)
    status = response.json()['status']

    if status == 'FINISHED':
        break

# Results
response = requests.get(url = owl + '/v3/jobs/'+jobId+'/findings', headers=owl_header,  verify=False)
```

Internal API

Collibra DQ also exposes the internal API so that all potential operations are available. The caveat is that these calls may change over time or expose underlying functionality.



controller-assignment-q Controller Assignment Q

GET /v2/assignment-q/ Get an assignment by Id

PUT /v2/assignment-q/assign-all-to-user Assign user to all existing assignment by the given parameters

PUT /v2/assignment-q/assign-to-user Assign user to an existing assignment

PUT /v2/assignment-q/assign-to-user-by-datashape-columnname Assign user to all existing assignment by Datashape column name

POST /v2/assignment-q/connect-multiple-to-external-service Connect multiple existing assignment to an external service

POST /v2/assignment-q/connect-to-external-service Connect existing assignment to an external service

POST /v2/assignment-q/create-for-behavior Create new assignment for a behavior from Hoot page

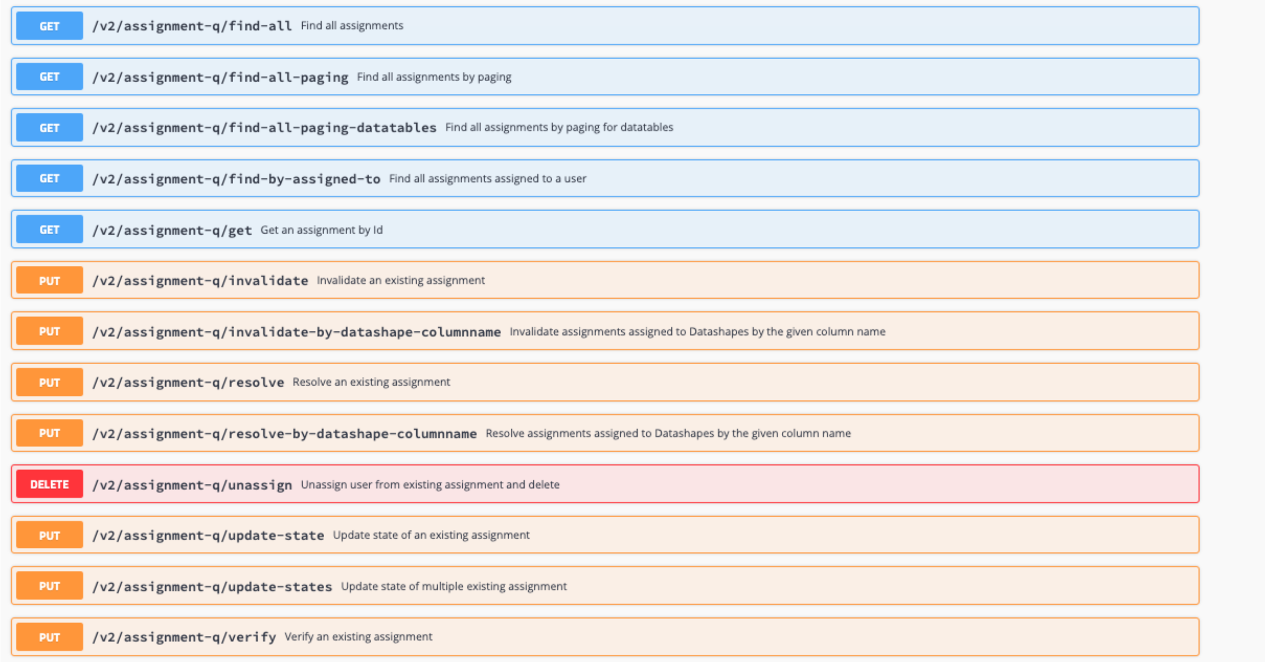
POST /v2/assignment-q/create-for-datashape Create new assignment for a datashape from Hoot page

POST /v2/assignment-q/create-for-observation Create new assignment for a observation from Hoot page

POST /v2/assignment-q/create-for-outlier Create new assignment for a outlier from Hoot page

POST /v2/assignment-q/create-for-ruleoutput Create new assignment for a rule output from Hoot page

POST /v2/assignment-q/disconnect-from-external-service Disconnect existing assignment from an external service



GET /v2/assignment-q/find-all Find all assignments

GET /v2/assignment-q/find-all-paging Find all assignments by paging

GET /v2/assignment-q/find-all-paging-datatables Find all assignments by paging for datatables

GET /v2/assignment-q/find-by-assigned-to Find all assignments assigned to a user

GET /v2/assignment-q/get Get an assignment by Id

PUT /v2/assignment-q/invalidate Invalidate an existing assignment

PUT /v2/assignment-q/invalidate-by-datashape-columnname Invalidate assignments assigned to Datashapes by the given column name

PUT /v2/assignment-q/resolve Resolve an existing assignment

PUT /v2/assignment-q/resolve-by-datashape-columnname Resolve assignments assigned to Datashapes by the given column name

DELETE /v2/assignment-q/unassign Unassign user from existing assignment and delete

PUT /v2/assignment-q/update-state Update state of an existing assignment

PUT /v2/assignment-q/update-states Update state of multiple existing assignment

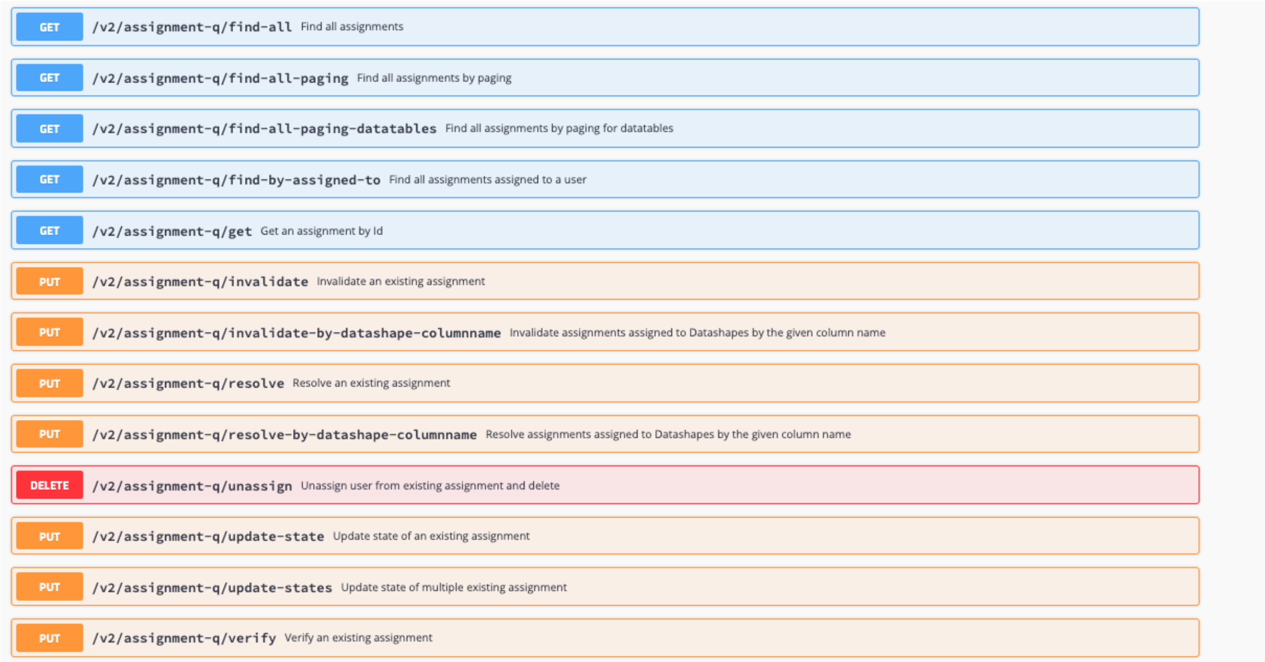
PUT /v2/assignment-q/verify Verify an existing assignment

Data Set Definition

The JSON for the full data set definition. It can be more terse to send in the cmdline string of just the variables you use for your DQ Job.

```
-df "yyyy/MM/dd" -owluser <user> -numexecutors 1 -executormemory
1g \
-f s3a://s3-datasets/dataset.csv -h <host>:5432/dev?-
currentSchema=public \
-fq "select * from dataset" -drivermemory 1g -master k8s:// -ds
dataset_csv_1 \
-deploymode cluster -bhlb 10 -rd "2021-04-01" -fullfile -log-
level INFO -cxn s3test5 \
-sparkprinc user2@CW.COM -sparkkeytab /tmp/user2.keytab
```

```
{
    "dataset": "",
    "runId": "",
    "runIdEnd": "",
    "runState": "DRAFT",
    "passFail": 1,
    "passFailLimit": 75,
    "jobId": 0,
    "coreMaxActiveConnections": null,
    "linkId": null,
    "licenseKey": "",
    "logFile": "",
    "logLevel": "",
    "hootOnly": false,
    "prettyPrint": true,
    "useTemplate": false,
    "parallel": false,
    "plan": false,
    "dataPreviewOff": false,
    "datasetSafeOff": false,
    "obslimit": 300,
    "pgUser": "",
    "pgPassword": "",
    "host": null,
    "port": null,
    "user": "anonymous : use -owluser",
    "alertEmail": null,
    "scheduleTime": null,
    "schemaScore": 1,
    "optionAppend": "",
    "keyDelimiter": "~~",
    "agentId": null,
    "load": {
      "readonly": false,
      "passwordManager": null,
      "alias": "",
      "query": "",
      "key": "",
      "expression": "",
      "addDateColumn": false,
      "zeroFillNull": false,
      "replaceNulls": "",
      "stringMode": false,
      "operator": null,
      "dateColumn": null,
      "transform": null,
      "filter": "",
      "filterNot": "",
      "sample": 1,
      "backRun": 0,
      "backRunBin": "DAY",
      "unionLookBack": false,
      "cache": true,
      "dateFormat": "yyyy-MM-dd",
      "timeFormat": "HH:mm:ss.SSS",
      "timestamp": false,
      "filePath": "",
      "fileQuery": "",
      "fullFile": false,
      "fileHeader": null,
      "inferSchema": true,
      "fileType": null,
      "delimiter": ",",
      "fileCharSet": "UTF-8",
      "skipLines": 0,
      "avroSchema": "",
      "xmlRowTag": "",
      "flatten": false,
      "handleMaps": false,
      "handleMixedJson": false,
      "multiLine": false,
      "lib": "",
      "driverName": null,
      "connectionName": "",
      "connectionUrl": "",
      "userName": "",
      "password": "",
      "connectionProperties": {},
      "hiveNative": null,
      "hiveNativeHWC": false,
      "useSql": true,
      "columnName": null,
      "lowerBound": null,
      "upperBound": null,
      "numPartitions": 0,
      "escapeWithBackTick": false,
      "escapeWithSingleQuote": false,
      "escapeWithDoubleQuote": false,
      "escapeCharacter": "",
      "hasHeader": true
    },
    "outliers": [
      {
        "id": null,
        "on": false,
        "only": false,
        "lookback": 5,
        "key": null,
        "include": null,
        "exclude": null,
        "dateColumn": null,
        "timeColumn": null,
        "timeBin": "DAY",
        "timeBinQuery": "",
        "categorical": true,
        "by": null,
        "limit": 300,
        "minHistory": 3,
        "historyLimit": 5,
        "score": 1,
        "aggFunc": "",
        "aggQuery": "",
        "query": "",
        "q1": 0.15,
        "q3": 0.85,
        "categoricalColumnConcatenation": false,
        "limitCategorical": null,
        "measurementUnit": "",
        "multiplierUpper": 1.35,
        "multiplierLower": 1.35,
        "record": true,
        "filter": null,
        "combine": true,
        "categoricalConfidenceType": "",
        "categoricalTopN": 3,
        "categoricalBottomN": 2,
        "categoricalMaxConfidence": 0.02,
        "categoricalMaxFrequencyPercentile": 0.25,
        "categoricalMinFrequency": 1,
        "categoricalMinVariance": 0,
        "categoricalMaxCategoryN": 1,
        "categoricalParallel": true,
        "categoricalAlgorithm": "",
        "categoricalAlgorithmParameters": {}
      }
    ],
    "outlier": {
      "id": null,
      "on": false,
      "only": false,
      "lookback": 5,
      "key": null,
      "include": null,
      "exclude": null,
      "dateColumn": null,
      "timeColumn": null,
      "timeBin": "DAY",
      "timeBinQuery": "",
      "categorical": true,
      "by": null,
      "limit": 300,
      "minHistory": 3,
      "historyLimit": 5,
      "score": 1,
      "aggFunc": "",
      "aggQuery": "",
      "query": "",
      "q1": 0.15,
      "q3": 0.85,
      "categoricalColumnConcatenation": false,
      "limitCategorical": null,
      "measurementUnit": "",
      "multiplierUpper": 1.35,
      "multiplierLower": 1.35,
      "record": true,
      "filter": null,
      "combine": true,
      "categoricalConfidenceType": "",
      "categoricalTopN": 3,
      "categoricalBottomN": 2,
      "categoricalMaxConfidence": 0.02,
      "categoricalMaxFrequencyPercentile": 0.25,
      "categoricalMinFrequency": 1,
      "categoricalMinVariance": 0,
      "categoricalMaxCategoryN": 1,
      "categoricalParallel": true,
      "categoricalAlgorithm": "",
      "categoricalAlgorithmParameters": {}
    },
    "pattern": {
      "id": null,
      "only": false,
      "lookback": 5,
      "key": null,
      "dateColumn": null,
      "include": null,
      "exclude": null,
      "score": 1,
      "minSupport": 0.000033,
      "confidence": 0.6,
      "limit": 30,
      "query": "",
      "filter": null,
      "timeBin": "DAY",
      "on": false,
      "match": true,
      "lowFreq": false,
      "bucketLimit": 450000,
      "deDupe": true
    },
    "patterns": [
      {
        "id": null,
        "only": false,
        "lookback": 5,
        "key": null,
        "dateColumn": null,
        "include": null,
        "exclude": null,
        "score": 1,
        "minSupport": 0.000033,
        "confidence": 0.6,
        "limit": 30,
        "query": "",
        "filter": null,
        "timeBin": "DAY",
        "on": false,
        "match": true,
        "lowFreq": false,
        "bucketLimit": 450000,
        "deDupe": true
      }
    ],
    "dupe": {
      "on": false,
      "only": false,
      "include": null,
      "exclude": null,
      "depth": 0,
      "lowerBound": 99,
      "upperBound": 100,
      "approximate": 1,
      "limitPerDupe": 15,
      "checkHeader": true,
      "filter": null,
      "ignoreCase": true,
      "score": 1,
      "limit": 300
    },
    "profile": {
      "on": true,
      "only": false,
      "include": null,
      "exclude": null,
      "shape": true,
      "correlation": null,
      "histogram": null,
      "semantic": null,
      "limit": 300,
      "histogramLimit": 0,
      "score": 1,
      "shapeTotalScore": 0,
      "shapeSensitivity": 0,
      "shapeMaxPerCol": 0,
      "shapeMaxColSize": 0,
      "shapeGranular": null,
      "behavioralDimension": "",
      "behavioralDimensionGroup": "",
      "behavioralValueColumn": "",
      "behaviorScoreOff": false,
      "behaviorLookback": 10,
      "behaviorMinSupport": 4,
      "profilePushDown": null,
      "behaviorRowCheck": true,
      "behaviorTimeCheck": true,
      "behaviorMinValueCheck": true,
      "behaviorMaxValueCheck": true,
      "behaviorNullCheck": true,
      "behaviorEmptyCheck": true,
      "behaviorUniqueCheck": true,
      "adaptiveTier": null
    },
    "source": {
      "on": false,
      "only": false,
      "validateValues": false,
      "matches": false,
      "sourcePushDownCount": false,
      "include": null,
      "exclude": null,
      "includeSrc": null,
      "excludeSrc": null,
      "key": null,
      "map": null,
      "score": 1,
      "limit": 30,
      "dataset": "",
      "driverName": "",
      "user": "",
      "password": "",
      "passwordManager": "",
      "connectionName": "",
      "connectionUrl": "",
      "query": "",
      "lib": "",
      "checkType": true,
      "checkCase": false,
      "validateValuesFilter": "",
      "validateSchemaOrder": false,
      "connectionProperties": {},
      "filePath": "",
      "fileQuery": "",
      "fullFile": false,
      "header": null,
      "skipLines": 0,
      "inferSchema": true,
      "fileType": null,
      "delimiter": ",",
      "fileCharSet": "UTF-8",
      "avroSchema": "",
      "xmlRowTag": "",
      "flatten": false,
      "handleMaps": false,
      "handleMixedJson": false,
      "multiLine": false,
      "hasHeader": true
    },
    "rule": {
      "on": true,
      "only": false,
      "lib": null,
      "name": "",
      "absoluteScoring": false,
      "ruleBreakPreviewLimit": 6
    },
    "colMatch": {
      "colMatchParallelProcesses": 3,
      "colMatchDurationMins": 20,
      "colMatchBatchSize": 2,
      "level": "exact",
      "fuzzyDistance": 1,
      "connectionList": []
    },
    "spark": {
      "numExecutors": 3,
      "driverMemory": "",
      "executorMemory": "",
      "executorCores": 1,
      "conf": "",
      "queue": "",
      "master": "local[*]",
      "principal": "",
      "keyTab": "",
      "deployMode": "",
      "jars": null,
      "packages": null,
      "files": null
    },
    "env": {
      "jdbcPrincipal": "",
      "jdbcKeyTab": ""
    },
    "record": {
      "on": false,
      "in": "",
      "notIn": "",
      "include": null,
      "percDeltaLimit": 0.1,
      "score": 1
    },
    "transforms": [],
    "pipeline": []
  }
```



GET /v2/assignment-q/find-all Find all assignments

GET /v2/assignment-q/find-all-paging Find all assignments by paging

GET /v2/assignment-q/find-all-paging-datatables Find all assignments by paging for datatables

GET /v2/assignment-q/find-by-assigned-to Find all assignments assigned to a user

GET /v2/assignment-q/get Get an assignment by Id

PUT /v2/assignment-q/invalidate Invalidate an existing assignment

PUT /v2/assignment-q/invalidate-by-datashape-columnname Invalidate assignments assigned to Datashapes by the given column name

PUT /v2/assignment-q/resolve Resolve an existing assignment

PUT /v2/assignment-q/resolve-by-datashape-columnname Resolve assignments assigned to Datashapes by the given column name

DELETE /v2/assignment-q/unassign Unassign user from existing assignment and delete

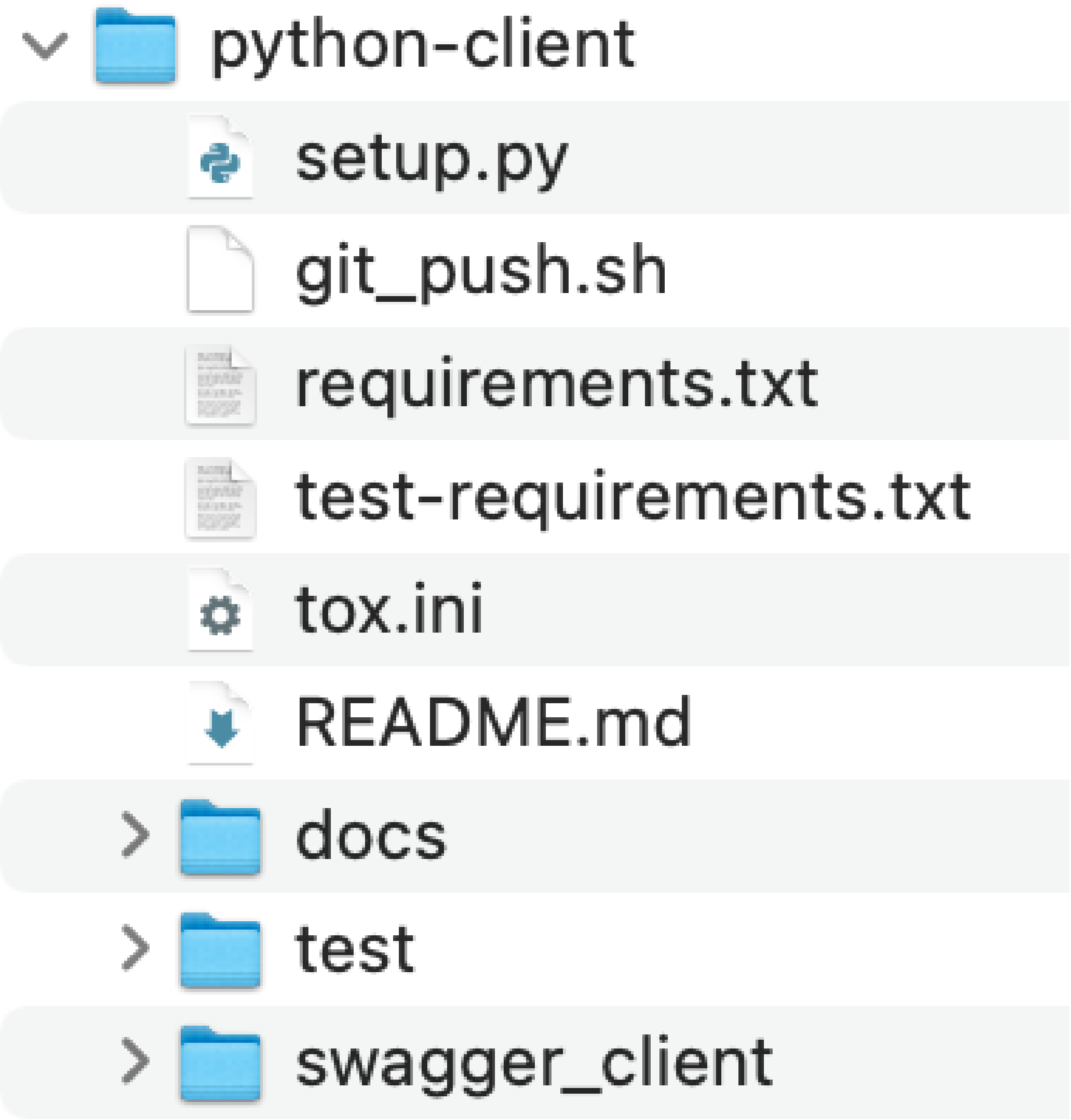
PUT /v2/assignment-q/update-state Update state of an existing assignment

PUT /v2/assignment-q/update-states Update state of multiple existing assignment

PUT /v2/assignment-q/verify Verify an existing assignment

Generate Client SDK

1. Go to https://editor.swagger.io/.
2. Click File Import URL.
3. Paste a URL that looks like this https://<host>/v2/api-docs?group=Product%20API.
4. Click generate client (python, java, scala, C#).



```
#Python SDK Example

#GET CMDLINE
cmdLine = get_job_cmdline(dataset)

#SUBMIT JOB
job_id = run(dataset, run_date)

#CHECK STATUS
status = get_job_status(job_id)

#GET DQ ISSUES
status = get_job_findings(dataset, run_date)
```

Swagger

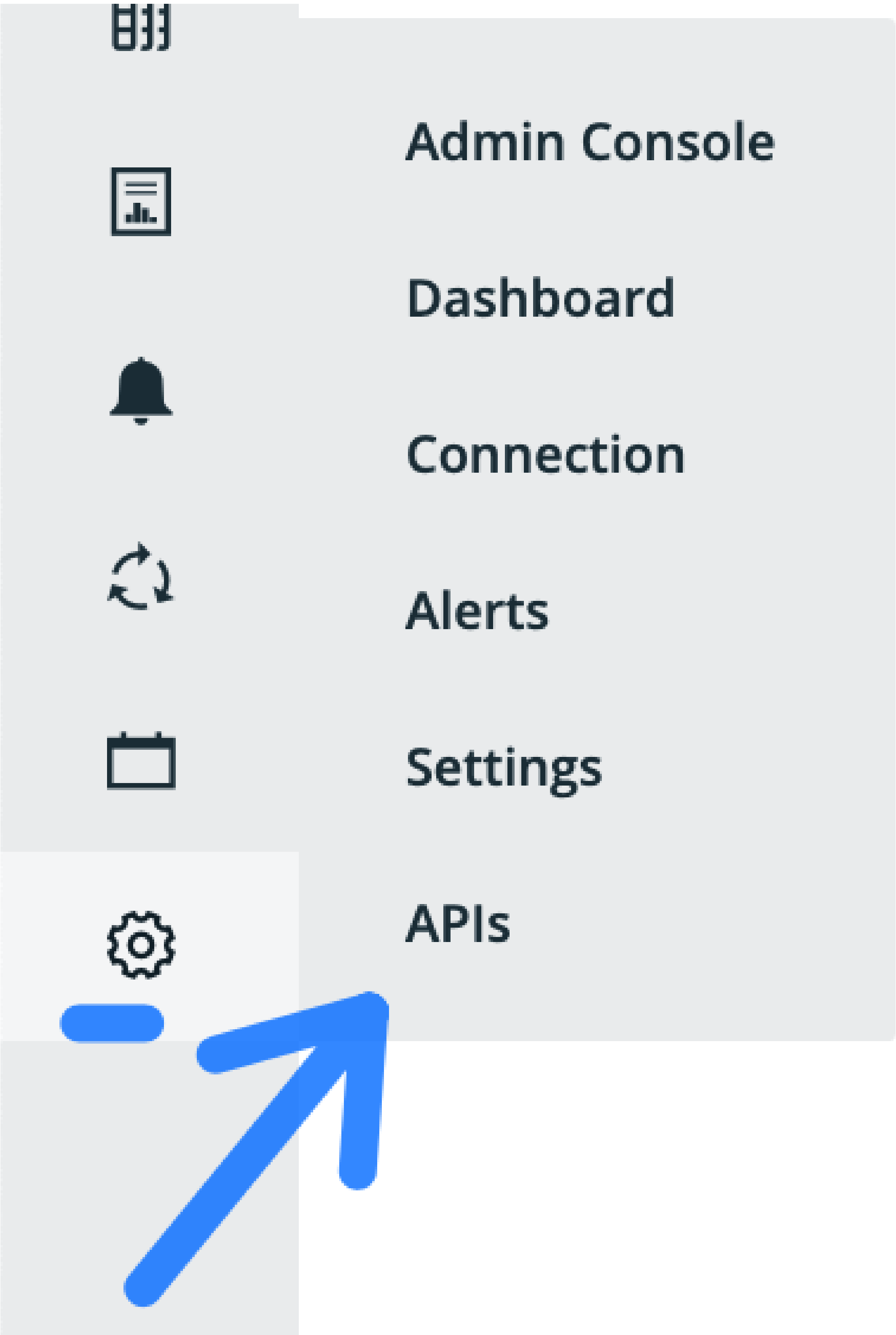
You can find Swagger in the Collibra DQ application.

Docs built into the application

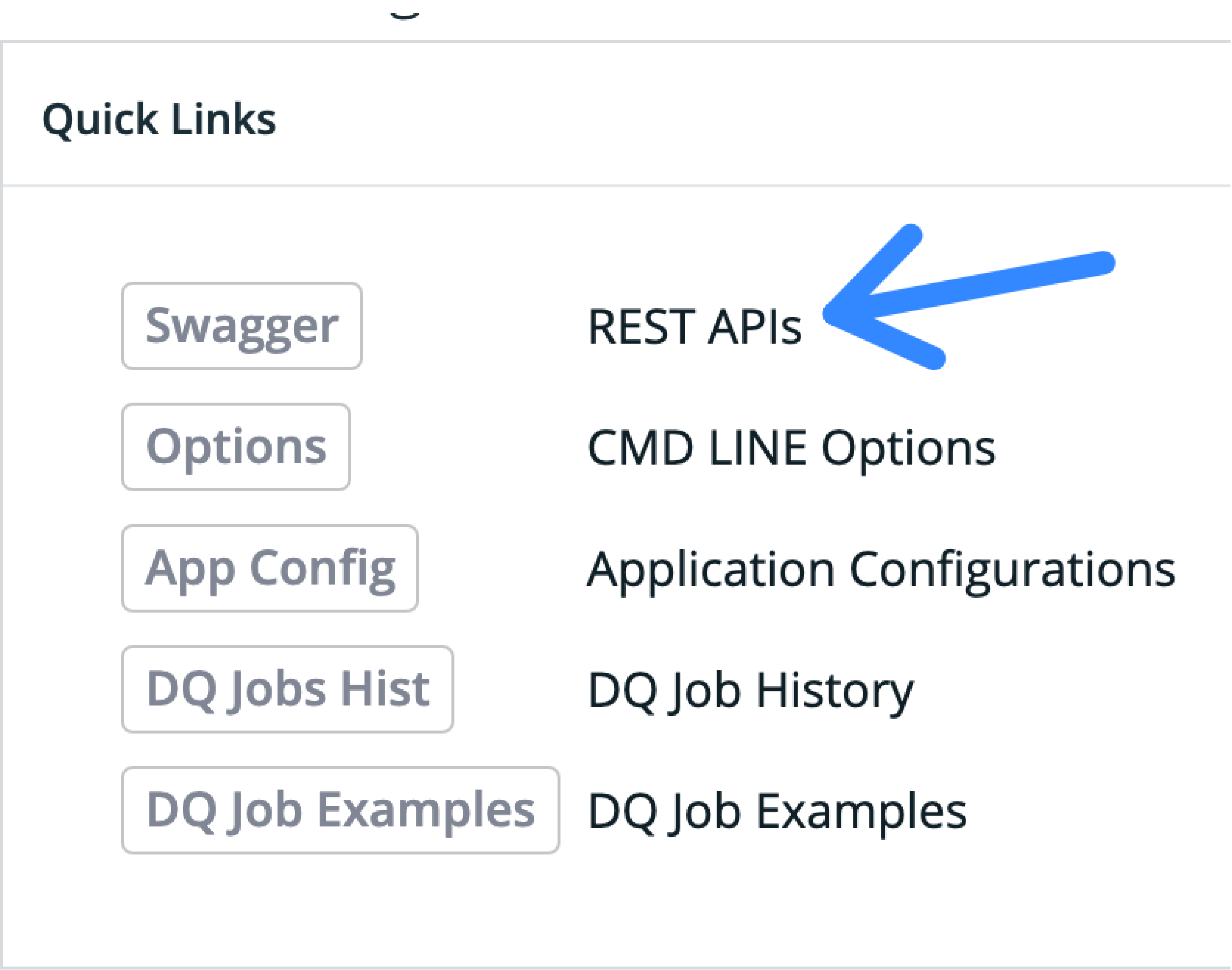
Collibra DQ comes with full swagger support out of the box.

```
http://<YOUR_IP_ADDRESS>/swagger-ui.html
```

Swagger can be found in the application under the Admin section labeled APIs.



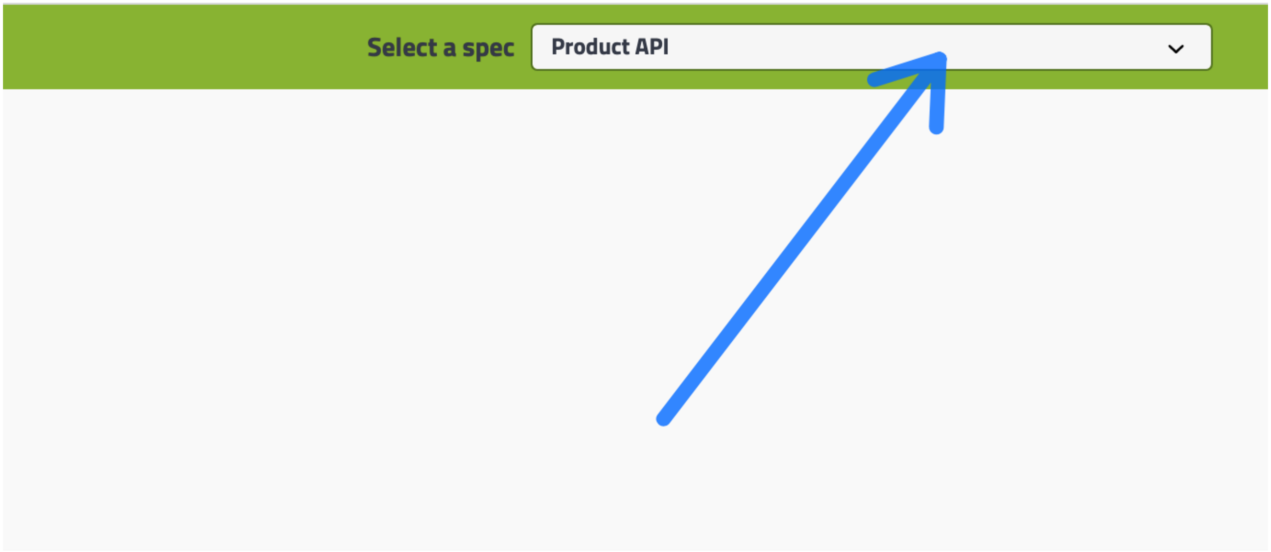
You will find a direct link to the Swagger page



Quick Links

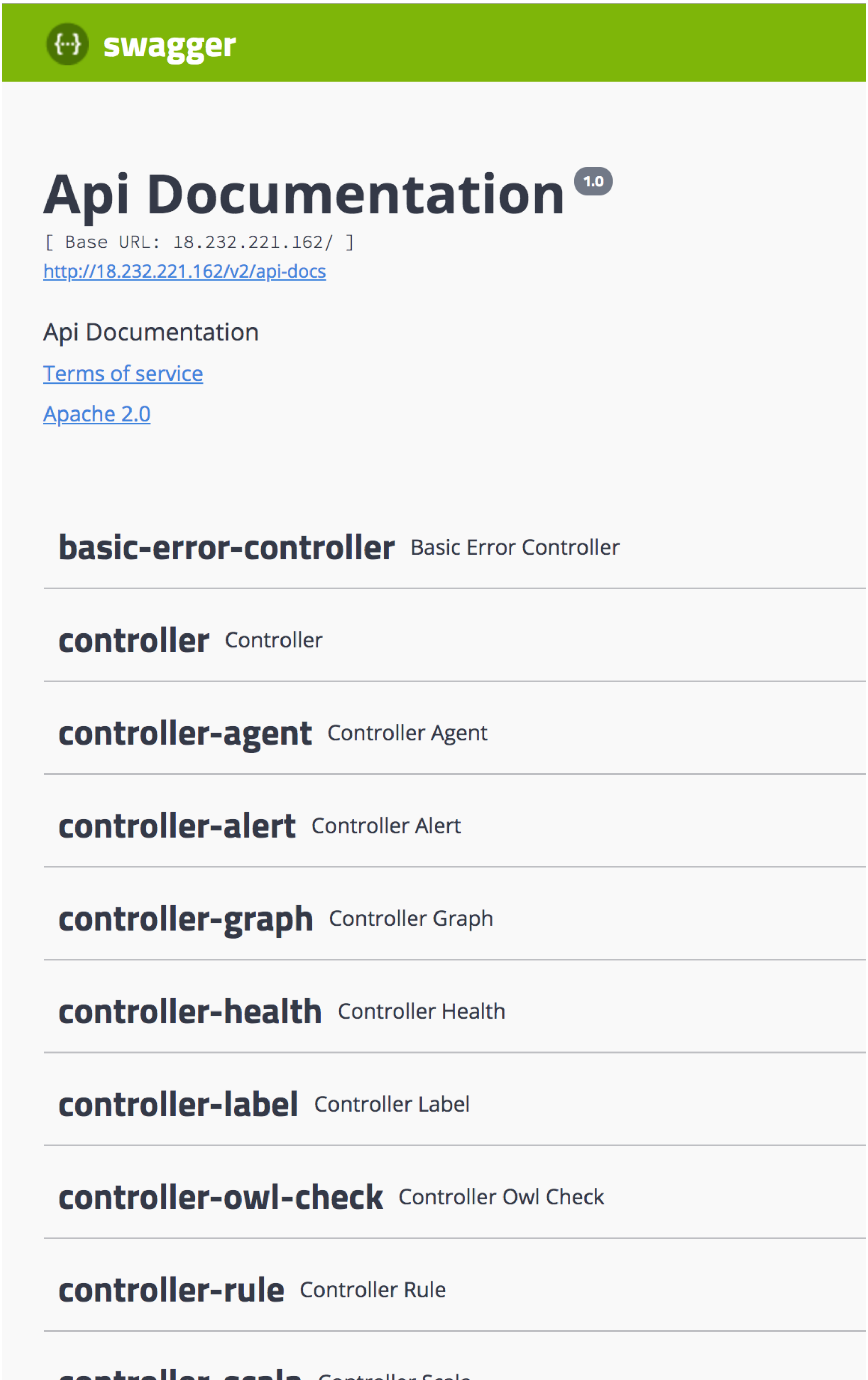
Swagger	REST APIs
Options	CMD LINE Options
App Config	Application Configurations
DQ Jobs Hist	DQ Job History
DQ Job Examples	DQ Job Examples

Toggle between Product API and Internal API.



Select a spec Product API

For example swagger API please visit - http://<YOUR_IP>:9000/v2/api-docs?group=UI Internal.



Api Documentation 1.0

[Base URL: 18.232.221.162/]

http://18.232.221.162/v2/api-docs

Api Documentation

Terms of service

Apache 2.0

basic-error-controller Basic Error Controller

controller Controller

controller-agent Controller Agent

controller-alert Controller Alert

controller-graph Controller Graph

controller-health Controller Health

controller-label Controller Label

controller-owl-check Controller Owl Check

controller-rule Controller Rule

controller-scale Controller Scale

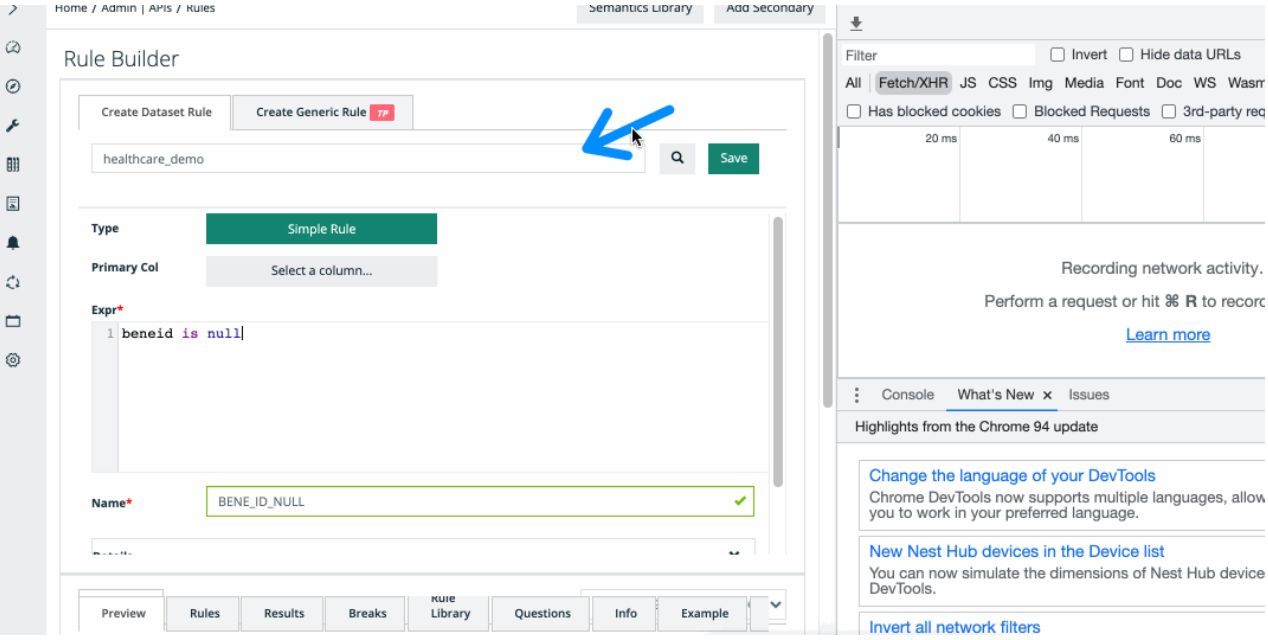
Find the endpoint

Find an API Endpoint

Any front-end action uses the API. You can find the corresponding endpoint using developer tools.

In this example, we will look at the api call for `/create rule`.

Locate the call in Developer Tools



healthcare_demo

Type: Simple Rule

Primary Col: Select a column...

Expr*

```
beneid is null
```

Name*: BENE_ID_NULL ✓

Recording network activity...

Perform a request or hit ⌘ R to record

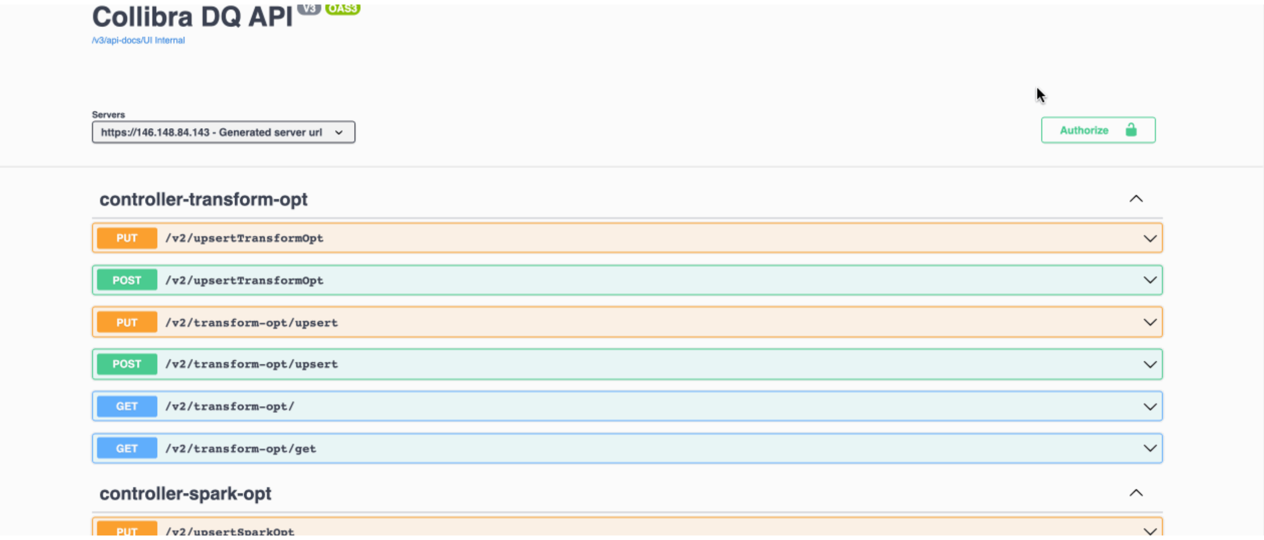
Highlights from the Chrome 94 update

Change the language of your DevTools
Chrome DevTools now supports multiple languages, allow you to work in your preferred language.

New Nest Hub devices in the Device list
You can now simulate the dimensions of Nest Hub device DevTools.

Invert all network filters

Locate the API in Swagger



controller-transform-opt

PUT /v2/upsertTransformOpt

POST /v2/upsertTransformOpt

PUT /v2/transform-opt/upsert

POST /v2/transform-opt/upsert

GET /v2/transform-opt/

GET /v2/transform-opt/get

controller-spark-opt

PUT /v2/upsertSparkOpt

All UI endpoints are the API and can be located in swagger. You can script against this externally as well.

Export and Import API

Promoting and moving data sets across environments.

Pre-requirements

> **Warning** The database needs the stored procedure (function) defined in order to use the Export/Import API.

V2 - Stable - available from 2022.02 release

Step 1a - Export content from source schema

GET https://<collibra-dq-url>/v2/**db-export**

Exports tables from database

Parameters

Query

`data sets*`	List of strings	List of data sets to export. You need to give at least one **valid** data set name into the list.
`schema`	String	Name of the schema/tenant where you want to perform the export. \\ *Default value:* **public**
`tables`	String	List of tables to export on the given schema & data set(s). \\ If you leave it empty, the following tables will be exported altogether: **rule_repo, owl_catalog, owl_rule, alert_cond, owl_check_repo, job_schedule, alert_output**
Responses		
● **200: OK**		List of SQL - INSERT statements as JSON list.

```
{
    // Response
}
```

● **400: Bad Request** Any error happened with error message

```
{
    // Response
}
```

Step 1b - Import content

POST https://<collibra-dq-url>/v2/**db-import**

Import content into the target tenant

The target schema/tenant name will be part of the input SQL INSERT statements.

The import is rung on non-transactional mode, any error happens in the middle, the saved items will be left in the database as is.

Parameters

Body

*	List of SQL INSERT, which will be imported into the target Collibra DQ metastore. Format: JSON string list
Responses	
● **200: OK**	When the import was successful.

```
{
    // Response
}
```

● **400: Bad Request** Any error happened with error message

```
{
    // Response
}
```

We suggest using db-export, but we will not remove get-exports. We do expect to consolidate the newer logic behind the method.

Step 1c - Get-Exports

You can pass in several dataset names and several tables at once. This endpoint will create a JSON payload

> **Note** Exports and Imports are currently limited to the 3 tables listed below.

These are the three most common tables. These are the supported tables for re-promotion (running the export multiple times). The most common use case is to copy jobs and rules from environment A to environment B. Running the export/import sequence on the same

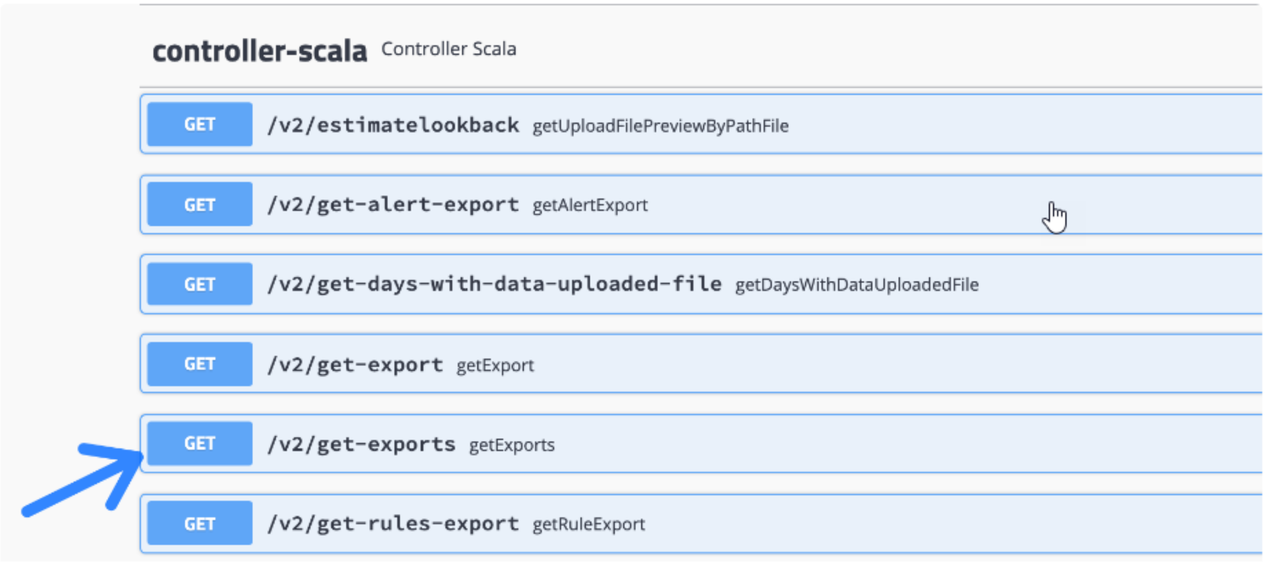
environment likely result in a key constraint conflict, unless in-between edits are made to the insert payload.

- owl_rule
- job_schedule
- owl_check_repo

```
http://<url>/v2/get-exports?dataset=public.dataset_scan_2,pub-
lic.dataset_scan_1&schema=public&tables=owl_rule,job_sched-
ule,owl_check_repo
```

Use Swagger to build this for you

This is located under controller-scala (internal API)



controller-scala Controller Scala

GET /v2/estimatelookback getUploadFilePreviewByPathFile

GET /v2/get-alert-export getAlertExport

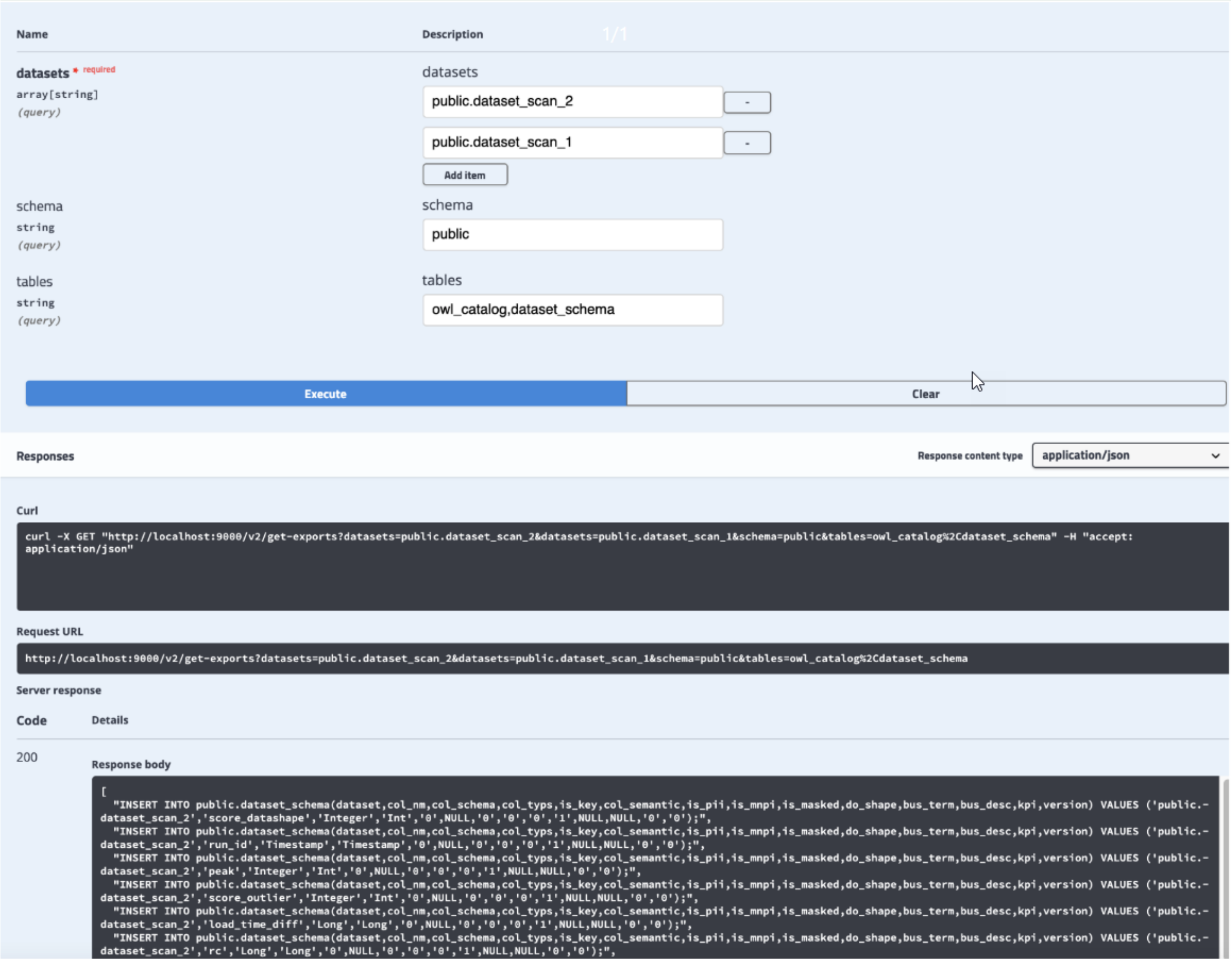
GET /v2/get-days-with-data-uploaded-file getDaysWithDataUploadedFile

GET /v2/get-export getExport

GET /v2/get-exports getExports

GET /v2/get-rules-export getRuleExport

Click Try it out to input the details



datasets * required
array[string]
(query)

datasets: public.dataset_scan_2 -
public.dataset_scan_1 -

schema
string
(query)

schema: public

tables
string
(query)

tables: owl_catalog,dataset_schema

Response content type: application/json

Curl

```
curl -X GET "http://localhost:9000/v2/get-exports?datasets=public.dataset_scan_2&datasets=public.dataset_scan_1&schema=public&tables=owl_catalog%2Cdataset_schema" -H "accept:
application/json"
```

Request URL

```
http://localhost:9000/v2/get-exports?datasets=public.dataset_scan_2&datasets=public.dataset_scan_1&schema=public&tables=owl_catalog%2Cdataset_schema
```

Server response

Code: 200

Details

Response body

```
[
  "INSERT INTO public.dataset_schema(dataset,col_nm,col_schema,col_typs,is_key,col_semantic,is_pii,is_mnpi,is_masked,do_shape,bus_term,bus_desc,kpi,version) VALUES ('public.-
dataset_scan_2','score_datashape','Integer','Int','0',NULL,'0','0','0','1',NULL,NULL,'0','0');",
  "INSERT INTO public.dataset_schema(dataset,col_nm,col_schema,col_typs,is_key,col_semantic,is_pii,is_mnpi,is_masked,do_shape,bus_term,bus_desc,kpi,version) VALUES ('public.-
dataset_scan_2','run_id','Timestamp','Timestamp','0',NULL,'0','0','0','1',NULL,NULL,'0','0');",
  "INSERT INTO public.dataset_schema(dataset,col_nm,col_schema,col_typs,is_key,col_semantic,is_pii,is_mnpi,is_masked,do_shape,bus_term,bus_desc,kpi,version) VALUES ('public.-
dataset_scan_2','peak','Integer','Int','0',NULL,'0','0','0','1',NULL,NULL,'0','0');",
  "INSERT INTO public.dataset_schema(dataset,col_nm,col_schema,col_typs,is_key,col_semantic,is_pii,is_mnpi,is_masked,do_shape,bus_term,bus_desc,kpi,version) VALUES ('public.-
dataset_scan_2','score_outlier','Integer','Int','0',NULL,'0','0','0','1',NULL,NULL,'0','0');",
  "INSERT INTO public.dataset_schema(dataset,col_nm,col_schema,col_typs,is_key,col_semantic,is_pii,is_mnpi,is_masked,do_shape,bus_term,bus_desc,kpi,version) VALUES ('public.-
dataset_scan_2','load_time_diff','Long','Long','0',NULL,'0','0','0','1',NULL,NULL,'0','0');",
  "INSERT INTO public.dataset_schema(dataset,col_nm,col_schema,col_typs,is_key,col_semantic,is_pii,is_mnpi,is_masked,do_shape,bus_term,bus_desc,kpi,version) VALUES ('public.-
dataset_scan_2','rc','Long','Long','0',NULL,'0','0','0','1',NULL,NULL,'0','0');",
```

Step 2 - Run-Import

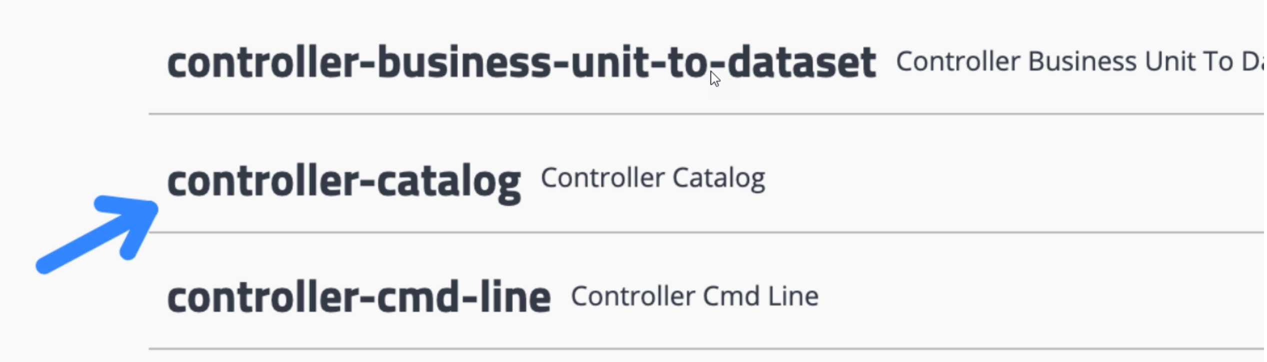
> **Note** You will want to perform a find/replace on the import payload to check for differences in connections, agents, spark and environment configurations. Migrating to different environments typically requires the payload to be modified.

Run import on the desired environment, passing the output of the previous statement to the body of the request.

```
http://<url>/v2/run-import
```

Use Swagger to try it out

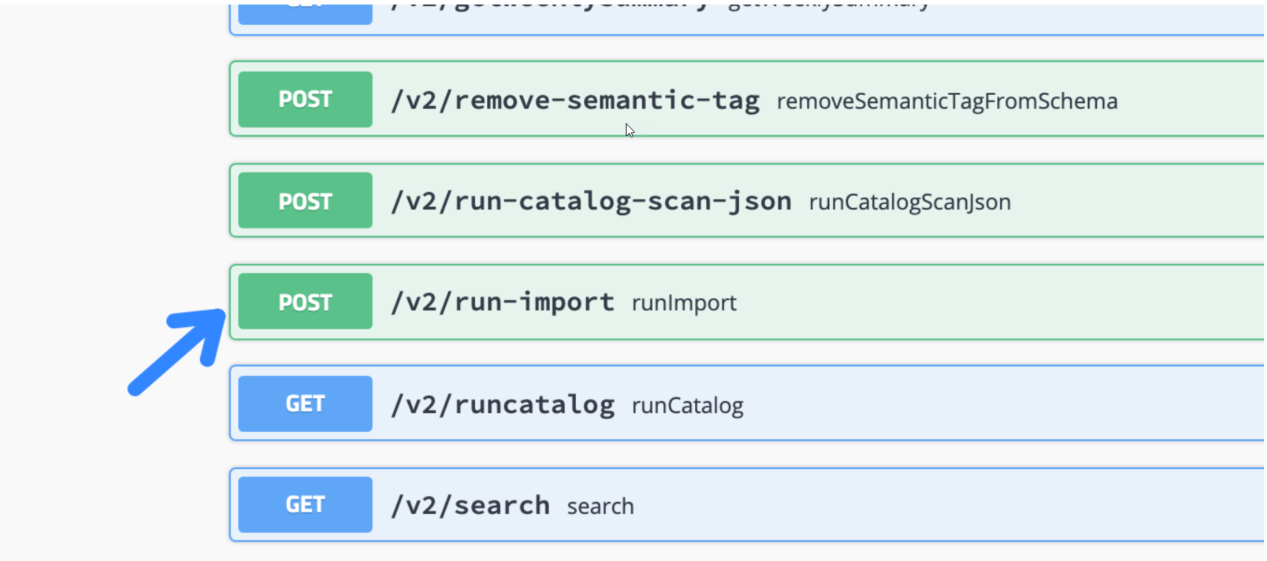
This is under controller-catalog.



controller-business-unit-to-dataset Controller Business Unit To Da

controller-catalog Controller Catalog

controller-cmd-line Controller Cmd Line



POST `/v2/remove-semantic-tag` removeSemanticTagFromSchema

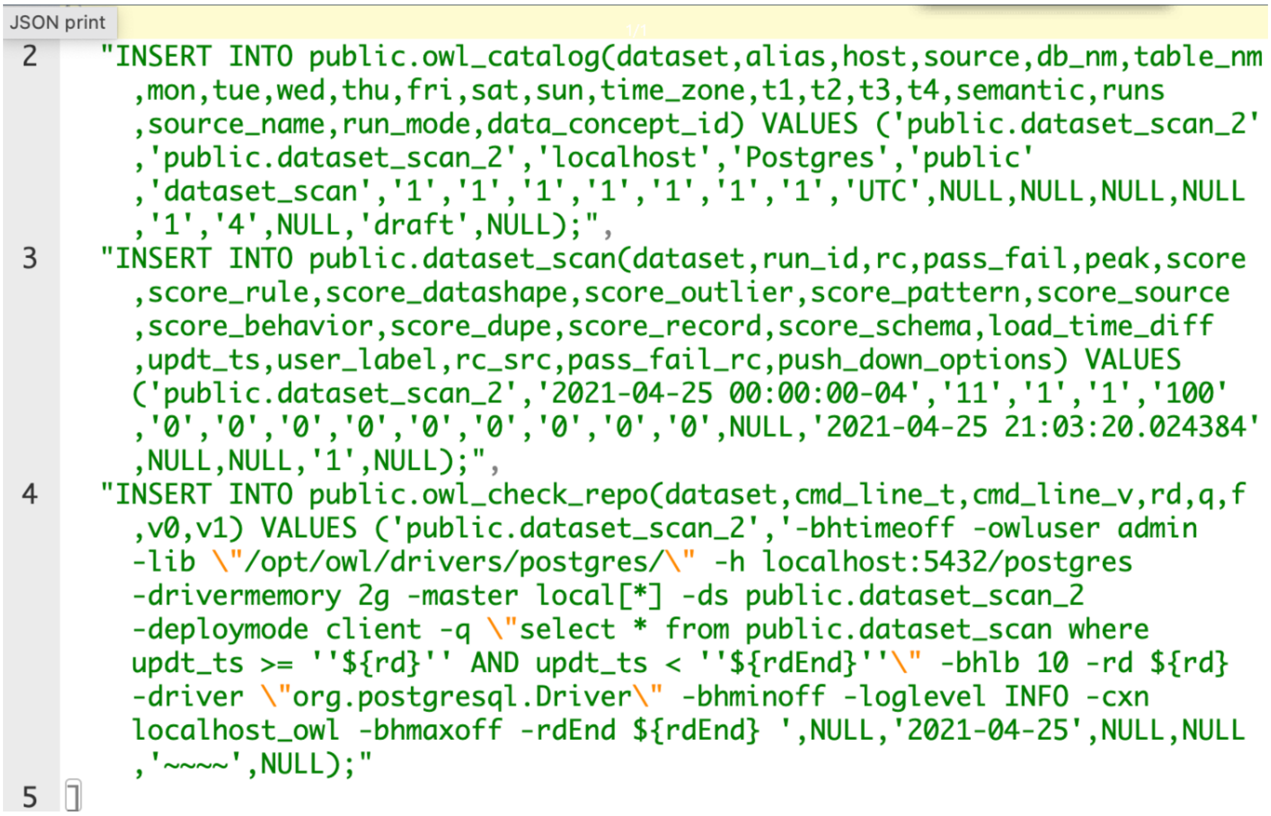
POST `/v2/run-catalog-scan-json` runCatalogScanJson

POST `/v2/run-import` runImport

GET `/v2/runcatalog` runCatalog

GET `/v2/search` search

This would be the body of the POST.



```
  "INSERT INTO public.owl_catalog(dataset,alias,host,source,db_nm,table_nm
    ,mon,tue,wed,thu,fri,sat,sun,time_zone,t1,t2,t3,t4,semantic,runs
    ,source_name,run_mode,data_concept_id) VALUES ('public.dataset_scan_2'
    ,'public.dataset_scan_2','localhost','Postgres','public'
    ,'dataset_scan','1','1','1','1','1','1','1','UTC',NULL,NULL,NULL,NULL
    ,'1','4',NULL,'draft',NULL);",
  "INSERT INTO public.dataset_scan(dataset,run_id,rc,pass_fail,peak,score
    ,score_rule,score_datashape,score_outlier,score_pattern,score_source
    ,score_behavior,score_dupe,score_record,score_schema,load_time_diff
    ,updt_ts,user_label,rc_src,pass_fail_rc,push_down_options) VALUES
    ('public.dataset_scan_2','2021-04-25 00:00:00-04','11','1','1','100'
    ,'0','0','0','0','0','0','0','0','0',NULL,'2021-04-25 21:03:20.024384'
    ,NULL,NULL,'1',NULL);",
  "INSERT INTO public.owl_check_repo(dataset,cmd_line_t,cmd_line_v,rd,q,f
    ,v0,v1) VALUES ('public.dataset_scan_2','-bhtimeoff -owluser admin
    -lib \"/opt/owl/drivers/postgres/\" -h localhost:5432/postgres
    -drivermemory 2g -master local[*] -ds public.dataset_scan_2
    -deploymode client -q \"select * from public.dataset_scan where
    updt_ts >= ''${rd}'' AND updt_ts < ''${rdEnd}''\" -bhlb 10 -rd ${rd}
    -driver \"org.postgresql.Driver\" -bhminoff -loglevel INFO -cxn
    localhost_owl -bhmaxoff -rdEnd ${rdEnd} ',NULL,'2021-04-25',NULL,NULL
    ,'~~~~',NULL);"
]
```

Requirement - Stored Procedure

The following function needs to be created in the Collibra DQ metastore, before this can run.

```
CREATE OR REPLACE FUNCTION public.dump(p_schema text, p_table
text, p_where text)
 RETURNS SETOF text
 LANGUAGE plpgsql
AS $function$
 DECLARE
     dumpquery_0 text;
     dumpquery_1 text;
     selquery text;
     selvalue text;
     valrec record;
     colrec record;
 BEGIN

     -- ------ --
     -- GLOBAL --
     --   build base INSERT
     --   build SELECT array[ ... ]
```

```
     dumpquery_0 := 'INSERT INTO ' ||  quote_ident(p_schema) ||
'.' || quote_ident(p_table) || '(';
     selquery    := 'SELECT array[';

     <<label0>>
     FOR colrec IN SELECT table_schema, table_name, column_
name, data_type
                   FROM information_schema.columns
                   WHERE table_name = p_table and table_schema
= p_schema
                   ORDER BY ordinal_position
     LOOP
         dumpquery_0 := dumpquery_0 || quote_ident(colrec.-
column_name) || ',';
         selquery    := selquery    || 'CAST(' || quote_ident
(colrec.column_name) || ' AS TEXT),';
     END LOOP label0;

     dumpquery_0 := substring(dumpquery_0 ,1,length(dumpquery_
0)-1) || ')';
     dumpquery_0 := dumpquery_0 || ' VALUES (';
     selquery    := substring(selquery    ,1,length(selquery)-
1)    || '] AS MYARRAY';
     selquery    := selquery    || ' FROM ' ||quote_ident(p_
schema)||'.'||quote_ident(p_table);
     selquery    := selquery    || ' WHERE '||p_where;
     -- GLOBAL --
     -- ------ --

     -- ----------- --
     -- SELECT LOOP --
     --   execute SELECT built and loop on each row
     <<label1>>
     FOR valrec IN  EXECUTE  selquery
     LOOP
         dumpquery_1 := '';
         IF not found THEN
             EXIT ;
         END IF;

         -- ----------- --
         -- LOOP ARRAY (EACH FIELDS) --
         <<label2>>
         FOREACH selvalue in ARRAY valrec.MYARRAY
         LOOP
             IF selvalue IS NULL
             THEN selvalue := 'NULL';
             ELSE selvalue := quote_literal(selvalue);
             END IF;
             dumpquery_1 := dumpquery_1 || selvalue || ',';
```

```
          END LOOP label2;
          dumpquery_1 := substring(dumpquery_1 ,1,length
(dumpquery_1)-1) || ');';
          -- LOOP ARRAY (EACH FIELD) --
          -- ----------- --

          -- debug: RETURN NEXT dumpquery_0 || dumpquery_1 || '
--' || selquery;
          -- debug: RETURN NEXT selquery;
          RETURN NEXT dumpquery_0 || dumpquery_1;

      END LOOP label1 ;
      -- SELECT LOOP --
      -- ----------- --

  RETURN ;
  END
  $function$
;
```

This assignment needs to be added.

```
alter function dump(text, text, text) owner to <ownername>;
```

Export and Import Example

> **Note** Best practice is to use get-exports and the owl_rule table post 2021.09 release. Please refer to the Export and Import API page for more details.

Steps

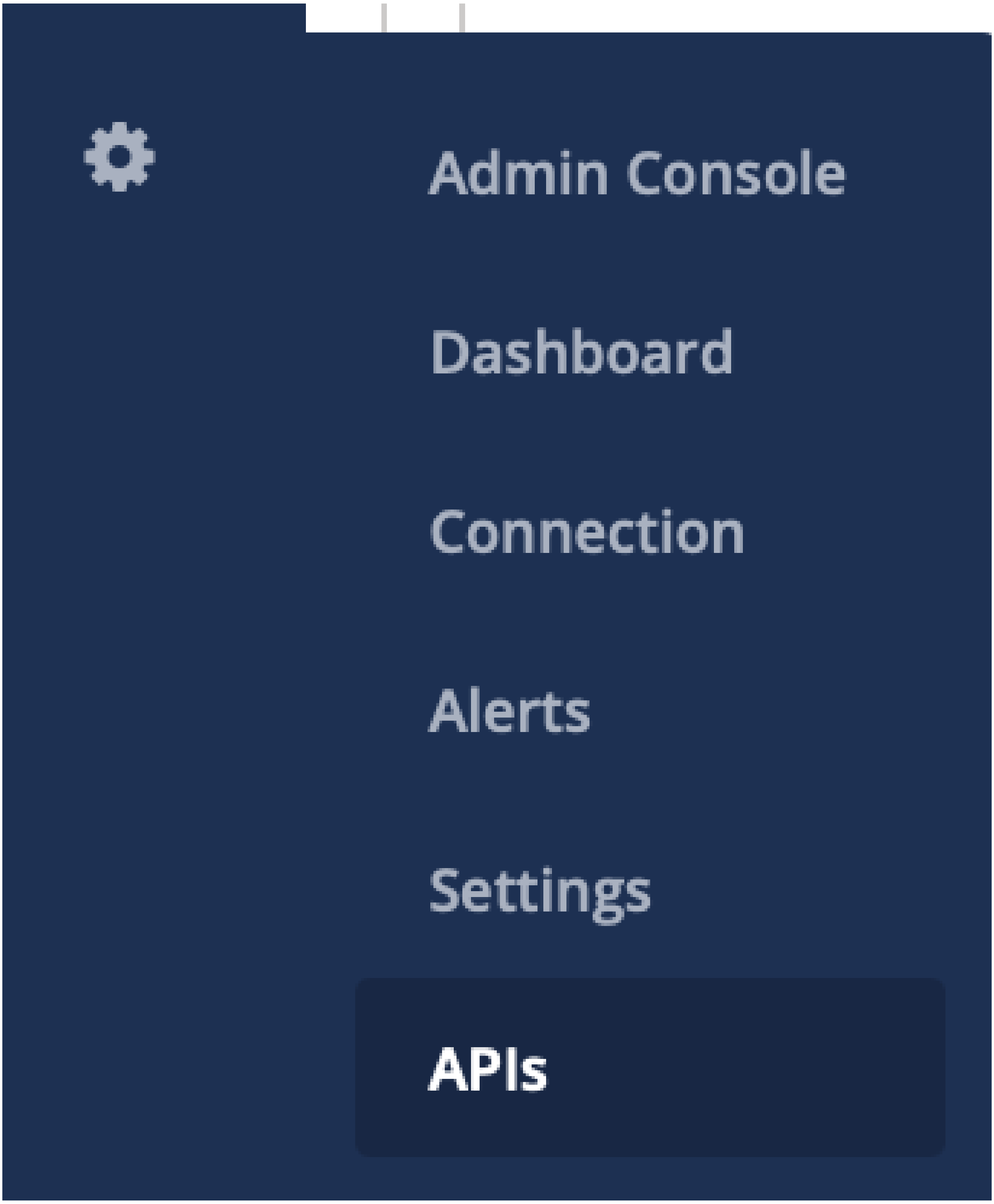
1. Find your dataset.
2. Pass your table to the following api call - http://<url>/v2/get-rules-export?dataset=public.transit_6.
3. Run import on the desired environment, passing the output of the previous statement to the body of the request - http://<url>/v2/run-import.

The following function needs to be declared in the postgres metastore before this can run.

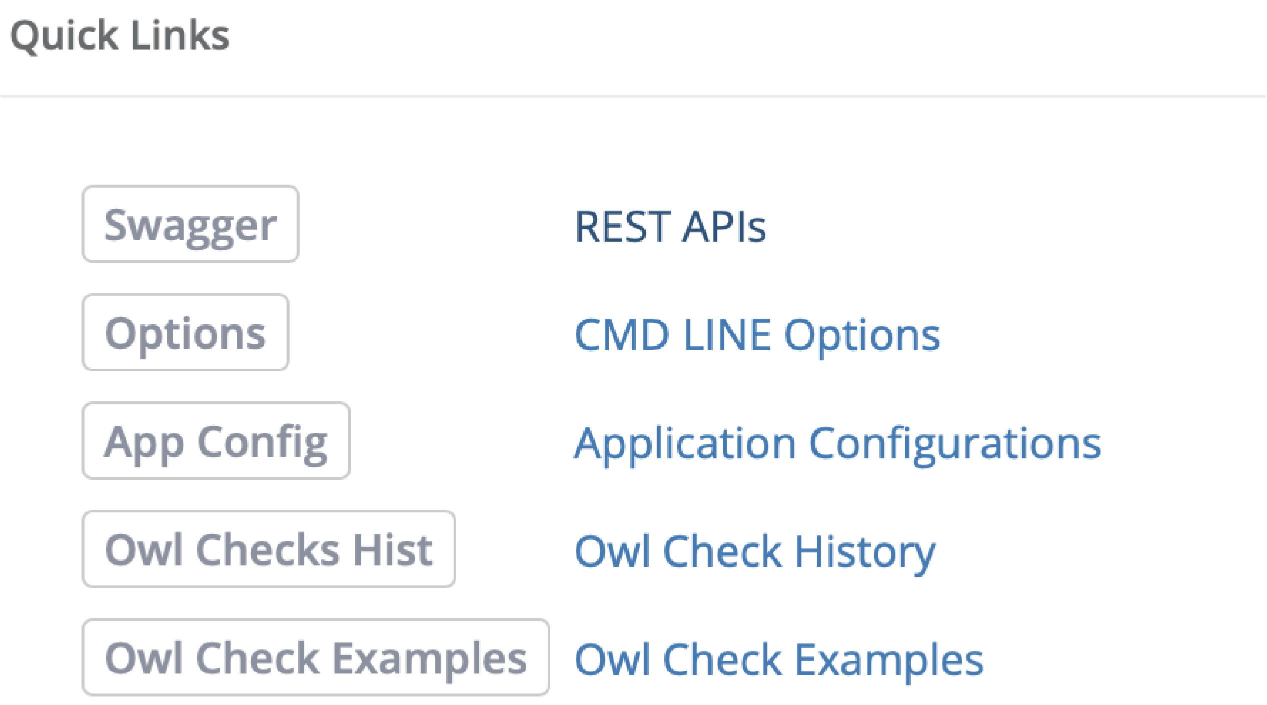
```
CREATE OR REPLACE FUNCTION public.dump(p_schema text, p_table
text, p_where text)
 RETURNS SETOF text
 LANGUAGE plpgsql
AS $function$
 DECLARE
     dumpquery_0 text;
     dumpquery_1 text;
     selquery text;
     selvalue text;
     valrec record;
     colrec record;
 BEGIN

     -- ------ --
     -- GLOBAL --
     --   build base INSERT
     --   build SELECT array[ ... ]
     dumpquery_0 := 'INSERT INTO ' ||  quote_ident(p_schema) ||
'.' || quote_ident(p_table) || '(';
     selquery    := 'SELECT array[';

     <<label0>>
     FOR colrec IN SELECT table_schema, table_name, column_name,
data_type
                   FROM information_schema.columns
                   WHERE table_name = p_table and table_schema =
p_schema
                   ORDER BY ordinal_position
     LOOP
         dumpquery_0 := dumpquery_0 || quote_ident(colrec.-
column_name) || ',';
         selquery    := selquery    || 'CAST(' || quote_ident
(colrec.column_name) || ' AS TEXT),';
     END LOOP label0;

     dumpquery_0 := substring(dumpquery_0 ,1,length(dumpquery_
0)-1) || ')';
     dumpquery_0 := dumpquery_0 || ' VALUES (';
     selquery    := substring(selquery    ,1,length(selquery)-
1)    || '] AS MYARRAY';
     selquery    := selquery    || ' FROM ' ||quote_ident(p_
schema)||'.'||quote_ident(p_table);
     selquery    := selquery    || ' WHERE '||p_where;
     -- GLOBAL --
     -- ------ --

     -- ----------- --
     -- SELECT LOOP --
     --   execute SELECT built and loop on each row
     <<label1>>
     FOR valrec IN  EXECUTE  selquery
     LOOP
         dumpquery_1 := '';
         IF not found THEN
             EXIT ;
         END IF;

         -- ----------- --
         -- LOOP ARRAY (EACH FIELDS) --
         <<label2>>
         FOREACH selvalue in ARRAY valrec.MYARRAY
         LOOP
             IF selvalue IS NULL
             THEN selvalue := 'NULL';
             ELSE selvalue := quote_literal(selvalue);
             END IF;
             dumpquery_1 := dumpquery_1 || selvalue || ',';
         END LOOP label2;
         dumpquery_1 := substring(dumpquery_1 ,1,length
(dumpquery_1)-1) || ');';
         -- LOOP ARRAY (EACH FIELD) --
         -- ----------- --

         -- debug: RETURN NEXT dumpquery_0 || dumpquery_1 || ' -
-' || selquery;
         -- debug: RETURN NEXT selquery;
         RETURN NEXT dumpquery_0 || dumpquery_1;

     END LOOP label1 ;
     -- SELECT LOOP --
     -- ----------- --

 RETURN ;
 END
 $function$
;
```

From Swagger

Navigate to the API page.



Find the Rest APIs link.



Quick Links

Swagger	REST APIs
Options	CMD LINE Options
App Config	Application Configurations
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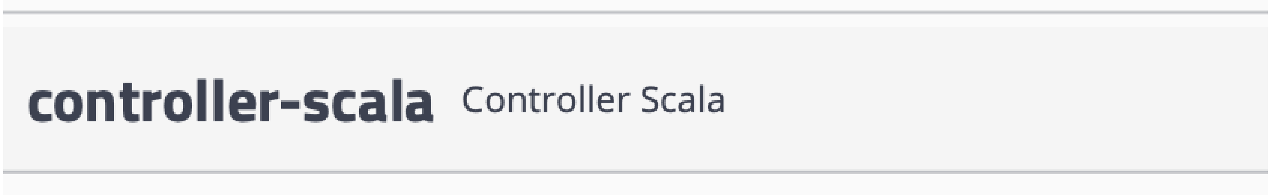
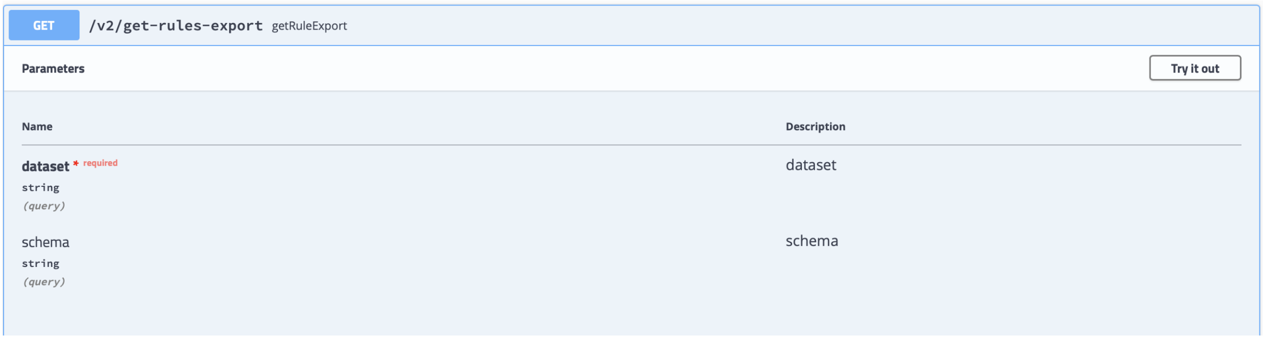
Drill-in to the controller-scala section.



controller-scala Controller Scala

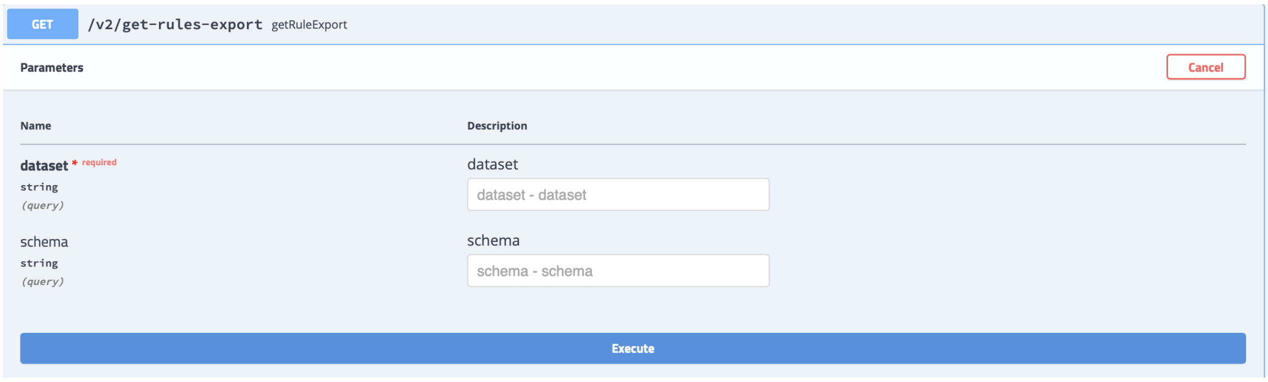
Find the get-rules-export call.



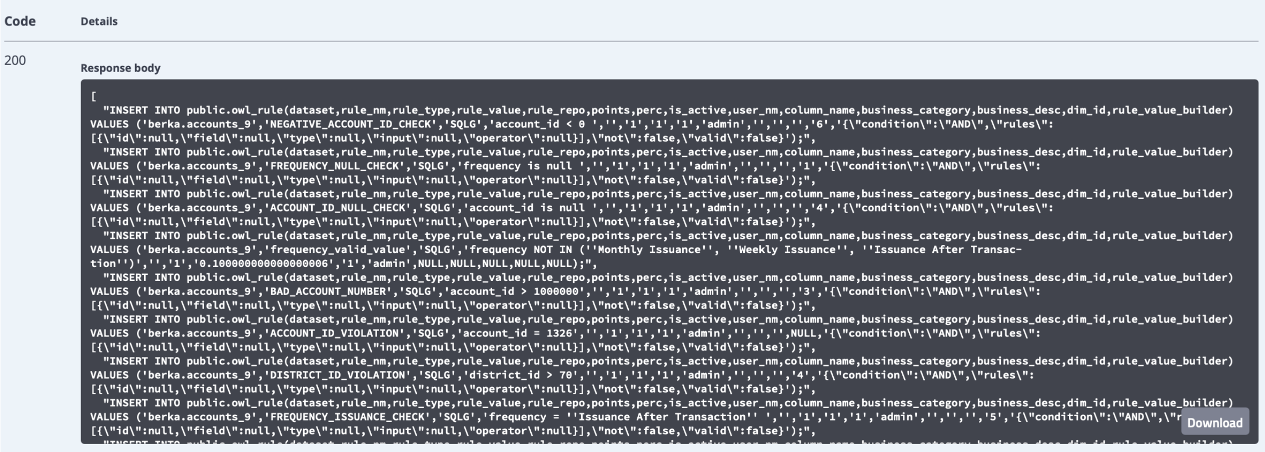
GET /v2/get-rules-export getRuleExport

Name	Description
dataset * required string *(query)*	dataset
schema string *(query)*	schema

Click Try it out and enter a data set name, Execute to run the call.

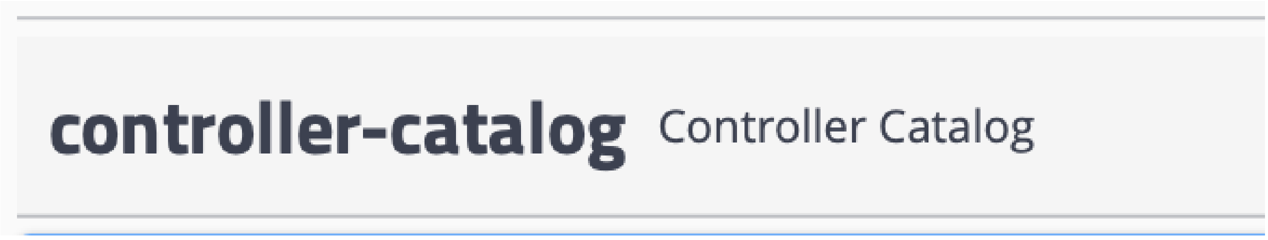


Copy the response body.

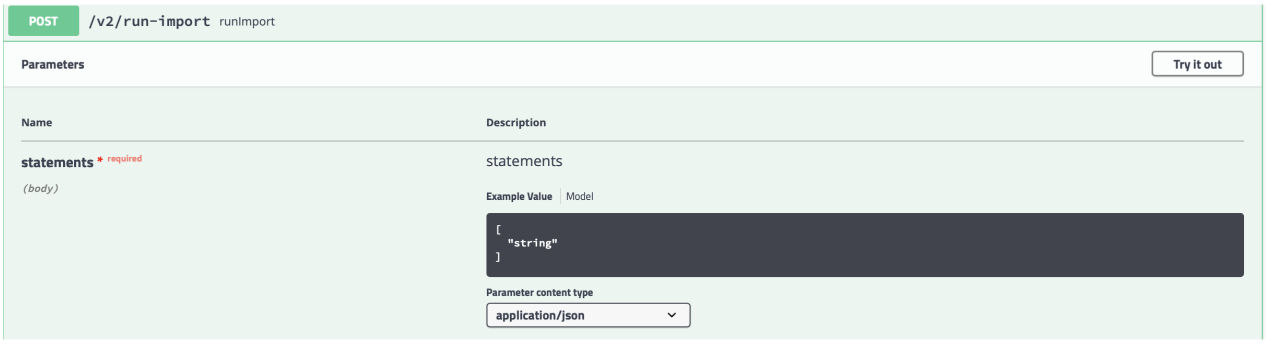


```
[
  "INSERT INTO public.owl_rule(dataset,rule_nm,rule_type,rule_value,rule_repo,points,perc,is_active,user_nm,column_name,business_category,business_desc,dim_id,rule_value_builder)
VALUES ('berka.accounts_9','NEGATIVE_ACCOUNT_ID_CHECK','SQLG','account_id < 0 ','','1','1','1','admin','','','','6','{\"condition\":\"AND\",\"rules\":
[{\"id\":null,\"field\":null,\"type\":null,\"input\":null,\"operator\":null}],\"not\":false,\"valid\":false}');",
  "INSERT INTO public.owl_rule(dataset,rule_nm,rule_type,rule_value,rule_repo,points,perc,is_active,user_nm,column_name,business_category,business_desc,dim_id,rule_value_builder)
VALUES ('berka.accounts_9','FREQUENCY_NULL_CHECK','SQLG','frequency is null ','','1','1','1','admin','','','','1','{\"condition\":\"AND\",\"rules\":
[{\"id\":null,\"field\":null,\"type\":null,\"input\":null,\"operator\":null}],\"not\":false,\"valid\":false}');",
  "INSERT INTO public.owl_rule(dataset,rule_nm,rule_type,rule_value,rule_repo,points,perc,is_active,user_nm,column_name,business_category,business_desc,dim_id,rule_value_builder)
VALUES ('berka.accounts_9','ACCOUNT_ID_NULL_CHECK','SQLG','account_id is null ','','1','1','1','admin','','','','4','{\"condition\":\"AND\",\"rules\":
[{\"id\":null,\"field\":null,\"type\":null,\"input\":null,\"operator\":null}],\"not\":false,\"valid\":false}');",
  "INSERT INTO public.owl_rule(dataset,rule_nm,rule_type,rule_value,rule_repo,points,perc,is_active,user_nm,column_name,business_category,business_desc,dim_id,rule_value_builder)
VALUES ('berka.accounts_9','frequency_valid_value','SQLG','frequency NOT IN (''Monthly Issuance'', ''Weekly Issuance'', ''Issuance After Transac-
tion'')','','1','0.10000000000000006','1','admin',NULL,NULL,NULL,NULL,NULL);",
  "INSERT INTO public.owl_rule(dataset,rule_nm,rule_type,rule_value,rule_repo,points,perc,is_active,user_nm,column_name,business_category,business_desc,dim_id,rule_value_builder)
VALUES ('berka.accounts_9','BAD_ACCOUNT_NUMBER','SQLG','account_id > 1000000','','1','1','1','admin','','','','3','{\"condition\":\"AND\",\"rules\":
[{\"id\":null,\"field\":null,\"type\":null,\"input\":null,\"operator\":null}],\"not\":false,\"valid\":false}');",
  "INSERT INTO public.owl_rule(dataset,rule_nm,rule_type,rule_value,rule_repo,points,perc,is_active,user_nm,column_name,business_category,business_desc,dim_id,rule_value_builder)
VALUES ('berka.accounts_9','ACCOUNT_ID_VIOLATION','SQLG','account_id = 1326','','1','1','1','admin','','','',NULL,'{\"condition\":\"AND\",\"rules\":
[{\"id\":null,\"field\":null,\"type\":null,\"input\":null,\"operator\":null}],\"not\":false,\"valid\":false}');",
  "INSERT INTO public.owl_rule(dataset,rule_nm,rule_type,rule_value,rule_repo,points,perc,is_active,user_nm,column_name,business_category,business_desc,dim_id,rule_value_builder)
VALUES ('berka.accounts_9','DISTRICT_ID_VIOLATION','SQLG','district_id > 70','','1','1','1','admin','','','','4','{\"condition\":\"AND\",\"rules\":
[{\"id\":null,\"field\":null,\"type\":null,\"input\":null,\"operator\":null}],\"not\":false,\"valid\":false}');",
  "INSERT INTO public.owl_rule(dataset,rule_nm,rule_type,rule_value,rule_repo,points,perc,is_active,user_nm,column_name,business_category,business_desc,dim_id,rule_value_builder)
VALUES ('berka.accounts_9','FREQUENCY_ISSUANCE_CHECK','SQLG','frequency = ''Issuance After Transaction'' ','','1','1','1','admin','','','','5','{\"condition\":\"AND\",\"r
[{\"id\":null,\"field\":null,\"type\":null,\"input\":null,\"operator\":null}],\"not\":false,\"valid\":false}');",
```

Navigate to the controller-catalog section.



Find run-import and Try it out.



statements * required

(body)

statements

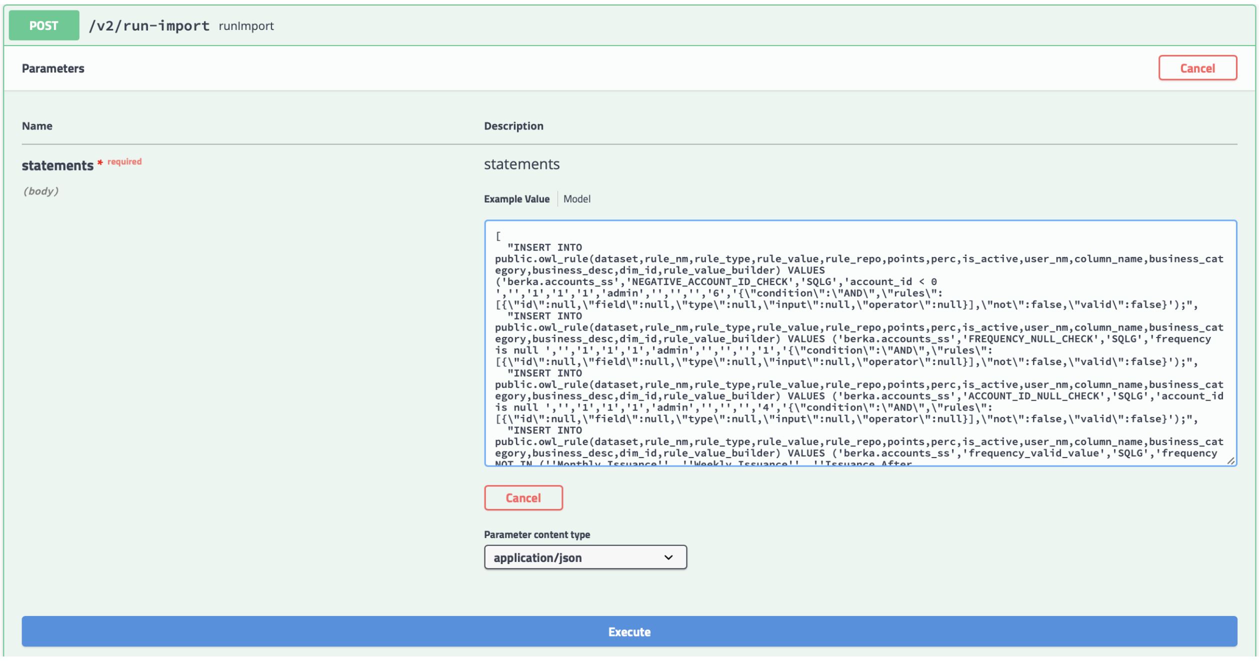
Example Value | Model

```
[
  "string"
]
```

Parameter content type

application/json

Make any edits and paste in the response body from the previous step.



statements * required

(body)

statements

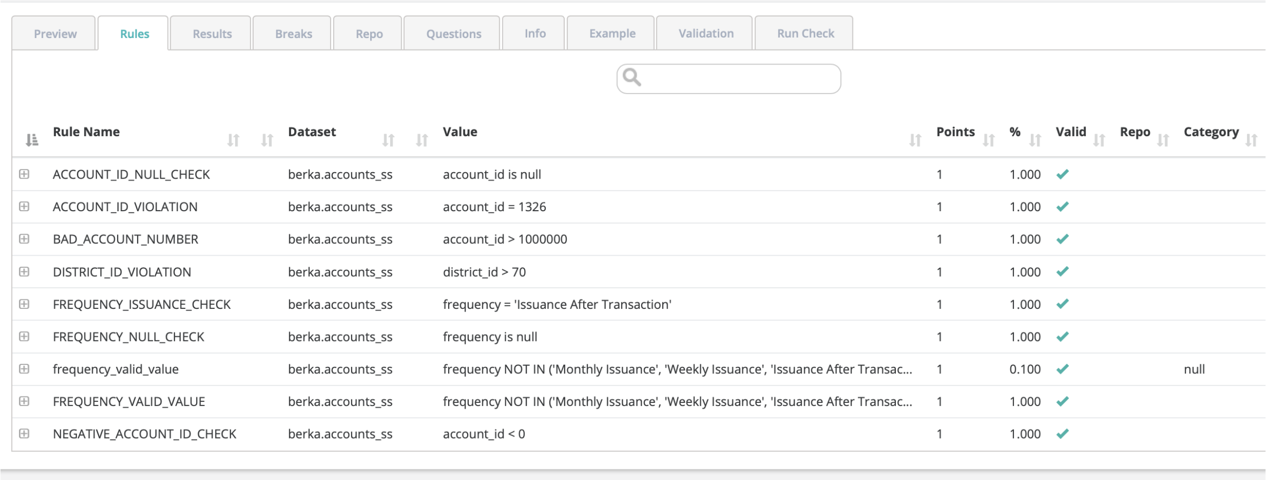
Example Value | Model

```
[
  "INSERT INTO
public.owl_rule(dataset,rule_nm,rule_type,rule_value,rule_repo,points,perc,is_active,user_nm,column_name,business_cat
egory,business_desc,dim_id,rule_value_builder) VALUES
('berka.accounts_ss','NEGATIVE_ACCOUNT_ID_CHECK','SQLG','account_id < 0
','','1','1','1','admin','','','','6','{\"condition\":\"AND\",\"rules\":
[{\"id\":null,\"field\":null,\"type\":null,\"input\":null,\"operator\":null}],\"not\":false,\"valid\":false}');",
  "INSERT INTO
public.owl_rule(dataset,rule_nm,rule_type,rule_value,rule_repo,points,perc,is_active,user_nm,column_name,business_cat
egory,business_desc,dim_id,rule_value_builder) VALUES ('berka.accounts_ss','FREQUENCY_NULL_CHECK','SQLG','frequency
is null ','','1','1','1','admin','','','','1','{\"condition\":\"AND\",\"rules\":
[{\"id\":null,\"field\":null,\"type\":null,\"input\":null,\"operator\":null}],\"not\":false,\"valid\":false}');",
  "INSERT INTO
public.owl_rule(dataset,rule_nm,rule_type,rule_value,rule_repo,points,perc,is_active,user_nm,column_name,business_cat
egory,business_desc,dim_id,rule_value_builder) VALUES ('berka.accounts_ss','ACCOUNT_ID_NULL_CHECK','SQLG','account_id
is null ','','1','1','1','admin','','','','4','{\"condition\":\"AND\",\"rules\":
[{\"id\":null,\"field\":null,\"type\":null,\"input\":null,\"operator\":null}],\"not\":false,\"valid\":false}');",
  "INSERT INTO
public.owl_rule(dataset,rule_nm,rule_type,rule_value,rule_repo,points,perc,is_active,user_nm,column_name,business_cat
egory,business_desc,dim_id,rule_value_builder) VALUES ('berka.accounts_ss','frequency_valid_value','SQLG','frequency
NOT IN (''Monthly Issuance'', ''Weekly Issuance'', ''Issuance After
```

Parameter content type

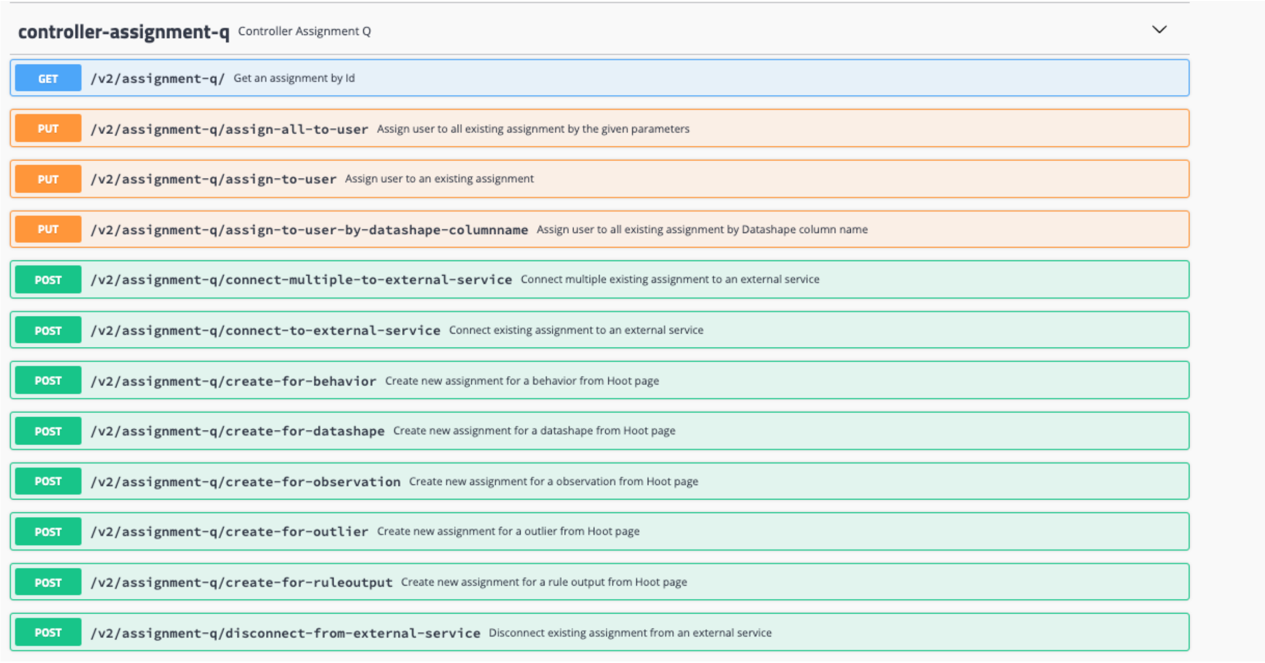
application/json

Visually validate the rules were transferred to another dataset successfully.



	Rule Name	Dataset	Value	Points	%	Valid	Repo	Category
⊞	ACCOUNT_ID_NULL_CHECK	berka.accounts_ss	account_id is null	1	1.000	✓		
⊞	ACCOUNT_ID_VIOLATION	berka.accounts_ss	account_id = 1326	1	1.000	✓		
⊞	BAD_ACCOUNT_NUMBER	berka.accounts_ss	account_id > 1000000	1	1.000	✓		
⊞	DISTRICT_ID_VIOLATION	berka.accounts_ss	district_id > 70	1	1.000	✓		
⊞	FREQUENCY_ISSUANCE_CHECK	berka.accounts_ss	frequency = 'Issuance After Transaction'	1	1.000	✓		
⊞	FREQUENCY_NULL_CHECK	berka.accounts_ss	frequency is null	1	1.000	✓		
⊞	frequency_valid_value	berka.accounts_ss	frequency NOT IN ('Monthly Issuance', 'Weekly Issuance', 'Issuance After Transac...	1	0.100	✓		null
⊞	FREQUENCY_VALID_VALUE	berka.accounts_ss	frequency NOT IN ('Monthly Issuance', 'Weekly Issuance', 'Issuance After Transac...	1	1.000	✓		
⊞	NEGATIVE_ACCOUNT_ID_CHECK	berka.accounts_ss	account_id < 0	1	1.000	✓		

Assignment API



controller-assignment-q Controller Assignment Q

GET `/v2/assignment-q/` Get an assignment by Id

PUT `/v2/assignment-q/assign-all-to-user` Assign user to all existing assignment by the given parameters

PUT `/v2/assignment-q/assign-to-user` Assign user to an existing assignment

PUT `/v2/assignment-q/assign-to-user-by-datashape-columnname` Assign user to all existing assignment by Datashape column name

POST `/v2/assignment-q/connect-multiple-to-external-service` Connect multiple existing assignment to an external service

POST `/v2/assignment-q/connect-to-external-service` Connect existing assignment to an external service

POST `/v2/assignment-q/create-for-behavior` Create new assignment for a behavior from Hoot page

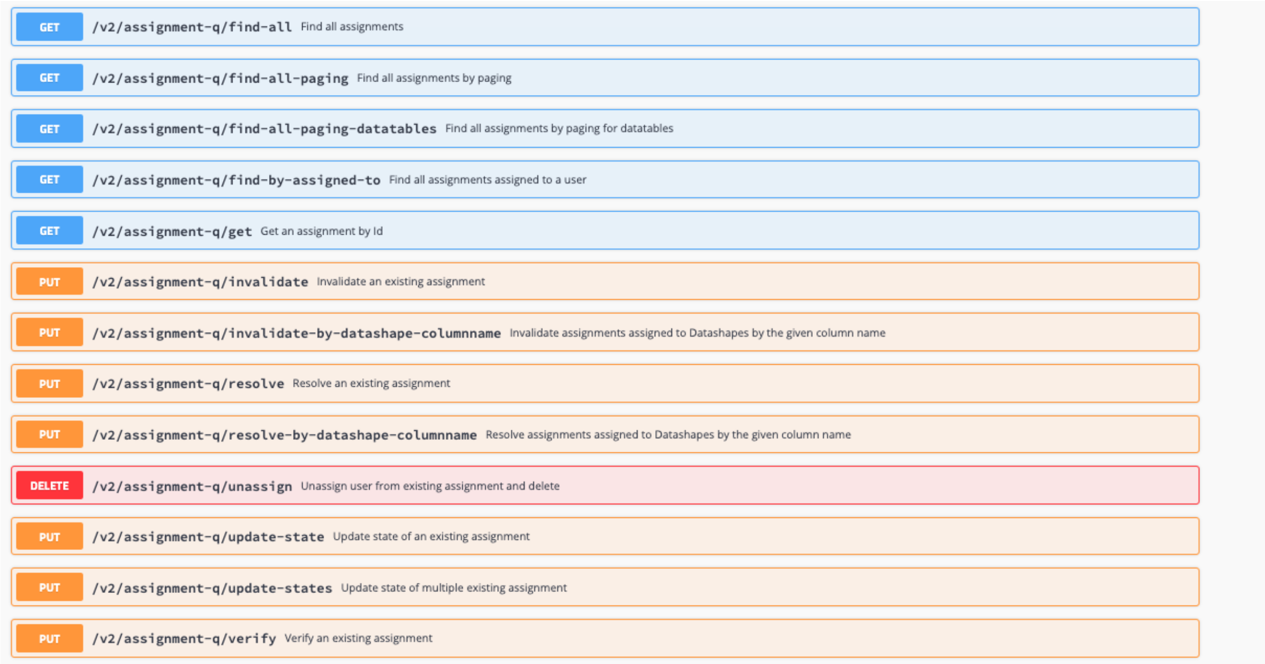
POST `/v2/assignment-q/create-for-datashape` Create new assignment for a datashape from Hoot page

POST `/v2/assignment-q/create-for-observation` Create new assignment for a observation from Hoot page

POST `/v2/assignment-q/create-for-outlier` Create new assignment for a outlier from Hoot page

POST `/v2/assignment-q/create-for-ruleoutput` Create new assignment for a rule output from Hoot page

POST `/v2/assignment-q/disconnect-from-external-service` Disconnect existing assignment from an external service



GET `/v2/assignment-q/find-all` Find all assignments

GET `/v2/assignment-q/find-all-paging` Find all assignments by paging

GET `/v2/assignment-q/find-all-paging-datatables` Find all assignments by paging for datatables

GET `/v2/assignment-q/find-by-assigned-to` Find all assignments assigned to a user

GET `/v2/assignment-q/get` Get an assignment by Id

PUT `/v2/assignment-q/invalidate` Invalidate an existing assignment

PUT `/v2/assignment-q/invalidate-by-datashape-columnname` Invalidate assignments assigned to Datashapes by the given column name

PUT `/v2/assignment-q/resolve` Resolve an existing assignment

PUT `/v2/assignment-q/resolve-by-datashape-columnname` Resolve assignments assigned to Datashapes by the given column name

DELETE `/v2/assignment-q/unassign` Unassign user from existing assignment and delete

PUT `/v2/assignment-q/update-state` Update state of an existing assignment

PUT `/v2/assignment-q/update-states` Update state of multiple existing assignment

PUT `/v2/assignment-q/verify` Verify an existing assignment

Time Zone API

UTC + global DateTime standard

Background on common time issues

Controlling dates and times has always been a troublesome topic for global systems. Server clock vs server code such as new Date() which may create a date in the local timezone of the server vs the Browser or clients timezone. Moving to the cloud only makes the problem worse when you need to consider the timezone the server might be in and inherit from it's system clock.

Collibra Data Quality's Solution - Keep it Simple

If everyone worked off of a globally understood format that is not subject to misinterpretation things would be more simple. Take 03/02/2019, for example. Is this March 2nd or February 3rd? That depends on which country you live in. Collibra DQ only accepts this format: YYYY-MM-DD. Extending this to time would mean YYYY-MM-DD 00:00:00.

CmdLine Examples

```
./owlcheck -ds trades -rd "2019-04-01" or -rd "2019-04-01 00:00:00"
```

Simple Example

A user running an DQ Check in New York and a user running an DQ Check three hours later in California.

CmdLine Arg	User Location	TimeZone	Stored in Owl (UTC)
-rd 2019-04-01	New York	implied EST	2019-04-01 04:00:00
-rd 2019-04-01	California	implied PST	2019-04-01 07:00:00

These jobs run three hours apart, even though they appear to run first thing in the morning to each user. Collibra DQ stores all dates in a common **UTC** format for global consistency.

On the Jobs page, the Start Time and Update Time columns are always based on the server time zone of the DQ Web App, and appear in the YYYY-MM-DD 00:00:00 format.

Web API or URL Example

http://localhost:9000/dq/hoot?dataset=atmCustomers&runId=2019-04-01 04:00:00
http://localhost:9000/dq/hoot?dataset=atmCustomers&runId=2019-04-01 07:00:00

For Convenience, if a user prefers seeing and interacting with dates in their local time zone:

http://localhost:9000/dq/hoot?dataset=atmCustomers&runId=2019-04-01 00:00:00&tz=EST http://localhost:9000/dq/hoot?dataset=atmCustomers&runId=2019-04-01 00:00:00&tz=PST

Cookie

Use cookies file to run Collibra DQ CURL commands.

```
curl -i -X POST -d username=<username> -d password=<password>
http://localhost:9000/login -c cookies.txt

curl -i --header "Accept:application/json" -X GET -b cookies.txt
"http://localhost:9000/v2/getsecuritymap"
```

Multi-Tenant without subdomain in URL (tenant parameter required):

```
curl -i -X POST -d username=<username> -d password=<password> -d
tenant=<tenant> -d tenant=public http://localhost:9000/login -c
cookies.txt

curl -i --header "Accept:application/json" -X GET -b cookies.txt
"http://localhost:9000/v2/getsecuritymap"
```

JWT

Use JSON web tokens to run Collibra DQ CURL commands.

```
TOKEN=$(curl -s -X POST http://localhost:9000/auth/signin -H
"Content-Type:application/json" -d "{\"user-
name\":\"<username>\", \"password\":\"<password>\"}" | jq -r
'.token')

curl -i -H 'Accept: application/json' -H "Authorization: Bearer
${TOKEN}" http://localhost:9000/v2/getsecuritymap
```

Multi-Tenant without subdomain in URL (tenant parameter [iss] required):

```
TOKEN=$(curl -s -X POST http://localhost:9000/auth/signin -H
"Content-Type:application/json" -d "{\"user-
name\":\"<username>\", \"password\":\"<password>\", \"is-
s\":\"<tenant>\"}"| jq -r '.token')

curl -i -H 'Accept: application/json' -H "Authorization: Bearer
${TOKEN}" http://localhost:9000/v2/getsecuritymap
```

Without Headers and jq display:

```
curl -H 'Accept: application/json' -H "Authorization: Bearer
${TOKEN}" http://localhost:9000/v2/getsecuritymap | jq '.' | cat
```

Livy

What is Livy?

At its core, Apache Livy is an optional component that changes how the **Collibra DQ Web** app caches remote files. From **Explorer**, Livy allows for interaction with Spark clusters over REST APIs. This is especially useful with larger data or Spark clusters, because with Livy, you can drill into those bigger files.

In a future release, we plan to make Livy a standard component as part of our data visualization, but as of 2022.04 it remains optional. An orange icon shows cached remote files.

Notebook

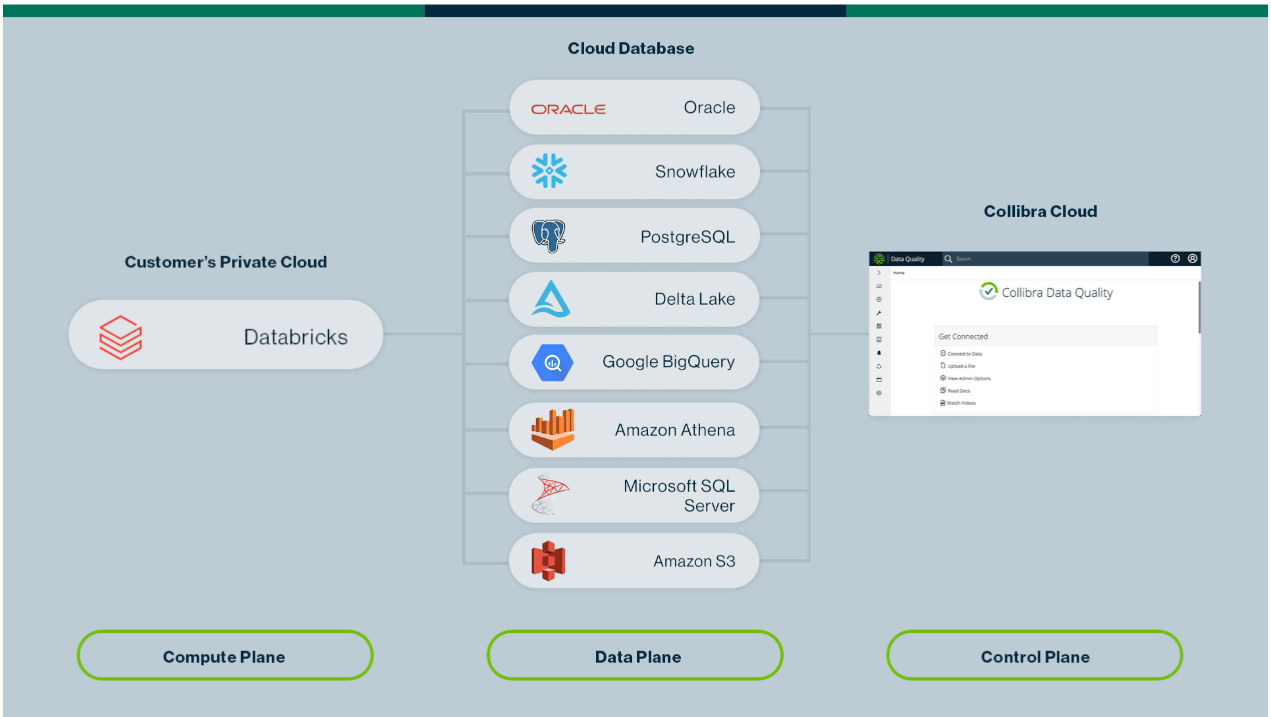
CDQ + Databricks

Learn how to create CDQ jobs in Databricks notebooks.

Introduction

This document provides how to guidance to help you to upload and add CDQ jars to a Databricks cluster and to run a CDQ job by invoking CDQ APIs (aka activities).

Design



CDQ Environment Setup

In this section, we explain the steps involved in setting up your CDQ environment in Databricks. This is the first step towards invoking CDQ APIs in Databricks.

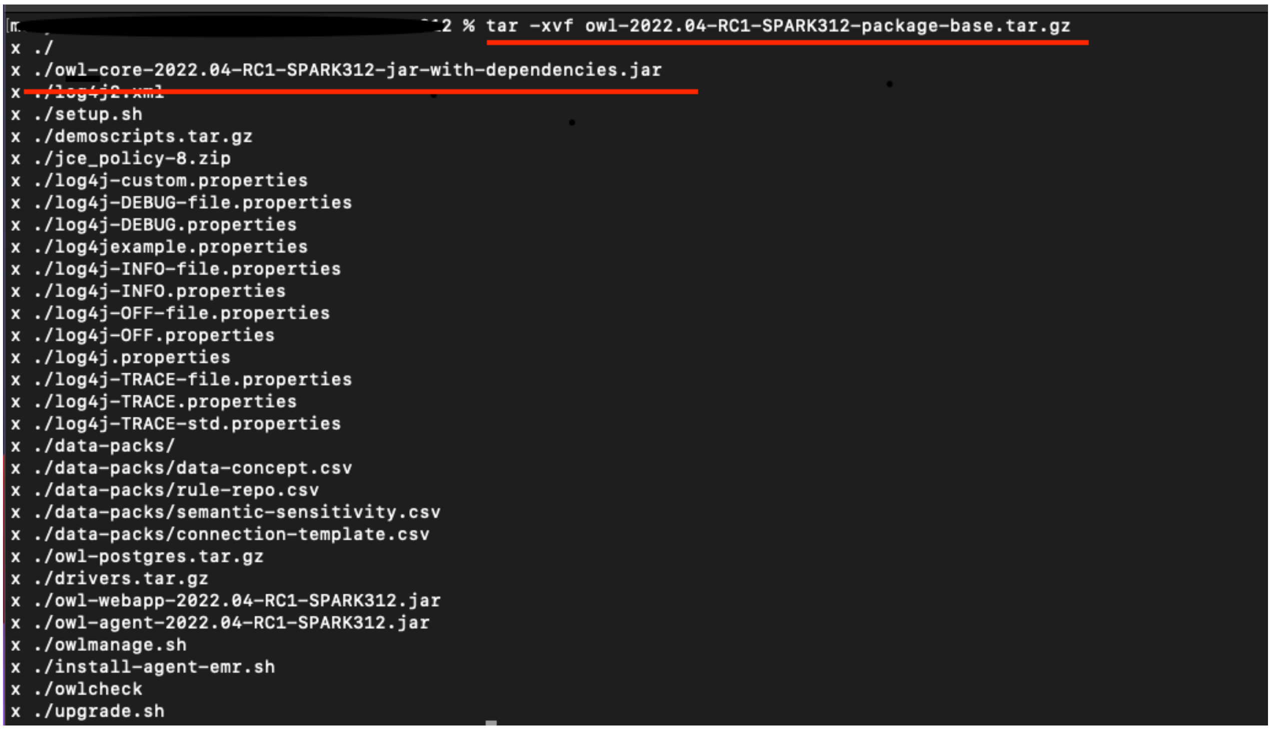
Step 1: Upload CDQ Core jar to Databricks

1. Extract the core jar from owl package zipped file.

The first step is to get the CDQ jar file. Once you have the cdq jar package file, you can get the jars by running the following commands:

`tar -xvf package.tar.gz`` **example:** `tar -xvf owl-2022.04-RC1-default-package-base.tar.gz`

Running this command instructs tar to extract the files from the zipped file. From the list of the files, you need to upload the owl-core-xxxx-jar-with-dependancies.jar to our Databricks file system which will be explained in the next section.

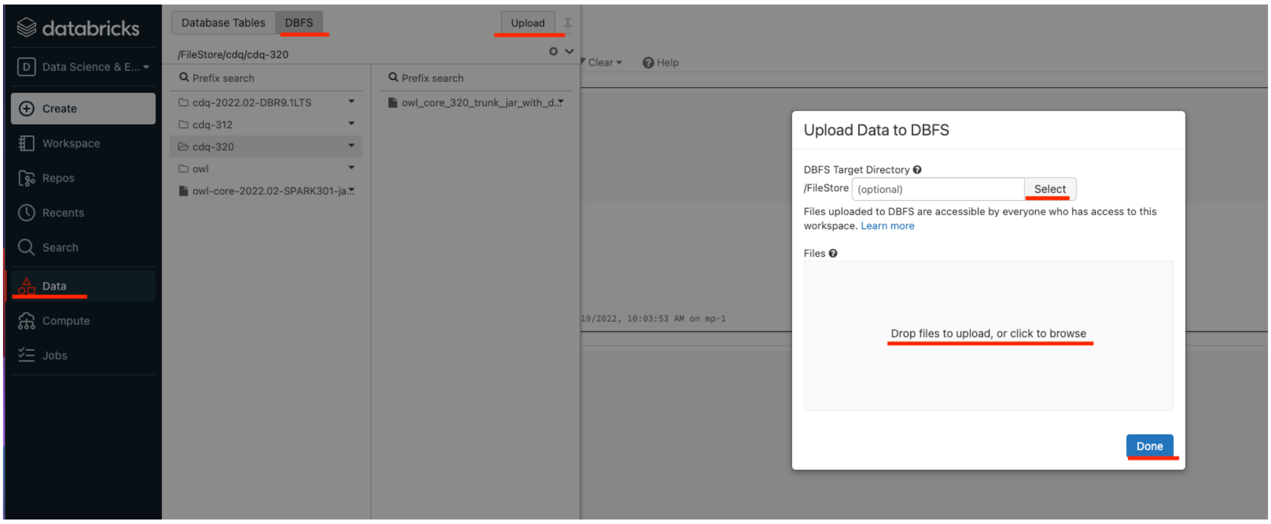


```
[redacted]2 % tar -xvf owl-2022.04-RC1-SPARK312-package-base.tar.gz
x ./
x ./owl-core-2022.04-RC1-SPARK312-jar-with-dependencies.jar
x ./log4j2.xml
x ./setup.sh
x ./demoscripts.tar.gz
x ./jce_policy-8.zip
x ./log4j-custom.properties
x ./log4j-DEBUG-file.properties
x ./log4j-DEBUG.properties
x ./log4jexample.properties
x ./log4j-INFO-file.properties
x ./log4j-INFO.properties
x ./log4j-OFF-file.properties
x ./log4j-OFF.properties
x ./log4j.properties
x ./log4j-TRACE-file.properties
x ./log4j-TRACE.properties
x ./log4j-TRACE-std.properties
x ./data-packs/
x ./data-packs/data-concept.csv
x ./data-packs/rule-repo.csv
x ./data-packs/semantic-sensitivity.csv
x ./data-packs/connection-template.csv
x ./owl-postgres.tar.gz
x ./drivers.tar.gz
x ./owl-webapp-2022.04-RC1-SPARK312.jar
x ./owl-agent-2022.04-RC1-SPARK312.jar
x ./owlmanage.sh
x ./install-agent-emr.sh
x ./owlcheck
x ./upgrade.sh
```

Step 2. Upload the file to Databricks file system using UI

The jars should be manually uploaded in Databricks file system. Below is the quick summary of the steps. You can find more details about upload files in Databricks page: https://docs.databricks.com/data/databricks-file-system.htmlhttps://docs.databricks.com/data/databricks-file-system.html#access-dbfs

1. Login to your Databricks account.
2. Click **Data** in the sidebar.
3. Click the **DBFS** button at the top of the page.
4. Upload the owl-core-xxxx-jar-with-dependancies.jar to your desired path.



/FileStore/cdq/cdq-320

19/2022, 10:03:53 AM on mp-1

Upload Data to DBFS

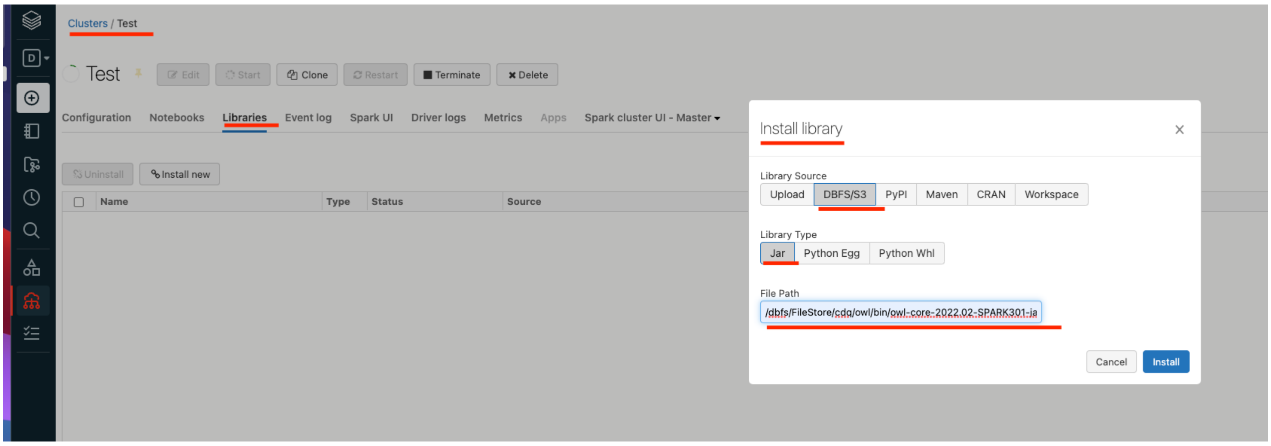
DBFS Target Directory
/FileStore (optional) Select

Files uploaded to DBFS are accessible by everyone who has access to this workspace. Learn more

Files
Drop files to upload, or click to browse

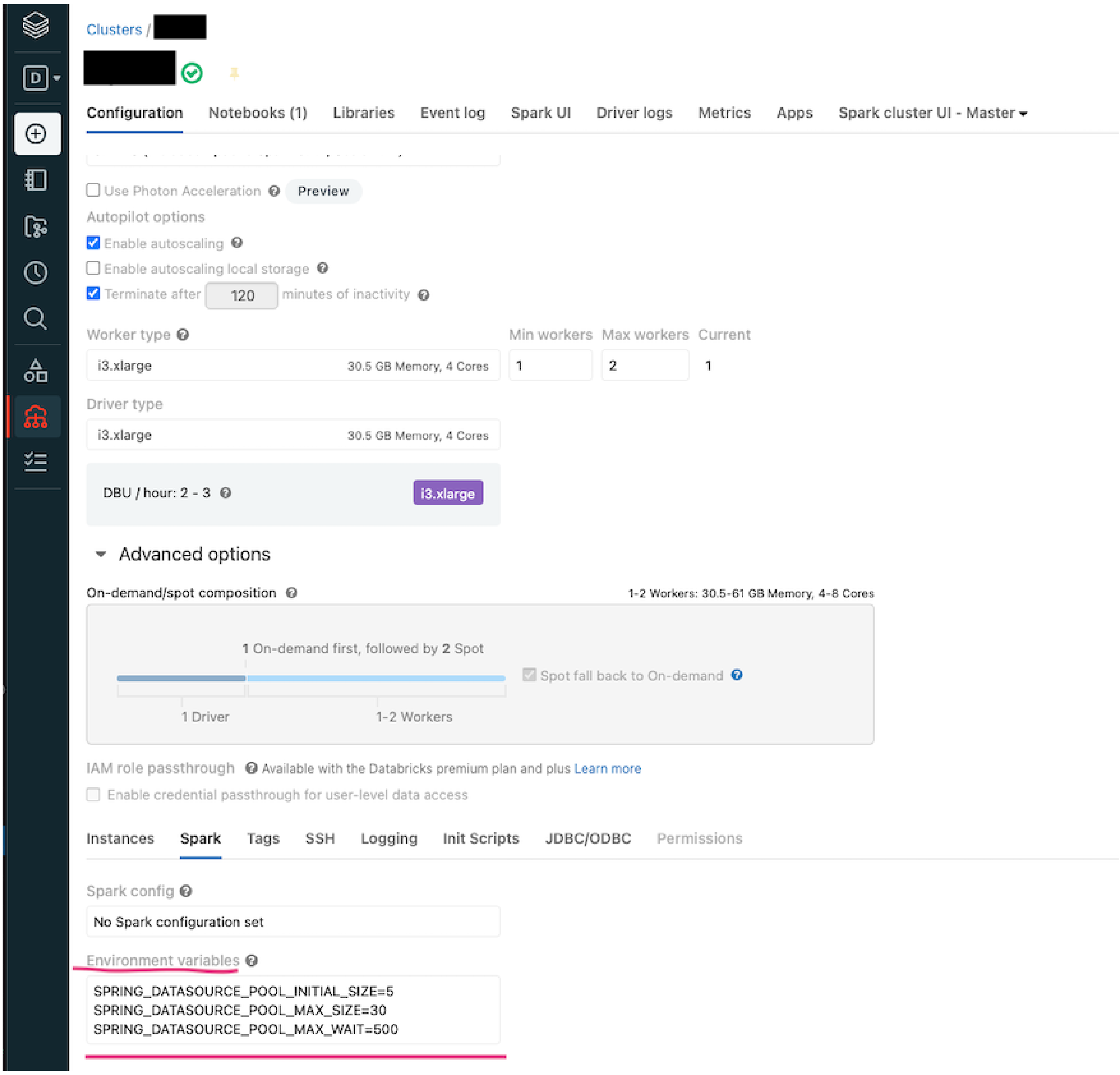
Done

Step 3. Install CDQ library in your Databricks cluster



File Path
/dbfs/FileStore/cdq/owl/bin/owl-core-2022.02-SPARK301-ja

Once this step is completed, you can create a workspace and start using CDQ APIs. **Step4. (Optional) Update datasource pool size** ****This step is only necessary if you get *PoolExhaustedException* when you call CDQ APIs. To solve the issue you can simply update the connection pool size in the spark environment. `SPRING_DATASOURCE_POOL_MAX_WAIT=500SPRING_DATASOURCE_POOL_MAX_SIZE=30SPRING_DATASOURCE_POOL_INITIAL_SIZE=5\` Here is the documentation from Databricks about how to set up environment variables: https://docs.databricks.com/clusters/configure.html#environment-variables



Clusters / [redacted]

[redacted]

Configuration · Notebooks (1) · Libraries · Event log · Spark UI · Driver logs · Metrics · Apps · Spark cluster UI - Master

□ Use Photon Acceleration Preview

Autopilot options

☑ Enable autoscaling

□ Enable autoscaling local storage

☑ Terminate after 120 minutes of inactivity

Worker type		Min workers	Max workers	Current
i3.xlarge	30.5 GB Memory, 4 Cores	1	2	1

Driver type

i3.xlarge 30.5 GB Memory, 4 Cores

DBU / hour: 2 - 3 i3.xlarge

Advanced options

On-demand/spot composition 1-2 Workers: 30.5-61 GB Memory, 4-8 Cores

1 On-demand first, followed by 2 Spot

☑ Spot fall back to On-demand

1 Driver 1-2 Workers

IAM role passthrough Available with the Databricks premium plan and plus Learn more

□ Enable credential passthrough for user-level data access

Instances · Spark · Tags · SSH · Logging · Init Scripts · JDBC/ODBC · Permissions

Spark config

No Spark configuration set

Environment variables

```
SPRING_DATASOURCE_POOL_INITIAL_SIZE=5
SPRING_DATASOURCE_POOL_MAX_SIZE=30
SPRING_DATASOURCE_POOL_MAX_WAIT=500
```

CDQ Working Example in DataBricks

Import Collibra DQ Library

```
import org.apache.spark.sql.SparkSession
import org.apache.spark.sql.functions._
import org.apache.spark.sql.types._
import scala.collection.JavaConverters._
import java.util.Date
import java.time.LocalDate
import java.text.SimpleDateFormat
import spark.implicits._
import java.util.{ArrayList, List, UUID}
// CDQ Imports
import com.owl.core.Owl
import com.owl.common.options._
import com.owl.common.domain2._
import com.owl.core.util.OwlUtils
spark.catalog.clearCache
```

Bringing In Customer Data From Another Database

```
val connProps = Map(
"driver" -> "org.postgresql.Driver",
"user" -> "????",
"password" -> "????",
"url" -> "jdbc:postgresql://xxx:0000/postgres",
"dbtable" -> "public.example_data")
//--- Load Spark DataFrame ---//
 val df = spark.read.format("jdbc").options(connProps).load display(df)
display(df) // view your data
```

Variables to setup CDQ metastore database location

```
val pgHost = "xxxx.amazonaws.com"
val pgDatabase = "postgres"
val pgSchema = "public"
val pgUser = "???????"
val pgPass = "????"
val pgPort = "0000"
```

Create Collibra DQ Test (Rules) and Detects Breaks

> **Note** If the rules are already created and assigned to a dataset from UI, calling owlcheck() automatically executes all the rules associated with the given dataset and there is no need to recreate the rule from notebook.

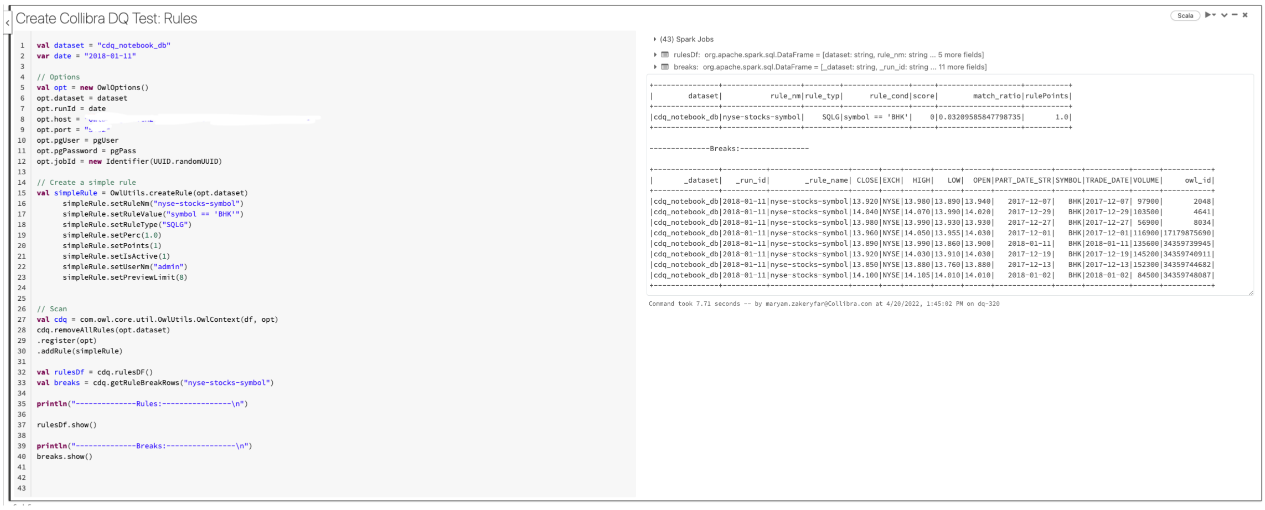
```
val dataset = "cdq_notebook_db_rules"
var date = "2018-01-11"

// Options
val opt = new OwlOptions()
opt.dataset = dataset
opt.runId = date
opt.host = pgHost
opt.port = pgPort
opt.pgUser = pgUser
opt.pgPassword = pgPass

opt.setDatasetSafeOff(false) // to enable historical overwrite
of dataset

// Create a simple rule and assign it to dataset
val simpleRule = OwlUtils.createRule(opt.dataset)
      simpleRule.setRuleNm("nyse-stocks-symbol")
      simpleRule.setRuleValue("symbol == 'BHK'")
      simpleRule.setRuleType("SQLG")
      simpleRule.setPerc(1.0)
      simpleRule.setPoints(1)
      simpleRule.setIsActive(1)
      simpleRule.setUserNm("admin")
      simpleRule.setPreviewLimit(8)

// Create a rule from generic rules that are created from UI:
val genericRule = OwlUtils.createRule(opt.dataset)
    genericRule.setRuleNm("exchangeRule") // this could be any
name
    genericRule.setRuleType("CUSTOM")
    genericRule.setPoints(1)
    genericRule.setIsActive(1)
    genericRule.setUserNm("admin")
    genericRule.setRuleRepo("exchangeCheckRule"); // Validate
the generic rule name //from UI
    genericRule.setRuleValue("EXCH") // COLUMN associate with
the rule


// Pre Routine
val cdq = com.owl.core.util.OwlUtils.OwlContext(df, opt)
cdq.removeAllRules(opt.dataset)
.register(opt)
.addRule(simpleRule)

// Scan
cdq.owlCheck()
```

```
val results = cdq.hoot() // returns object Hoot, not a DataFrame
//See Json Results(Option for downstream processing)
println("--------------Results:----------------\n")
println(results) //optional

//Post Routine, See DataFrame Results (Option for downstream pro-
cessing)
val breaks = cdq.getRuleBreakRows("nyse-stocks-symbol")
println("--------------Breaks:----------------\n")
display(breaks)

// Different Options for handling bad records
val badRecords = breaks.drop("_dataset","_run_id", "_rule_name",
"owl_id")
display(badRecords)

val goodRecords = df.except(badRecords)
display(goodRecords)
```

Write the breaks(bad records) DataFrame to a Parquet file

```
// Remove the file if it exists
dbutils.fs.rm("/tmp/databricks-df-example.parquet", true)
breaks.write.parquet("/tmp/databricks-df-example.parquet")
```

Below image shows the code snippet and the result in Databricks:

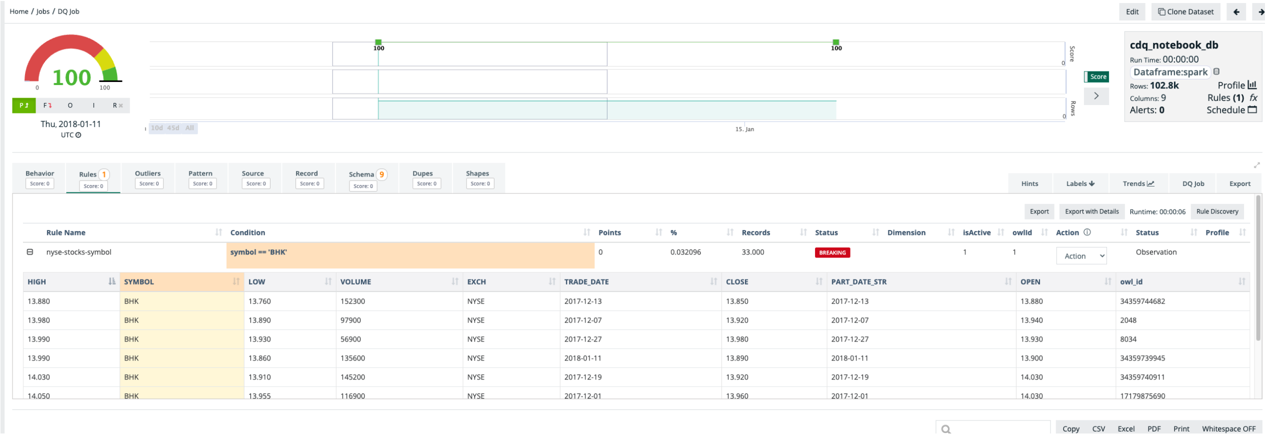


Create Collibra DQ Test: Rules

```
val dataset = "cdq_notebook_db"
var date = "2018-01-11"

// Options
val opt = new OwlOptions()
opt.dataset = dataset
opt.runId = date
opt.host = [redacted]
opt.port = [redacted]
opt.pgUser = pgUser
opt.pgPassword = pgPass
opt.jobId = new Identifier(UUID.randomUUID)

// Create a simple rule
val simpleRule = OwlUtils.createRule(opt.dataset)
      simpleRule.setRuleNm("nyse-stocks-symbol")
      simpleRule.setRuleValue("symbol == 'BHK'")
      simpleRule.setRuleType("SQLG")
      simpleRule.setPerc(1.0)
      simpleRule.setPoints(1)
      simpleRule.setIsActive(1)
      simpleRule.setUserNm("admin")
      simpleRule.setPreviewLimit(8)


// Scan
val cdq = com.owl.core.util.OwlUtils.OwlContext(df, opt)
cdq.removeAllRules(opt.dataset)
.register(opt)
.addRule(simpleRule)

val rulesDf = cdq.rulesDF()
val breaks = cdq.getRuleBreakRows("nyse-stocks-symbol")

println("-------------Rules:---------------\n")

rulesDf.show()

println("-------------Breaks:---------------\n")
breaks.show()
```

```
(43) Spark Jobs
rulesDf:  org.apache.spark.sql.DataFrame = [dataset: string, rule_nm: string ... 5 more fields]
breaks:  org.apache.spark.sql.DataFrame = [_dataset: string, _run_id: string ... 11 more fields]

+---------------+------------------+--------+---------------+-----+-------------------+----------+
|        dataset|           rule_nm|rule_typ|      rule_cond|score|        match_ratio|rulePoints|
+---------------+------------------+--------+---------------+-----+-------------------+----------+
|cdq_notebook_db|nyse-stocks-symbol|    SQLG|symbol == 'BHK'|    0|0.03209585847798735|       1.0|
+---------------+------------------+--------+---------------+-----+-------------------+----------+

-------------Breaks:---------------

+---------------+----------+------------------+------+----+------+------+------+-------------+------+----------+------+-----------+
|       _dataset|   _run_id|        _rule_name| CLOSE|EXCH|  HIGH|   LOW|  OPEN|PART_DATE_STR|SYMBOL|TRADE_DATE|VOLUME|     owl_id|
+---------------+----------+------------------+------+----+------+------+------+-------------+------+----------+------+-----------+
|cdq_notebook_db|2018-01-11|nyse-stocks-symbol|13.920|NYSE|13.980|13.890|13.940|   2017-12-07|   BHK|2017-12-07| 97900|       2048|
|cdq_notebook_db|2018-01-11|nyse-stocks-symbol|14.040|NYSE|14.070|13.990|14.020|   2017-12-29|   BHK|2017-12-29|103500|       4641|
|cdq_notebook_db|2018-01-11|nyse-stocks-symbol|13.980|NYSE|13.990|13.930|13.930|   2017-12-27|   BHK|2017-12-27| 56900|       8034|
|cdq_notebook_db|2018-01-11|nyse-stocks-symbol|13.960|NYSE|14.050|13.955|14.030|   2017-12-01|   BHK|2017-12-01|116900|17179875690|
|cdq_notebook_db|2018-01-11|nyse-stocks-symbol|13.890|NYSE|13.990|13.860|13.900|   2018-01-11|   BHK|2018-01-11|135600|34359739945|
|cdq_notebook_db|2018-01-11|nyse-stocks-symbol|13.920|NYSE|14.030|13.910|14.030|   2017-12-19|   BHK|2017-12-19|145200|34359740911|
|cdq_notebook_db|2018-01-11|nyse-stocks-symbol|13.850|NYSE|13.880|13.760|13.880|   2017-12-13|   BHK|2017-12-13|152300|34359744682|
|cdq_notebook_db|2018-01-11|nyse-stocks-symbol|14.100|NYSE|14.105|14.010|14.010|   2018-01-02|   BHK|2018-01-02| 84500|34359748087|
+---------------+----------+------------------+------+----+------+------+------+-------------+------+----------+------+-----------+

Command took 7.71 seconds -- by maryam.zakeryfar@Collibra.com at 4/20/2022, 1:45:02 PM on dq-320
```

The breaks and the rules can be viewed in CDQ web as well.



Thu, 2018-01-11
UTC

cdq_notebook_db
Run Time: 00:00:00
Dataframe:spark
Rows: 102.8k
Columns: 9
Alerts: 0

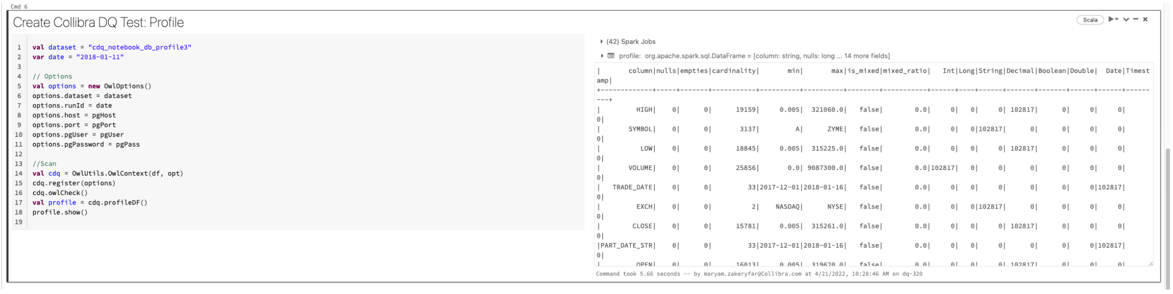
Runtime: 00:00:06

	Rule Name	Condition	Points	%	Records	Status	Dimension	isActive	owlId	Action	Status	Profile
⊟	nyse-stocks-symbol	symbol == 'BHK'	0	0.032096	33.000	BREAKING		1	1	Action	Observation	

HIGH	SYMBOL	LOW	VOLUME	EXCH	TRADE_DATE	CLOSE	PART_DATE_STR	OPEN	owl_id
13.880	BHK	13.760	152300	NYSE	2017-12-13	13.850	2017-12-13	13.880	34359744682
13.980	BHK	13.890	97900	NYSE	2017-12-07	13.920	2017-12-07	13.940	2048
13.990	BHK	13.930	56900	NYSE	2017-12-27	13.980	2017-12-27	13.930	8034
13.990	BHK	13.860	135600	NYSE	2018-01-11	13.890	2018-01-11	13.900	34359739945
14.030	BHK	13.910	145200	NYSE	2017-12-19	13.920	2017-12-19	14.030	34359740911
14.050	BHK	13.955	116900	NYSE	2017-12-01	13.960	2017-12-01	14.030	17179875690

Create Collibra DQ Test (Profile)

```
val dataset = "cdq_notebook_nyse_profile"

val runList = List("2018-01-01", "2018-01-02", "2018-01-03",
"2018-01-04", "2018-01-05"
for(runID <- runList {
// Options
val options = new OwlOptions()
options.dataset = dataset
options.host = pgHost
options.port = pgPort
options.pgUser = pgUser
options.pgPassword = pgPass

//Scan
val profileOpt = new ProfileOpt
profileOpt.on = true
profileOpt.setShape(true)
profileOpt.setShapeSensitivity(5.0)
profileOpt.setShapeMaxPerCol(10)
profileOpt.setShapeMaxColSize(10)
profileOpt.setShapeGranular(true)
profileOpt.behaviorEmptyCheck = true
profileOpt.behaviorMaxValueCheck = true
profileOpt.behaviorMinValueCheck = true
profileOpt.behaviorNullCheck = true
profileOpt.behaviorRowCheck = true
profileOpt.behaviorMeanValueCheck = true
profileOpt.behaviorUniqueCheck = true
profileOpt.behaviorMinSupport = 5 // default is 4
profileOpt.behaviorLookback = 5
options.profile = profileOpt

var date = runId
var df_1 = df.where($"TRADE_DATE"===s"$date")

//Scan
val cdq = OwlUtils.OwlContext(df_1, options)
cdq.register(opt)
cdq.owlCheck()
val profile = cdq.profileDF()
profile.show()
}
```

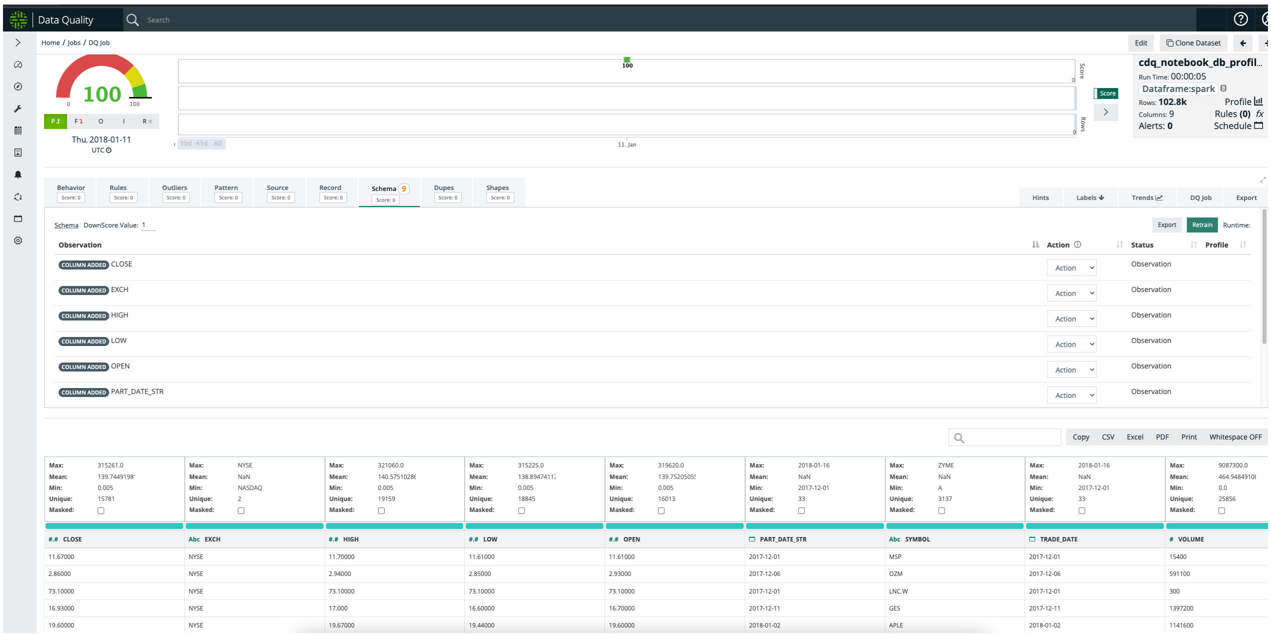


Cmd 6

Create Collibra DQ Test: Profile

```scala
val dataset = "cdq_notebook_db_profile3"
var date = "2018-01-11"

// Options
val options = new OwlOptions()
options.dataset = dataset
options.runId = date
options.host = pgHost
options.port = pgPort
options.pgUser = pgUser
options.pgPassword = pgPass

//Scan
val cdq = OwlUtils.OwlContext(df, opt)
cdq.register(options)
cdq.owlCheck()
val profile = cdq.profileDF()
profile.show()

```

```
(42) Spark Jobs
profile:  org.apache.spark.sql.DataFrame = [column: string, nulls: long ... 14 more fields]
|       column|nulls|empties|cardinality|       min|       max|is_mixed|mixed_ratio|   Int|Long|String|Decimal|Boolean|Double|  Date|Timest
amp|
+-------------+-----+-------+-----------+----------+----------+--------+-----------+------+----+------+-------+-------+------+------+------
---+
|         HIGH|    0|      0|      19159|     0.005|  321060.0|   false|        0.0|     0|   0|     0| 102817|      0|     0|     0|
0|
|       SYMBOL|    0|      0|       3137|         A|      ZYME|   false|        0.0|     0|   0|102817|      0|      0|     0|     0|
0|
|          LOW|    0|      0|      18845|     0.005|  315225.0|   false|        0.0|     0|   0|     0| 102817|      0|     0|     0|
0|
|       VOLUME|    0|      0|      25856|       0.0| 9087300.0|   false|        0.0|102817|   0|     0|      0|      0|     0|     0|
0|
|   TRADE_DATE|    0|      0|         33|2017-12-01|2018-01-16|   false|        0.0|     0|   0|     0|      0|      0|     0|102817|
0|
|         EXCH|    0|      0|          2|    NASDAQ|      NYSE|   false|        0.0|     0|   0|102817|      0|      0|     0|     0|
0|
|        CLOSE|    0|      0|      15781|     0.005|  315261.0|   false|        0.0|     0|   0|     0| 102817|      0|     0|     0|
0|
|PART_DATE_STR|    0|      0|         33|2017-12-01|2018-01-16|   false|        0.0|     0|   0|     0|      0|      0|     0|102817|
0|
|         OPEN|    0|      0|      16013|     0.005|  319620.0|   false|        0.0|     0|   0|     0| 102817|      0|     0|     0|
Command took 5.66 seconds -- by maryam.zakeryfar@Collibra.com at 4/21/2022, 10:28:46 AM on dq-320
```



Thu, 2018-01-11
UTC

cdq_notebook_db_profil...
Run Time: 00:00:05
Dataframe:spark
Rows: 102.8k
Columns: 9
Alerts: 0
Profile
Rules (0)
Schedule

Behavior	Rules	Outliers	Pattern	Source	Record	Schema 9	Dupes	Shapes
Score: 0	Score: 0	Score: 0	Score: 0	Score: 0	Score: 0	Score: 0	Score: 0	Score: 0

Schema DownScore Value: 1

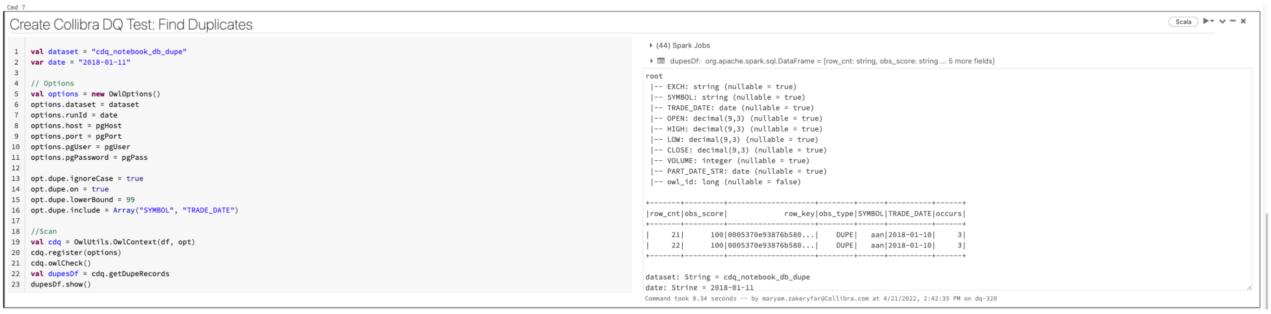
Observation	Action	Status	Profile
COLUMN ADDED CLOSE	Action	Observation	
COLUMN ADDED EXCH	Action	Observation	
COLUMN ADDED HIGH	Action	Observation	
COLUMN ADDED LOW	Action	Observation	
COLUMN ADDED OPEN	Action	Observation	
COLUMN ADDED PART_DATE_STR	Action	Observation	

	CLOSE	EXCH	HIGH	LOW	OPEN	PART_DATE_STR	SYMBOL	TRADE_DATE	VOLUME
Max:	315261.0	NYSE	321060.0	315225.0	319620.0	2018-01-16	ZYME	2018-01-16	9087300.0
Mean:	139.7449198	NaN	140.5751028	138.8947411	139.7520505	NaN	NaN	NaN	464.9484910
Min:	0.005	NASDAQ	0.005	0.005	0.005	2017-12-01	A	2017-12-01	0.0
Unique:	15781	2	19159	18845	16013	33	3137	33	25856
Masked:	□	□	□	□	□	□	□	□	□

#.# CLOSE	Abc EXCH	#.# HIGH	#.# LOW	#.# OPEN	PART_DATE_STR	Abc SYMBOL	TRADE_DATE	# VOLUME
11.67000	NYSE	11.70000	11.61000	11.61000	2017-12-01	MSP	2017-12-01	15400
2.86000	NYSE	2.94000	2.85000	2.93000	2017-12-06	OZM	2017-12-06	591100
73.10000	NYSE	73.10000	73.10000	73.10000	2017-12-01	LNC.W	2017-12-01	300
16.93000	NYSE	17.000	16.60000	16.70000	2017-12-11	GES	2017-12-11	1397200
19.60000	NYSE	19.67000	19.44000	19.60000	2018-01-02	APLE	2018-01-02	1141600

Create Collibra DQ Test (Dupes)

```
val dataset = "cdq_notebook_db_dupe"
var date = "2018-01-11"

// Options
val options = new OwlOptions()
options.dataset = dataset
options.runId = date
options.host = pgHost
options.port = pgPort
options.pgUser = pgUser
options.pgPassword = pgPass

opt.dupe.ignoreCase = true
opt.dupe.on = true
opt.dupe.lowerBound = 99
opt.dupe.include = Array("SYMBOL", "TRADE_DATE")

//Scan
val cdq = OwlUtils.OwlContext(df, opt)
cdq.register(options)
cdq.owlCheck()

val dupesDf = cdq.getDupeRecords
dupesDf.show()
```



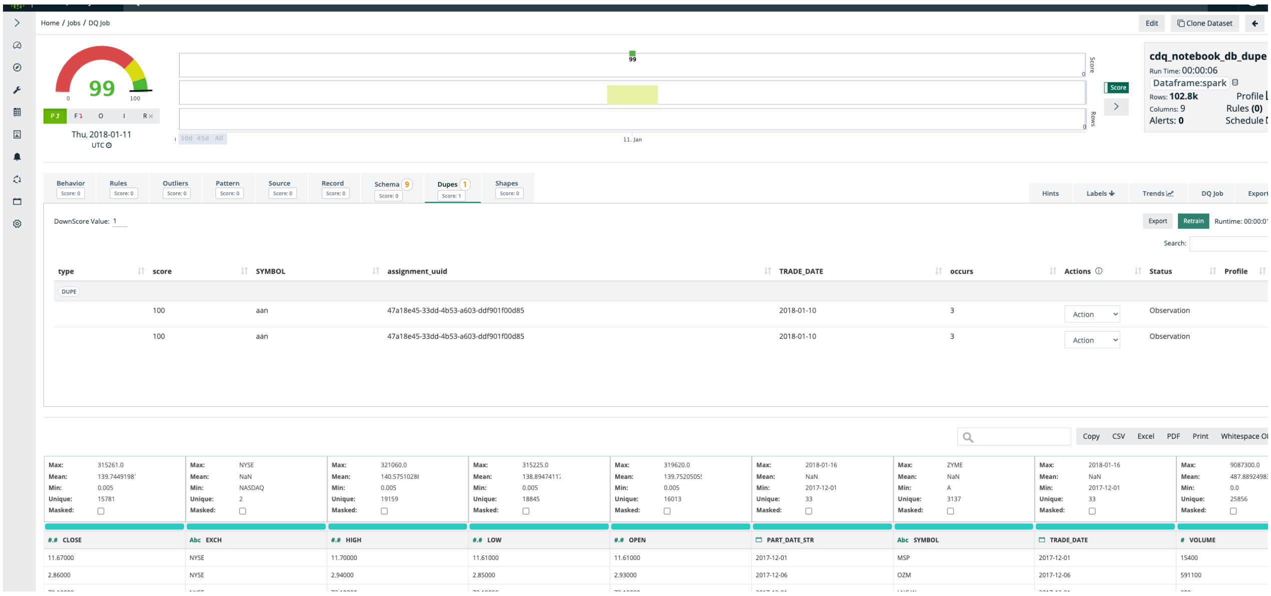
Create Collibra DQ Test: Find Duplicates

```
val dataset = "cdq_notebook_db_dupe"
var date = "2018-01-11"

// Options
val options = new OwlOptions()
options.dataset = dataset
options.runId = date
options.host = pgHost
options.port = pgPort
options.pgUser = pgUser
options.pgPassword = pgPass

opt.dupe.ignoreCase = true
opt.dupe.on = true
opt.dupe.lowerBound = 99
opt.dupe.include = Array("SYMBOL", "TRADE_DATE")

//Scan
val cdq = OwlUtils.OwlContext(df, opt)
cdq.register(options)
cdq.owlCheck()
val dupesDf = cdq.getDupeRecords
dupesDf.show()
```

(44) Spark Jobs

dupesDf: org.apache.spark.sql.DataFrame = [row_cnt: string, obs_score: string ... 5 more fields]

```
root
 |-- EXCH: string (nullable = true)
 |-- SYMBOL: string (nullable = true)
 |-- TRADE_DATE: date (nullable = true)
 |-- OPEN: decimal(9,3) (nullable = true)
 |-- HIGH: decimal(9,3) (nullable = true)
 |-- LOW: decimal(9,3) (nullable = true)
 |-- CLOSE: decimal(9,3) (nullable = true)
 |-- VOLUME: integer (nullable = true)
 |-- PART_DATE_STR: date (nullable = true)
 |-- owl_id: long (nullable = false)

+-------+---------+--------------------+--------+------+----------+------+
|row_cnt|obs_score|             row_key|obs_type|SYMBOL|TRADE_DATE|occurs|
+-------+---------+--------------------+--------+------+----------+------+
|     21|      100|0005370e93876b580...|    DUPE|   aan|2018-01-10|     3|
|     22|      100|0005370e93876b580...|    DUPE|   aan|2018-01-10|     3|
+-------+---------+--------------------+--------+------+----------+------+

dataset: String = cdq_notebook_db_dupe
date: String = 2018-01-11
Command took 8.34 seconds -- by maryam.zakeryfar@Collibra.com at 4/21/2022, 2:42:35 PM on dq-320
```



cdq_notebook_db_dupe

Run Time: 00:00:06

Dataframe:spark

Rows: **102.8k** Profile

Columns: 9 Rules **(0)**

Alerts: **0** Schedule

DownScore Value: 1

Runtime: 00:00:0

type	score	SYMBOL	assignment_uuid	TRADE_DATE	occurs	Actions	Status	Profile
DUPE								
	100	aan	47a18e45-33dd-4b53-a603-ddf901f00d85	2018-01-10	3	Action	Observation	
	100	aan	47a18e45-33dd-4b53-a603-ddf901f00d85	2018-01-10	3	Action	Observation	

	#.# CLOSE	Abc EXCH	#.# HIGH	#.# LOW	#.# OPEN	PART_DATE_STR	Abc SYMBOL	TRADE_DATE	# VOLUME
Max:	315261.0	NYSE	321060.0	315225.0	319620.0	2018-01-16	ZYME	2018-01-16	9087300.0
Mean:	139.7449198	NaN	140.5751028	138.8947411	139.7520505	NaN	NaN	NaN	487.8892498
Min:	0.005	NASDAQ	0.005	0.005	0.005	2017-12-01	A	2017-12-01	0.0
Unique:	15781	2	19159	18845	16013	33	3137	33	25856
Masked:	☐	☐	☐	☐	☐	☐	☐	☐	☐
	11.67000	NYSE	11.70000	11.61000	11.61000	2017-12-01	MSP	2017-12-01	15400
	2.86000	NYSE	2.94000	2.85000	2.93000	2017-12-06	OZM	2017-12-06	591100

Create Collibra DQ Test (Outlier)

```
import scala.collection.JavaConverters._
import java.util
import java.util.{ArrayList, List, UUID}

val dataset = "cdq_notebook_db_outlier"
var date = "2018-01-11"

// Options
val options = new OwlOptions()
options.dataset = dataset
options.runId = date
options.host = pgHost
options.port = pgPort
options.pgUser = pgUser
options.pgPassword = pgPass

opt.dupe.on = false

val dlMulti: util.List[OutlierOpt] = new util.ArrayList[OutlierOpt]
val outlierOpt = new OutlierOpt()
outlierOpt.combine = true
outlierOpt.dateColumn = "trade_date"
outlierOpt.lookback = 4
outlierOpt.key = Array("symbol")
outlierOpt.include = Array("high")
outlierOpt.historyLimit = 10
dlMulti.add(outlierOpt)

opt.setOutliers(dlMulti)

val cdq = OwlUtils.OwlContext(df, opt)
        .register(opt)

cdq.owlCheck
val outliers = cdq.getOutliers()
outliers.show
outliers.select("value")
```

Known API Limitations

CDQ activities cannot be called independently for the time being. DQ Check() function should be called before calling any of the activities. For example, to get the profile DataFrame you should call the below code snippet:

```
cdq.owlCheck()
cdq.getProfileDF()
```

DQ-Databricks Submit

Introduction

In this page we will demonstrate two paths to run a spark submit job on Databricks's cluster. The first approach is to run a DQ spark submit job using Databricks UI and the second approach is by invoking Databricks rest API.

> **Note** These are only examples to demonstrate how to achieve DQ spark submit to Databricks's cluster. These paths are **not** supported in production and DQ team does **not** support any bug coverages or professional services or customer questions for these flows.

Limitations

There are a few limitation to spark-submit jobs in Databricks listed in this section: https://docs.databricks.com/jobs.html#create-a-job. Also, spark-submit is only on new clusters from both the UI via Jobs or calling the REST APIs. See Step 4 in: https://docs.databricks.com/jobs.html#create-a-job where it lists that spark-submit is handled by new clusters only.

Steps to create and run a spark submit job from Databricks UI:

1. Grant Collibra DQ Database access to your instance of Databricks.
2. Upload DQ jars in Databricks File System (DBFS).
3. Set up environment variables for your new cluster.
4. Prepare the DQ JSON payload.
5. Create and Run your job.
6. View the status and result of your job from the DQ Jobs page.

Database access

To begin, ensure that sure your Databricks instance has access to the DQ Database.

The entire subnet must be whitelisted to connect to the database. As specified in Databricks' documentation on subnets, Databricks must have access to at least two subnets for each database. To connect to the two Databricks subnets where the nodes will be instantiated, you must allow AWS to whitelist your IP address range.

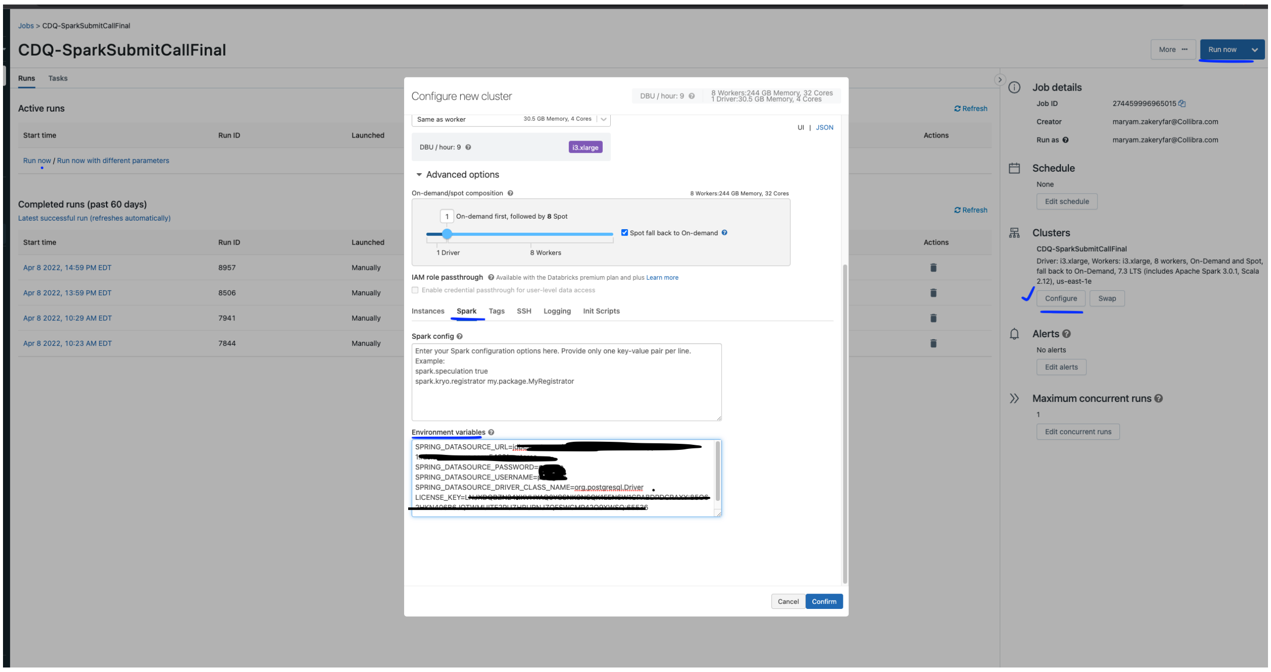
Upload DQ's jars in DBFS

The jars should be manually uploaded in Databricks file system. The steps can be found on Databricks website: https://docs.databricks.com/data/databricks-file-system.html#access-dbfs.

Environment variables for the new cluster:

Here is the documentation from Databricks about how to set up environment variables: https://docs.databricks.com/clusters/configure.html#environment-variables

These CDQ environment variables should be set on the new cluster : `SPRING_DATASOURCE_URL=xx`\ `SPRING_DATASOURCE_USERNAME=xx`\ `SPRING_DATASOURCE_DRIVER_CLASS_NAME=xx`\ `LICENSE_KEY=xx // This is DQ's license key`



Jobs > CDQ-SparkSubmitCallFinal

CDQ-SparkSubmitCallFinal

Active runs

Start time	Run ID	Launched	Actions
Run now / Run now with different parameters			

Completed runs (past 60 days)

Latest successful run (refreshes automatically)

Start time	Run ID	Launched	Actions
Apr 8 2022, 14:59 PM EDT	8957	Manually	
Apr 8 2022, 13:59 PM EDT	8506	Manually	
Apr 8 2022, 10:29 AM EDT	7941	Manually	
Apr 8 2022, 10:23 AM EDT	7844	Manually	

Configure new cluster

DBU / hour: 9 | 8 Workers:244 GB Memory, 32 Cores
1 Driver:30.5 GB Memory, 4 Cores

Same as worker — 30.5 GB Memory, 4 Cores

DBU / hour: 9 — i3.xlarge

Advanced options

On-demand/spot composition — 8 Workers:244 GB Memory, 32 Cores

1 On-demand first, followed by **8** Spot

☑ Spot fall back to On-demand

1 Driver — 8 Workers

IAM role passthrough — Available with the Databricks premium plan and plus Learn more

□ Enable credential passthrough for user-level data access

Spark config

```
Enter your Spark configuration options here. Provide only one key-value pair per line.
Example:
spark.speculation true
spark.kryo.registrator my.package.MyRegistrator
```

Environment variables

```
SPRING_DATASOURCE_URL=jd[redacted]
SPRING_DATASOURCE_PASSWORD=[redacted]
SPRING_DATASOURCE_USERNAME=[redacted]
SPRING_DATASOURCE_DRIVER_CLASS_NAME=org.postgresql.Driver
LICENSE_KEY=L[redacted]
```

Job details

Job ID 274459996965015

Creator maryam.zakeryfar@Collibra.com

Run as maryam.zakeryfar@Collibra.com

Schedule

None

Clusters

CDQ-SparkSubmitCallFinal

Driver: i3.xlarge, Workers: i3.xlarge, 8 workers, On-Demand and Spot, fall back to On-Demand, 7.3 LTS (includes Apache Spark 3.0.1, Scala 2.12), us-east-1e

Alerts

No alerts

Maximum concurrent runs

1

JSON payload

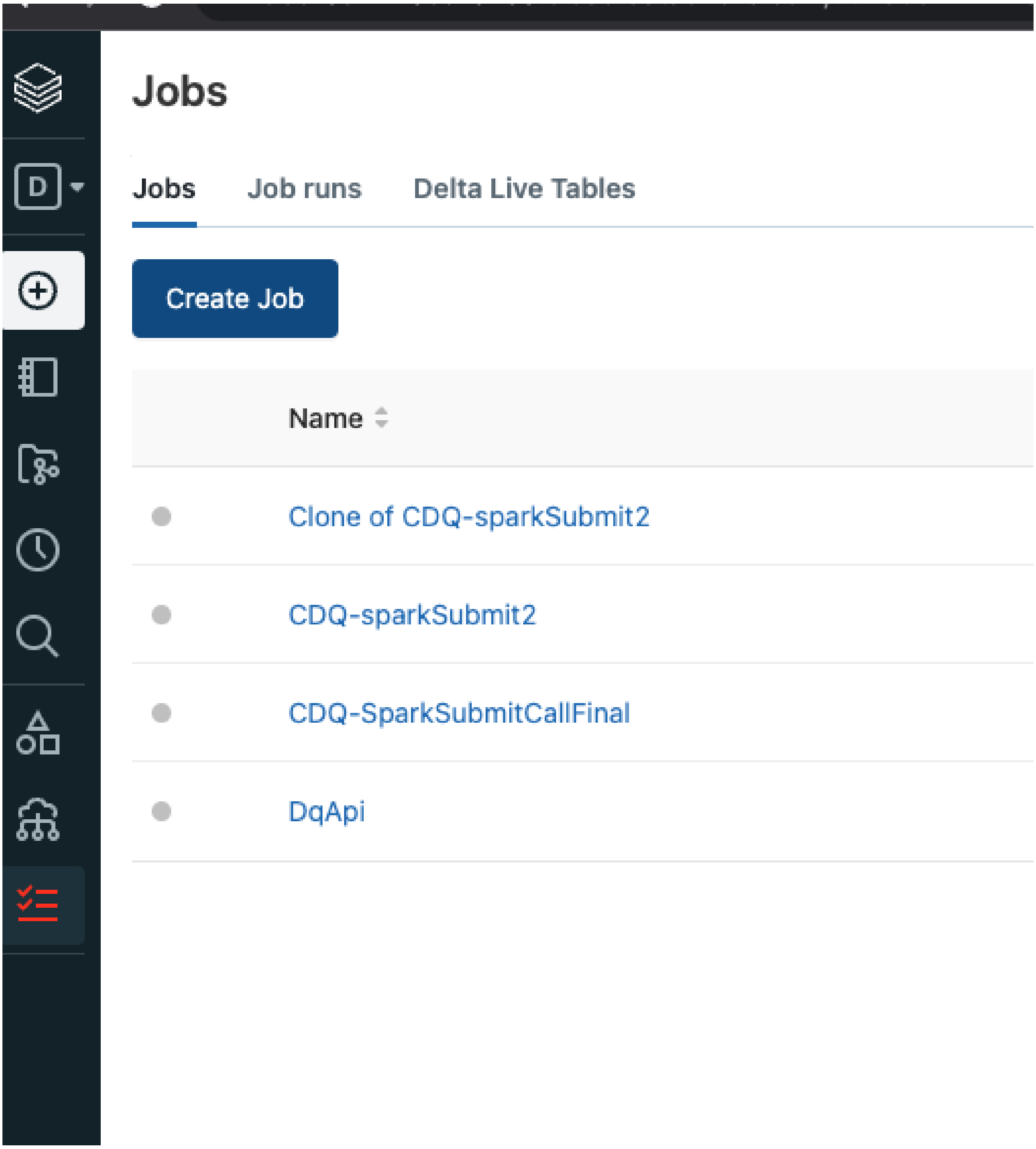
Once the above steps are completed, you can submit a spark submit job with DQ's parameters. Payload parameters can be from DQ's web Run command. You can copy and paste the parameters to prepare a JSON payload. Here is one sample:

```
                     "--class",
                    "com.owl.core.cli.OwlCheck",
                    "dbfs:/FileStore/cdq/owl-core-2022.02-
SPARK301-jar-with-dependencies.jar",
                    "-lib",
                    "dbfs:/FileStore/cdq/owl/drivers/postgres",
                    "-q",
                    "select * from xx.xxx",
                    "-bhlb",
                    "10",
                    "-rd",
                    "2022-03-16",
                    "-driver",
                    "owl.com.org.postgresql.Driver",
                    "-drivermemory",
                    "4g",
                    "-cxn",
                    "metastore",
                    "-h",
                    "xxxx.xxxxxx.amazonaws.com:xxxx/postgres",
                    "-ds",
                    "public.agent_2",
                    "-deploymode",
                    "cluster",
                    "-owluser",
                    "admin"
                ]
```

Run the job

Once you have completed the above steps, you can create a spark submit job through Databricks UI.

You can then add the environment variables to the cluster and click Run on Databricks UI.



Jobs

	Name
●	Clone of CDQ-sparkSubmit2
●	CDQ-sparkSubmit2
●	CDQ-SparkSubmitCallFinal
●	DqApi

Check the result in DQ web:

Once the job is submitted, you can login to your DQ web instance and check the job in the Jobs page.

Spark submit by invoking Databricks REST API

There are public REST APIS available for the Jobs API, including the latest version.

For this path we need to do the steps 1-4 of the the previous section and then call directly the REST API using Postman, or your preferred API testing tool. We assume that as per step 2, CDQ jars are uploaded to the DBFS path in the location dbfs:/FileStore/cdq. Also JDBC postgres driver should be uploaded to DBFS. For example:
dbfs:/FileStore/cdq/owl/drivers/postgres

Steps:

1. Prepare the DQ JSON Payload.
2. Authenticate the Databricks REST API.

JSON payload

Sample JSON payload:

```
POST /api/2.1/jobs/runs/submit HTTP/1.1Host:
xxxxxx.cloud.databricks.com\ `Content-Type: application/json`\
`Authorization: Bearer ~~xxxxxxxxxxxxx~~\ Cache-Control: no-cache\ Postman-
Token: xxxxxxxx`
```

```
{
  "tasks": [
    {
      "task_key": "CDQ-SparkSubmitCallFinal",
      "spark_submit_task": {
        "parameters": [
          "--class",
          "com.owl.core.cli.OwlCheck",
          "dbfs:/FileStore/cdq/owl-core-2022.02-SPARK301-jar-
with-dependencies.jar",
          "-lib",
          "dbfs:/FileStore/cdq/owl/drivers/postgres",
          "-q",
          "select * from public.agent",
          "-bhlb",
          "10",
          "-rd",
          "2022-03-16",
          "-driver",
          "owl.com.org.postgresql.Driver",
          "-drivermemory",
          "4g",
          "-cxn",
          "metastore",
          "-h",
          "xxxs.amazonaws.com:xxx/postgres",
          "-ds",
          "public.agent_2",
          "-deploymode",
          "cluster",
          "-owluser",
          "admin"
        ]
      },
      "new_cluster": {
        "cluster_name": "",
        "spark_version": "7.3.x-scala2.12",
        "aws_attributes": {
          "zone_id": "us-east-1e",
          "first_on_demand": 1,
          "availability": "SPOT_WITH_FALLBACK",
          "spot_bid_price_percent": 100,
          "ebs_volume_count": 0
        },
        "node_type_id": "i3.xlarge",
        "spark_env_vars": {
          "SPRING_DATASOURCE_URL": "jdbc:postgresql://xxx-xx-
xxs.amazonaws.com:xx/postgres",
          "SPRING_DATASOURCE_PASSWORD": "xxx",
          "SPRING_DATASOURCE_USERNAME": "xxx",
          "SPRING_DATASOURCE_DRIVER_CLASS_NAME": "org.-
postgresql.Driver",
          "LICENSE_KEY": "xxxx"
        },
        "enable_elastic_disk": false,
        "num_workers": 8
      },
      "timeout_seconds": 0
    }
  ]
}
```

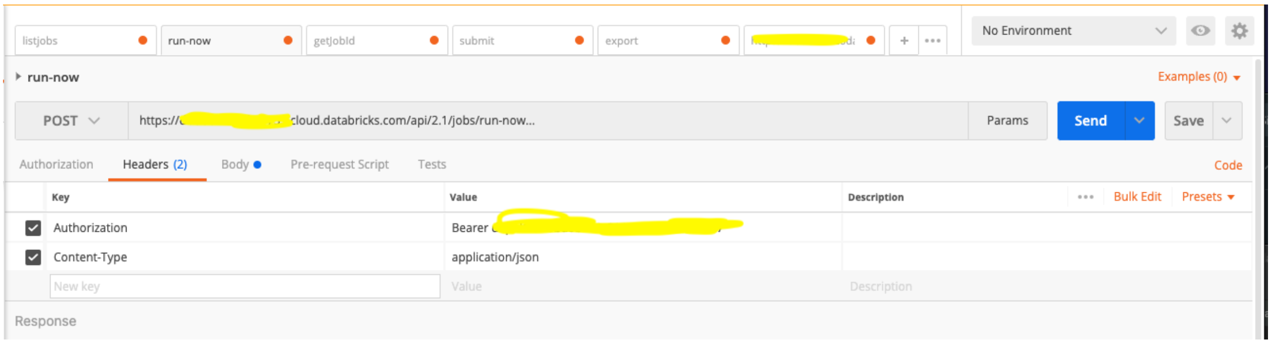
Values to be updated in above payload are:

Cluster variables:`"SPRING_DATASOURCE_URL":"SPRING_DATASOURCE_PASSWORD":"SPRING_DATASOURCE_USERNAME":"LICENSE_KEY": //CDQ License key``

CDQ variables\ Users can customize the variables based on the activity they choose from CDQ Web. They can copy the variables from Run CMD option of their DQ job and paste it in their Json message. ``

Authenticate the Databricks REST API

Here is the Databricks documentation about how to create a personal access token: https://docs.databricks.com/dev-tools/api/latest/authentication.html

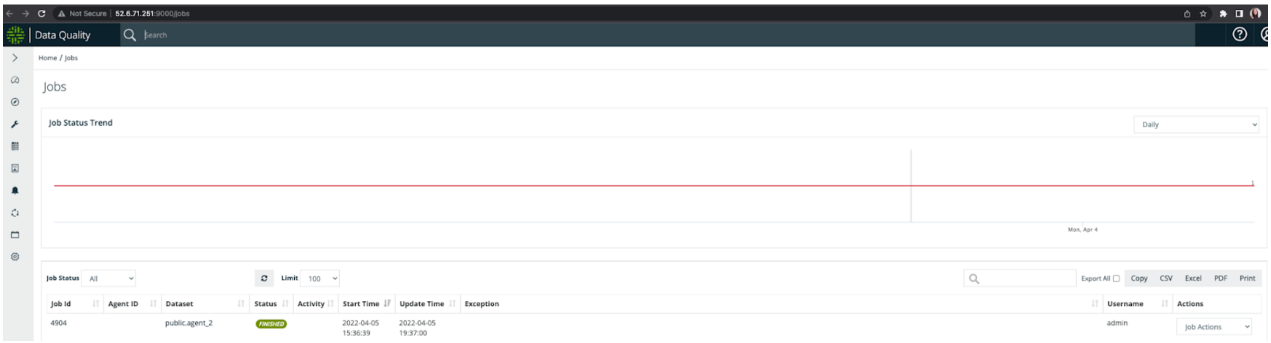


POST https://[redacted]cloud.databricks.com/api/2.1/jobs/run-now...

	Key	Value	Description
☑	Authorization	Bearer [redacted]	
☑	Content-Type	application/json	
	New key	Value	Description

View the job's result in DQ web

You can view the result of your job run by navigating to the DQ Jobs page.



Job Status: All

Limit: 100

Job Id	Agent ID	Dataset	Status	Activity	Start Time	Update Time	Exception	Username	Actions
4904		public.agent_2	FINISHED		2022-04-05 15:36:39	2022-04-05 19:37:00		admin	Job Actions

Examples

Programmatic DQ

Don't like leaving your notebook? Want to build DQ into your in-house data quality pipeline? Collibra DQ can do both!

Simple

Load Table use SparkJDBC

```
//--- Configure Table From Database ---//
val connProps = Map (
  "driver"   -> "org.postgresql.Driver",
  "user"     -> s"${user}",
  "password" -> s"${pass}",
  "url"      ->
s"jdbc:postgresql://${host}:${port}/${database}",
  "dbtable"  -> "owl_test.nyse"
)

//--- Load Spark DataFrame ---//
val jdbcDF = spark.read.format("jdbc").options(connProps).load
jdbcDF.show
```

Configure Collibra DQ Options

Connect to DQ's Metadata Database and control DQ scan options. Wrap sparkDF with DQ context.

```
import com.owl.common.options._
import com.owl.core.util.OwlUtils

val opt = new OwlOptions
//--- Owl Metastore ---//
opt.host = s"$owlHost"
opt.port = s"5432/postgres?currentSchema=public"
opt.pgUser = s"$owlUser"
opt.pgPassword = s"$owlPass"
//--- Run Options ---//
opt.dataset = "owl_test.nyse"
opt.runId = "2018-01-10"
opt.datasetSafeOff = true

val owl = OwlUtils.OwlContext(jdbcDF, opt)
```

Register with Catalog and Run Profile

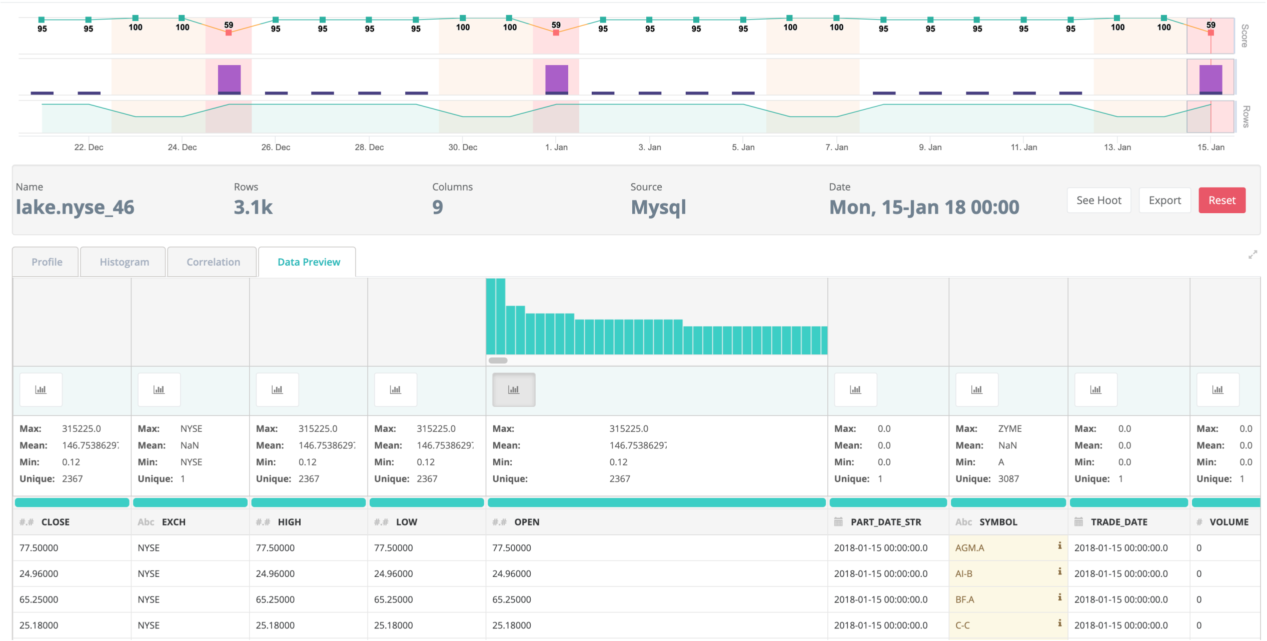
```
//--- Register with Owl Catalog ---//
owl.register(opt)

//--- Profile Dataset ---//
val profile = owl.profileDF
profile.show
```

Notice that DQ returns results as Dataframes. This is a fantastic abstraction that allows you to ignore all domain objects and custom types and interact with a scaleable generic result set using common protocols like "where" or "filter" or "save" or "write" all with parallel operations.

```
+--------------+-----+-------+-----------+---+---+--------+-----
------+------+----+------+-------+-------+------+----+---------+
|        column|nulls|empties|cardinality|min|max|is_mixed|-
mixed_
ratio|   Int|Long|String|Decimal|Boolean|Double|Date|Timestamp|
+--------------+-----+-------+-----------+---+---+--------+-----
------+------+----+------+-------+-------+------+----+---------+
|     tenant_
id|
0
|
0
|
60
|
0
|
9
|
false
|
0.0|100000|   0|      0|       0|       0|      0|    0|         0|
|           a11|
0
|
0
|
1
|a11|a11|
false
|
0.0|      0|   0|100000|       0|       0|      0|    0|         0|
|           a10|
0
|
0
|
1
|a10|a10|
false
|
0.0|      0|   0|100000|       0|       0|      0|    0|         0|
|  account_type|    0|      0|          3| 02|
06
|
false
|
0.0|100000|   0|      0|       0|       0|      0|    0|         0|
|           a13|
0
|
0
|
1
|a13|a13|
false
|
0.0|      0|    0|100000|       0|       0|      0|    0|         0|
|security_
alias|
0
|
0
|
3
|
0
|
2
|
false
|
0.0|100000|    0|      0|       0|       0|      0|    0|         0|
|           a12|
0
|
0
|
1
|a12|a12|
false
|
0.0|      0|    0|100000|       0|       0|      0|    0|         0|
+--------------+-----+-------+-----------+---+---+--------+-----
------+------+----+------+-------+-------+------+----+---------+
```

Profile UI

While the spark DF.show() is a nice and convenient output format, you may prefer a rich UI visual that tracks the data tests over time. The UI provides trend analysis, data drift, data relationships and more.



Name lake.nyse_46
Rows 3.1k
Columns 9
Source Mysql
Date Mon, 15-Jan 18 00:00

#.# CLOSE	Abc EXCH	#.# HIGH	#.# LOW	#.# OPEN	PART_DATE_STR	Abc SYMBOL	TRADE_DATE	# VOLUME
Max: 315225.0 Mean: 146.7538629? Min: 0.12 Unique: 2367	Max: NYSE Mean: NaN Min: NYSE Unique: 1	Max: 315225.0 Mean: 146.7538629? Min: 0.12 Unique: 2367	Max: 315225.0 Mean: 146.7538629? Min: 0.12 Unique: 2367	Max: 315225.0 Mean: 146.7538629? Min: 0.12 Unique: 2367	Max: 0.0 Mean: 0.0 Min: 0.0 Unique: 1	Max: ZYME Mean: NaN Min: A Unique: 3087	Max: 0.0 Mean: 0.0 Min: 0.0 Unique: 1	Max: 0.0 Mean: 0.0 Min: 0.0 Unique: 1
77.50000	NYSE	77.50000	77.50000	77.50000	2018-01-15 00:00:00.0	AGM.A	2018-01-15 00:00:00.0	0
24.96000	NYSE	24.96000	24.96000	24.96000	2018-01-15 00:00:00.0	AI-B	2018-01-15 00:00:00.0	0
65.25000	NYSE	65.25000	65.25000	65.25000	2018-01-15 00:00:00.0	BF.A	2018-01-15 00:00:00.0	0
25.18000	NYSE	25.18000	25.18000	25.18000	2018-01-15 00:00:00.0	C-C	2018-01-15 00:00:00.0	0

Duplicates

Take duplicate detection for example. A common use case where a business wants to make sure they do not have repeated or duplicate records in a table. Set the lowerBound to the percent fuzzy match you are willing to accept, commonly 87% or higher is an interesting match. You might also want to target a single day or week or month that you shouldn't have dupes within. Notice the .where function and then pass in a custom dataframe to the DQ context.

```
opt.dupe.on = true
opt.dupe.lowerBound = 99
opt.dupe.include = Array("SYMBOL", "EXCH")

val df1Day = jdbcDF.where("TRADE_DATE = '2018-01-10' ")
val owl = OwlUtils.OwlContext(df1Day, opt)

val dupes = owl.dupesDF
dupes.show

// rdd collect
dupes.rdd.collect.foreach(println)

// records linked together for remediation
owl.getDupeRecords.show
```

Outliers

Gaining and understanding of your outliers is a commonly desired DQ function. DQ has several configurations to help find the most meaningful outliers in your dataset and over time. Below compares the current day to a baseline of days in the historical dataframe.

```
opt.outlier.on = true
opt.outlier.lookback = 6
opt.outlier.dateColumn = "TRADE_DATE"
opt.outlier.timeBin = OutlierOpt.TimeBin.DAY
opt.outlier.key = Array("SYMBOL")

val df1Day = jdbcDF2.where("TRADE_DATE = '2018-01-10' ")
val owl = OwlUtils.OwlContextWithHistory(dfCurrent = df1Day,
dfHist = jdbcDF2, opt = opt)
val outliers = owl.outliersDF
outliers.show
```

Advanced

Programmatic DQ

Don't like leaving your notebook? Want to build data quality into your in-house data quality pipeline? Collibra DQ can do both!

Real World Examples

Rules

Let's assume we were provided a file named "atm_cust_file" and want to load it into a database table as well as scan it for all possible errors. We want to provide a couple levels of protection. 1) A business rule checking if *a customer joined before before the company was founded*. 2) Check if the file 100% matches to the DataFrame or db table we've created. 3) Check for all possible outliers or anomalies in the dataset. Each one of these 3 issues had a different impact to the business and causes a different flow to trigger in our pipeline.

Add Rule

Let's create a simple rule and assign points to the overall scoring system for later delegation.

```
    val rule = new domain2.Rule
    rule.setRuleNm("customer_before_company")
    rule.setRuleValue("customer_since_date < '1956-11-01'")
    rule.setPerc(1.0)
    rule.setPoints(1)
    rule.setIsActive(1)
    rule.setUserNm("Kirk")
    rule.setDataset("ATM_CUSTOMER3")
    Util.addRule(rule=rule)
```

Now let's chain together the remaining two items that were part of our original requirement. Note that DQ has six additional ML DQ features that we did not turn on in this case.

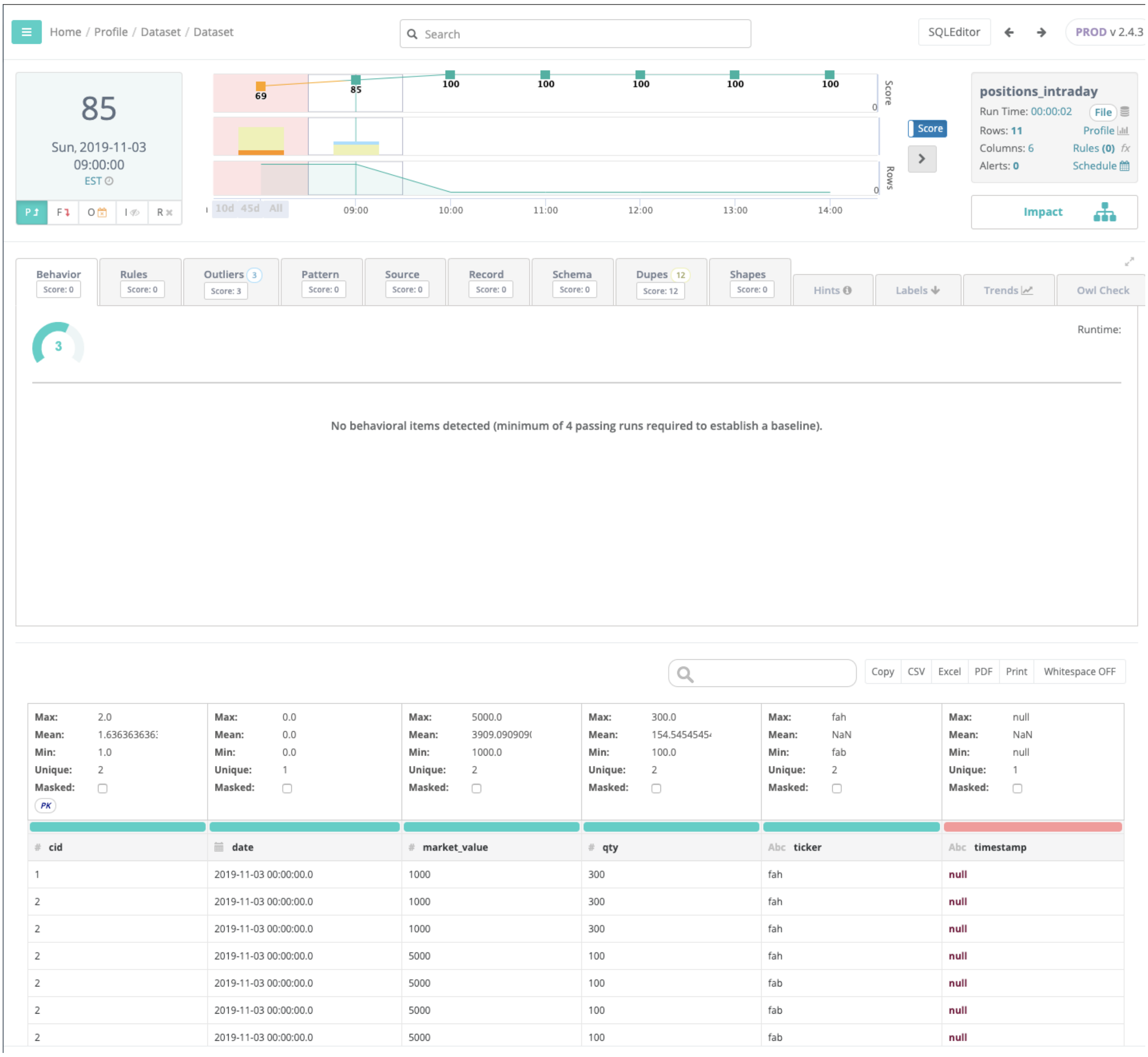
```
val owl = Util.OwlContext(df, atmCustFile, props)

// first register with catalog if not registered
owl.register(props)

// Check if dataframe matches the source file 'atm_cust_file'
val source = owl.validateSrcDF
if (source.count() > 1) {
  // create service now ticket and exit with fail based on not
matching to original file
}

owl.addAdHocRule(rule)
val ruleBreaks = owl.rulesDF
if (ruleBreaks.count() > 1) {
  if (ruleBreaks.where($"score" > 5).count > 1) {
    // create service now ticket and exit with fail based on
rules
  }
}

val outliers = owl.outliersDF
if (outliers.where($"confidence" < 10).count > 3) {
  // Owl email Alert to business group for attention
  // where 3 outliers have a confidence below 10
}
```

Chapter 17

Ingesting Intraday Files

Here we illustrate an example of how to work with files when using DQ programmatically. This can be implemented in both a Notebook setting and in your own codebase.

```
////////////////////////////////////////////////////////////////-
///////////
    //                  USE CASE - Ingesting Intraday
Files                  //

////////////////////////////////////////////////////////////////-
///////////

    // Part of your pipeline includes the ingestion of files
that have the date
    // and hour encoded in the file name. How do you process
those files using Owl?
    //
    // Format: <name>_<year>_<month>_<day>.csv
    //
    // Build up a data structure containg the files you want to
process (here we
    // just use a simple list, but you may want to be pulling
from a pubsub
    // queue, AWS bucket, etc...). Here we just use a simple
file list of 6
    // hours of trade position data.
    val position_files = List(
      new File(getClass.getResource("/position_file_2019_11_03_
08.csv").getPath),
      new File(getClass.getResource("/position_file_2019_11_03_
09.csv").getPath),
      new File(getClass.getResource("/position_file_2019_11_03_
10.csv").getPath),
      new File(getClass.getResource("/position_file_2019_11_03_
11.csv").getPath),
      new File(getClass.getResource("/position_file_2019_11_03_
12.csv").getPath),
      new File(getClass.getResource("/position_file_2019_11_03_
13.csv").getPath),
      new File(getClass.getResource("/position_file_2019_11_03_
14.csv").getPath))

    // Create your spark session.
    val spark = SparkSession.builder
      .master("local")
      .appName("test")
      .getOrCreate()

    // Configure Owl.
    val opt = new OwlOptions
    opt.dataset = "positions"
    opt.load.delimiter = ","
    opt.spark.master = "local[1]"
    opt.dupe.on = true
    opt.dupe.include = Array("ticker", "cid")
    opt.outlier.on = true
    opt.outlier.key = Array("cid")
    opt.outlier.timeBin = TimeBin.HOUR
    // Customize this to only process a subset of the data.
    opt.load.fileQuery = "select * from dataset"

    position_files.foreach { file: File =>
      // Tell Owl where to find the file.
      opt.load.filePath = file.getPath

      // Parse the filename to construct the run date (-rd) that
will be passed
      // to Owl.
      val name = file.getName.split('.').head
      val parts = name.split("_")
      val date = parts.slice(2, 5).mkString("-")
      val hour = parts.takeRight(1).head

      // Must be in format 'yyyy-MM-dd' or 'yyyy-MM-dd HH:mm'.
      val rd = s"${date} ${hour}"

      // Tell Owl to process data
      opt.runId = rd

      // Create a DataFrame from the file.
      val df = OwlUtils.load(opt.load.filePath, opt.-
load.delimiter, spark)

      // Instantiate an OwlContext with the dataframe and our
custom configuration.
      val owl = OwlUtils.OwlContext(df, spark, opt)

      // Make sure Owl has catalogued the dataset.
      owl.register(opt)

      // Let Owl do the rest!
      owl.owlCheck()

    }
```



positions_intraday
Run Time: 00:00:02
Rows: 11
Columns: 6
Alerts: 0
File
Profile
Rules (0)
Schedule

No behavioral items detected (minimum of 4 passing runs required to establish a baseline).

	cid	date	market_value	qty	ticker	timestamp
Max:	2.0	0.0	5000.0	300.0	fah	null
Mean:	1.636363636:	0.0	3909.090909(	154.5454545‹	NaN	NaN
Min:	1.0	0.0	1000.0	100.0	fab	null
Unique:	2	1	2	2	2	1
Masked:	□	□	□	□	□	□

cid	date	market_value	qty	ticker	timestamp
1	2019-11-03 00:00:00.0	1000	300	fah	null
2	2019-11-03 00:00:00.0	1000	300	fah	null
2	2019-11-03 00:00:00.0	1000	300	fah	null
2	2019-11-03 00:00:00.0	5000	100	fah	null
2	2019-11-03 00:00:00.0	5000	100	fab	null
2	2019-11-03 00:00:00.0	5000	100	fab	null
2	2019-11-03 00:00:00.0	5000	100	fab	null

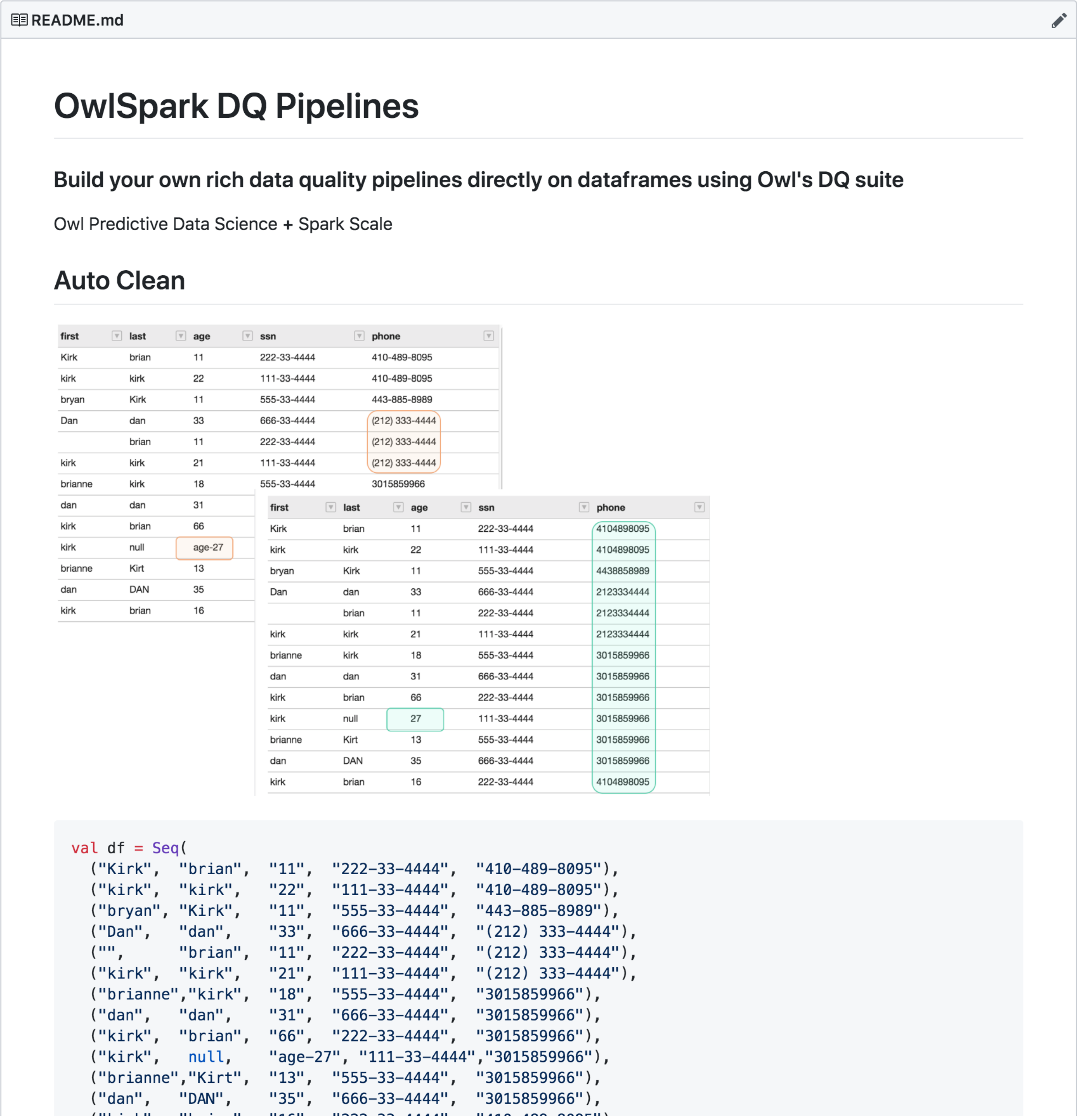
All Pipeline Activities in One Line

For brevity and convenience, DQ allows a DF to be loaded in the constructor and in one line run all nine dimensions of data quality "owl.owlcheck". To adjust the DQ dimensions you simply set the properties in the props object.

```
val owl = Util.OwlContext(df, atmCustFile, props)
owl.owlCheck
```

Example of some common property settings

```
val props = new Props()
props.filePath = s"${filePath}/atm_customer_${rd.replace("-","_")}.csv"
props.runId = rd
props.dateCol = "OWL_RUN_ID"
props.dataset = "ATM_CUSTOMER3"
props.del = ","
props.datasetSafety = false
props.calculateBoundaries = true
props.fileLookBack = true
props.timeBin = "DAY"

// outlier, missing records
props.dl = true
props.dlKey = "customer_id"
props.dlLb = 4

// pattern mining
props.freqPatternMiningByKey = true
props.fpgKey = "customer_id"
props.fpgLookback = 4
props.fpgDateCol = "OWL_RUN_ID"
props.fpgCols = "card_number,first_name,last_name,checking_savings"
props.fpgLowFreq = true

// validate Src
props.validateSrc = true
props.valSrcKey = "customer_id"

// fuzzy match
props.isDupe = true
props.dupeCutOff = 88
props.depth = 3
props.dupeExcludeCols = "customer_id,card_number,customer_since_date,OWL_RUN_ID"
```



OwlSpark DQ Pipelines

Build your own rich data quality pipelines directly on dataframes using Owl's DQ suite

Owl Predictive Data Science + Spark Scale

Auto Clean

first	last	age	ssn	phone
Kirk	brian	11	222-33-4444	410-489-8095
kirk	kirk	22	111-33-4444	410-489-8095
bryan	Kirk	11	555-33-4444	443-885-8989
Dan	dan	33	666-33-4444	(212) 333-4444
	brian	11	222-33-4444	(212) 333-4444
kirk	kirk	21	111-33-4444	(212) 333-4444
brianne	kirk	18	555-33-4444	3015859966
dan	dan	31		
kirk	brian	66		
kirk	null	age-27		
brianne	Kirt	13		
dan	DAN	35		
kirk	brian	16		

first	last	age	ssn	phone
Kirk	brian	11	222-33-4444	4104898095
kirk	kirk	22	111-33-4444	4104898095
bryan	Kirk	11	555-33-4444	4438858989
Dan	dan	33	666-33-4444	2123334444
	brian	11	222-33-4444	2123334444
kirk	kirk	21	111-33-4444	2123334444
brianne	kirk	18	555-33-4444	3015859966
dan	dan	31	666-33-4444	3015859966
kirk	brian	66	222-33-4444	3015859966
kirk	null	27	111-33-4444	3015859966
brianne	Kirt	13	555-33-4444	3015859966
dan	DAN	35	666-33-4444	3015859966
kirk	brian	16	222-33-4444	4104898095

```
val df = Seq(
  ("Kirk",  "brian",  "11",  "222-33-4444",  "410-489-8095"),
  ("kirk",  "kirk",   "22",  "111-33-4444",  "410-489-8095"),
  ("bryan", "Kirk",   "11",  "555-33-4444",  "443-885-8989"),
  ("Dan",   "dan",    "33",  "666-33-4444",  "(212) 333-4444"),
  ("",      "brian",  "11",  "222-33-4444",  "(212) 333-4444"),
  ("kirk",  "kirk",   "21",  "111-33-4444",  "(212) 333-4444"),
  ("brianne","kirk",  "18",  "555-33-4444",  "3015859966"),
  ("dan",   "dan",    "31",  "666-33-4444",  "3015859966"),
  ("kirk",  "brian",  "66",  "222-33-4444",  "3015859966"),
  ("kirk",   null,    "age-27", "111-33-4444","3015859966"),
  ("brianne","Kirt",  "13",  "555-33-4444",  "3015859966"),
  ("dan",   "DAN",    "35",  "666-33-4444",  "3015859966"),
```

Using Notebooks to build DQ Pipelines

For examples on how to do this, see our Notebook repository below.

GitHub - kirkhas/owl-notebooks: Owl Spark DQ Pipelines

Collibra Data Quality & Observability Rules

Global rules

Distributed with the application by default and you can use them from UI/CLI/Notebooks.

Rule types

- Invalid_Email_Check
- Invalid_Phone_Num_Check
- Invalid_Zip_Code_Check
- Invalid_SSN_Check
- Invalid_IP_Address_Check
- Invalid_Gender_Check
- Invalid_EIN_Check
- Invalid_State_Check
- Invalid_Credit_Card_Check
- Valid_Email_Check
- Valid_Phone_Num_Check
- Valid_Zip_Code_Check
- Valid_SSN_Check
- Valid_IP_Address_Check
- Valid_Gender_Check
- Valid_EIN_Check
- Valid_State_Check
- Valid_Credit_Card_Check
- Percent_Move_5 Percent_Move_10
- Percent_Move_20 Percent_Move_50
- Not_In_Previous_run
- Not_In_Current_run
- Having_Count_Greater_Than_One

SQL based rules

Simple rule

Rule Type - SQLG

Simple rule

Freeform SQL

RuleType - SQLF

Freeform SQL

Simple rule

Simple rules would be applied to filter a condition on a single column in a single table.

Example #1

In this example you can see how to create a simple SQL rule, with name **simple_sql_rule**.

Code	Description
rule.setRuleNm("**simple_sql_rule**")	Adding the name of the given rule
rule.setRuleValue("**startDate < '2011-11-01'"**)	Setting the simple SQL expression. No **JOIN** allowed between tables!
rule.setRuleType("**SQLG**")	Setting the rule type

Code

example_simple_sql_rule.scala

```
import com.owl.core.Owl
import com.owl.core.util.OwlUtils
import com.owl.common.bll.{RuleBll, RuleTemplateBll}
import com.owl.common.domain2.Rule
import com.owl.common.options.{LoadOpt, OwlOptions}

import org.junit.{Assert, Test}

import org.apache.spark.sql.SparkSession
import org.apache.spark.sql.functions._

val loadOptions = new LoadOpt {
  pghost = "localhost:5432/postgres"
  pguser = "username"
  pgpassword = "password"
}

//----- Init Spark ----- //
def sparkInit(): SparkSession = {
  val sparkSession = SparkSession.builder
    .master("local")
    .appName("test")
    .getOrCreate()
  sparkSession
}

@Test def simpleRule(): Unit = {

  // Arrange
  val spark = sparkInit()
  import spark.implicits._

  val headers = "firstName,lastName,startDate"
  val source = Seq(
    ("Thomas", "Martinez", "2010-11-01"),
    ("Harry", "Williams", "2012-05-01"),
    ("Ethan", "Davis", "2009-08-01")
  )
  val arr = headers.split(",")
  val df = source.toDF(arr: _*)

  val opt = new OwlOptions {
    runId = "2019-09-20"
    dataset = "simple_sql_rule_ds"
    onReadOnly = false
    load = loadOptions
  }

  val rule = new Rule {
    setDataset(opt.dataset)
    setRuleNm("simple_sql_rule")
    setRuleValue("startDate < '2011-11-01'")
    setRuleType("SQLG")
    setPerc(1.0)
    setPoints(1)
    setIsActive(1)
    setUserNm("admin")
  }

  val owl = OwlUtils.OwlContext(df, opt)
    .register(opt)

  OwlUtils.addRule(rule)

  // Act
  owl.owlCheck()

  // Assert
  import scala.collection.JavaConversions
  val hootRule = JavaConversions.asScalaBuffer
(owl.hoot.rules).find(x => rule.getRuleNm.equals
(x.getRuleNm)).orNull
```

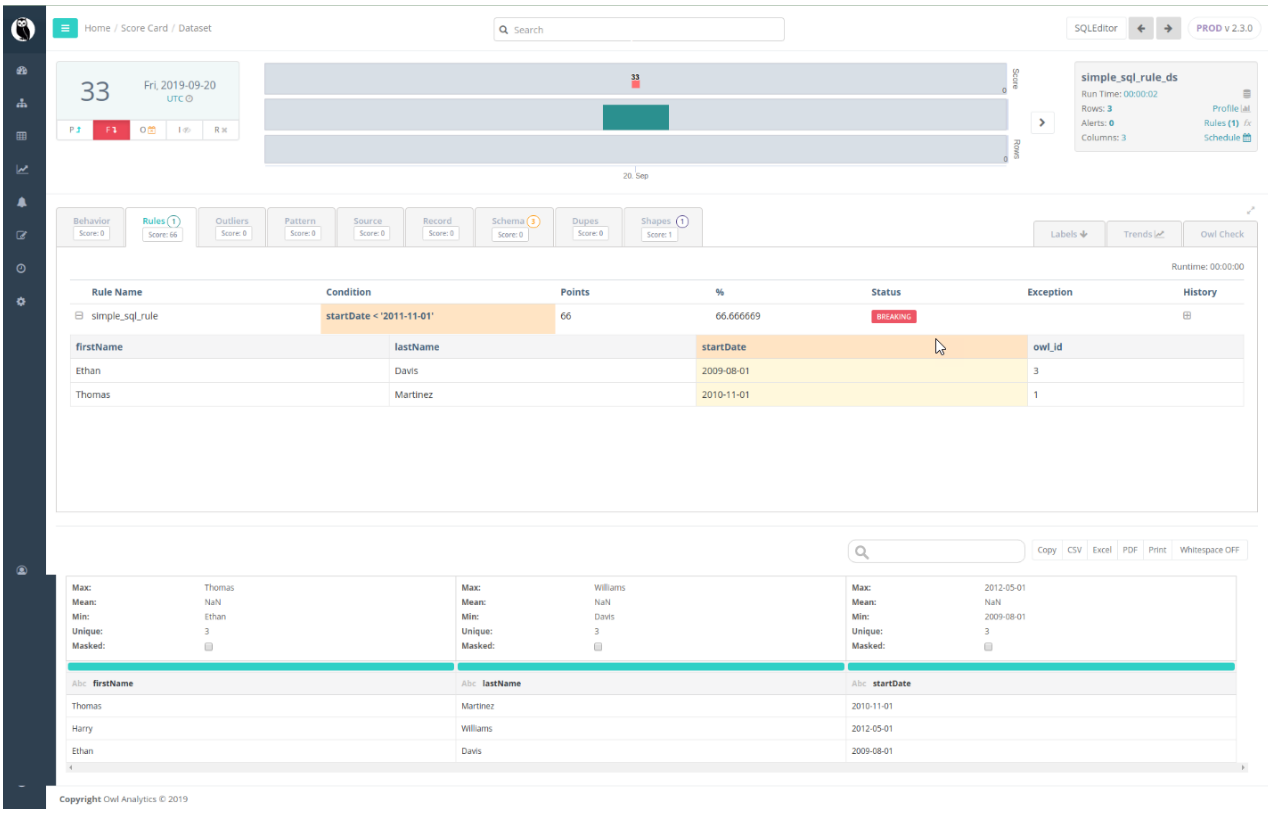
```
  Assert.assertNotNull(hootRule)
  Assert.assertEquals(66, hootRule.getScore)
}

// Execute notebook
simpleRuleNotebook()
```

Result

via Code

You can do multiple assertion on the result of the OwlCheck process.
Using **owl.hoot** parameter will provide access to the execution results, in this case for the rule.

via UI



simple_sql_rule_ds
Run Time: 00:00:02
Rows: 3
Alerts: 0
Columns: 3

Runtime: 00:00:00

Rule Name	Condition	Points	%	Status	Exception	History
⊟ simple_sql_rule	startDate < '2011-11-01'	66	66.666669	BREAKING		⊞

firstName	lastName	startDate	owl_id
Ethan	Davis	2009-08-01	3
Thomas	Martinez	2010-11-01	1

Max:	Thomas	**Max:**	Williams	**Max:**	2012-05-01
Mean:	NaN	**Mean:**	NaN	**Mean:**	NaN
Min:	Ethan	**Min:**	Davis	**Min:**	2009-08-01
Unique:	3	**Unique:**	3	**Unique:**	3
Masked:	□	**Masked:**	□	**Masked:**	□

Abc **firstName**	Abc **lastName**	Abc **startDate**
Thomas	Martinez	2010-11-01
Harry	Williams	2012-05-01
Ethan	Davis	2009-08-01

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Example #2

In this example you can see how to create a simple SQL with rule with **templates**, with name **simple_sql_rule_with_template**.

Steps

1. Create the rule template, where the template column name should be marked with **$colNm** string.\

```
val ruleTemplate = RuleTemplateBll.createRuleTemplate(
    "not_null_or_empty",
    "Column cannot contain null or empty values",
    " $colNm is null or $colNm = \'\' or $colNm  = \'null\'
"
)
```

2. Create the Rule instance, where value of **RuleValue** will be used to replace **$colNm** in the template expression.\

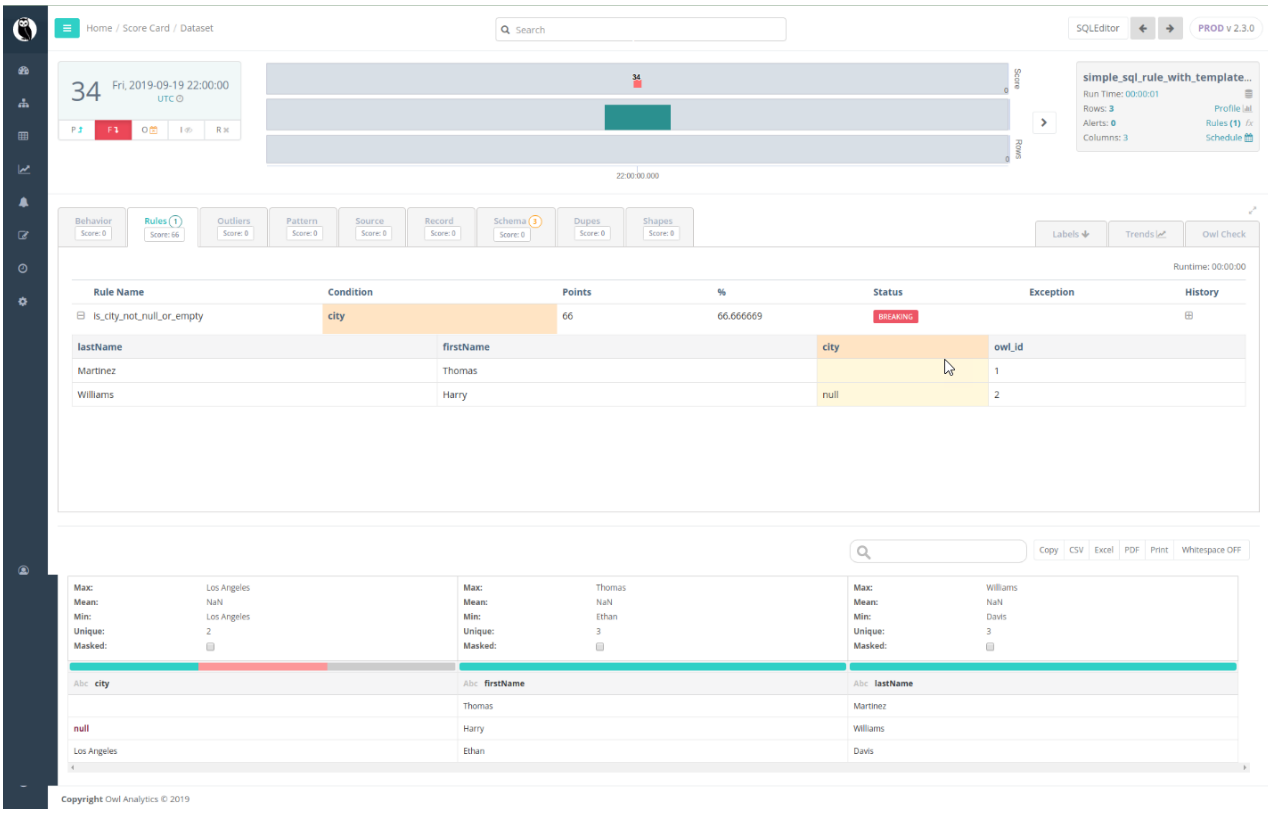
```
val rule = RuleBll.createRule(opt.dataset)
rule.setRuleNm("is_city_not_null_or_empty")
rule.setRuleValue("city")
rule.setRuleType("CUSTOM") // legacy type required to look
into rule repo
rule.setRuleRepo("not_null_or_empty") // custom rule name
to pull rule value from rule repo
rule.setPerc(1.0)
rule.setPoints(1)
rule.setIsActive(1)
rule.setUserNm("admin")
```

Code

```
import com.owl.core.Owl
import com.owl.core.util.OwlUtils
import com.owl.common.bll.{RuleBll, RuleTemplateBll}
import com.owl.common.domain2.Rule
import com.owl.common.options.{LoadOpt, OwlOptions}

import org.junit.{Assert, Test}

import org.apache.spark.sql.SparkSession
import org.apache.spark.sql.functions._

val loadOptions = new LoadOpt {
  pghost = "localhost:5432/postgres"
  pguser = "username"
  pgpassword = "password"
}

//----- Init Spark ----- //
def sparkInit(): SparkSession = {
  val sparkSession = SparkSession.builder
    .master("local")
    .appName("test")
    .getOrCreate()

  sparkSession
}

@Test def simpleRuleWithTemplate(): Unit = {

  // Arrange
  val spark = sparkInit()
  import spark.implicits._

  val headers = "firstName,lastName,city"
  val source = Seq(
    ("Thomas", "Martinez", ""),
    ("Harry", "Williams", null),
    ("Ethan", "Davis", "Los Angeles")
  )
  val arr = headers.split(",")
  val df = source.toDF(arr: _*)

  val opt = new OwlOptions {
    runId = "2019-09-20"
    dataset = "simple_sql_rule_with_template_ds"
    onReadOnly = false
    load = loadOptions
  }

  val ruleTemplate = RuleTemplateBll.createRuleTemplate("not_
null_or_empty","Column cannot contain null or empty values", "
$colNm is null or $colNm = \'\' or $colNm  = \'null\' ")

  val rule = RuleBll.createRule(opt.dataset)
  rule.setRuleNm("is_city_not_null_or_empty")
  rule.setRuleValue("city")
  rule.setRuleType("CUSTOM") // legacy type required to look
into rule repo
  rule.setRuleRepo("not_null_or_empty") // custom rule name to
pull rule value from rule repo
  rule.setPerc(1.0)
  rule.setPoints(1)
  rule.setIsActive(1)
  rule.setUserNm("admin")

  val owl = OwlUtils.OwlContext(df, opt)
    .register(opt)

  OwlUtils.addRuleTemplate(ruleTemplate)
  OwlUtils.addRule(rule)

  // Act
  owl.owlCheck()

  // Assert
  import scala.collection.JavaConversions
  val hootRule = JavaConversions.asScalaBuffer
(owl.hoot.rules).find(x => rule.getRuleNm.equals
(x.getRuleNm)).orNull
  Assert.assertNotNull(hootRule)
  Assert.assertEquals(66, hootRule.getScore)
}

// Execute notebook
simpleRuleWithTemplate()
```

Result

via UI



Rule Name	Condition	Points	%	Status	Exception	History
⊟ is_city_not_null_or_empty	city	66	66.666669	BREAKING		⊞

lastName	firstName	city	owl_id
Martinez	Thomas		1
Williams	Harry	null	2

Max:	Los Angeles	Max:	Thomas	Max:	Williams
Mean:	NaN	Mean:	NaN	Mean:	NaN
Min:	Los Angeles	Min:	Ethan	Min:	Davis
Unique:	2	Unique:	3	Unique:	3
Masked:	□	Masked:	□	Masked:	□

Abc city	Abc firstName	Abc lastName
	Thomas	Martinez
null	Harry	Williams
Los Angeles	Ethan	Davis

Freeform SQL

It would be used when applying a complex condition across multiple tables/columns and generally when more flexibility/customization is desired.

Individual statement

Syntax

```
SELECT * FROM @<dataset_name> <table_alias>
WHERE <filter_expression>
GROUP BY <group_by_expression>
HAVING <having_expression>
```

The base of the statement is given with **@<dataset_name>** style. In general the <dataset_name> is the same, where the rule is attached to, but basically you can use any valid dataset name in the expression.

Examples

Simple rule expression

```
opt.dataset = "example_ds"

val rule = RuleBll.createRule(opt.dataset)
rule.setRuleNm("is_city_not_null_or_empty")
rule.setRuleValue("select * from @example_ds t where t.amount >
'5000'")
rule.setRuleType("SQLF")
rule.setPerc(1.0)
rule.setPoints(1)
rule.setIsActive(1)
rule.setUserNm("admin")
```

Complex rule expression

```
opt.dataset = "unique_rule_ds"

val rule = RuleBll.createRule(opt.dataset)
rule.setRuleNm("unique_rule")
rule.setRuleValue("select * from ( select count(*) as cnt, customer_id from @unique_rule_ds group by customer_id ) having cnt > 1")
rule.setRuleType("SQLF")
rule.setPerc(1.0)
rule.setPoints(1)
rule.setIsActive(1)
rule.setUserNm("admin")
```

RegExp expression

```
opt.dataset = "regexp_rule_ds"

val rule = RuleBll.createRule(opt.dataset)
rule.setRuleNm("LIKE_rule")
rule.setRuleValue("select * from @regexp_rule_ds.SYMBOL rlike '^ABB+'   ")
rule.setRuleType("SQLG")
rule.setPerc(0.02)
rule.setPoints(1)
rule.setIsActive(1)
rule.setUserNm("admin")
```

Join statements

Available join types between multiple data sets

- WHERE tableA.id = tableB.id style
- INNER JOIN
- LEFT <OUTER> JOIN
- RIGHT <OUTER> JOIN

Joining other data sets

- Getting historical state of the same data set

  Syntax: @t<n>,
  where *n* parameter means, how many days should we go back in the past at the base data set (marked with @<data set_name>)

  Example:

  - **@t1**, will point to the data which was used at yesterday's run
  - **@t4**, will point to the data which was used 4 days ago
- Getting different data set
  Syntax: @<other_data set_name>

WHERE style

Look-back dataset

```
SELECT * FROM @<dataset_name> <table_alias>, @t1 [<history_
table_alias>]
WHERE <join_expression> AND <filter_expression>
```

Example

```
opt.dataset = "example_ds"

val rule = RuleBll.createRule(opt.dataset)
rule.setRuleValue("select * from @example_ds t, @t1  where t.cus-
tomer_id = t1.customer_id  and t.card_number <> t1.card_number
")
rule.setRuleType("SQLF")
```

Different data set

```
SELECT * FROM @<dataset_name> <table_alias>, @<other_dataset_
name> [<other_alias>]
WHERE <join_expression> AND <filter_expression>
```

Example

```
opt.dataset = "example_ds"
opt2.dataset = "other_ds"

val rule = RuleBll.createRule(opt.dataset)
rule.setRuleValue("select * from @example_ds t, @other_ds ds2
where t.customer_id = ds2.customer_id  and t.card_number <> ds2.-
card_number ")
rule.setRuleType("SQLF")
```

LEFT JOIN

Example

```
opt.dataset = "example_ds"

val rule = RuleBll.createRule(opt.dataset)
rule.setRuleNm("not_back2back_days")
rule.setRuleValue(" select * from @example_ds A LEFT OUTER JOIN
@t1 B ON A.customer_id = B.customer_id where A.customer_id is
not null and B.customer_id is null  ")
rule.setRuleType("SQLF")
rule.setPerc(1.0)
rule.setPoints(1)
rule.setIsActive(1)
rule.setUserNm("admin")
```

Data type based rules

Simple check for individual columns.

Rule types

Empty check

Rule type: EMPTYCHECKDescription: Checking whether the target column has empty values or not.

Null check

Rule type: NULLCHECKDescription: Checking whether the target column has *NULL* values or not.

Date check

Rule type: DATECHECKDescription: Checking whether the target column has **only** DATE values or not.

Integer check

Rule type: INTCHECKDescription: Checking whether the target column has **only** INTEGER values or not

Double check

Rule type: DOUBLECHECKDescription: Checking whether the target column has **only** DOUBLE values or not.

String check

Rule type: STRINGCHECKDescription: Checking whether the target column has **only** STRING values or not.

Mixed datatype check

Rule type: DATATYPECHECKDescription: ---

Syntax

- **<rule_type>** - Fixed key to the rule type
- **<column_name>** - Column to apply the rule
- **<rule_name>** - Custom name of the rule

```
opt.dataset = "example_ds"

val rule = RuleBll.createRule(opt.dataset)
rule.setRuleNm("<rule_name>")
rule.setRuleValue("<column_name>")
rule.setRuleType("<rule_type>")
rule.setPerc(1.0)
rule.setPoints(1)
rule.setIsActive(1)
rule.setUserNm("admin")
```

Outliers

This real life use-case is when you have a large file or data frame with many days of data but you want the run profile to be the current day so that it trends properly overtime. Another nuance to this use-case is that the customer_id is a unique field to the user and it should not show up in the analytics i.e. an outlier. But the customer_id should be available when the user wants to query the rest api end points. The customer_id is then used to link back the users original dataset. A bloomberg_Id (BB_ID) is a common example.

CSV File

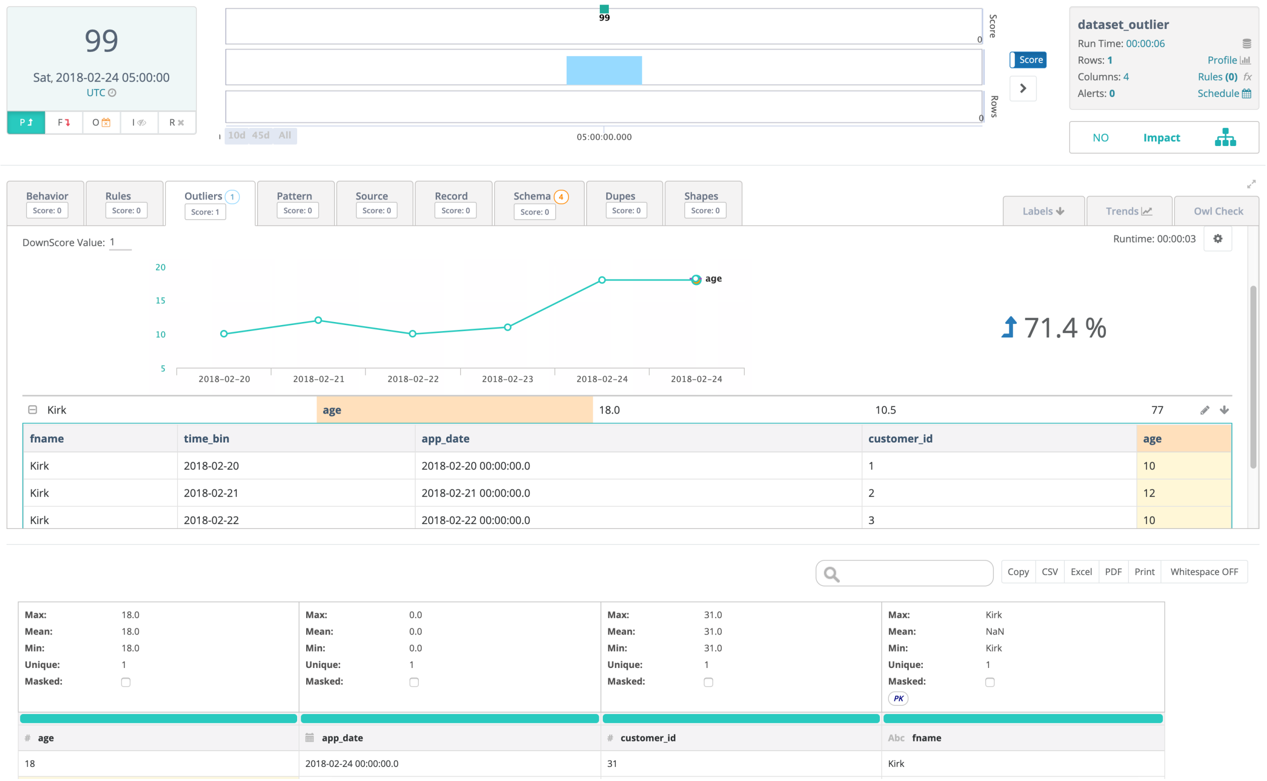
```
fname,app_date,age,customer_id
Kirk,2018-02-24,18,31
Kirk,2018-02-23,11,4
Kirk,2018-02-22,10,3
Kirk,2018-02-21,12,2
Kirk,2018-02-20,10,1
```

Notebook Code (Spark Scala)

```
val filePath = getClass.getResource("/notebooktest.csv").getPath

val spark = SparkSession.builder
  .master("local")
  .appName("test")
  .getOrCreate()

val opt = new OwlOptions()
opt.dataset = "dataset_outlier"
opt.runId = "2018-02-24"
opt.outlier.on = true
opt.outlier.key = Array("fname")
opt.outlier.dateColumn = "app_date"
opt.outlier.timeBin = OutlierOpt.TimeBin.DAY
opt.outlier.lookback = 5
opt.outlier.excludes = Array("customer_id")

val dfHist = OwlUtils.load(filePath = filePath, delim = ",",
sparkSession = spark)
val dfCurrent = dfHist.where(s"app_date = '${opt.runId}' ")

val owl = OwlUtils.OwlContextWithHistory(dfCurrent=dfCurrent,
dfHist=dfHist, opt=opt)
owl.register(opt)
owl.owlCheck()
```

Owl Web UI

Score drops from 100 to 99 based on the single outlier in the file. Row count is 1 because there is only 1 row in the current data frame. The historical data frame was provided for context and you can see those rows in the outlier drill-in. The customer_id is available in the data preview and can be used as an API hook to link back to the original data set.



Kirk	age	18.0	10.5	77

fname	time_bin	app_date	customer_id	age
Kirk	2018-02-20	2018-02-20 00:00:00.0	1	10
Kirk	2018-02-21	2018-02-21 00:00:00.0	2	12
Kirk	2018-02-22	2018-02-22 00:00:00.0	3	10

Max:	18.0	**Max:**	0.0	**Max:**	31.0	**Max:**	Kirk
Mean:	18.0	**Mean:**	0.0	**Mean:**	31.0	**Mean:**	NaN
Min:	18.0	**Min:**	0.0	**Min:**	31.0	**Min:**	Kirk
Unique:	1	**Unique:**	1	**Unique:**	1	**Unique:**	1
Masked:	□	**Masked:**	□	**Masked:**	□	**Masked:** PK	□

# age	app_date	# customer_id	Abc fname
18	2018-02-24 00:00:00.0	31	Kirk

After you run an DQcheck using owl.owlcheck you might want to check individual scores to see what type of issues were in the data. Collibra DQ sends back the records with issues in the format of a DataFrame using the notebook cmds or JSON from the REST api.

```
val hoot = owl.hoot

println(s"SHAPE   ${hoot.shapeScore} ")
println(s"DUPE    ${hoot.dupeScore} ")
println(s"OUTLIER ${hoot.outlierScore} ")
println(s"PATTERN ${hoot.patternScore} ")
println(s"RECORD  ${hoot.recordScore} ")
println(s"SCHEMA  ${hoot.schemaScore} ")
println(s"BEHAVIOR${hoot.behaviorScore} ")
println(s"SOURCE  ${hoot.sourceScore} ")
println(s"RULES   ${hoot.ruleScore} ")

if (hoot.shapeScore > 0) {
  owl.getShapeRecords.show
}
if (hoot.dupeScore > 0) {
  owl.getDupeRecords.show
}
```

```
+-------+---------+--------------------+--------+-----------+---
----+------+
|row_cnt|obs_score|             row_key|obs_type|customer_
id|  fname|owl_id|
+-------+---------+--------------------+--------+-----------+---
----+------+
|     21|       46|afa89984ce472a409...|    DUPE|         32|   -
Kirk|     1|
|     22|       46|afa89984ce472a409...|    DUPE|         31|Kir-
k's.|     2|
|     23|       60|41ea2d828b1a5fbf2...|    DUPE|         30|   -
 Dan|     3|
|     24|       60|41ea2d828b1a5fbf2...|    DUPE|         27|   -
 Dan|     6|
```

```
+---------------+--------------------+--------+----------+------
--------+--------+-------+-------+---+--------------------+-----
------+-------+------+--------+
|        dataset|              run_id|col_name|col_format|col_
format_cnt|owl_rank|row_cnt|row_key|age|            app_date|-
customer_id|  fname|owl_id|time_bin|
+---------------+--------------------+--------+----------+------
--------+--------+-------+-------+---+--------------------+-----
------+-------+------+--------+
|dataset_outlier|2018-02-24
00:00:...|   fname|   xxxx'x.|             1|        1|       2|xx-
xx'x.| 18|2018-02-24
00:00:...|          31|Kirk's.|     2|    null|
+---------------+--------------------+--------+----------+------
--------+--------+-------+-------+---+--------------------+-----
------+-------+------+--------+
```

GET http://$host/**v2/getoutlier?dataset=dataset_outlier&runId=2018-02-24**

GetOutlier

Parameters

Path

data set	string	name of data set
data set	string	yyyy-MM-dd format can include time and timezone
Responses		

● 200		

```
{
    confidence: 77
    dataset: "dataset_outlier"
    keyArr: null
    lb: 0
    outColumn: "age"
    outKey: "Kirk"
    outMedian: "10.5"
    outValue: "18.0"
    runId: "2018-02-24T05:00:00.000+0000"
    ub: 0
    }
```

GET http://$host**/v2/getdatashapes?dataset=dataset_outlier&runId=2018-02-24**

GetShape

Parameters

Path

data set	string	name of data set
runId	string	yyyy-MM-dd format can include time and timezone
Responses		
● 200		

Column Match

This example shows how one can get column level match statistics across datasources in an Owl Notebook. Supports exact and fuzzy matching.

Set ColMatch Parameters

```
    %spark
    import com.owl.common.domain._
    import com.owl.common.Props
    import com.owl.core.util.OwlUtils
    import scala.collection.JavaConverters._
    import com.owl.common.Utils
    val c1 = new Connection()
    c1.dataset = "silo.account"
    c1.user = "user"
    c1.password = "pass"
    c1.query = "select id, networth, acc_name, acc_branch from 
silo.account limit 200000"
    c1.url = "jdbc:mysql://<db url>:3306"

    val c2 = new Connection()
    c2.dataset = "silo.user_account"
    c2.user = "user"
    c2.password = "pass"
    c2.query = "SELECT acc_name, acc_branch, networth FROM 
silo.account limit 200000"
    c2.url = "jdbc:mysql://<db url>:3306"

    val c3 = new Connection()
    c3.dataset = "silo.user_account"
    c3.user = "user"
    c3.password = "pass"
    c3.query = "SELECT acc_name as acc_name2, acc_branch, 
networth FROM silo.account limit 100000"
    c3.url = "jdbc:mysql://<db url>:3306"

    props.dataset = "colMatchTest1"
    props.runId = "2017-02-04"
    props.connectionList = List(c1,c2,c3).asJava
    props.colMatchBatchSize = 2
    props.colMatchDurationMins = 3
    val owl = OwlUtils.OwlContext(spark.emptyDataFrame, props)
```

Exact Match

```
%spark
props.colMatchLevel = "exact"
owl.register(props)
owl.colMatchDF().show
```

Chapter 17

Sample Result

```
+------------+-----------------+----------+----------+----------
-----+
|   dataset_1|        dataset_2|     col_1|     col_2|matchPer-
centage|
+------------+-----------------+----------+----------+----------
-----+
|silo.account|silo.user_account|        id|  acc_
name|              0|
|silo.account|silo.user_account|        id|acc_
branch|              0|
|silo.account|silo.user_
account|        id|  networth|              0|
|silo.account|silo.user_account|        id|    owl_
id|              0|
|silo.account|silo.user_account|  networth|  acc_
name|              0|
|silo.account|silo.user_account|  networth|acc_
branch|             16|
|silo.account|silo.user_
account|  networth|  networth|            100|
|silo.account|silo.user_account|  networth|    owl_
id|              0|
|silo.account|silo.user_account|  acc_name|  acc_
name|             87|
|silo.account|silo.user_account|  acc_name|acc_
branch|              0|
|silo.account|silo.user_account|  acc_
name|  networth|              0|
|silo.account|silo.user_account|  acc_name|    owl_
id|              0|
|silo.account|silo.user_account|acc_branch|  acc_
name|              0|
|silo.account|silo.user_account|acc_branch|acc_
branch|             87|
|silo.account|silo.user_account|acc_
branch|  networth|             12|
|silo.account|silo.user_account|acc_branch|    owl_
id|              0|
|silo.account|silo.user_account|    owl_id|  acc_
name|              0|
|silo.account|silo.user_account|    owl_id|acc_
branch|              0|
|silo.account|silo.user_account|    owl_
id|  networth|              0|
|silo.account|silo.user_account|    owl_id|    owl_
id|              0|
+------------+-----------------+----------+----------+----------
-----+
only showing top 20 rows
```

Fuzzy Match

```
%spark
props.colMatchLevel = "fuzzy"
props.colMatchFuzzyDistance = 4
owl.register(props)
owl.colMatchDF().show
```

Chapter 17

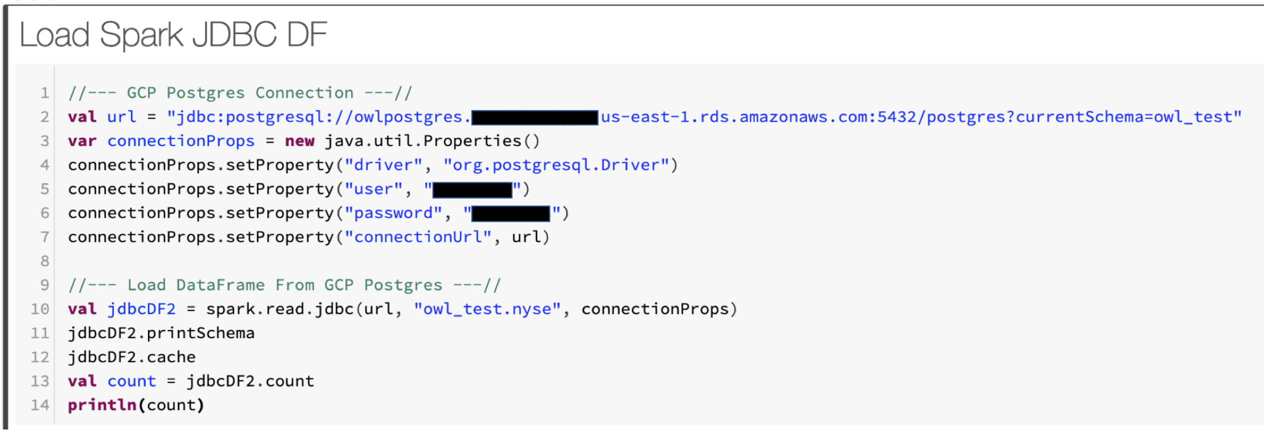
Sample Result

```
+------------+-----------------+----------+----------+----------
-----+
|   dataset_1|        dataset_2|     col_1|     col_2|matchPer-
centage|
+------------+-----------------+----------+----------+----------
-----+
|silo.account|silo.user_account|        id|  acc_
name|              5|
|silo.account|silo.user_account|        id|acc_
branch|             27|
|silo.account|silo.user_
account|        id|  networth|             22|
|silo.account|silo.user_account|        id|    owl_
id|              0|
|silo.account|silo.user_account|  networth|  acc_
name|            100|
|silo.account|silo.user_account|  networth|acc_
branch|            233|
|silo.account|silo.user_
account|  networth|  networth|            200|
|silo.account|silo.user_account|  networth|    owl_
id|              0|
|silo.account|silo.user_account|  acc_name|  acc_
name|            162|
|silo.account|silo.user_account|  acc_name|acc_
branch|            262|
|silo.account|silo.user_account|  acc_
name|  networth|             75|
|silo.account|silo.user_account|  acc_name|    owl_
id|              0|
|silo.account|silo.user_account|acc_branch|  acc_
name|            262|
|silo.account|silo.user_account|acc_branch|acc_
branch|            612|
|silo.account|silo.user_account|acc_
branch|  networth|            175|
|silo.account|silo.user_account|acc_branch|    owl_
id|              0|
|silo.account|silo.user_account|    owl_id|  acc_
name|              0|
|silo.account|silo.user_account|    owl_id|acc_
branch|              0|
|silo.account|silo.user_account|    owl_
id|  networth|              0|
|silo.account|silo.user_account|    owl_id|    owl_
id|              0|
+------------+-----------------+----------+----------+----------
-----+
only showing top 20 rows
```

AWS DataBricks

Getting started

First use vanilla spark code to setup connection properties and access a database table via spark jdbc. Entire code example available at the end for copy paste.



Load Spark JDBC DF

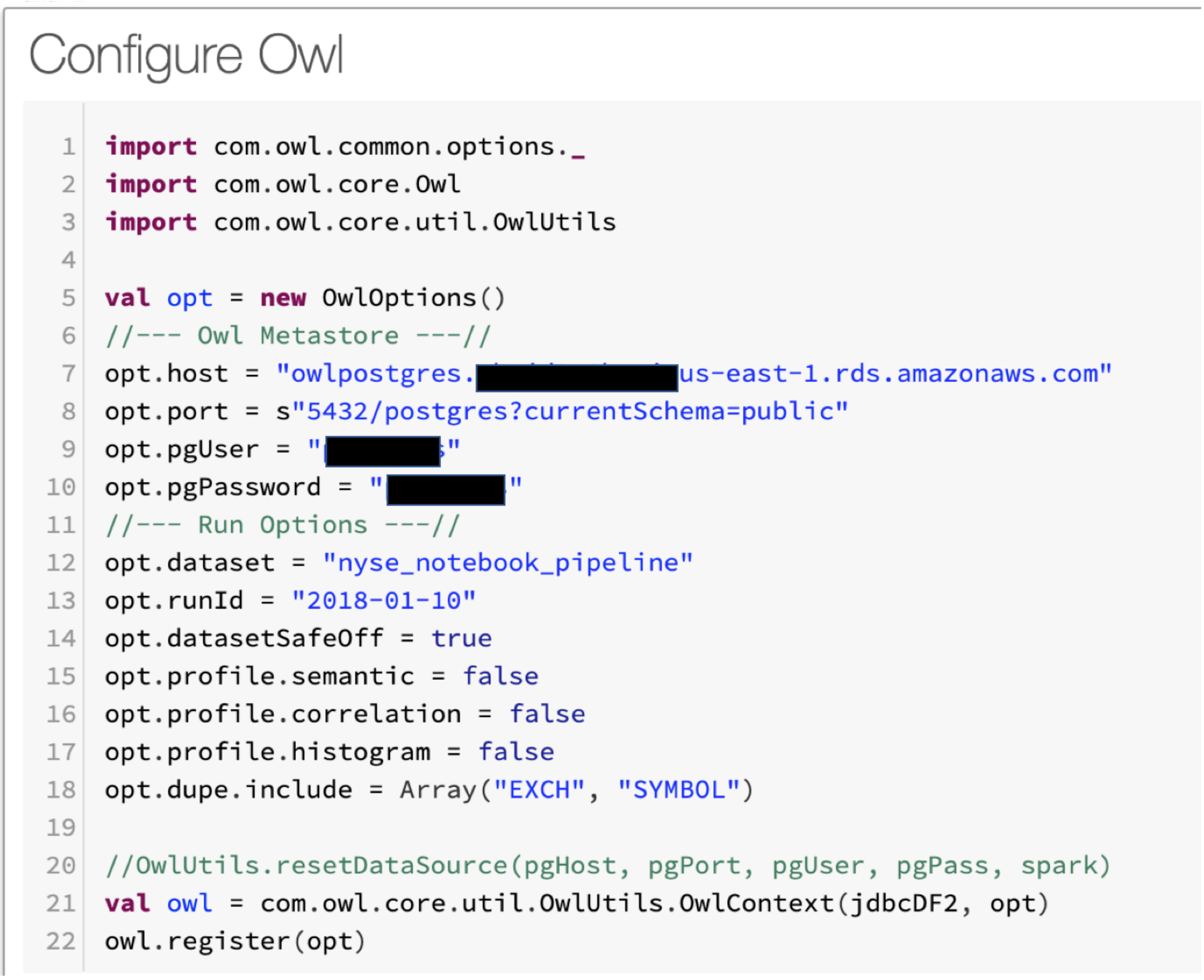
```
//--- GCP Postgres Connection ---//
val url = "jdbc:postgresql://owlpostgres.[redacted]us-east-1.rds.amazonaws.com:5432/postgres?currentSchema=owl_test"
var connectionProps = new java.util.Properties()
connectionProps.setProperty("driver", "org.postgresql.Driver")
connectionProps.setProperty("user", "[redacted]")
connectionProps.setProperty("password", "[redacted]")
connectionProps.setProperty("connectionUrl", url)

//--- Load DataFrame From GCP Postgres ---//
val jdbcDF2 = spark.read.jdbc(url, "owl_test.nyse", connectionProps)
jdbcDF2.printSchema
jdbcDF2.cache
val count = jdbcDF2.count
println(count)
```

Schema output, Row Count and Runtime

```
root
 |-- EXCH: string (nullable = true)
 |-- SYMBOL: string (nullable = true)
 |-- TRADE_DATE: date (nullable = true)
 |-- OPEN: decimal(9,3) (nullable = true)
 |-- HIGH: decimal(9,3) (nullable = true)
 |-- LOW: decimal(9,3) (nullable = true)
 |-- CLOSE: decimal(9,3) (nullable = true)
 |-- VOLUME: integer (nullable = true)
 |-- PART_DATE_STR: date (nullable = true)

Row Count: 102,817
Runtime: 00:00:03
```

Next Configure Owl Options and Point to Owl Metastore

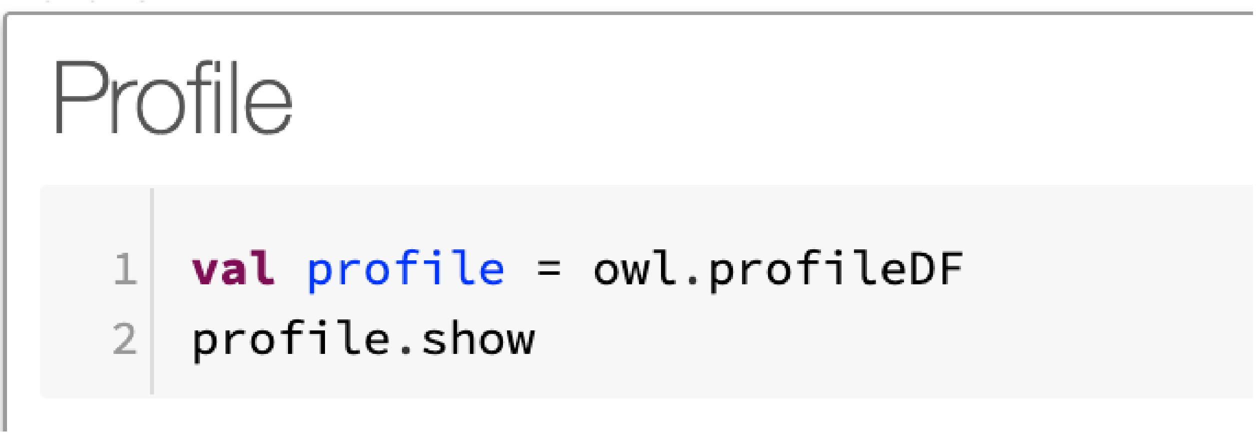
This requires that you have imported the Collibra DQ libraries into your notebook or databricks env.



Configure Owl

```
import com.owl.common.options._
import com.owl.core.Owl
import com.owl.core.util.OwlUtils

val opt = new OwlOptions()
//--- Owl Metastore ---//
opt.host = "owlpostgres.[redacted]us-east-1.rds.amazonaws.com"
opt.port = s"5432/postgres?currentSchema=public"
opt.pgUser = "[redacted]"
opt.pgPassword = "[redacted]"
//--- Run Options ---//
opt.dataset = "nyse_notebook_pipeline"
opt.runId = "2018-01-10"
opt.datasetSafeOff = true
opt.profile.semantic = false
opt.profile.correlation = false
opt.profile.histogram = false
opt.dupe.include = Array("EXCH", "SYMBOL")

//OwlUtils.resetDataSource(pgHost, pgPort, pgUser, pgPass, spark)
val owl = com.owl.core.util.OwlUtils.OwlContext(jdbcDF2, opt)
owl.register(opt)
```

Next Run a Profile



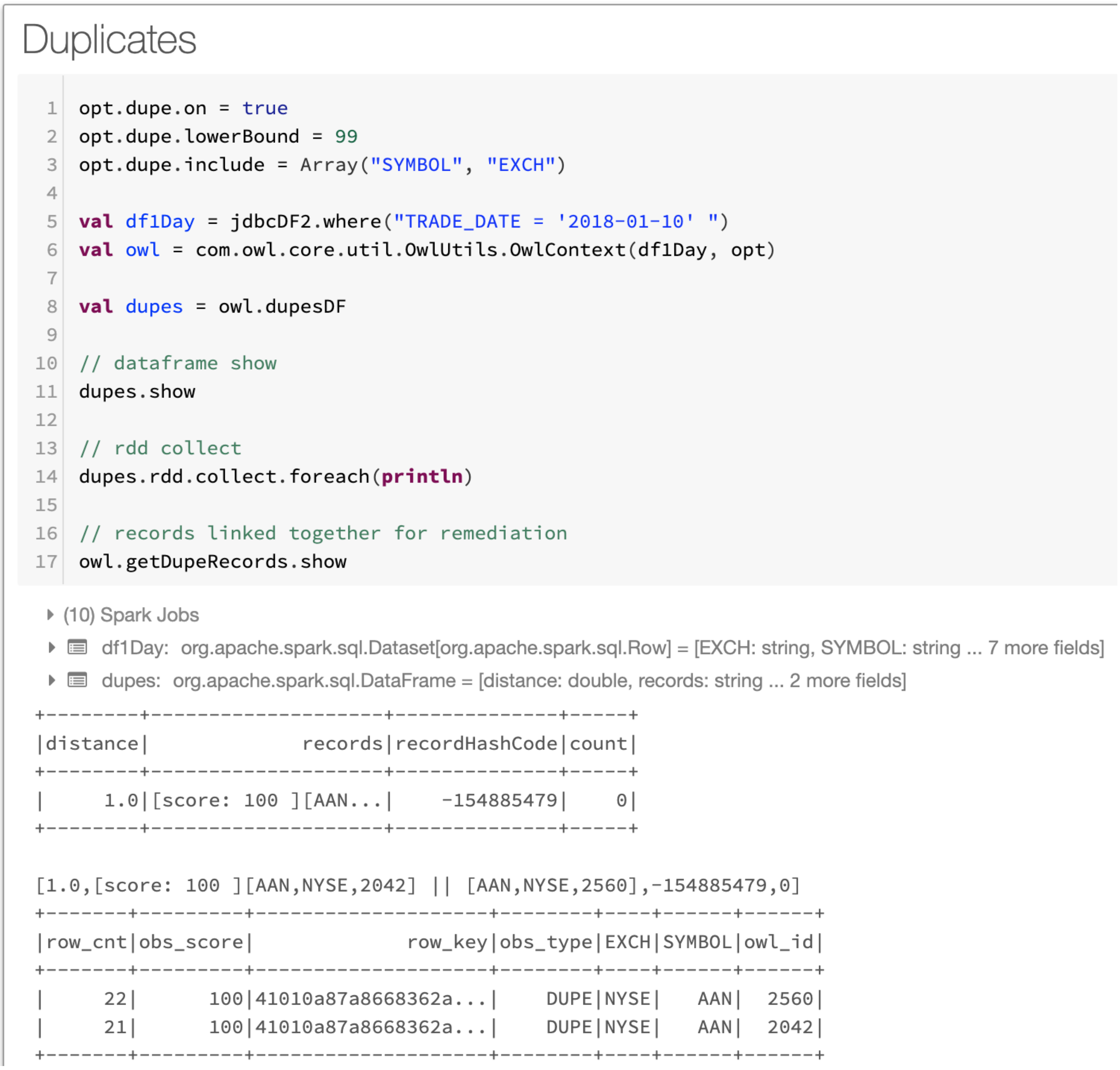
Profile

```
val profile = owl.profileDF
profile.show
```

```
+-------------+-----+-------+-----------+--------+-----------+--
----+----+------+-------+-------+------+------+---------+
|       column|nulls|empties|cardinality|is_mixed|mixed_
ratio|
Int|Long|String|Decimal|Boolean|Double|  Date|Timestamp|
+-------------+-----+-------+-----------+--------+-----------+--
----+----+------+-------+-------+------+------+---------+
|
HIGH
|
0|      0|      19159|   false|        0.0|     0|   0|     0|
102817|      0|     0|     0|        0|
|
SYMBOL
|
0
|
0
|
3137
|
false
|
0.0|     0|   0|102817|      0|      0|     0|     0|        0|
|
LOW
|
0|      0|      18845|   false|        0.0|     0|   0|     0|
102817|      0|     0|     0|        0|
|
VOLUME
|
0
|
0
|
25856
|
false
|
0.0|102817|   0|     0|      0|      0|     0|     0|        0|
|   TRADE_
DATE
|
0
|
0
|
33
|
false
|
0.0|     0|   0|     0|      0|      0|     0|102817|        0|
|
EXCH
|
0
|
0
|
2
|
false
|
0.0|     0|   0|102817|      0|      0|     0|     0|        0|
|
CLOSE
|
0|      0|      15781|   false|        0.0|     0|   0|     0|
102817|      0|     0|     0|        0|
|PART_DATE_
STR
|
0
|
0
|
33
|
false
|
0.0|     0|   0|     0|      0|      0|     0|102817|        0|
|
OPEN
|
0|      0|      16013|   false|        0.0|     0|   0|     0|
102817|      0|     0|     0|        0|
+-------------+-----+-------+-----------+--------+-----------+--
----+----+------+-------+-------+------+------+---------+
```

Next Check for Duplicates

Notice there is a duplicate discovered. NYSE AAN record exists twice in the 10/1/2018. This should not happen as end of day stock data should only have 1 record per stock symbol. Great DQ finding.



Duplicates

```
opt.dupe.on = true
opt.dupe.lowerBound = 99
opt.dupe.include = Array("SYMBOL", "EXCH")

val df1Day = jdbcDF2.where("TRADE_DATE = '2018-01-10' ")
val owl = com.owl.core.util.OwlUtils.OwlContext(df1Day, opt)

val dupes = owl.dupesDF

// dataframe show
dupes.show

// rdd collect
dupes.rdd.collect.foreach(println)

// records linked together for remediation
owl.getDupeRecords.show
```

▸ (10) Spark Jobs

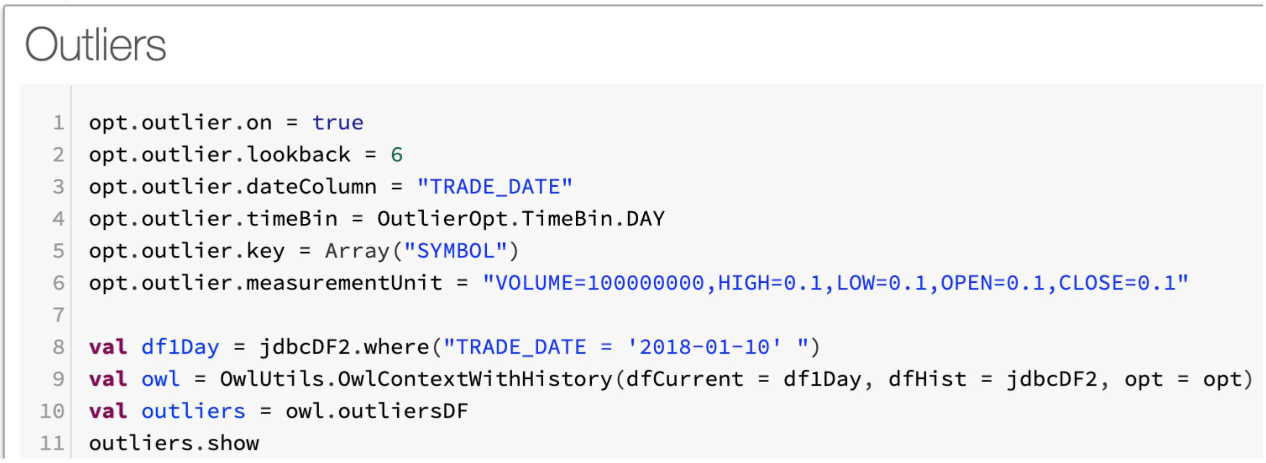
▸ df1Day: org.apache.spark.sql.Dataset[org.apache.spark.sql.Row] = [EXCH: string, SYMBOL: string ... 7 more fields]

▸ dupes: org.apache.spark.sql.DataFrame = [distance: double, records: string ... 2 more fields]

```
+--------+--------------------+--------------+-----+
|distance|             records|recordHashCode|count|
+--------+--------------------+--------------+-----+
|     1.0|[score: 100 ][AAN...|    -154885479|    0|
+--------+--------------------+--------------+-----+

[1.0,[score: 100 ][AAN,NYSE,2042] || [AAN,NYSE,2560],-154885479,0]
+-------+---------+--------------------+--------+----+------+------+
|row_cnt|obs_score|             row_key|obs_type|EXCH|SYMBOL|owl_id|
+-------+---------+--------------------+--------+----+------+------+
|     22|      100|41010a87a8668362a...|    DUPE|NYSE|   AAN|  2560|
|     21|      100|41010a87a8668362a...|    DUPE|NYSE|   AAN|  2042|
+-------+---------+--------------------+--------+----+------+------+
```

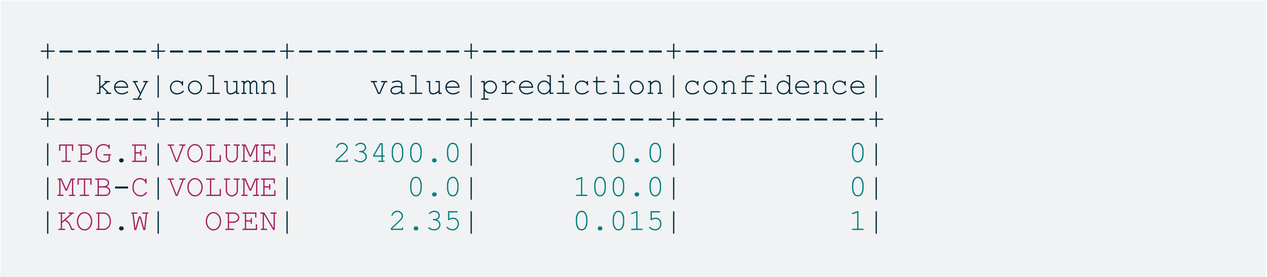
Next Scan for Outliers

Notice that KOD.w the camera company Kodak commonly trades at less than 2 pennies and jumps to $2.35. Absolutely an outlier. This was a news event named Kodak coin, google it.



Outliers

```
opt.outlier.on = true
opt.outlier.lookback = 6
opt.outlier.dateColumn = "TRADE_DATE"
opt.outlier.timeBin = OutlierOpt.TimeBin.DAY
opt.outlier.key = Array("SYMBOL")
opt.outlier.measurementUnit = "VOLUME=100000000,HIGH=0.1,LOW=0.1,OPEN=0.1,CLOSE=0.1"

val df1Day = jdbcDF2.where("TRADE_DATE = '2018-01-10' ")
val owl = OwlUtils.OwlContextWithHistory(dfCurrent = df1Day, dfHist = jdbcDF2, opt = opt)
val outliers = owl.outliersDF
outliers.show
```



```
+-----+------+---------+----------+----------+
|  key|column|    value|prediction|confidence|
+-----+------+---------+----------+----------+
|TPG.E|VOLUME|  23400.0|       0.0|         0|
|MTB-C|VOLUME|      0.0|     100.0|         0|
|KOD.W|  OPEN|     2.35|     0.015|         1|
```

Entire Code Snippet

```
//--- GCP Postgres Connection ---//
val url = "jdbc:postgresql://${host}:5432/postgres?currentSchema=owl_test"
var connectionProps = new java.util.Properties()
connectionProps.setProperty("driver", "org.postgresql.Driver")
connectionProps.setProperty("user", "${user}")
connectionProps.setProperty("password", "${pass}")
connectionProps.setProperty("connectionUrl", url)

//--- Load DataFrame From GCP Postgres ---//
val jdbcDF2 = spark.read.jdbc(url, "owl_test.nyse", connectionProps)
jdbcDF2.printSchema
jdbcDF2.cache
jdbcDF2.count

//--- Owl Library Imports ---//
import com.owl.common.options._
import com.owl.core.Owl
import com.owl.core.util.OwlUtils

val opt = new OwlOptions()
//--- Owl Metastore ---//
opt.host = s"${host}"
opt.port = s"5432/postgres?currentSchema=public"
opt.pgUser = s"$user"
opt.pgPassword = s"$pass"

//--- Run Options ---//
opt.dataset = "nyse_notebook_pipeline"
opt.runId = "2018-01-10"
opt.datasetSafeOff = true

opt.dupe.on = true
opt.dupe.lowerBound = 99
opt.dupe.include = Array("SYMBOL", "EXCH")

opt.outlier.on = true
opt.outlier.lookback = 6
opt.outlier.dateColumn = "TRADE_DATE"
opt.outlier.timeBin = OutlierOpt.TimeBin.DAY
opt.outlier.key = Array("SYMBOL")
opt.outlier.measurementUnit = "VOLUME=100000000,HIGH=0.1,LOW=0.1,OPEN=0.1,CLOSE=0.1"

//--- Initialize Owl ---//
val currentDay = jdbcDF2.where(s"TRADE_DATE = '${opt.runId}' ")
val owl = OwlUtils.OwlContextWithHistory(dfCurrent = currentDay,
                                  dfHist = jdbcDF2, opt = opt)

//--- Pipeline Cmds ---//
owl.register(opt)
val profile = owl.profileDF
val outliers = owl.outliersDF
val dupes = owl.dupesDF
```

Required configuration

- **DataBricks Runtime**: 5.4 (includes Apache Spark 2.4.3, Scala 2.11)
- **Python Version**: 3

Required libraries

- **DQ jar file***Example: owl_core_trunk_jar_with_dependencies.jar* __
- **JDBC driver:** org.springframework:spring-jdbc:4.3.16.RELEASE\
- **Database specific JDBC connector drivers***Example#1: mysql:mysql-connector-java:8.0.17Example#2: org.postgresql:postgresql:jar:42.2.8*

Azure DataBricks

Run a Collibra DQ check on any file in Azure Blob

Read the File by setting up the azure key.

```
spark.conf.set("fs.azure.ac-
count.key.abcCompany.blob.core.windows.net"
,"GBB6Upzj4AxQld7cFv7wBYNoJzIp/WEv/5NslqszY3nAAlsalBNQ==")

val df = spark.read.parquet("wasbs://company-abc@-
abceCompany.blob.core.windows.net/FILE_NAME/20190201_FILE_NAME.-
parquet")
```

Process the file using Collibra DQ

```
// register in Owl Catalog, Optional
val owl = new Owl(df).register

// run a full DQ Check
owl.owlCheck()
```

Additional imports and input options

```
import com.owl.core._
import com.owl.common._

val props = new Props()
props.dataset = datasetName
props.runId = 2019-03-02
props..... // look at the many input options
```

Give your data a little quality time.

Options (base)

API documentation for Java Class DQOptions.

The Class properties are laid out in the following format headers to allow Gitbook indexing.

ClassName field_name

field type | *`default`* __Description

DQOptions data set

String | _`StringUtils.Empty`_ __Unique string ID for the DQCheck Data set. Cannot contain `"."`,`"-"`,`"#"`,`"@"`\

Example Code

Initializing

Scala

```
import com.owl.common.options.OwlOptions

val opts = new OwlOptions()
```

Java

```
import com.owl.common.options.OwlOptions

OwlOptions opts = new OwlOptions();
```

{% endtab %} {% endtabs %}

Options API

Field mappings

Field name	CLI prop	Description
dataset	*ds*	dataset name, example: userTable or users or user_file
runId	*rd*	run date, must be in format **yyyy-MM-dd** or for incremental use Hours or Minutes **yyyy-MM-dd HH:mm**
runIdEnd	*rdEnd*	end date for query ranges **t_date >= $ and t_date < $**, must be in format **yyyy-MM-dd** or for incremental use Hours or Minutes **yyyy-MM-dd HH:mm**
passFail	*passfaillimit*	Limit for passing or failing runs
jobId		
onReadOnly	*readonly*	Do not persist results to the Owl meta-store - useful during testing.

Load Options

Field name	CLI prop	Description
fullFile	*fullfile*	use entire file for lookbacks instead of just filequery
fileQuery		
header		
headerSrc		
hasHeader		
isParallel		
isJson		
isMixedJson		
isMapsJson		
flatten		
isMultiLine		
sparkprinc		
sparkkeytab		
jdbcprinc		
jdbckeytab		
srcpwdmgr		
pwdmgr		
pguser	pguser	
pgpassword	pgpassword	

Field name	CLI prop	Description
pghost	host	
pgport	port	
executorcores		
isParquet		
isAvro		
avroSchema		
isXml		
xmlRowTag		
isOrc		
dateFmt		
timeFmt		
datasetSafety		
filePath		
delimiter		
fileLookBack		
dbLookBack		
connectionURL		
userName		
password		
sqlQuery		
connectionProps		

Field name	CLI prop	Description
zkHost	~~~~	*Deprecated*
zkPort	~~~~	*Deprecated*
zkPath	~~~~	*Deprecated*

Outlier Options

Field name	CLI prop	Description
on	dl	deep learning
lookback	dllb	deep learning lookback example value 5, for 5 days
key	dlkey	deep learning key. comma delim key ex: symbol,date
ateField		
bin		
includes	dlinc	deep learning col limit, example : open,close,high,volume
excludes	dlexc	deep learning col exclusion, example : open,close,high,volume
categorical		
by		
limit		
historyLimit		
score		

FPG Options

Field name	CLI prop	Description
on	fpgon	pattern mining
lookback	fpglb	lookback interval for pattern mining. Ex: **-fpglb 5**
key	fpgkey	natural key for pattern mining activity
dateField	fpgdc	date column for pattern mining. Ex: **-fpgdc date_col**
lowFreq		***Deprecated***
includes	fpginc	pattern mining is expensive use this input to limit the observed cols
excludes	fpgexc	pattern mining is expensive use this input to limit the observed cols
timeBin	fpgtbin	time bin for pattern mining. Ex: **-fpgtbin DAY**
score	fpgscore	score for pattern mining records
minSupport	fpgsupport	
confidence	fpgconfidence	

Dupe Options

Field name	CLI prop	Description
on	dupe	duplicate record detection
includes	dupeinc	duplicate record detection, column inclusion list
excludes	dupeexc	duplicate record detection, column exclusion list
depth		
lowerBound	dupelb	duplicate lower bounds on percent match default [85]
upperBound		

Field name	CLI prop	Description
blocksize		
useCache		
checkHeader		
exactMatch		
ignoreCase	dupenocase	duplicate record detection, column exclusion list
score	dupescore	
limit	dupelimit	Limit for dupe rows stored

Profile Options

Field name	CLI prop	Description
on		
includes		
excludes		
dataShapeOn		
statsOn		
correlationOn		
histogramOn		
cardinalityOn		
dataShapeColsInc		
dataShapeColsExc		

Source Options

Field name	CLI prop	Description
on		
includes		
excludes		
key		
fileQuery		
map		
score		
datasetSrc		
driverSrc		
userNameSrc		
passwordSrc		
connectionURLSrc		
sqlQuerySrc		
connectionPropsSrc		

Rule Options

Field name	CLI prop	Description
on		
rulesOnly		
semantic		

ColMatch Options

Field name	CLI prop	Description
colMatchParallelProcesses		
colMatchDurationMins		
colMatchBatchSize		
connectionList		

Spark Options

Field name	CLI prop	Description
numExecutors		
executorMemory		
driverMemory		
executorCores		
master		
jars		
libs		
driver		

Misc Options

Field name	CLI prop	Description
obslimit		
nullValue		

Chapter 17

Classes

Chapter 17

Load

```
package com.owl.common.options;

import org.apache.commons.lang3.StringUtils;

import java.util.Properties;

/**
 * Owl Options related to data loading
 */
public class LoadOpt {
    // Options order: "unsorted",
    // "dataset scope columns", "dataset scope rows", "look
back",
    // "common options for both data sources", "file as data
source", "db as data source"

    public static final String SINGLE_QUOTE = "'";
    public static final String DOUBLE_QUOTE = "\"";
    public static final String BACK_TICK = "`";

    /**
     * If true, don't save any metadata
     * TODO confirm if this is correct
     */
    public Boolean readonly = false;

    /**
     * The Password manager.
     */
    public String passwordManager = null;

    /**
     * Catalog alias (Catalog name)
     */
    public String alias = StringUtils.EMPTY;

    // --- Dataset Scope Column specifications ------- //
    // Properties that select columns for Dataset activities or
modifies (data type or new columns)
    // prior and/or during loading into Spark DF
    /**
     * Dataset scope query. (IMPORTANT)
     * The query should contain all the columns necessary to run
the activities.
     * TODO: figure out if this gets used when using files
     */
    public String query = StringUtils.EMPTY;
    /**
     * Concatenated column names (sep = ",") for columns that
are keys
     * TODO: confirm
     */
    public String key = StringUtils.EMPTY;

    /**
     * SELECT expression to transform expressions with assign-
ment by "=" and delimited by "|".
     * e.g. colname=cast(colname as string)|colname2=colname2
(cast as date)
     */
    public String expression = StringUtils.EMPTY;

    /**
     * Add "OWL_RUN_ID" UNIX timestamp (s) column to Spark DF
usng the OwlOptions.runId.
     * Does not obey timeStampDivisor (timestamp in seconds
because Spark)
     */
    public Boolean addDateColumn = false;

    /**
     * Fill null values in Spark DF with 0 (numeric columns
only)
     */
    public Boolean zeroFillNull = false;

    /**
     * A string that indicates a null value; any value matching
this string will be set as nulls in the Spark DF
     * Default: "" -> NULL
     * Example: 'null' -> NULL
     * --
     * Note: to emptyStirngFillNull (replace String column null
-> "", use expression
     */
    public String replaceNulls = StringUtils.EMPTY;

    /**
     * All data types forced to strings for type safe pro-
cessing.
     * Not implemented in activity (yet)
     */
    public Boolean stringMode = false;

    // --- Dataset Scope Row specifications ------- //
    // Properties that filter rows for Dataset activities
    // prior and/or during loading into Spark DF
    /**
     * Convert row into string and only use rows containing this
value.
     * Strict matching only.
     */
    public String filter = StringUtils.EMPTY;

    /**
     * Convert row into string and only use rows containing this
value.
     * Strict matching only.
     */
    public String filterNot = StringUtils.EMPTY;

    // --- Look back ------- //
    // For Look back feature
    /**
     * Build up history of OwlChecks. Does not include current
OwlCheck.
     * TODO: Document the relationship with unionLookBack
     */
    public Integer backRun = null;

    /**
     * Whether to load data for looking back in history.
     * How much historical data to load is based on Out-
lierOpt.lookback and PatternOpt.lookback.
     */
    public Boolean unionLookBack = false;

    // --- Shared Data Loading Options ------- //
    // Properties that affect data loading & pre-processing for
both files and db as source
    /**
     * Whether to use cached data for activities
     */
    public Boolean cache = true;

    /**
     * The year, month, and day format of date columns in the
dataset for loading the data only.
     * Default = "yyyy-MM-dd"
     */
    public String dateFormat = "yyyy-MM-dd";

    /**
```

```
     * The hour, minute, second, and milisecond format of date
columns in the dataset for loading the data only/
     * Default = "HH:mm:ss.SSS"
     * Not used. Questionably why separate timeFormat variable
exists when dateFromat can represent hms as well.
     */
    public String timeFormat = "HH:mm:ss.SSS";

    /**
     * Whether to convert date columns (specified by activity
opts) in dataset
     * into timestamp in ms (to make it seconds, set Props.-
timeStampDivisor = "s")
     * TODO: Needs LoadOpt.timeStampDivisor and fix Utils.scala
date2Timestamp
     */
    public Boolean timestamp = false;

    /* TODO add timeStampDivisor here and map between owl props?
     public String timeStampDivisor = "ms"
     */

    // --- Using file as data source ------- //
    // Properties that control where & how static file is read
    /**
     * Full path to the file.
     * If hdfs, then "hdfs://...".
     * If s3, then "s3://...", "s3a://...", or "s3n://...".
     * If parquet, then "...parquet" or "...PARQUET"
     */
    public String filePath = StringUtils.EMPTY;

    /**
     * SQL query used on file.
     * owl_id is added if not included in select clause.
     * If empty, then defaults to full file query.
     * (Does not update LoadOpts.fullFile to true).
     */
    public String fileQuery = StringUtils.EMPTY;

    /**
     * Whether to use full file (i.e. use all columns) on data
load
     */
    public Boolean fullFile = false;

    /**
     * File column names, comma separated
     */
    public String fileHeader = null;

    /* TODO checkHeader needs to be moved here from DupeOpt
     public Boolean checkHeader = true;*/

    /**
     * Whether to have Spark infer the schema of data source
     * If props.profile2 == true, this is overwritten to false!
     * If xml file, this is ignored and schema is always
inferred by Spark on xml data load.
     * If avro file, this value is respected (but may get over-
written by props.profile2)
     * (see activity2.Load.file)
     */
    public Boolean inferSchema = true;

    /**
     * Sample without replacement from file. Valid value is a
fraction [0, 1.0].
     * Only affects when filetype is xml or unspecified (and
therefore assumed to be delimited table)
     */
    public Double sample = 1.0;

    /**
     * Filetype (avro, json, orc, parquet, xml). Unspecified
file
     */
    public FileType fileType = null;

    /**
     * Delimiter for file. If number of characters after repla-
cing "\" with "" is 2 or more character
     * (e.g. compound delimiters like \t\t), then defaults to
"\t" and attempts to read file as tsv
     * See Activity2.load.file for details
     */
    public String delimiter = ",";

    /**
     * File character encoding
     */
    public String fileCharSet = "UTF-8";

    /**
     * The Avro schema for relevant avro file. Ignored if empty
string
```

```
     */
    public String avroSchema = StringUtils.EMPTY;

    /**
     * The Xml row tag for xml file. Ignored if empty string.
     */
    public String xmlRowTag = StringUtils.EMPTY;

    /**
     * Whether to flatten arrays in nested schema
     * TODO explain better. Does this only affect JSON file?
     */
    public Boolean flatten = false;

    /**
     * Whether data contains maps in json that requires extra
handling"
     * TODO explain better. Does this only affect JSON file?
     */
    public Boolean handleMaps = false;

    /**
     * Whether to handle mixed json.
     * TODO explain better. Does this only affect JSON file?
     */
    public Boolean handleMixedJson = false;

    /**
     * Spark.read option multiline, for JSON file only
     */
    public Boolean multiLine = false;

    // --- Using database as data source ------ //
    /**
     * Path to DB Driver. (e.g. /opt/owl/driver/postgres)
     */
    public String lib = StringUtils.EMPTY;

    /**
     * DB Driver name (Java namespace, e.g. org.-
postgresql.Driver).
     * Leave as null (default) and LoadOpts.connectionURL will
resolve the driver name.
     */
    public String driverName = null;

    /**
```

```
     * Connections name in metastore DB (pub-
lic.connections.aliasname).
     * Does not refer to the "name" of the database. Refers to
"aliasname" that the user set when
     * uploading connection config to Owl.
     */
    public String connectionName = StringUtils.EMPTY;

    /**
     * The Connection url, prefixed by jdbc.
     * e.g. "jdbc:postgresql://localhost:5432"
     */
    public String connectionUrl = StringUtils.EMPTY;

    /**
     * DB username
     */
    public String userName = StringUtils.EMPTY;

    /**
     * DB password
     */
    public String password = StringUtils.EMPTY;

    /**
     * JDBC Connection properties (e.g. fetchsize)
     */
    public Properties connectionProperties = null;

    /**
     * Whether data source is Hive Native (not using JDBC)
     * TODO: Why is the default null as opposed to false?
     */
    public Boolean hiveNative = null;

    /**
     * Whether data source is Hive Hadoop Web Cluster (not using
JDBC)
     */
    public Boolean hiveNativeHWC = false;

    // --- Parallel JDBC ------- //
    /**
     * When running parallel JDBC, use LoadOpts.query and OwlOp-
tions.dataset as base table
     */
    public Boolean useSql = true;
    /**
     * When running parallel JDBC, specify column name
     * ?? Activity2.Load and web has hard-coded magic string
"OWLAUTOJDBC"
     */
    public String columnName = null;

    /**
     * When running parallel JDBC, the upper bound for partition
column.
     * (e.g. "1000000")
     */
    public String lowerBound = null;

    /**
     * When running parallel JDBC, the upper bound for partition
column.
     * (e.g. "5000000")
     */
    public String upperBound = null;

    /**
     * When running parallel JDBC, the number of partitions
used.
     * If 0, then numPartitions used is based on the number of
available Spark Executor (1/2 ~ 2/3)
     * If > 20, then overwritten to 20 (no more than 20 con-
current connections to a database on a single dataset)
     */
    public Integer numPartitions = 0;

    // --- SQL Query properties ---------- //
    // TODO: does this effect DB as source or file as source as
well?
    /**
     * Whether the escape character would be back tick (`).
     * Ignored if escapeCharacter is non-empty (if using
OwlCheck from Options).
     * Marked as true if props.escapeCharacter is a tick
     * (to preserve bijection between props and opts, and vice
versa).
     */
    public Boolean escapeWithBackTick = false;
    /**
     * Whether the escape character would be single quote (').
     * Ignored if escapeCharacter is non-empty (if using
OwlCheck from Options).
     * Marked as true if props.escapeCharacter is a tick
     * (to preserve bijection between props and opts, and vice
versa).
     */
    public Boolean escapeWithSingleQuote = false;
    /**
     * Whether the escape character would be double quote (").
     * Ignored if escapeCharacter is non-empty(if using OwlCheck
from Options).
     * Marked as true if props.escapeCharacter is a tick
     * (to preserve bijection between props and opts, and vice
versa).
     */
    public Boolean escapeWithDoubleQuote = false;

    /**
     * Specify custom escape character. This takes precedence
over all other escapeWithXYZ options.
     * i.e. if non-empty, then other escapeWithXYZ options are
ignored.
     * If empty (default), no escaping attempt is made (and SQL
query may fail if it contains reserved word)
     *
     * @deprecated Access level of this field will be changed to
private. Please use {@link #setEscapeCharacter(String)} instead.
     */
    @Deprecated
    public String escapeCharacter = StringUtils.EMPTY;


    /**
     * The enum File type.
     */
    public enum FileType {
        /**
         * Avro file type.
         */
        avro,
        /**
         * Json file type.
         */
        json,
        /**
         * Orc file type.
         */
        orc,
        /**
         * Parquet file type.
         */
        parquet,
        /**
         * Xml file type.
         */
        xml
    }
}
```

Profile

```
public class ProfileOpt {

    public Boolean on = true;          //Whether to run profile
    public Boolean only = false;       //Whether to run only profile
    public String[] include;           //Which columns to include
    public String[] exclude;           //Which columns to exclude
    public Boolean shape = true;       //Disable shape detection
    public Boolean correlation = null;//On/Off Pearsons Correlation, null=auto
    public Boolean histogram = null;   //On/Off Histograming, null=auto
    public Boolean semantic = null;    //On/Off Semantic discovery, null=auto

    public Integer limit = 300;
    public Integer histogramLimit = 0;
    public Double score = 1.0;          //downscore points per Shape issue
    public Integer shapeTotalScore = 0;
    public Double shapeSensitivity = 0.00;
    public Integer shapeMaxPerCol = 0;
    public Integer shapeMaxColSize = 0;
    public String behavioralDimension = StringUtils.EMPTY;
    public String behavioralDimensionGroup = StringUtils.EMPTY;
    public String behavioralValueColumn = StringUtils.EMPTY;
    public Boolean behaviorScoreOff = false;  // disable behavior scoring
```

Chapter 17

Dupe

```java
package com.owl.common.options;

/**
 * Options for Dupe Activity
 */
public class DupeOpt {

    /**
     * Whether to run Dupe Activity
     */
    public Boolean on = false;           // --dupe

    /**
     * @deprecated Unused for Activity2
     */
    public Boolean only = false;         // --dupeonly

    /**
     * Column names to include Dupe Activity
     */
    public String[] include;             // -dupeinc

    /**
     * Column names to exclude Dupe Activity
     */
    public String[] exclude;             // dupeexc

    /**
     * Indicator for complexity. See Activ-
ity2.Dupe.Scala.execute()
     * depth == 0 : exact match (sets props.dupeExactMatch =
TRUE downstream)
     */
    public Integer depth = 2;            // -depth

    /**
     * The minimum dupe scores between two duplicates. (cur-
rently calculated as "edit distance", out of upperBound)
     * Two values with dupe score less than this is lowerBound
are not duplicates (i.e. "truly" different values)
     */
    public Integer lowerBound = 80;      // -dupelb, -dupecutoff

    /**
     * The maximum possible dupe score for duplicate records
(for a given dupe detection method).
     * Currently assumed to be 100.
     */
    public Integer upperBound = 100;    // -dupeub, -dupeper-
matchupperlimit

    /**
     * Approximate dupe score used to create block index (when
DF is large)
     */
    public Integer approximate = 1;     // -dupeapprox

    /**
     * Number of observations per unique duplicate
     */
    public Integer limitPerDupe = 15;

    /**
     * Whether to process column headers when data load uses
manual column names (LoadOpts.fileHeader)
     * TODO this belongs in LoadOpts, not DupeOpts
     */
    public Boolean checkHeader = true;

    /**
     * TODO remove
     *
     * @deprecated not used;
     */
    public String filter;

    /**
     * If true, dupe activity is case insensitive. If false,
dupe activity is case sensitive.
     * Convenience feature for upper and lower set to 100
     */
    public Boolean ignoreCase = false;      //-dupenocase

    /**
     * Number of points each duplicate contributes to the total
schema score (in Hoot)
     */
    public Double score = 1.0;                  //-
dupescore  points per duplicate found default 1

    /**
     * Number of unique duplicates to compute during dupe activ-
ity
     */
    public Integer limit = 300;                 //-
dupelimit  default 300
```

Source

```
public class SourceOpt {

    public Boolean on = false;              //-vs
    public Boolean only = false;            //-sourceonly
    public Boolean validateValues = false;  //-validatevalues
    public Boolean matches = false;         //-matches

    public String[] include;               //-valinc
    public String[] exclude;               //-valexc
    public String[] key;                    //valkey
    public Map<String, String> map;         //
    public Double score = 1.0;              // points per val-
idate source found, default 1-5
    public Integer limit = 30;              //-valsrclimit
    public String delimiter = ",";          //-srcdel
    public String fileCharSet = "UTF-8";     //-srcencoding
    public String filePath = StringUtils.EMPTY; //--srcfile

    public String header = null;            //-srcheader
    public String dataset = StringUtils.EMPTY;
    public String driverName = StringUtils.EMPTY;
    public String user = StringUtils.EMPTY;
    public String password = StringUtils.EMPTY;
    public String passwordManager = StringUtils.EMPTY;
    public String connectionName = StringUtils.EMPTY;
    public String connectionUrl = StringUtils.EMPTY;
    public String query = StringUtils.EMPTY;
    public String fileQuery = StringUtils.EMPTY;
    public String lib = StringUtils.EMPTY;
    public Properties connectionProperties;
```

FAQs

How to specify OWL database connection properties

OwlOptions

```
import com.owl.common.options.OwlOptions

val opt = new OwlOptions()
opt.dataset = "<dataset_name>"
opt.runId = "<date>"  // YYYY-MM-DD
opt.load.pguser = "<db_username>"
opt.load.pgpassword = "<db_password>"
opt.load.pghost = "<ip>:<port>/<database_name>"
```

Props

```
import com.owl.common.Props

val props = new Props()
props.dataset = "<dataset_name>"
props.runId = "<date>"  // YYYY-MM-DD
props.pguser = "<db_username>"
props.pgpassword = "<db_password>"
props.host = "<ip>:<port>/<database_name>"
```

Command Line

Scale + Data Science

Where Scale meets Data Science. Scale linearly with your data by adding executors and/or memory.

```
-f "file:///Users/home/salary_data.csv" \
-d "," \
-rd "2018-01-08" \
-ds "salary_data"
-numexecutors 2 \
-executormemory 2g
```

Yarn Master

If CollibraDQ is run on an edge node on a popular hadoop distribution such as HDP, CDH, EMR it will automatically register the jobs with Yarn Resource Manager.

Spark Master

DQ also runs using spark master by using the -master input and passing in spark:url.

Spark Standalone

DQ runs in standalone most but naturally will not distribute the processing beyond the hardware it was activated on.

Options	Description
deploymode	spark deploymode option
drivermemory	driver memory example 3G for local space
executorcores	spark executor cores
executormemory	spark executor memory option example 3G
master	overrides local[*], i.e. spark://myhost:7077, yarn-client, yarn-cluster
sparkprinc	kerberos principal name ex: owl@OWL.COM

Use Spark-Submit directly bypassing DQCheck

```
spark-submit \
--driver-class-path /opt/owl/drivers/postgres42/postgresql-
42.2.4.jar \
--driver-library-path /opt/owl/drivers/postgres42/postgresql-
42.2.4.jar \
--driver-memory 3g --num-executors 2 --executor-memory 1g \
--master spark://Kirks-MBP.home:7077 \
--class com.owl.core.cli.OwlCheck /opt/owl/bin/owl-core-trunk-
jar-with-dependencies.jar \
-u user -p pass -c jdbc:postgresql://xyz.chzid9w0hpyi.us-east-
1.rds.amazonaws.com/postgres \
-ds accounts -rd 2019-05-05 -dssafeoff -q "select * from
accounts"
-driver org.postgresql.Driver -lib /opt/owl/drivers/postgres42/
```

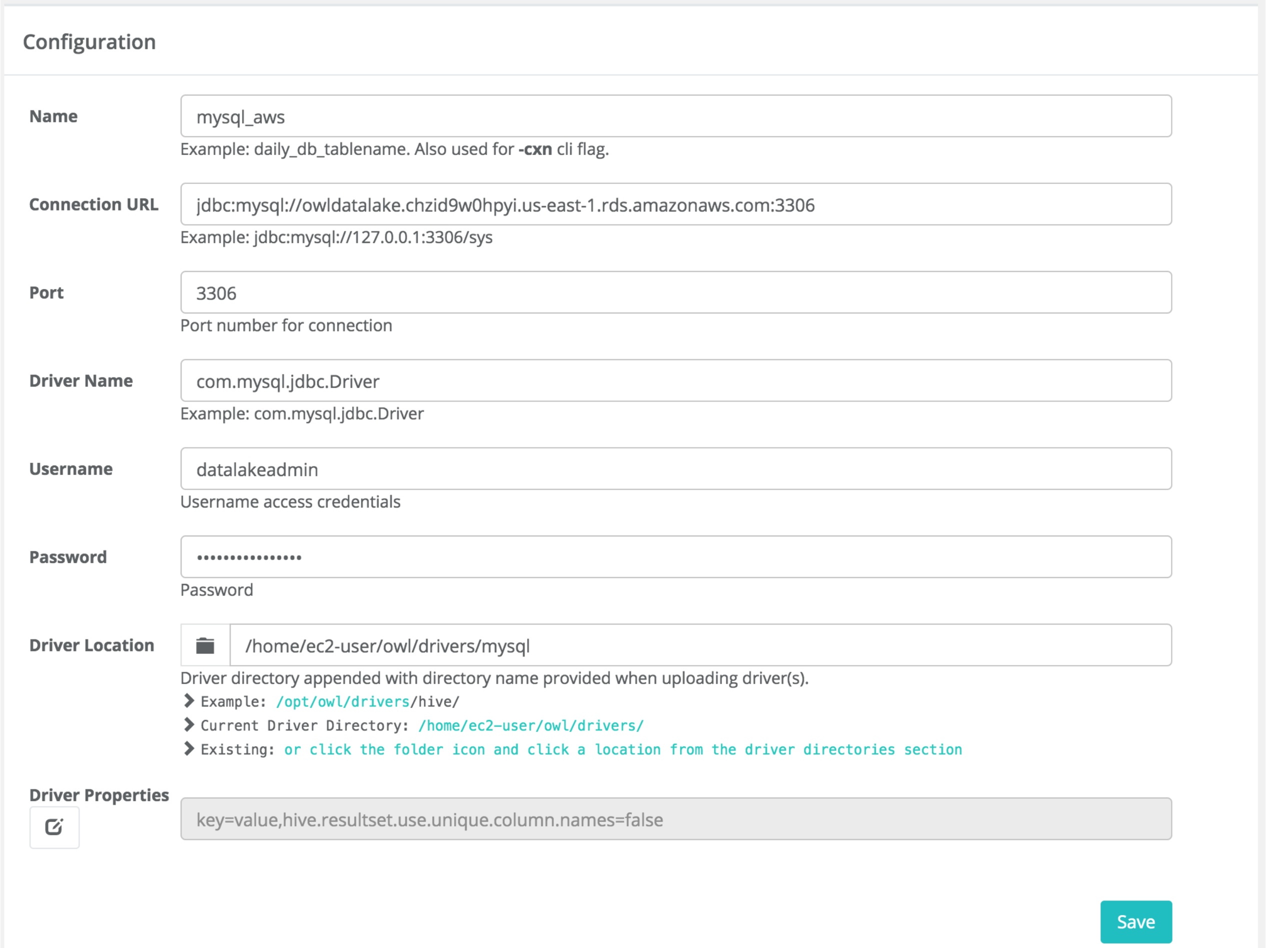
Parallel JDBC Spark-Submit

```
spark-submit \
--driver-class-path /opt/owl/drivers/postgres42/postgresql-42.2.4.jar \
--driver-library-path /opt/owl/drivers/postgres42/postgresql-42.2.4.jar \
--conf spark.driver.extraJavaOptions=-Dlog4j.configuration=file:///opt/owl/config/log4j-TRACE.properties \
--conf spark.executor.extraJavaOptions=-Dlog4j.configuration=file:///opt/owl/config/log4j-TRACE.properties \
--files /opt/owl/config/log4j-TRACE.properties \
--driver-memory 2g --num-executors 2 --executor-memory 1g --master spark://Kirks-MBP.home:7077  \
--class com.owl.core.cli.OwlCheck /opt/owl/bin/owl-core-trunk-jar-with-dependencies.jar \
-u us -p pass -c jdbc:postgresql://xyz.chzid9w0hpyi.us-east-1.rds.amazonaws.com/postgres \
-ds aumdt -rd 2019-05-05 -dssafeoff -q "select * from aum_dt" \
-driver org.postgresql.Driver -lib /opt/owl/drivers/postgres42/  \
-connectionprops fetchsize=6000 -master spark://Kirks-MBP.home:7077 \
-corroff -histoff -statsoff \
-columnname updt_ts -numpartitions 4 -lowerbound 1557597987353 -upperbound 1557597999947
```

DQ Job JDBC

Connect to any database via JDBC.

```
-q "select * from lake.stock_eod where date = '2017-01-20' " \
-u username -p password \
-c "jdbc:mysql://instance.chzid9w0hpyi.us-east-1.rds.amazonaws.com:3306" \
-rd "2017-01-20" \
-dc "date" \
-ds "stocks" \
-driver com.mysql.jdbc.Driver \
-lib "/home/ec2-user/owl/drivers/mysql/"
```



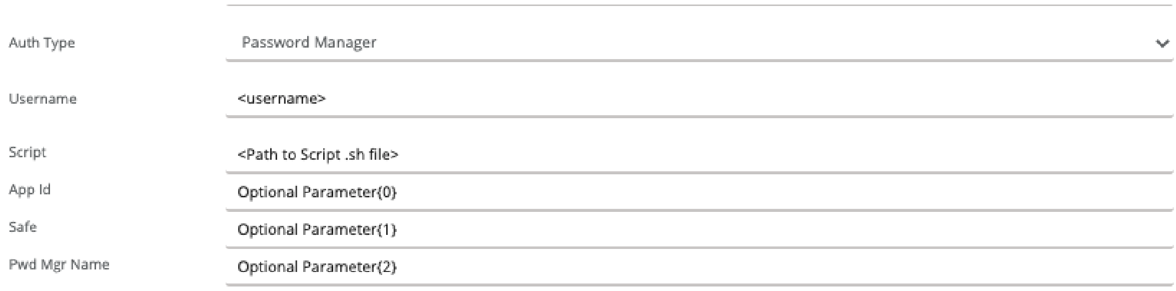
Configuration

Name	mysql_aws Example: daily_db_tablename. Also used for **-cxn** cli flag.
Connection URL	jdbc:mysql://owldatalake.chzid9w0hpyi.us-east-1.rds.amazonaws.com:3306 Example: jdbc:mysql://127.0.0.1:3306/sys
Port	3306 Port number for connection
Driver Name	com.mysql.jdbc.Driver Example: com.mysql.jdbc.Driver
Username	datalakeadmin Username access credentials
Password	•••••••••••••••• Password
Driver Location	/home/ec2-user/owl/drivers/mysql Driver directory appended with directory name provided when uploading driver(s).
Driver Properties	key=value,hive.resultset.use.unique.column.names=false

```
> Example: /opt/owl/drivers/hive/
> Current Driver Directory: /home/ec2-user/owl/drivers/
> Existing: or click the folder icon and click a location from the driver directories section
```

Password Manager

You can configure Collibra DQ to call a script file to retrieve a password from a password manager vault or other storage container. The customer is responsible for generating a script to pull just the password and DQ uses that value dynamically when the connection is needed for the UI or when kicking off an DQCheck.



Auth Type	Password Manager
Username	<username>
Script	<Path to Script .sh file>
App Id	Optional Parameter{0}
Safe	Optional Parameter{1}
Pwd Mgr Name	Optional Parameter{2}

In the connection dialog, select Password Manager from the Auth Type dropdown, and supply a user name. The script is the path to the .sh script on the machine where the web application is running, and the user account that runs DQ-web should be allowed to execute the script. You can either use the optional parameters or pass any parameters your script needs directly inline on the Script value.

Fetch Size

It is important to consider the drivers fetch size when loading greater than 1 Million rows across the network. DQ allows you to set this driver property in the WebApp but this is only for web interaction therefore "fetchsize" will not help here. DQ also allows fetchsize in the DQCheck by passing in a connection property.

CMD line

```
-connectionprops "fetchsize=3000"
```

Notebook

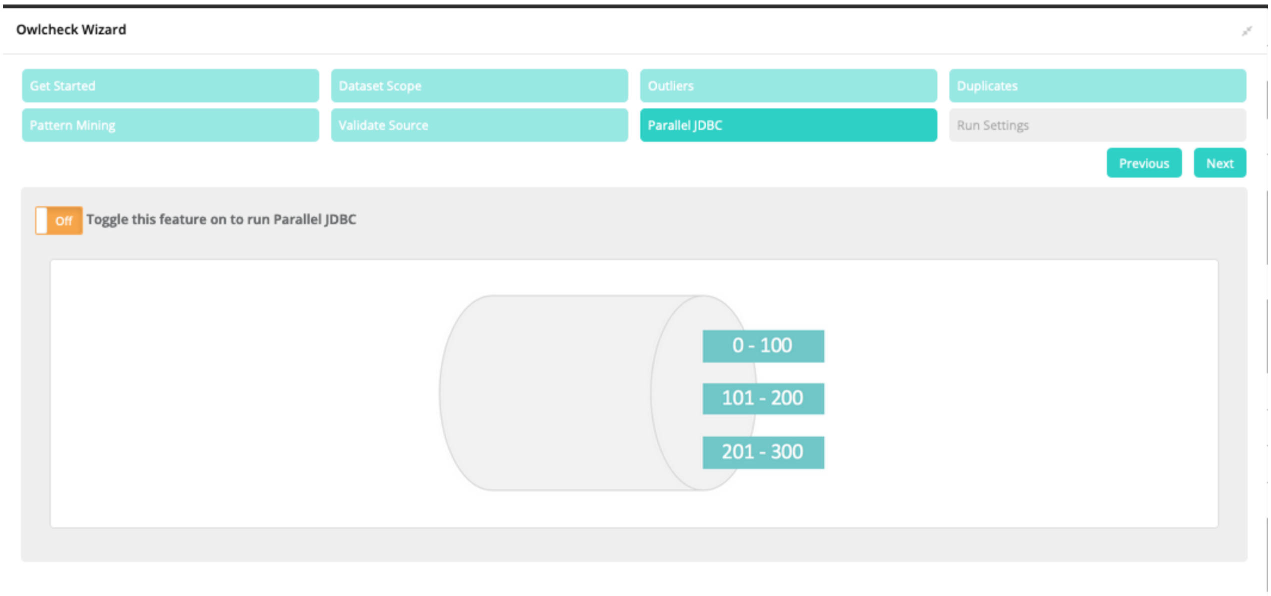
```
props.connectionProps.put("fetchsize", "3000")
```

Parallel JDBC

For greater performance or moving large datasets across a network DQ supports parallel JDBC, which can be enabled by passing `numpartitions` to DQCheck. This can be a 2-5X improvement in many cases.

```
-lib "/opt/owl/drivers/mysql8/"
-cxn mysql
-q "select * from lake.nyse where trade_date = '${rd}' "
-rd 2018-01-01
-ds nyse
-columnname volume
-numpartitions 4
-lowerbound "0"
-upperbound "5000000000"
-usesql
```

DQ also supports auto parallelization, which will configure the `numPartitions` parameter for you based on the size of your data. This is enabled in the UI when you create a dataset using the DQCheck wizard.


Owlcheck Wizard

Toggle this feature on to run Parallel JDBC

DQ Job BigQuery

Example CMD Line

```
-lib "/opt/owl/drivers/bigquery/bigquery/core/" \
-h <IP_ADDRESS>:5432/postgres \
-master spark://<SPARK_MASTER>:7077 \
-ds samples.loan_customer \
-deploymode client \
-q "select * from samples.loan_customer" \
-rd "2021-08-02" \
-driver "com.simba.googlebigquery.jdbc42.Driver" \
-cxn BigQuery
```

Steps for the BigQuery Connection

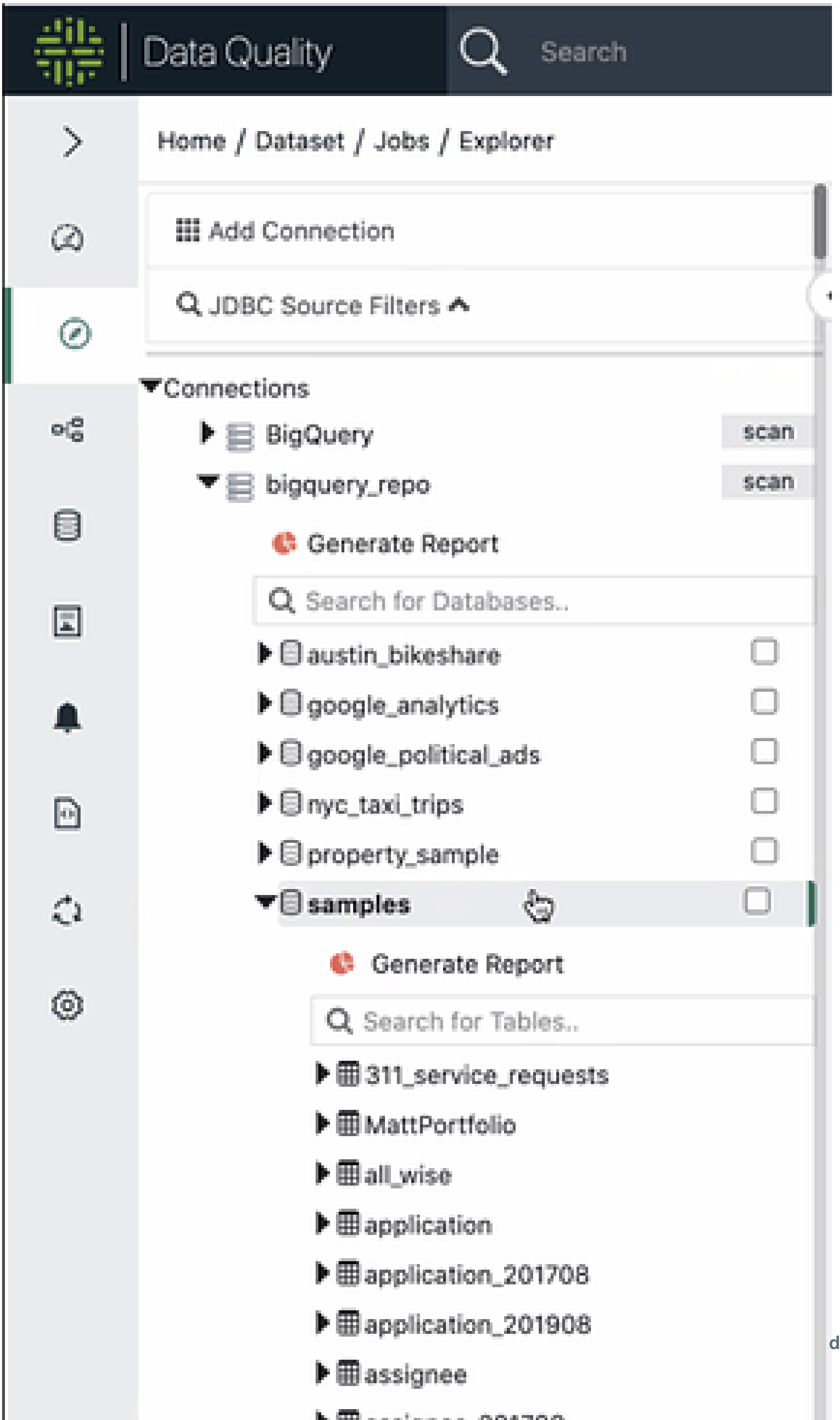
1. **We would use this Simba driver**: com.simba.googlebigquery.jdbc42.Driver.
2. **We would make an owl-gcp.json** (your org auth key in JSON format).
3. **We would create a JDBC connection** (for example only do not use this JDBC URL): jdbc:bigquery://https://www.googleapis.com/bigquery/v2:443;ProjectId=;OAuthType=0;OAuthServiceAcctEmail=<1234567890>-compute@developer.gserviceaccount.com;OAuthPvtKeyPath=/opt/ext/owl-gcp.json;Timeout=86400
4. **Requires a path to a JSON file** that contains the service account for authorization. That same file is provided to the Spark session to make a direct to storage connection for maximum parallelism once Core fires up."

The above and explained there are actually a number of others steps which must be performed to achieve success:

1. **Password for the BigQuery Connector form in Collibra DQ must be a base64 encoded string created from the json file (see step 3. above)** and input as password. For example: `base64 your_json.json -w 0` or `cat your_json.json | base64 -w 0`

2. **Check that this JARs exists and is on the path of the Collibra DQ Web UI server** (eg. <INSTALL_PATH>/owl/drivers/bigquery/core). Look at your driver directory location which contains this BigQuery JAR: spark-bigquery_2.12-0.18.1.jar
3. **Make sure there are all the needed JARs present in <INSTALL_PATH>/owl/drivers/bigquery/:** **** *animal-sniffer-annotations-1.19.jargoogle-api-services-bigquery-v2-rev20201030-1.30.10.jargrpc-google-cloud-bigquerystorage-v1beta1-0.106.4.jarlistenablefuture-9999.0-empty-to-avoid-conflict-with-guava.jarannotations-4.1.1.4.jargoogle-auth-library-credentials-0.22.0.jargrpc-google-cloud-bigquerystorage-v1beta2-0.106.4.jaropencensus-api-0.24.0.jarapi-common-1.10.1.jargoogle-auth-library-oauth2-http-0.22.0.jargrpc-grpclb-1.33.1.jaropencensus-contrib-http-util-0.24.0.jarauto-value-annotations-1.7.4.jarGoogleBigQueryJDBC42.jargrpc-netty-shaded-1.33.1.jarperfmark-api-0.19.0.jaravro-1.10.0.jargoogle-cloud-bigquery-1.125.0.jargrpc-protobuf-1.33.1.jarprotobuf-java-3.13.0.jarchecker-compat-qual-2.5.5.jargoogle-cloud-bigquerystorage-1.6.4.jargrpc-protobuf-lite-1.33.1.jarprotobuf-java-util-3.13.0.jarcommons-codec-1.11.jargoogle-cloud-core-1.93.10.jargrpc-stub-1.33.1.jarproto-google-cloud-bigquerystorage-v1-1.6.4.jarcommons-compress-1.20.jargoogle-cloud-core-http-1.93.10.jargson-2.8.6.jarproto-google-cloud-bigquerystorage-v1alpha2-0.106.4.jarcommons-lang3-3.5.jargoogle-http-client-1.38.0.jarguava-23.0.jarproto-google-cloud-bigquerystorage-v1beta1-0.106.4.jarcommons-logging-1.2.jargoogle-http-client-apache-v2-1.38.0.jarhttpclient-4.5.13.jarproto-google-cloud-bigquerystorage-v1beta2-0.106.4.jarconscrypt-openjdk-uber-2.5.1.jargoogle-http-client-appengine-1.38.0.jarhttpcore-4.4.13.jarproto-google-common-protos-2.0.1.jarcoregoogle-http-client-jackson2-1.38.0.jarj2objc-annotations-1.3.jarproto-google-iam-v1-1.0.3.jarerror_prone_annotations-2.4.0.jargoogle-oauth-client-1.31.1.jarjackson-annotations-2.11.0.jargrpc-alts-1.33.1.jarjackson-core-2.11.3.jarslf4j-api-1.7.30.jarfailureaccess-1.0.1.jargrpc-api-1.33.1.jarjackson-databind-2.11.0.jargax-1.60.0.jargrpc-auth-1.33.1.jarjavax.annotation-api-1.3.2.jarthreetenbp-1.5.0.jargax-grpc-1.60.0.jargrpc-context-1.33.1.jarjoda-time-2.10.1.jargax-httpjson-0.77.0.jargrpc-core-1.33.1.jarjson-20200518.jargoogle-api-client-1.31.1.jargrpc-google-cloud-bigquerystorage-v1-1.6.4.jarjsr305-3.0.2.jar*
4. You may get a CLASSPATH conflict regarding the JAR files.

5. Make sure the BigQuery connector Scala version matches your Spark Scala. version.


Data Quality
Search
Home / Dataset / Jobs / Explorer
Add Connection
JDBC Source Filters
Connections
BigQuery
scan
bigquery_repo
scan
Generate Report
Search for Databases..
austin_bikeshare
google_analytics
google_political_ads
nyc_taxi_trips
property_sample
samples
Generate Report
Search for Tables..
311_service_requests
MattPortfolio
all_wise
application
application_201708
application_201908
assignee

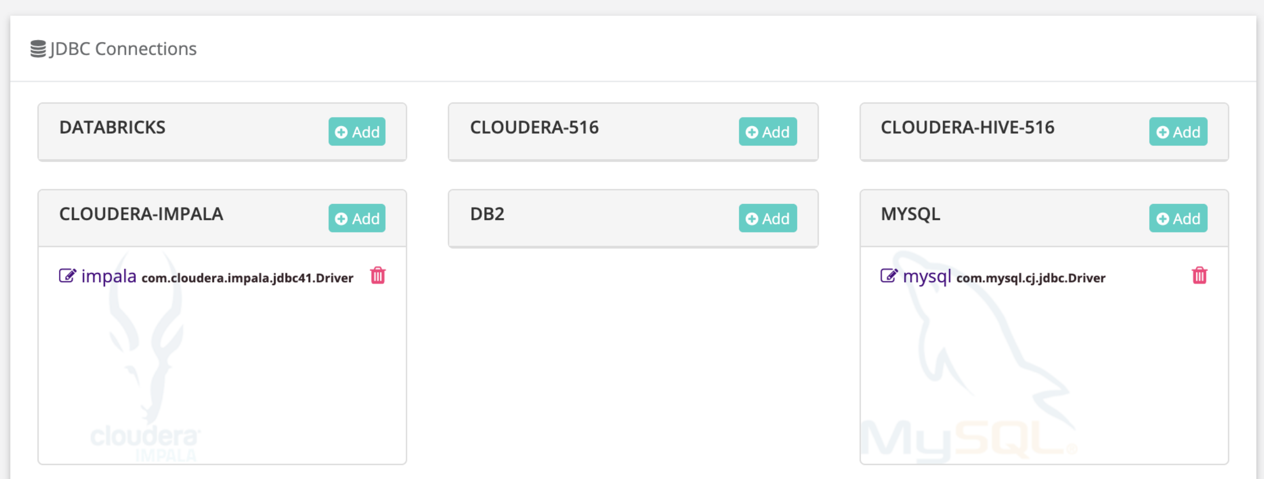
DQ Job Databricks

Lake vs Swamp

The difference between a business-critical lake and a swamp is *quality*. The accuracy and cleanliness of data is directly proportional to the quality of insights end-users will derive. Data lakes that gain broad adoption have strong governance programs. The challenge is, adding a data quality program typically takes 6-12 months but the project never really ends due to the volume, variety and velocity of incoming data. Collibra DQ uses autoML so solve this problem. DQ constantly monitors the lake with native integration and unlimited scale. Use DQ to generate the equivalent of 10K rules, while continuously adapting to the natural variance in your data. When erroneous data enters your lake DQ alerts the data steward and provide a rich visual displaying the break records and explainable AI describing the issue. DQ's approach is to learn from data and become incrementally smarter each day to ensure a statistically defensible data quality program.

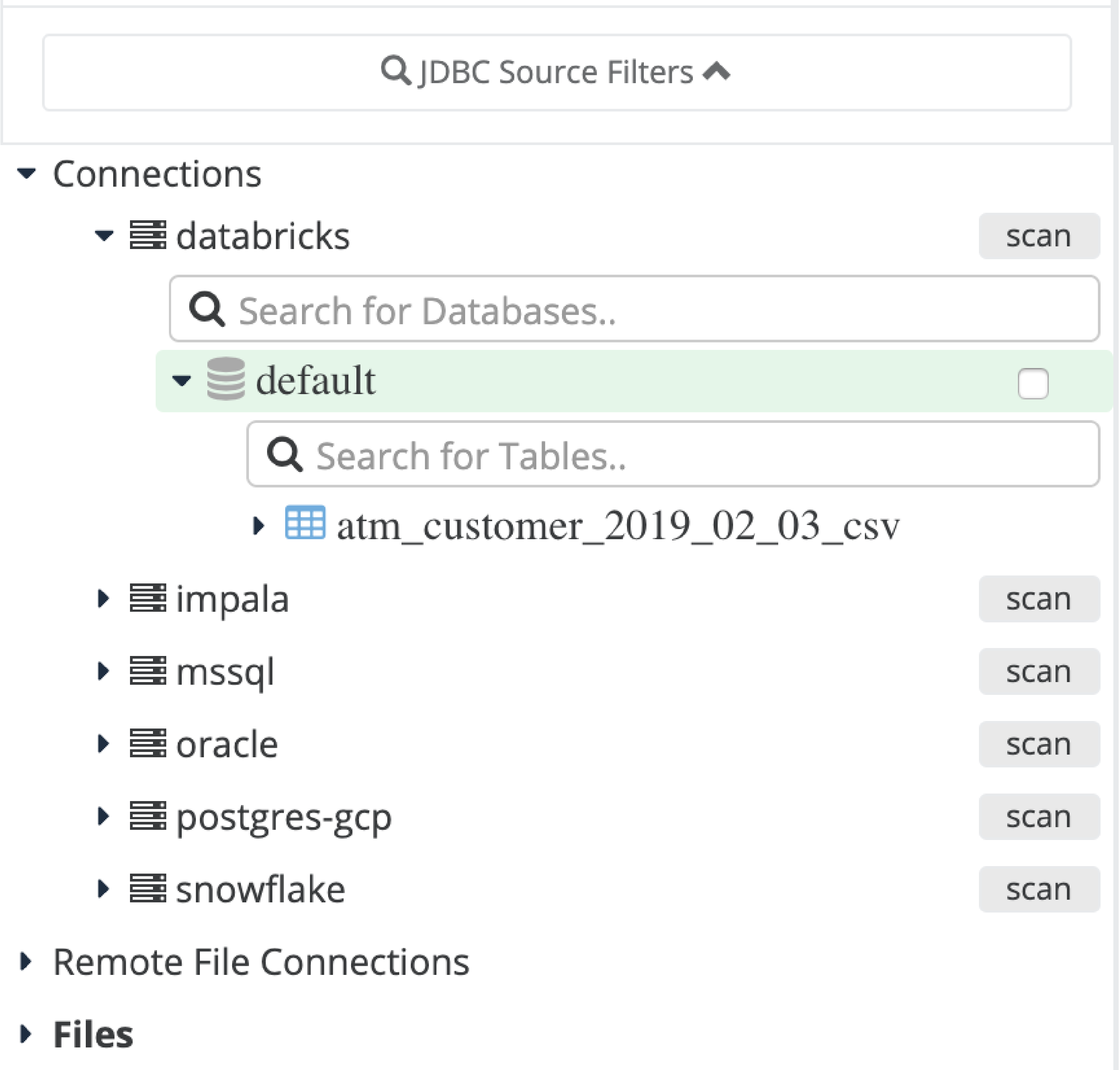
Native Integration with Delta Lake (Databricks)

Out of the box DQ comes with a connection template for Databricks. To connect, simply paste in your *username*, *password* and *connection URL*.



Explore Databricks Assets and Add DQ Checks

Quickly explore DB assets that are cataloged in Delta Lake the same way you would any database (file tree explorer). Use DQ wizard to add data quality to any Databricks table or file. Create a modern data quality program using machine learning in minutes.



9 dimensions of Data Quality

Use the wizard to apply DQ's autoML and predictive data quality features across all of your assets in Delta Lake. Click Scan button to put every table in Delta Lake under DQ management in 1 click. DQ creates a data quality program on all Delta Lake assets in a matter of hours. With traditional technologies this task used to require domain experts, rule writers and identification of critical elements.

Out of the Box DQ measures

DQ Dimension	Desc
Outliers	numeric and categorical outlier detection
Shapes	formatting and incorrect characters
Patterns	relationship probabilities
Correlations	strengths of relationships between columns
Duplicates	fuzzy and exact matching
Schema Evolution	schema drift
Rules	ability to add your own business rules
Source Matching	difference from source to target detection

DQ Job Hive

Run a data quality check on a Hive table. Use the -hive flag for a native connection via the HCat, this does not require a JDBC connection and is optimized for distributed speed and scale.

Hive Native, no JDBC Connection

Open source platforms like HDP, EMR and CDH use well known standards and because of this DQ takes advantage of things like HCat and it removes the need for JDBC connection details as well as offers optimum data read speeds. DQ recommends and supports this with the -hive flag.

```
./owlcheck -ds hive_table -rd 2019-03-13 \
-q "select * from hive_table" -hive
```

Example output. A hoot is a valid JSON response

```
{
  "dataset": "hive_table",
  "runId": "2019-02-03",
  "score": 100,
  "behaviorScore": 0,
  "rows": 477261,
  "prettyPrint": true
}
```

Hive JDBC

1. You need to use the hive JDBC driver, commonly org.apache.hive.HiveDriver.
2. You need to locate your driver JDBC Jar with the version that came with your EMR, HDP or CDH
    a. This jar is commonly found on an edge node under /opt/hdp/libs/hive/hive-jdbc.jar etc...

```
./owlcheck -rd 2019-06-07 -ds hive_table \
-u <user> -p <pass> -q "select * from table" \
-c "jdbc:hive2://<HOST>:10000/default" \
-driver org.apache.hive.HiveDriver \
-lib /opt/owl/drivers/hive/ \
-master yarn -deploymode client
```

HDP Driver - org.apache.hive.HiveDriver

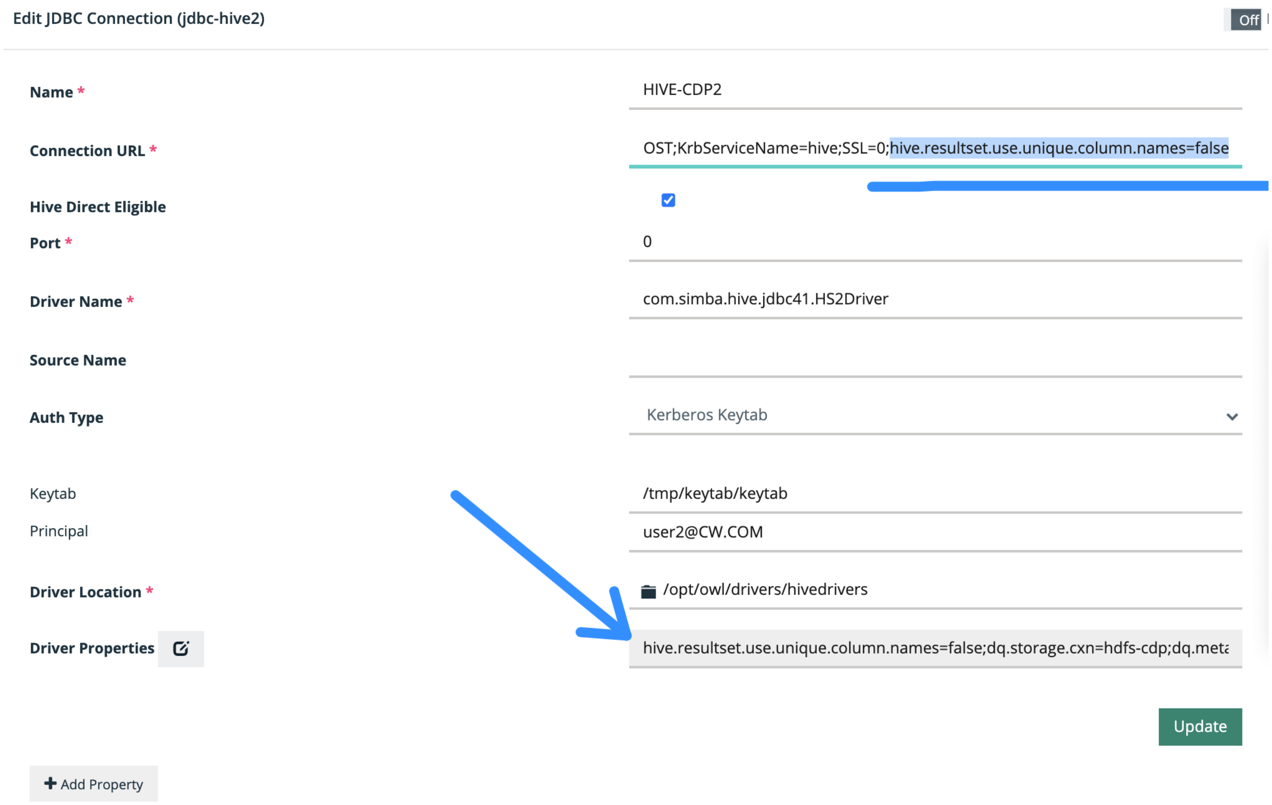
CDH Driver - com.cloudera.hive.jdbc41.Datasource

For CDH all the drivers are packaged under, HiveJDBC41_cdhversion.zip.

Troubleshooting

A common JDBC connection is hive.resultset.use.unique.column.names=false.

This can be added directly to the JDBC connection url string or to the driver properties section.



Edit JDBC Connection (jdbc-hive2)

Off

Name * HIVE-CDP2

Connection URL * OST;KrbServiceName=hive;SSL=0;hive.resultset.use.unique.column.names=false

Hive Direct Eligible ☑

Port * 0

Driver Name * com.simba.hive.jdbc41.HS2Driver

Source Name

Auth Type Kerberos Keytab

Keytab /tmp/keytab/keytab

Principal user2@CW.COM

Driver Location * /opt/owl/drivers/hivedrivers

Driver Properties hive.resultset.use.unique.column.names=false;dq.storage.cxn=hdfs-cdp;dq.meta

Test your hive connection via beeline to make sure it is correct before going further.

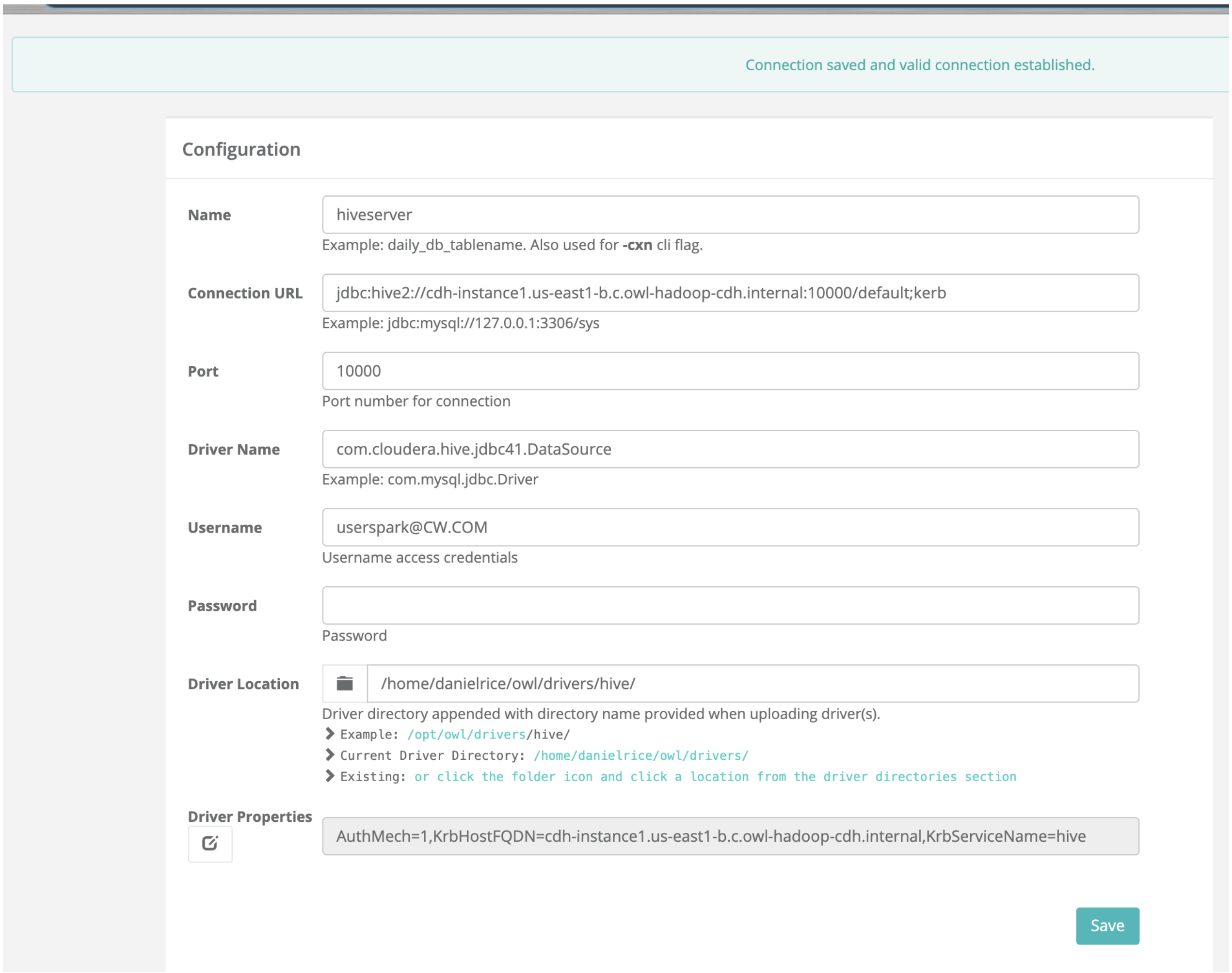
```
beeline -u 'jdbc:hive2://<HOST>:10000/default;principal=hive/cdh-instance1.us-east1-b.c.company-hadoop-cdh.internal@CW.COM;useSSL=true' -d org.apache.hive.jdbc.HiveDriver
```

Kerberos Example

```
jdbc:hive2://<HOST>:10000/default;principal=hive/cdh-instance1.us-east1-b.c.company-hadoop-cdh.internal@CW.COM;useSSL=true
```

Connecting DQ WebApp to Hive JDBC

Notice the driver properties for kerberos and principals.



Connection saved and valid connection established.

Configuration

Name: hiveserver
Example: daily_db_tablename. Also used for **-cxn** cli flag.

Connection URL: jdbc:hive2://cdh-instance1.us-east1-b.c.owl-hadoop-cdh.internal:10000/default;kerb
Example: jdbc:mysql://127.0.0.1:3306/sys

Port: 10000
Port number for connection

Driver Name: com.cloudera.hive.jdbc41.DataSource
Example: com.mysql.jdbc.Driver

Username: userspark@CW.COM
Username access credentials

Password:
Password

Driver Location: /home/danielrice/owl/drivers/hive/
Driver directory appended with directory name provided when uploading driver(s).

```
> Example: /opt/owl/drivers/hive/
> Current Driver Directory: /home/danielrice/owl/drivers/
> Existing: or click the folder icon and click a location from the driver directories section
```

Driver Properties: AuthMech=1,KrbHostFQDN=cdh-instance1.us-east1-b.c.owl-hadoop-cdh.internal,KrbServiceName=hive

In very rare cases where you can't get the jar files to connect properly one workaround is to add this to the DQ-web startup script.

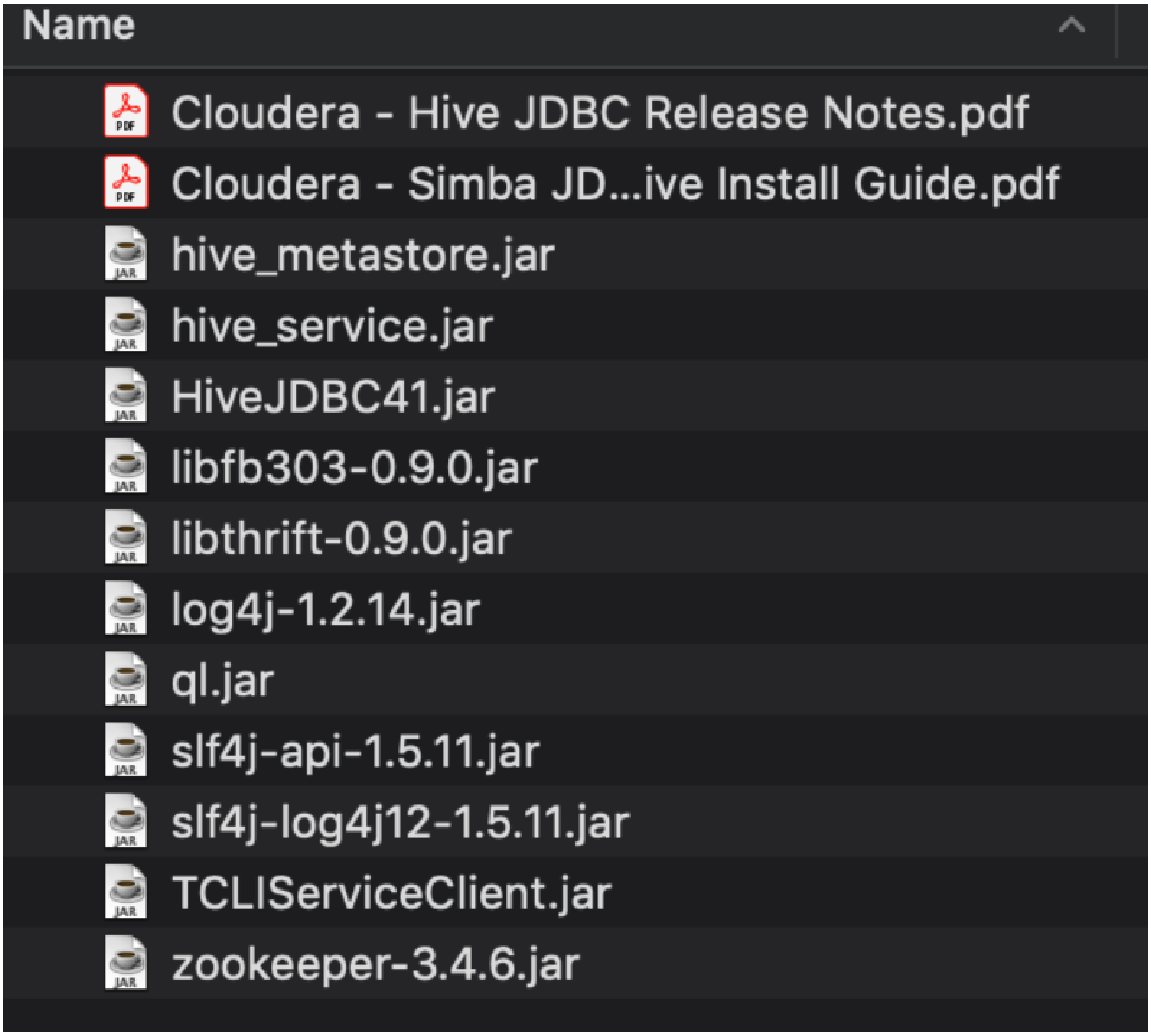
```
$JAVA_HOME/bin/java -Dload-
er.path=lib,/home/danielrice/owl/drivers/hive/ \
-DowlAppender=owlRollingFile \
-DowlLogFile=owl-web -Dlog4j.configurationFile=file://$INSTALL_
PATH/config/log4j2.xml \
$HBASE_KERBEROS -jar $owlweb $ZKHOST_KER \
--logging.level.org.springframework=INFO $TIMEOUT \
--server.session.timeout=$TIMEOUT \
--server.port=9001 > $LOG_PATH/owl-web-app.out 2>&1 & echo $!
>$INSTALL_PATH/pids/owl-web.pid
```

Class Not Found apache or client or log4j etc...

Any class not found error means that you do not have the "standalone-jar" or you do not have all the jars needed for the driver.

Hive JDBC Jars

It is common for Hive to need a lot of .jar files to complete the driver setup.



Name

Cloudera - Hive JDBC Release Notes.pdf
Cloudera - Simba JD...ive Install Guide.pdf
hive_metastore.jar
hive_service.jar
HiveJDBC41.jar
libfb303-0.9.0.jar
libthrift-0.9.0.jar
log4j-1.2.14.jar
ql.jar
slf4j-api-1.5.11.jar
slf4j-log4j12-1.5.11.jar
TCLIServiceClient.jar
zookeeper-3.4.6.jar

Java jar cmds

Sometimes it is helpful to look inside the jar and make sure it has all the needed files.

```
jar -tvf hive-jdbc.jar
```

DQ Job Files

For example, a large file `transaction_2021-01-01.csv` might contain the following transaction data with two transaction per day spanning all of January.

transaction_id	account_id	date	amount
1	1	2021-01-01	100
2	2	2021-01-01	120
3	1	2021-01-02	90
4	2	2021-01-02	115
...		...	...
61	1	2021-01-31	100
62	2	2021-01-31	999

and this file might be located on the directory `~/customer/transaction-2021-01-01/`.

```
~/customer
  ├── transaction-2021-01-01
  │   └── transaction_2021-01-01.csv
  ├── transaction-2021-02-01
  │   └── transaction_2021-02-01.csv
  ... # folders for 2021-03-01 to 2021-11-01 ommitted
  ├── transaction-2021-12-01
  │   └── transaction_2021-12-01.csv
```

Other folders with similar pattern may exist in your directory, such as `~/customer/transaction-2021-02-1`. Note that February data is located in a separate directory with a similar pattern for all the months of 2021. This dataset could similarly have 2 account IDs and 1 transaction per account per day (= 28 x 2 = 56 rows of data). For this example, let's assume this is the case for all the files.

To run an DQCheck on this single file containing multiple dates, you have the following choices.

DQChecks with **file**

1. Run an DQCheck on all the rows in a single file.

```
./owlcheck
    -ds DQCheck_transactions_jan21
    -rd "2021-01-01"
    -f "~/customer/transaction-2021-01-01/transaction_2021-01-
01.csv"
    -fq "select * from dataset"
    ... # other relevant options
```

Here we assume that run date (`-rd`) is "2021-01-01" because it is currently January 1, 2021. The above command would lead to an DQCheck on 62 rows of data spanning all of January 2021 from a single file located at `~/customer/transaction-2021-01-01/transaction_20210101.csv`. If you were to schedule a job to run this job monthly and next job ran on February 1st, 2021, then same DQ checks will be performed on the **same set of 62 rows** with same score as your DQCheck run from January 1, 2021. For example, the follow-up scheduled job running on February 1st, 2021 would be:

```
./owlcheck
    -ds DQCheck_transactions_jan21
    -rd "2021-02-01"
    -f "~/customer/transaction-2021-01-01/transaction_2021-01-
01.csv"
    -fq "select * from dataset"
    ... # other relevant options
```

This type of DQCheck on a single file is suitable if you are verifying a static file `~/customer/transaction-2021-01-01/transaction_20210101.csv` that does not change over time and expect the score to be the same every run. Hence, it is suggested to name the dataset that reflect this, such as `DQCheck_transaction_jan21` to reflect the idea that this dataset is checking the Data Quality of transaction table containing January 2021 data. Similar DQCheck for February 2021 data would then be a separate and independent dataset named `DQCheck_transaction_feb21` This type of DQCheck can also be used if `~/customer/transaction-2021-01-01/transaction_20210101.csv` is changing (the rows are changing values or new rows are being added) and want to detect data quality changes. Transaction file doesn't fit with this scenario, but the idea is that the above command specifies Data Quality DQChecks on the entirety of the file. The run date is a date that you choose to assign for that DQCheck. It is conventional to have one-to-one mapping between run date and the date corresponding to the date that DQ checks are being performed. Run date does not have to match with the data underlying the file.

2. Run an DQCheck on subset of rows from a single file

The single file contains daily data for January of 2021. To run Data Quality checks on January 1st, January 2nd, ... , and January 31st, you need to run 31 DQChecks, each with subset of rows from the file. Note the `where` clause in `-fq` matching with the run date `-rd`

```
./owlcheck
    -ds DQCheck_transactions_jan21
    -rd "2021-01-01"
    -f "~/customer/transaction-2021-01-01/transaction_2021-01-
01.csv"
    -fq "select * from dataset where date = '2021-01-01'"
    ... # other relevant options

./owlcheck
    -ds DQCheck_transactions_jan21
    -rd "2021-01-02"
    -f "~/customer/transaction-2021-01-01/transaction_2021-01-
01.csv"
    -fq "select * from dataset where date = '2021-01-02'"
    ... # other relevant options

... # Owlchecks for -rd 2021-01-03 to 2021-01-30 ommitted

./owlcheck
    -ds DQCheck_transactions_jan21
    -rd "2021-01-31"
    -f "~/customer/transaction-2021-01-01/transaction_2021-01-
01.csv"
    -fq "select * from dataset where date = '2021-01-31'"
    ... # other relevant options
```

By using the same dataset name `-ds`, all 31 DQCheck will appear under one dataset `DQCheck_transaction_jan21` in the Hoot page.

A convenient way to parameterize this run date is to use `${rd}` in the query.

```
./owlcheck
    -ds DQCheck_transactions_jan21
    -rd "2021-01-01"
    -f "~/customer/transaction-2021-01-01/transaction_2021-01-
01.csv"
    -fq "select * from dataset where date = '${rd}'"
    ... # other relevant options
```

A daily scheduled job starting on January 1st, 2021 to January 31, 2021 will automatically replace the `${rd}` with "2021-01-01", "2021-01-02", ... , and "2021-01-31" for the respective run date.

3. Run an DQCheck on subset of rows from a single file with day lookback

For certain core components like **Outlier**, a set of rows corresponding to historical training data can be used to establish a baseline. For example, the row with `transaction_id` 62 has amount of 999. This looks like an outlier that we want to catch. This value of 999 seems to be an outlier because past transaction amounts for `account_id`2 are in the 100s range. We can use historical data from January 15th to January 30th and use that info to see if January 31st data contains any outliers. In this scenario, our single file `~/customer/transaction-2021-01-01/transaction_2021-01-01.csv` contains such historical data because that file contains all the data for all of January. How do we use the same file for both current data (January 31st) and historical (January 15th to January 30th) data? You do not have to split the files into two. You can simply do exactly what you would do for DQCheck on "2021-01-31" with a `-fullfile` flag. The `-fullfile` flag tells the DQCheck that "the file in `-f` contains the historical data. Construct a query and subset those rows for me".

```
./owlcheck
    -ds DQCheck_transactions_jan21
    -rd "2021-01-31"
    -f "~/customer/transaction-2021-01-01/transaction_2021-01-
01.csv"
    -fq "select * from dataset where date = '2021-01-31'"
    -fullfile
    # outlier options
    -dc "date"
    -dl
    -tbin "DAY" # look back time bin is day
    -dllb 15 # look back up to 15 days
    ... # other relevant options
```

DQChecks with *multiple files*

4. Run an DQCheck on a single file with lookback using series of file

Recall our folder structure:

```
~/customer
  ├── transaction-2021-01-01
  │   └── transaction_2021-01-01.csv
  ├── transaction-2021-02-01
  │   └── transaction_2021-02-01.csv
  ... # ommitted for space
  ├── transaction-2021-12-01
  │   └── transaction_2021-12-01.csv
```

If we want to run an DQCheck for December of 2021 and use July of 2021 to November of 2021 as our historical training dataset, how can we load *multiple files*? Just like how –`fullfile` provides a convenient way to create historical training dataset on a single file, –`fllb` (file lookback) provides a convenient way to load *series of files* with patterns while still pointing to the target file (December file) in -`f`

```
./owlcheck
    -ds DQCheck_transactions_dec21
    -rd "2021-12-01"
    -f "~/customer/transaction-2021-12-01/transaction_2021-12-01.csv"
    -fq "select * from dataset"
    -fllb
    # outlier options
    -dc "date"
    -dl
    -tbin "MONTH"
    -dllb 5 # look back up to 5 months
    ... # other relevant options
```

One caveat to this -`fllb` method __ is that the DQCheck history must be "primed" first so that the DQ knows the file path of the past series of files. In fact, -`fllb` does not use the file path provided in -`f` and loads different files from different folders. *It relies on the DQCheck history* under the same -`ds` name. -`fllb` means lookback up to N number of past consecutive DQChecks. For each of those past DQCheck, look up the file path -`f` used in the past and follow those paths. The number N is determined by the maximum number of lookbacks from

Outlier (-dllb) and Patterns (-fpglb). In the DQCheck above, because -dllb 5 is provided along with -fllb, it means "Look up 5 past DQChecks and load those files as historical dataset". In summary, in order to run an DQCheck on "2021-12-01" and have that DQCheck for that date "look up" the files in ~/customer/transaction-2021-07-01/transaction_2021-07-01.csv, ~/customer/transaction-2021-08-01/transaction_2021-08-01.csv, ~/customer/transaction-2021-09-01/transaction_2021-09-01.csv, ~/customer/transaction-2021-10-01/transaction_2021-10-01.csv, and ~/customer/transaction-2021-11-01/transaction_2021-11-01.csv, you need to have ran DQChecks for "2021-07-01", "2021-08-01", ... , and "2021-11-01" under the same dataset name. Therefore, it would be more logical, best-practice is to name the dataset –ds DQCheck_transaction_2021 and run series of monthly owlchecks up to "2021-12-01" (but the name of the dataset is up to you)/

```
# Prime past Owlchecks so that "2021-12-01" knows the file path
of past months
./owlcheck
    -ds DQCheck_transactions_2021
    -rd "2021-07-01"
    -f "~/customer/transaction-2021-07-01/transaction_2021-07-
01.csv"
    -fq "select * from dataset"

./owlcheck
    -ds DQCheck_transactions_2021
    -rd "2021-08-01"
    -f "~/customer/transaction-2021-08-01/transaction_2021-08-
01.csv"
    -fq "select * from dataset"


./owlcheck
    -ds DQCheck_transactions_2021
    -rd "2021-09-01"
    -f "~/customer/transaction-2021-08-01/transaction_2021-09-
01.csv"
    -fq "select * from dataset"

./owlcheck
    -ds DQCheck_transactions_2021
    -rd "2021-10-01"
    -f "~/customer/transaction-2021-08-01/transaction_2021-10-
01.csv"
    -fq "select * from dataset"

./owlcheck
    -ds DQCheck_transactions_2021
    -rd "2021-11-01"
    -f "~/customer/transaction-2021-11-01/transaction_2021-11-
01.csv"
    -fq "select * from dataset"

# Priming 5 past Owlchecks complete. Now run the 2021-12-01
./owlcheck
    -ds DQCheck_transactions_2021
    -rd "2021-12-01"
    -f "~/customer/transaction-2021-12-01/transaction_202-11-
201.csv"
    -fq "select * from dataset"
    -fllb
    # outlier options
    -dc "date"
    -dl
    -tbin "MONTH"
    -dllb 5 # look back up to 5 months
    ... # other relevant options
```

In this scenario, since the folder paths have a pattern, we can use `-br` for priming in one command instead of writing five DQCheck commands. The flag `-br` runs DQChecks consecutively from the past and increments by monthly if `-tbin "MONTH"` (by default `-tbin DAY`so the default behavior is to increment daily). The different folder paths on each past consecutive run dates are replaced with `${rd}`. The below command is identical to the above:

```
# Prime past Owlchecks so that "2021-12-01" knows the file path
of past months
./owlcheck
    -ds DQCheck_transactions_2021
    -rd "2021-12-01"
    -f "~/customer/transaction-${rd}/transaction_${rd}.csv"
    -fq "select * from dataset"
    -br 5 # run 5 runs to in the past
    -tbin "MONTH" # <-- required since we want a MONTHLY back-
run. Default "DAY"

# Priming complete. Now run the 2021-12-01
./owlcheck
    -ds DQCheck_transactions_2021
    -rd "2021-12-01"
    -f "~/customer/transaction-2021-12-01/transaction_2021-12-
01.csv"
    -fq "select * from dataset"
    -fllb
    # outlier options
    -dc "date"
    -dl
    -tbin "MONTH"
    -dllb 5 # look back up to 5 months
    ... # other relevant options
```

This pattern is designed so that a single DQCheck command can be scheduled and `${rd}` be used to replace the folder & file path. Your `~/customer` folder could contain transactions for all the years, spanning all the way back to 1992 and into the future like so:

```
~/customer

  ├── transaction-1992-01-01
  │   └── transaction_1992-01-01.csv
  ├── transaction-1992-01-01
  │   └── transaction_1992-01-01.csv
  ... # ommitted for space
  ├── transaction-2021-01-01
  │   └── transaction_2021-01-01.csv
  ├── transaction-2021-02-01
  │   └── transaction_2021-02-01.csv
  ... # ommitted for space
  ├── transaction-2021-12-01
  │   └── transaction_2021-12-01.csv
  ... # hasn't happened yet!
```

In this scenario, a monthly scheduled job would get rid of the need to "prime" the DQCheck history, since your past scheduled jobs would have already ran the past DQChecks.

DQ Job HDFS

Run data quality on a file in HDFS. Collibra DQ automatically infers the schema and create an internal training model.

```
-f "hdfs:///demo/ssn_test2.csv" \
-d "," \
-rd "2018-01-08" \
-ds "ssn_hdfs_file" \
-master yarn \
-deploymode cluster \
-numexecutors 2 \
-executormemory 2g
```

DQ Job JSON

Files

Run against a file using -json. Additionally, options are available for -flatten and -multiline. This is helpful for nested and various formats.

```
-ds json_file_example \
-f s3a://bucket_name/file.json \
-h instance.us-east4-c.c.owl-node.internal:5432/postgres \
-master spark://instance.us-east4-c.c.owl-node.internal:7077 \
-json \
-flatten \
-multiline
```

> **Note** Automatic flattening will infer schema and explode all structs, arrays, and map types.

Using Spark SQL

```
-ds public.json_sample \
-lib "/opt/owl/drivers/postgres/" \
-h instance.us-east4-c.c.owl-node.internal:5432/postgres \
-master spark://instance.us-east4-c.c.owl-node.internal:7077
-q "select * from public.jason"
-rd "2021-01-17"
-driver "org.postgresql.Driver"
-cxn postgres-gcp
-fq "select  \
get_json_object(col_3, '$.data._customer_name') AS  `data_customer_name` , \
get_json_object(col_3, '$.data._active_customer') AS  `data_active_customer` , \
from dataset "
```

> **Note** Pass in the path to Owls' -fq parameter. This is great for mixed data types within a database. For example, if you store JSON data as a string or a blob among other data.

```
// Flatten
val colArr = new JsonReader().flattenSchema(df.schema)
colArr.foreach(x => println(x))
```

> **Note** This Owl utility traverses the entire schema and print the proper get JSON object spark sql strings. You can use this instead of typing each query statement into the command line -fq parameter as seen above.

Using DQ Libraries

```
import com.owl.common.options._
import com.owl.core.util.OwlUtils
import com.owl.core.activity2.JsonReader

val connProps = Map (
  "driver"   -> "org.postgresql.Driver",
  "user"     -> "user",
  "password" -> "password",
  "url"      -> "jdbc:postgresql://10.173.0.14:5432/postgres",
  "dbtable"  -> "public.data"
)

// Spark
var rdd = spark.read.format("jdbc").options
(connProps).load.select($"col_name").map(x=>x.toString()).rdd
var df = spark.read.json(rdd)

// Flatten
val colArr = new JsonReader().flattenSchema(df.schema)
val flatJson = df.select(colArr: _*)
flatJson.cache.count

// Opts
val dataset = "json_example"
val runId = s"2021-01-14"
val opt = new OwlOptions()
opt.dataset = dataset
opt.runId = runId
opt.datasetSafeOff = true

// Owlcheck
OwlUtils.resetDataSource("instance.us-east4-c.c.owl-node.in-
ternal","5432/postgres","user","pass", spark)
val owl = OwlUtils.OwlContext(flatJson, opt)
owl.register(opt)
owl.owlCheck
```

> **Note** JsonReader()
> This uses DQ's JsonReader to do the heavy lifting.

DQ Job MySql

Video Tutorial (MySQL)

Add automatic data quality to any database in 60 seconds. This example shows a single table being selected for DQ, however Collibra DQ also provides the ability to scan all schemas and tables at once.

JDBC Connect from Kirk Haslbeck on Vimeo.

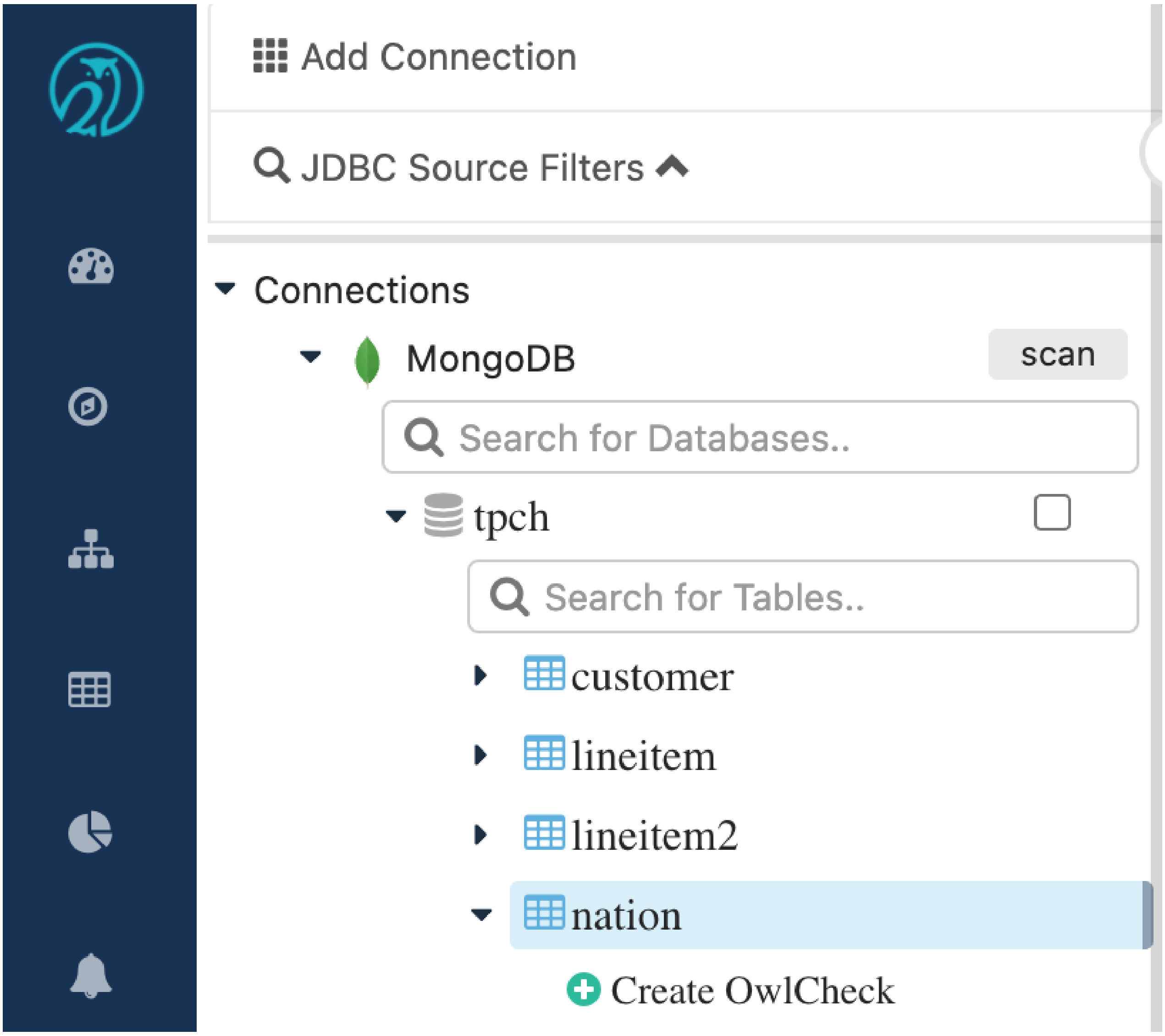
Connect to any database using JDBC. Mysql example below.

```
-q "select * from lake.stock_eod where date = '2017-01-20' " \
-u username -p password \
-c "jdbc:mysql://owldatalake.chzid9w0hpyi.us-east-1.rd-
s.amazonaws.com:3306" \
-rd "2017-01-20" \
-dc "date" \
-ds "stocks" \
-driver com.mysql.jdbc.Driver \
-lib "/home/ec2-user/owl/drivers/mysql/"
```

DQ Job MongoDB

Browse MongoDB like any other relational database

Using Collibra DQ's file tree explorer browse Mongo "collections" like "tables". Then use the wizard to create standard DQ scans.



CMD Line

Copy paste-able cmdline example for simple spark submit job.

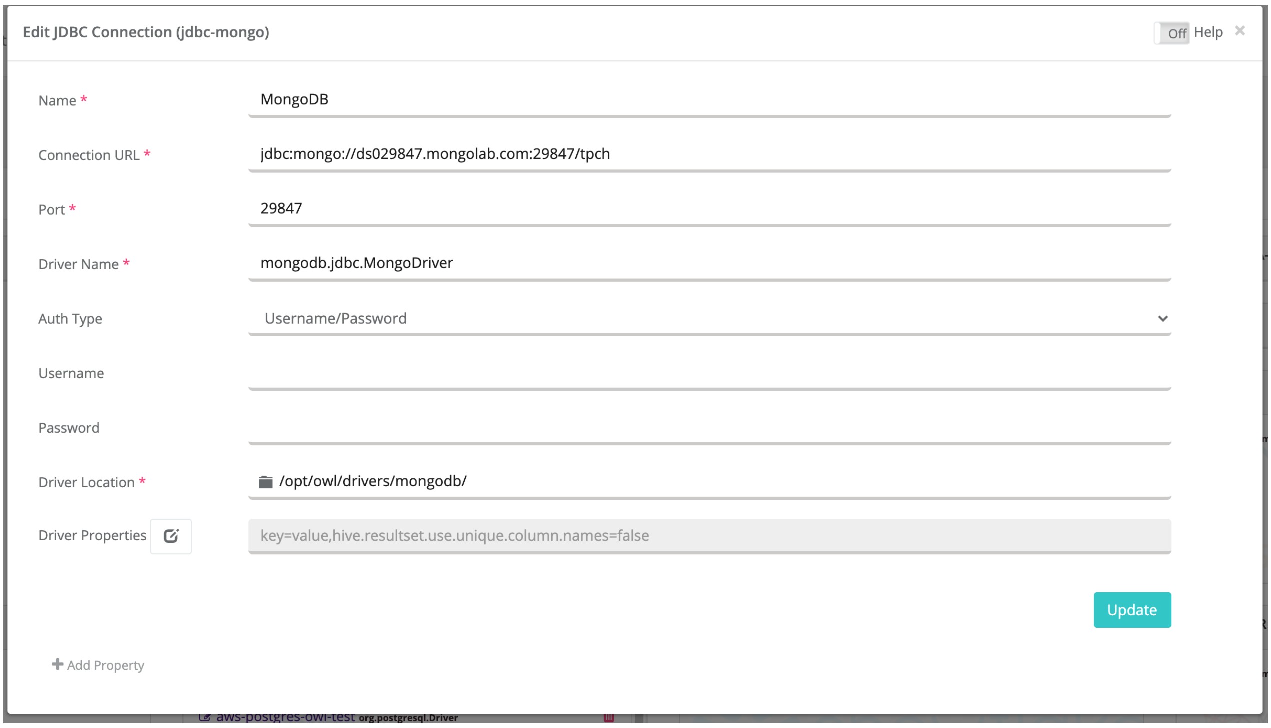
```
-lib "/opt/owl/drivers/mongodb/"
-h localhost:5432/postgres
-master local[*]
-ds tpch.lineitem_7
-br 10 -deploymode client
-q "select * from tpch.lineitem where l_shipdate between '${rd}
00:00:00.000+0000'
and '${rdEnd} 00:00:00.000+0000' "
-bhlb 10 -rd "1998-12-01"
-driver "mongodb.jdbc.MongoDriver"
-loglevel INFO -cxn MongoDB -rdEnd "1998-12-02"
```

Drivers and Config

In order to make this possible Collibra DQ requires two drivers, MongoDB driver and UnityJDBC Driver. Out of the box DQ comes preconfigured with these drivers. You simply open the MongoDB connection template and paste in your JDBC URL.

```
driverClass: mongodb.jdbc.MongoDriver

path: /opt/owl/drivers/mongodb/
    +-- mongoJdbc.jar
    +-- unityJDBC.jar
```

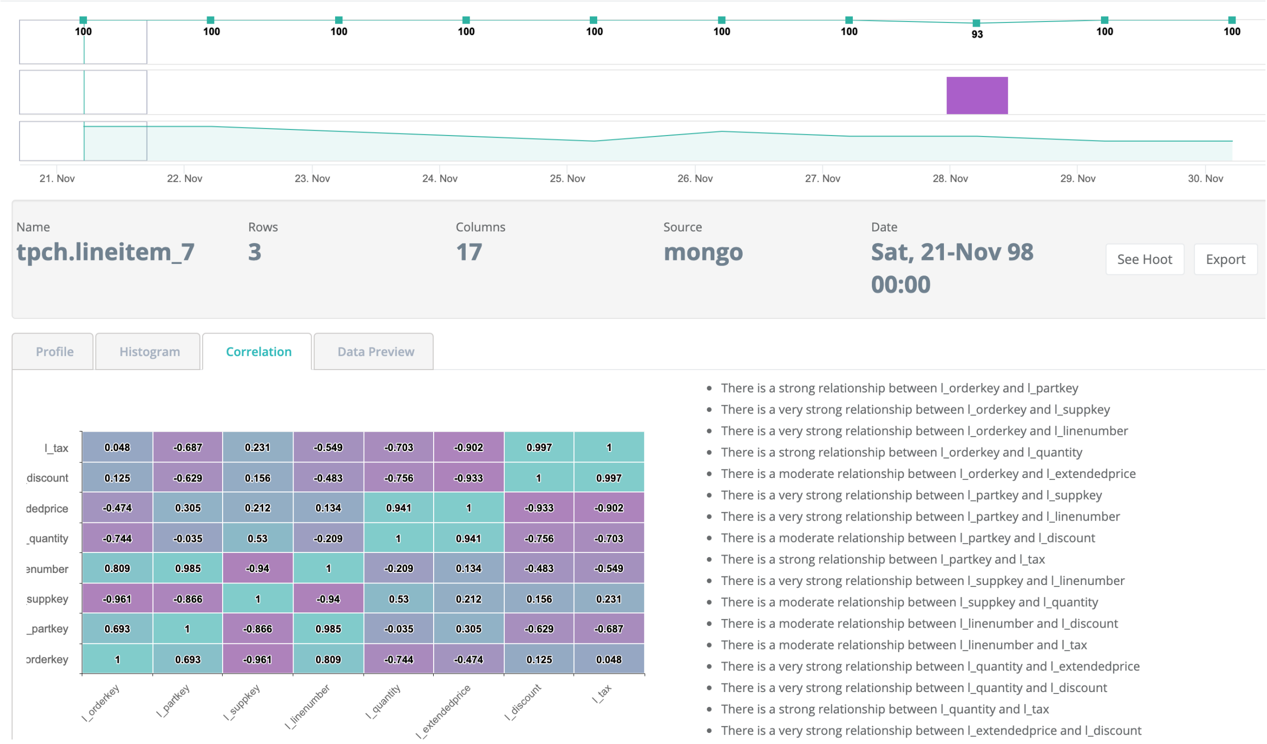
Simply paste in JDBC Info



Edit JDBC Connection (jdbc-mongo)

Name *	MongoDB
Connection URL *	jdbc:mongo://ds029847.mongolab.com:29847/tpch
Port *	29847
Driver Name *	mongodb.jdbc.MongoDriver
Auth Type	Username/Password
Username	
Password	
Driver Location *	/opt/owl/drivers/mongodb/
Driver Properties	key=value,hive.resultset.use.unique.column.names=false

Discover Correlations, Relationships, DQ issues and Much More...

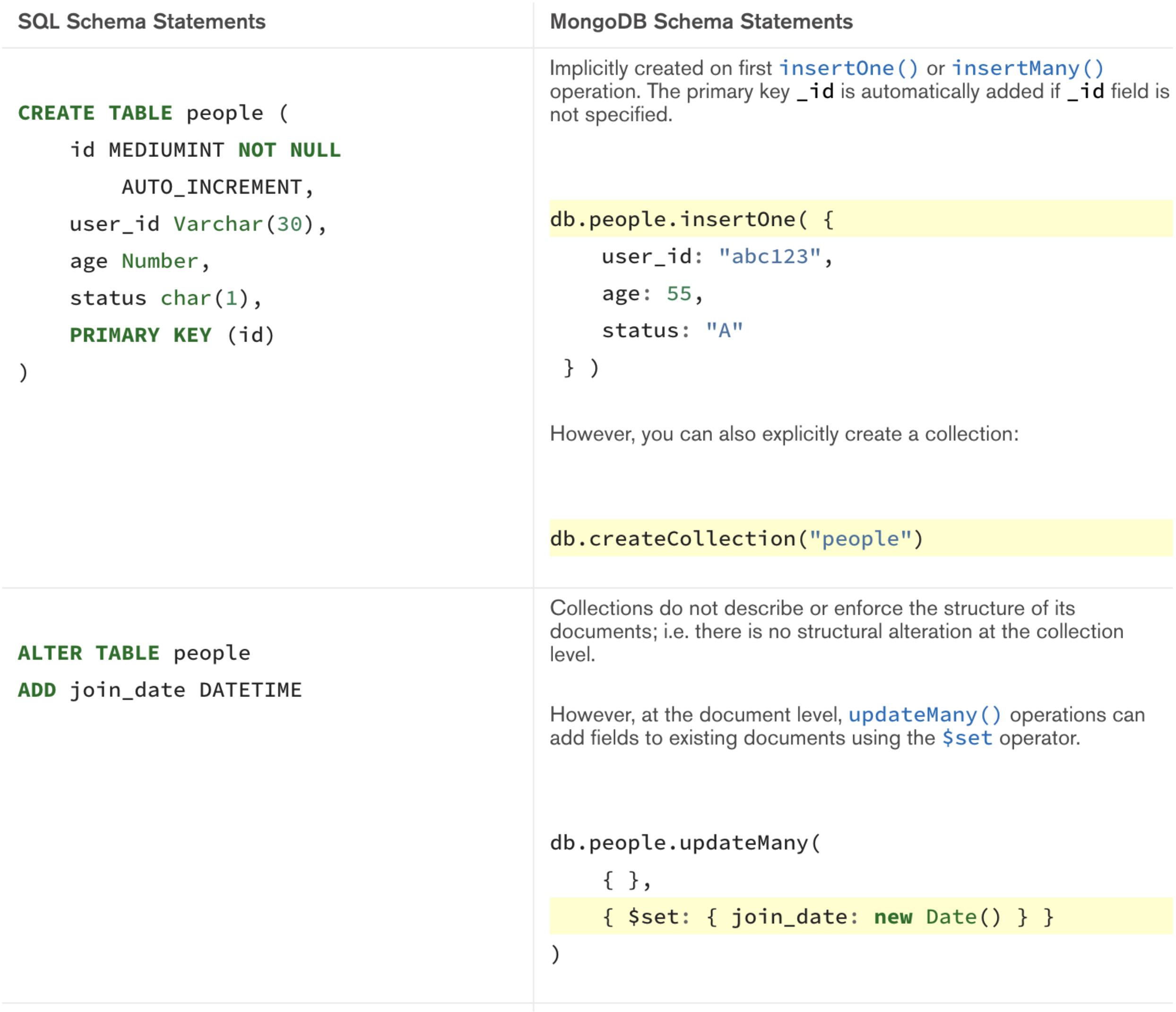


Name	Rows	Columns	Source	Date
tpch.lineitem_7	3	17	mongo	Sat, 21-Nov 98 00:00

	l_orderkey	l_partkey	l_suppkey	l_linenumber	l_quantity	l_extendedprice	l_discount	l_tax
l_tax	0.048	-0.687	0.231	-0.549	-0.703	-0.902	0.997	1
discount	0.125	-0.629	0.156	-0.483	-0.756	-0.933	1	0.997
dedprice	-0.474	0.305	0.212	0.134	0.941	1	-0.933	-0.902
_quantity	-0.744	-0.035	0.53	-0.209	1	0.941	-0.756	-0.703
enumber	0.809	0.985	-0.94	1	-0.209	0.134	-0.483	-0.549
suppkey	-0.961	-0.866	1	-0.94	0.53	0.212	0.156	0.231
_partkey	0.693	1	-0.866	0.985	-0.035	0.305	-0.629	-0.687
orderkey	1	0.693	-0.961	0.809	-0.744	-0.474	0.125	0.048

- There is a strong relationship between l_orderkey and l_partkey
- There is a very strong relationship between l_orderkey and l_suppkey
- There is a very strong relationship between l_orderkey and l_linenumber
- There is a strong relationship between l_orderkey and l_quantity
- There is a moderate relationship between l_orderkey and l_extendedprice
- There is a very strong relationship between l_partkey and l_suppkey
- There is a very strong relationship between l_partkey and l_linenumber
- There is a moderate relationship between l_partkey and l_discount
- There is a strong relationship between l_partkey and l_tax
- There is a very strong relationship between l_suppkey and l_linenumber
- There is a moderate relationship between l_suppkey and l_quantity
- There is a moderate relationship between l_linenumber and l_discount
- There is a moderate relationship between l_linenumber and l_tax
- There is a very strong relationship between l_quantity and l_extendedprice
- There is a very strong relationship between l_quantity and l_discount
- There is a strong relationship between l_quantity and l_tax
- There is a very strong relationship between l_extendedprice and l_discount

The following table presents the various SQL statements related to table-level actions and the corresponding MongoDB statements.https://docs.mongodb.com/manual/reference/sql-comparison/



SQL Schema Statements	MongoDB Schema Statements

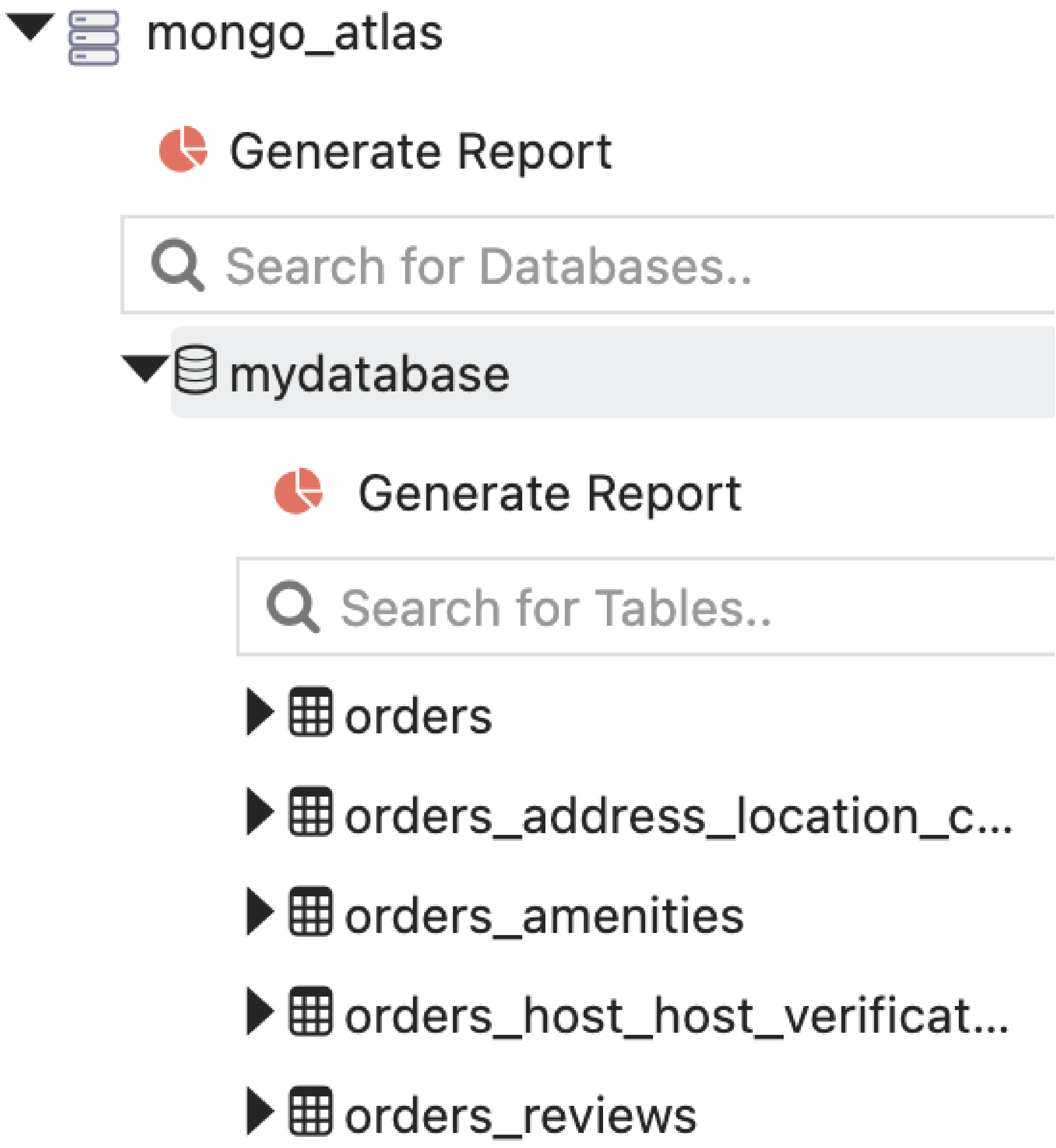
`CREATE TABLE people (`
`    id MEDIUMINT NOT NULL`
`        AUTO_INCREMENT,`
`    user_id Varchar(30),`
`    age Number,`
`    status char(1),`
`    PRIMARY KEY (id)`
`)`
	Implicitly created on first `insertOne()` or `insertMany()` operation. The primary key `_id` is automatically added if `_id` field is not specified.
	`db.people.insertOne( {`
	`    user_id: "abc123",`
	`    age: 55,`
	`    status: "A"`
	` } )`
	However, you can also explicitly create a collection:
	`db.createCollection("people")`

`ALTER TABLE people`
`ADD join_date DATETIME`
	Collections do not describe or enforce the structure of its documents; i.e. there is no structural alteration at the collection level.
	However, at the document level, `updateMany()` operations can add fields to existing documents using the `$set` operator.
	`db.people.updateMany(`
	`    { },`
	`    { $set: { join_date: new Date() } }`
	`)`

Limiting Collections in the JDBC URL

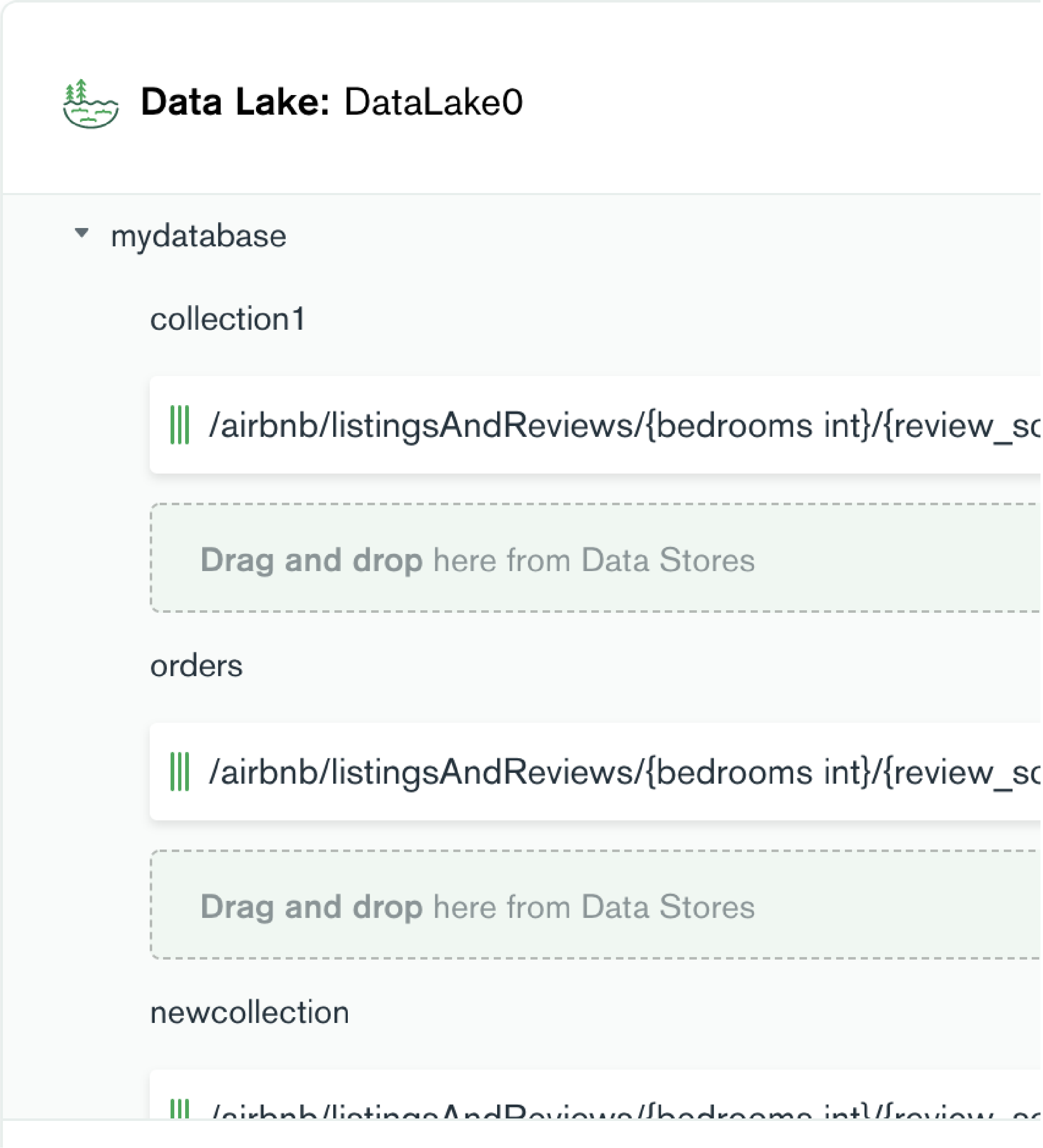
```
jdbc:mongodb://<dbuser>:<password>@datalake0-dza-
1q.a.query.-
mon-
god-
b.net/<mydata-
base>?ssl=true&authSource=admin&rebuildschema=true&tables=orders
```

There are three collections in this mongodb atlas lake. By adding &tables=orders in the URL params you can see only order collections show up in the explorer.



Three Collections in MongoDB Atlas

The total number of collections in mongodb atlas lake.



Data Lake: DataLake0

mydatabase

collection1

/airbnb/listingsAndReviews/{bedrooms int}/{review_sc

Drag and drop here from Data Stores

orders

/airbnb/listingsAndReviews/{bedrooms int}/{review_sc

Drag and drop here from Data Stores

newcollection

/airbnb/listingsAndReviews/{bedrooms int}/{review_sc

DQ Job S3

S3 permissions need to be setup appropriately.

> **Note** S3 connections should be defined using the root bucket. Nested S3 connections are not supported.

Example Minimum Permissions

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "VisualEditor0",
            "Effect": "Allow",
            "Action": [
                "s3:ListBucketMultipartUploads",
                "s3:ListBucket",
                "s3:ListMultipartUploadParts",
                "s3:PutObject",
                "s3:GetObject",
                "s3:GetBucketLocation"
            ],
            "Resource": [
                "arn:aws:athena:*:<AWSAccountID>:workgroup/prima-
ry",
                "arn:aws:s3:::<S3 bucket name>/*",
                "arn:aws:s3:::<S3 bucket name>",
                "arn:aws:glue:*:<AWSAccountID>:catalog",
                "arn:aws:glue:*:<AWSAccountID>:database/<databas-
e name>",
                "arn:aws:glue:*:<AWSAccountID>:table/<database
name>/*"
            ]
        }
    ]
}
```

(Needs appropriate driver) http://central.maven.org/maven2/org/apache/hadoop/hadoop-aws/ Hadoop AWS Driver hadoop-aws-2.7.3.2.6.5.0-292.jar

```
-f "s3a://s3-location/testfile.csv" \
-d "," \
-rd "2018-01-08" \
-ds "salary_data_s3" \
-deploymode client \
-lib /home/ec2-user/owl/drivers/aws/
```

Databricks Utils Or Spark Conf

```
val AccessKey = "xxx"
val SecretKey = "xxxyyyzzz"
//val EncodedSecretKey = SecretKey.replace("/", "%2F")
val AwsBucketName = "s3-location"
val MountName = "kirk"

dbutils.fs.unmount(s"/mnt/$MountName")

dbutils.fs.mount(s"s3a://${AccessKey}:${SecretKey}@${AwsBucketName}", s"/mnt/$MountName")
//display(dbutils.fs.ls(s"/mnt/$MountName"))

//sse-s3 example
dbutils.fs.mount(s"s3a://$AccessKey:$SecretKey@$AwsBucketName",
s"/mnt/$MountName", "sse-s3")
```

Databricks Notebooks using S3 buckets

```
val AccessKey = "ABCDED"
val SecretKey = "aaasdfwerwerasdfB"
val EncodedSecretKey = SecretKey.replace("/", "%2F")
val AwsBucketName = "s3-location"
val MountName = "abc"

// bug if you don't unmount first
dbutils.fs.unmount(s"/mnt/$MountName")

// mount the s3 bucket
dbutils.fs.mount
(s"s3a://${AccessKey}:${EncodedSecretKey}@${AwsBucketName}",
s"/mnt/$MountName")
display(dbutils.fs.ls(s"/mnt/$MountName"))

// read the dataframe
val df = spark.read.text(s"/mnt/$MountName/atm_customer/atm_customer_2019_01_28.csv")
```

DQ Job Snowflake

Example CMD Line

```
-h <IP_ADDRESS>:5432/postgres \
-drivermemory 4g \
-master spark://<SPARK_MASTER>:7077 \
-ds PUBLIC.TRANSLATION \
-deploymode client \
-q "select * from PUBLIC.TRANSLATION" \
-rd "2021-07-24" \
-driver "net.snowflake.client.jdbc.SnowflakeDriver" \
-cxn snowflake
```

Example JDBC Connection URL

jdbc:snowflake://<IP_ADDRESS>.snowflakecomputing.com?db=DEMODB&warehouse=COMPUTE_WH&schema=PUBLIC

Drive Name

net.snowflake.client.jdbc.SnowflakeDriver

Advanced

A Collibra DQ Check is a bash script that is essentially the launch point for any DQ Job to scan a data set. A data set can be a flat file, such as textfile, json file, parquet file, etc, or a table from any number of databases, such as Oracle, Postgres, Mysql, Greenplum, DB2, SQLServer, Teradata, etc.

Example Run a data quality check on any file by setting the file path.

```
./owlcheck -ds stock_trades -rd 2019-02-23 -f /path/to/file.csv
-d ,
```

Example output below. A hoot is a valid JSON response

```
{
  "dataset": "stock_trades",
  "runId": "2019-02-03",
  "score": 100,
  "behaviorScore": 0,
  "rows": 477261,
  "passFail": 1,
  "peak": 1,
  "dayOfWeek": "Sun",
  "avgRows": 0,
  "cols": 5,
  "activeRules": 0,
  "activeAlerts": 0,
  "runTime": "00:00:23",
  "dqItems": {},
  "datashapes": [],
  "validateSrc": [],
  "alerts": [],
  "prettyPrint": true
}
```

Monthly Data

Sometimes you may want to run monthly profiles with aggregated data. In this case, the scheduling tool can supply the $ as a variable such as $runDate and the end date as $endDate. 1 line examples for bash or shell below.

```
echo "Hello World Owl"

runDate=$(date +"%Y-%m-%d")
endDate=$(date -d "$runDate +1 month" +%Y-%m-%d)

echo $runDate
echo $endDate

./owlcheck \
-q "select * from table where date >= '$runDate' and date <
'$endDate' " \
-ds example \
-rd $runDate \
-tbin MONTH
```

Monthly BackRun (Using Collibra Data Quality's built-in Monthly)

Collibra Data Quality has 2 convenient features here:

1. The use of built-in $ and $ removes the need for any shell scripting.
2. Using -br, DQ will replay 20 months of data using this template automatically.

```
./owlcheck \
-q "select * from table where date >= '${rd}' and date <
'${rdEnd}' " \
-ds example
-rd 2019-01-01
-rdEnd 2019-02-01
-tbin MONTH
-br 20
```

Daily Data

One of the most common examples is data loading or running once a day. A job control framework can pass in this value or you can pull it from shell.

```
echo "Hello World Owl"

runDate=$(date +"%Y-%m-%d")
echo $runDate

./owlcheck \
-q "select * from table where date = '$runDate' " \
-ds example \
-rd $runDate \
-tbin DAY
```

Daily Data (Using Collibra Data Quality's built-in Daily)

```
./owlcheck \
-q "select * from table where date = '${rd}' " \
-ds example \
-rd 2019-03-14
```

Daily Data with Timestamp instead of Date

```
./owlcheck \
-q "select * from table where TS >= '${rd} 00:00:00' and TS <=
'${rd} 23:59:59' " \
-ds example \
-rd 2019-03-14
```

OR Timestamp using $

```
./owlcheck \
-q "select * from table where TS >= '${rd} 00:00:00' and TS <
'${rdEnd} 00:00:00' " \
-ds example \
-rd 2019-03-14 \
-rdEnd 2019-03-15 \
-tbin DAY
```

Hourly Data

```
./owlcheck \
-q "select * from table where TS >= '${rd}' and TS < '${rdEnd}'
" \
-ds example \
-rd    "2019-03-14 09:00:00" \
-rdEnd "2019-03-14 10:00:00" \
-tbin HOUR
```

DQ Check Template with Service Hook

The best practice is to make a generic job that would be repeatable for every DQ Check. Below is an example that first hits Collibra Data Quality using a REST call and then runs the response.

```
curl -X GET "http://$host/v2/-
getowlchecktemplate?dataset=lake.loan_customer" \
-H "accept: application/json"
```

The above REST call returns the below DQ Check. It is left up to the Job Control to replace the $ with the date from the Job Control system. You can use Collibra DQ's built-in scheduler to save these steps.

```
./owlcheck \
-lib "/home/danielrice/owl/drivers/mysql/" \
-cxn mysql \
-q "select * from lake.loan_customer where load_dt = '${rd}' " \
-key post_cd_num -ds lake.loan_customer \
-rd ${rd} \
-dc load_dt -dl -dlkey usr_name,post_cd_num -dllb 5 \
-tbin DAY -by DAY -dupe -dupeinc ip_address_home,usr_name -
dupecutoff 85 \
-fpgon -fpgkey usr_name,post_cd_num -fpgdc load_dt -fpglb 5 -
fpgtbin DAY \
-loglevel INFO \
-h $host:5432/owltrunk \
-owluser {user}
```

REST API End Point

The easiest option is to use the **runtemplate** end point API call to make requests to from cmdLine or JobControl System. This endpoint gets the DQ Check saved in Collibra instead of the client needing to know the DQ Check details.

POST https://$host**/v2/runtemplate?dataset=lake.spotify**

RunTemplate

Parameters

Path

dataset	string	name of dataset. -ds OR opt.dataset

rd	string	yyyy-MM-dd format can add time or timezone. if note passed in it will use the current day
rdEnd	string	yyyy-MM-dd format can add time or timezone. if not passed it will not be used
Responses		

● 200

```
{
  "msg": "Success, Owl Check is Running as process 13996",
  "pid": "13996",
  "runid": "2017-01-01",
  "starttime": "Thu Oct 17 13:27:01 EDT 2019",
  "cmd": "cmd": "-ds lake.spotify -rd 2019-10-17   -q \"select *
from lake.spotify\" -cxn mysql -lib /opt/owl/drivers/mysql/ -
drivermemory 2G -histoff   -owluser {user}",
  "dataset": "lake.spotify"
}
```

Curl example for the above Rest Call

```
TOKEN=$(curl -s -X POST http://$host/auth/signin -H "Content-
Type:application/json" -d "{\"username\":\"$username\", \"pass-
word\":\"$password\"}" | jq -r '.token')

curl -i -H 'Accept: application/json' \
  -H "Authorization: Bearer ${TOKEN}" \
  http://$host/v2/runtemplate?dataset=lake.spotify
```

Bash Script

A generic and repeatable DQCheck script for job schedulers, that hooks into Collibra to get the template.

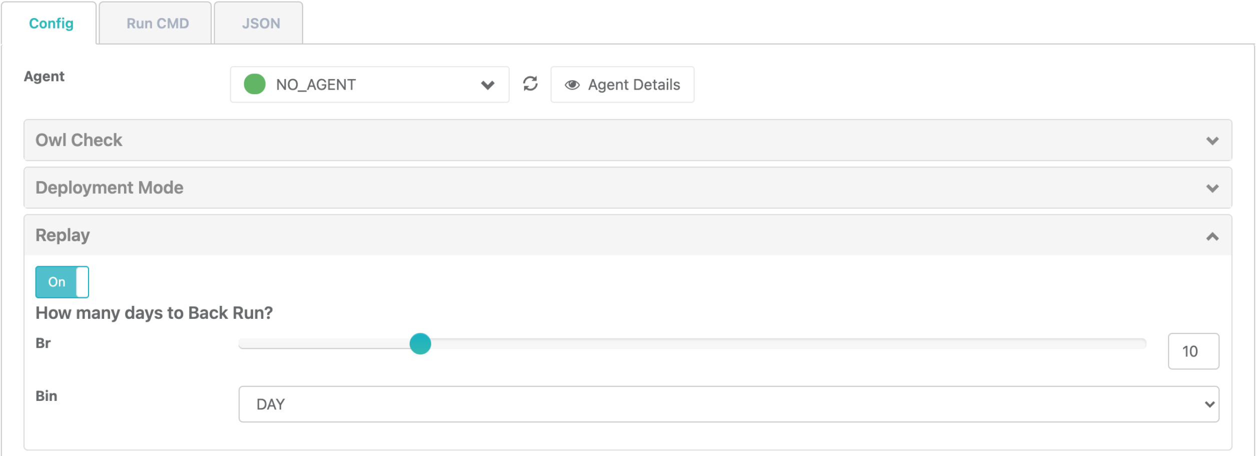
```
#1 authenticate
curl -sb -X POST -d username={user} -d password={password}
http://$OWL_HOST/login -c cookies.txt

#2 get template
owlcheck_args=$(curl -b cookies.txt -H "accept: applic-
ation/json" -X GET http://$OWL_HOST/v2/-
getowlcheckcmdlinebydataset\?dataset=insurance | sed 's/.*\[\
(.*\)\]/\1/' | sed -e "s/^\"//" -e "s/\"$//"  | sed 's/\\\"\
(.*\)\\\"/\x27\1\x27/')

#3 replace ${rd} with job_run_date
job_run_date="2019-03-14 10:00:00"
owlcheck_args=${owlcheck_args//'${rd}'/$job_run_date}

#4 run owlcheck
eval owlcheck $owlcheck_args
```

For more Information on Collibra Data Quality's Scheduler, visit the DQ Job Cron page.

DQ Job Back Run

How to Replay a Data Test

Many times you will want to see how a dataset plays out over time. This could be five days or five months. Using this slider the tool will automatically create training sets and profiles as well as run any rules or outliers you've put in place.



Agent: NO_AGENT

On

How many days to Back Run?

Br: 10

Bin: DAY

Quickly Replay 30 days of data, -br 30

Add -br to any DQCheck and replay in time order. Jan 1st, Jan 2nd, Jan 3rd...To do this we need to use the ${rd} variable that DQ provides as a run_date replacement for job control and templates. Also note that if you run from the cmdline you need to escape "$"s. So use \${rd}. If you are running from a Notebook or Java or Scala or the Rest API you do not need to escape the ${rd} variable.

```
./owlcheck \
-ds OWLDB2.NYSE_STOCKS3 -rd "2018-01-14" \
-lib "/opt/owl/drivers/db2/" \
-cxn db2 \
-q "select * from OWLDB2.NYSE_STOCKS where TRADE_DATE =
'\${rd}'" \
-br 4
```

Replay 4 Months of data, -br 4 -tbin MONTH

In situations where your data rolls up into Months, you may want to re-run several months of data but not a day at a time. In this case we will use -br with -tbin.

```
./owlcheck \
-ds OWLDB2.NYSE_STOCKS3 \
-rd "2018-01-01" \
-q "select * from OWLDB2.NYSE_STOCKS where TRADE_DATE =
'\${rd}'" \
-br 4 \
-tbin MONTH \
-lib "/opt/owl/drivers/db2/" \
-cxn db2
```

Monthly using a range for the entire Month

```
./owlcheck \
-ds OWLDB2.NYSE_STOCKS3 \
-rd "2018-01-01" \
-rdEnd "2018-02-01" \
-q "select * from OWLDB2.NYSE_STOCKS where TRADE_DATE >= '${rd}'
and TRADE_DATE < '${rdEnd}'" \
-br 4 \
-tbin MONTH
-lib "/opt/owl/drivers/db2/" \
-cxn db2
```

DQ Job Cron

Template for Job Control

Cron / Autosys / Control M / Oozie

It is common for organization to need to run jobs on a schedule. Below are a few shell tricks to get a date from bash and use an DQCheck with template variables.

Kinit and get run_date from shell or job control variable, pass it into Collibra DQ using $run_date.

```
%sh
run_date=$(date +%Y-%m-%d)
run_date=$(date '+%Y-%m-%d %H:%M')
echo $run_date

#kinit
echo "password" | kinit  userabc@CW.COM

~/owl/bin/owlcheck -q "select * from lake.stock_eod where date =
'$run_date' " \
-u user -p pass \
-c "jdbc:mysql://owldatalake.chzid9w0hpyi.us-east-1.rd-
s.amazonaws.com:3306" \
-rd "$run_date" \
-dc "date" \
-dl \
-dllb 7 \
-dlminhist 2 \
-tbin DAY \
-dlkey sym,exch \
-ds "lake.stock_nasdaq" \
-driver "com.mysql.jdbc.Driver" \
-lib "/home/ec2-user/owl/drivers/mysql/" \
-master yarn -deploymode client -numexecutors 1 -executormemory
1g \
-loglevel DEBUG
```

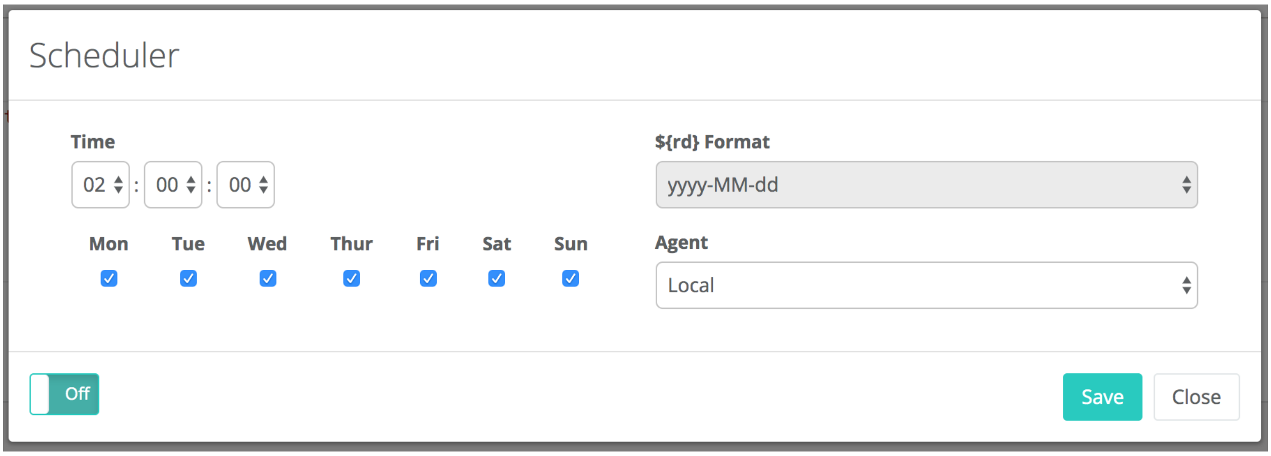
Template

You can also use -template to use DQ as a service hook and remove the need to pass in almost anything. In this case, DQ looks up the template automatically from either a previous run or if you've saved a template, and use these variables. Any variable at the cmdline will override and win/replace. This is a great way to remove connection and other information from being hard coded into the job control framework and allows edit ability from DQ Webapp.

```
%sh
~/owl/bin/owlcheck -usetemplate -ds lake.stock_nasdaq -rd $run_
date
```

Owl Scheduler - Built In

A quick option is to use DQ's built in scheduler. DQ automatically substitutes the runtime variables like $ into the job. This also gives you control to edit the DQCheck.



Scheduler

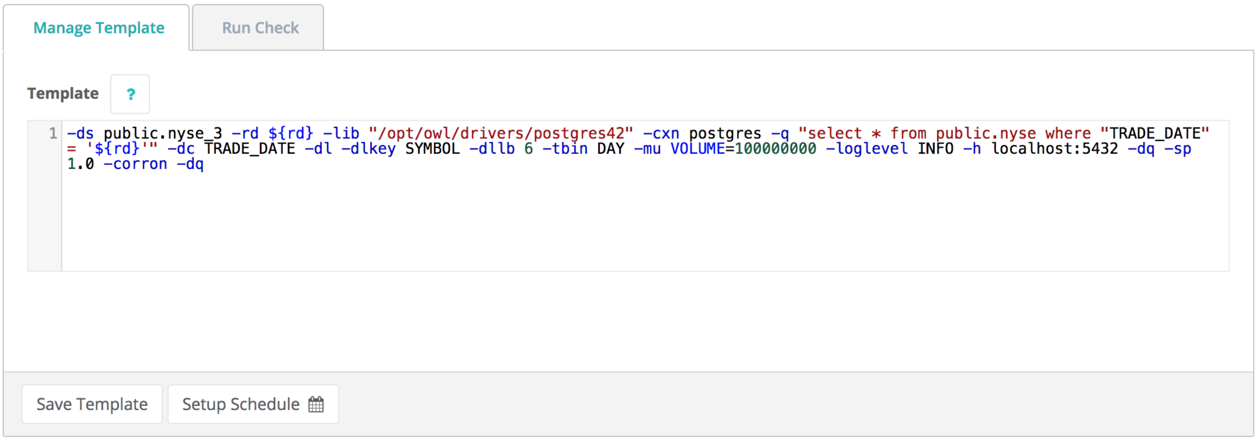
Time: 02 : 00 : 00

Mon ☑ Tue ☑ Wed ☑ Thur ☑ Fri ☑ Sat ☑ Sun ☑

${rd} Format: yyyy-MM-dd

Agent: Local

The schedule is based on the DQCheck Template. This way the runtime variables are replaced in each run. Notice the $ below.

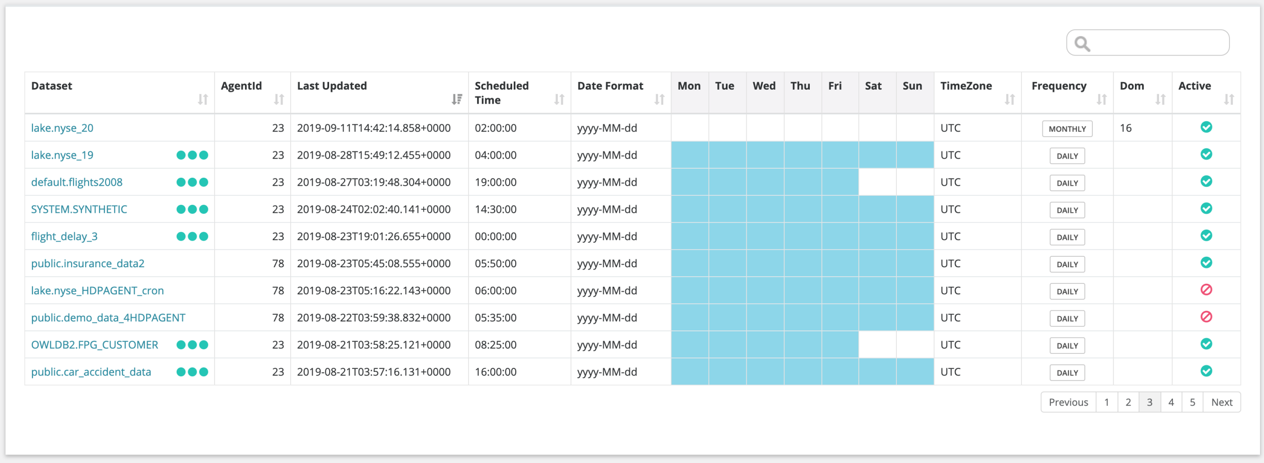


Template

```
-ds public.nyse_3 -rd ${rd} -lib "/opt/owl/drivers/postgres42" -cxn postgres -q "select * from public.nyse where "TRADE_DATE"
= '${rd}'" -dc TRADE_DATE -dl -dlkey SYMBOL -dllb 6 -tbin DAY -mu VOLUME=100000000 -loglevel INFO -h localhost:5432 -dq -sp
1.0 -corron -dq
```

All Scheduled Jobs in One Place

Under the jobs dashboard you can see an overview schedule with all running jobs and their status.



Dataset	AgentId	Last Updated	Scheduled Time	Date Format	Mon	Tue	Wed	Thu	Fri	Sat	Sun	TimeZone	Frequency	Dom	Active
lake.nyse_20	23	2019-09-11T14:42:14.858+0000	02:00:00	yyyy-MM-dd								UTC	MONTHLY	16	✓
lake.nyse_19 ●●●	23	2019-08-28T15:49:12.455+0000	04:00:00	yyyy-MM-dd	■	■	■	■	■	■	■	UTC	DAILY		✓
default.flights2008 ●●●	23	2019-08-27T03:19:48.304+0000	19:00:00	yyyy-MM-dd	■	■	■	■	■			UTC	DAILY		✓
SYSTEM.SYNTHETIC ●●●	23	2019-08-24T02:02:40.141+0000	14:30:00	yyyy-MM-dd	■	■	■	■	■	■	■	UTC	DAILY		✓
flight_delay_3 ●●●	23	2019-08-23T19:01:26.655+0000	00:00:00	yyyy-MM-dd	■	■	■	■	■	■	■	UTC	DAILY		✓
public.insurance_data2	78	2019-08-23T05:45:08.555+0000	05:50:00	yyyy-MM-dd	■	■	■	■	■	■	■	UTC	DAILY		✓
lake.nyse_HDPAGENT_cron	78	2019-08-23T05:16:22.143+0000	06:00:00	yyyy-MM-dd	■	■	■	■	■	■	■	UTC	DAILY		⊘
public.demo_data_4HDPAGENT	78	2019-08-22T03:59:38.832+0000	05:35:00	yyyy-MM-dd	■	■	■	■	■	■	■	UTC	DAILY		⊘
OWLDB2.FPG_CUSTOMER ●●●	23	2019-08-21T03:58:25.121+0000	08:25:00	yyyy-MM-dd	■	■	■	■	■			UTC	DAILY		✓
public.car_accident_data ●●●	23	2019-08-21T03:57:16.131+0000	16:00:00	yyyy-MM-dd	■	■	■	■	■	■	■	UTC	DAILY		✓

DQ Job Kafka

Kafka Requires Zookeeper

Apache Kafka typically requires zookeeper. This file and cmd can be run from inside /kafka/bin.

```
# Start the ZooKeeper service
# Note: Soon, ZooKeeper will no longer be required by Apache
Kafka.
$ bin/zookeeper-server-start.sh config/zookeeper.properties
```

Start a Kafka Server

Precursor step to Collibra DQ (you likely already have this step completed if you use Kafka).

```
bin/kafka-server-start.sh config/server.properties
```

Start a Kafka Topic

Precursor step to DQ (you likely already have this step completed if you use Kafka).

```
bin/kafka-topics.sh --create --bootstrap-server localhost:9092 -
-replication-factor 1 --partitions 1 --topic test

# prefered cmd is below
bin/kafka-topics.sh --create --zookeeper localhost:2181 --rep-
lication-factor 1 --partitions 1 --topic test
```

Put a msg on "test" Topic

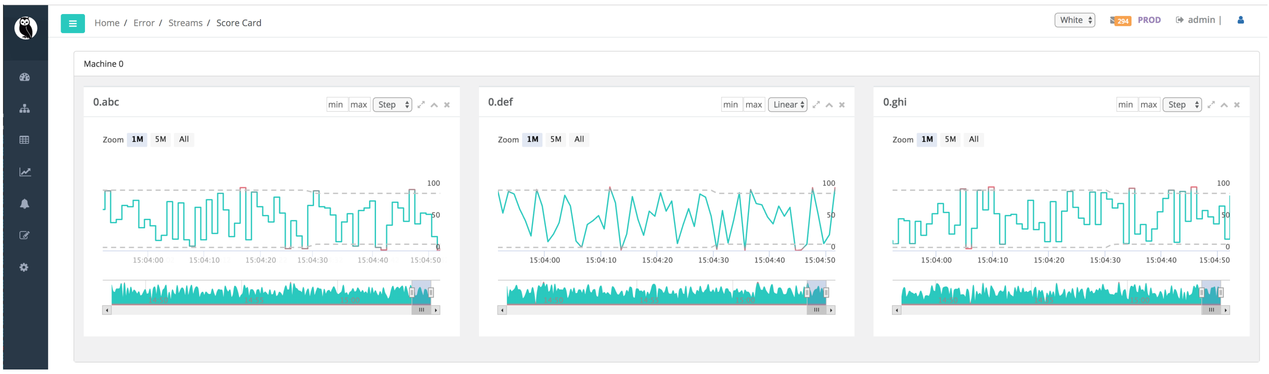
```
bin/kafka-console-producer.sh --broker-list localhost:9092 --
topic test
```

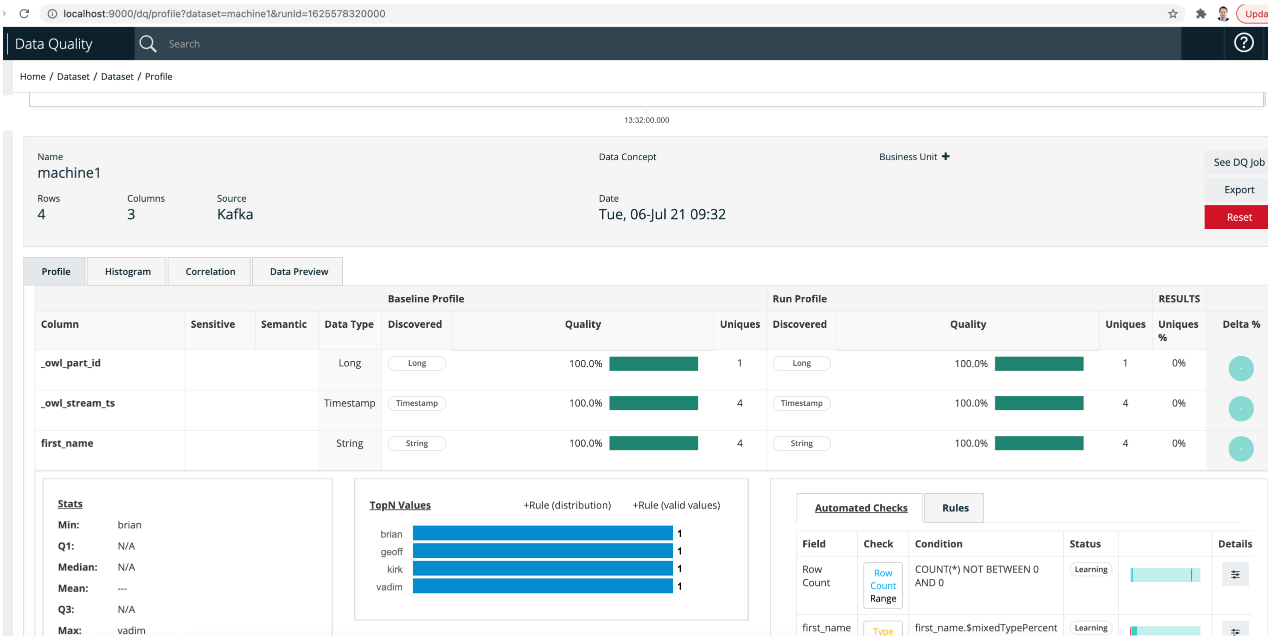
Kafka Consumer or DQ Consumer

Kafka works as a topic so you can have many consumers. Here is a basic cmdline consumer but we can add DQ as a second consumer.

```
bin/kafka-console-consumer.sh --bootstrap-server localhost:9092
--topic test --from-beginning
```

```
/opt/owl/bin/owlcheck.sh
      -kafkatopic test
      -ds machine1
      -streamformat csv
      -kafkaport  9092
      -kafkabroker localhost
      -streaminterval 60
      -stream -kafka
      -header  first_name
      -master local
```





Name
machine1

Data Concept

Business Unit

Rows
4

Columns
3

Source
Kafka

Date
Tue, 06-Jul 21 09:32

				Baseline Profile			Run Profile			RESULTS	
Column	Sensitive	Semantic	Data Type	Discovered	Quality	Uniques	Discovered	Quality	Uniques	Uniques %	Delta %
_owl_part_id			Long	Long	100.0%	1	Long	100.0%	1	0%	
_owl_stream_ts			Timestamp	Timestamp	100.0%	4	Timestamp	100.0%	4	0%	
first_name			String	String	100.0%	4	String	100.0%	4	0%	

Stats

Min:	brian
Q1:	N/A
Median:	N/A
Mean:	---
Q3:	N/A
Max:	vadim

TopN Values

brian	1
geoff	1
kirk	1
vadim	1

Automated Checks Rules

Field	Check	Condition	Status		Details
Row Count	Row Count Range	COUNT(*) NOT BETWEEN 0 AND 0	Learning		
first_name	Type	first_name.$mixedTypePercent	Learning		

Streams vs Sensors

Technically speaking anything moving in real-time is a stream of data but DQ classifies streams and IoT sensors as slightly different for the following reasons:

Sensors

Sensors are commonly a standard time-series. Signal, Time, Value.

Signal	Time	Value
device1-CPU	2019-02-11 13:40:55	4

Signal	Time	Value
device1-CPU	2019-02-11 14:33:20	2

Streams

Streams commonly look like messages, jsons, avro or batch data but constantly flowing. Another way to think of it is a multiple time-series.

```
[
    trade: {
        price: 23.75,
        qty: 20,
        symbol: HDP
    },
        trade: {
    }
]
```

fname	age	networth	email
Joe	45	$130,000	joe@yahoo.com
Mark	33	$125,000	mark@yahoo.com

The difference between a Sensor and a Stream in the above example is that in the case of the sensor the user is primarily concerned with the actual value of the "Value". Meaning a spike in temperature or a drop in CPUs. But in a stream of customer data there isn't a time "X" and value "Y" there are many values "Y" and you a user is interested in the overall quality of both the entire stream and the individual values. Relationship analysis and other correlative functions apply here. If you were to chart a "stream" what would you chart? The row count volume or just one of the columns or the count of something? But if you were to chart a sensor you know exactly what you would chart... the "Value" over "Time".

Fortunately DQ has already thought and worked through the many nuances required to understand, monitor and predict accurately for all of these use-case. All that is required is to subscribe the stream.

DQ Job LinkID

Link ID is an out-of-the-box feature that lets you link the findings of a DQ Job back to the source record, or key, for remediation outside the application. The link ID should be unique and is most commonly the primary key. Composite primary key is also supported.

Collibra Data Quality supports one or many primary key columns in your data sets for record linkage to your original table, file, or data frame. If your primary key column contains many columns, use a comma to delineate.

Providing the link ID

There are two ways to provide the link ID:

1. From the command line using `-linkid`.
2. In a notebook via opt.linkId.

Combining link ID and Run Discovery

To combine the features of link ID and Run Discovery, first enable link ID and then use Run Discovery. This lets you apply sensitivity labels to data classes and trigger breaks for all the records that do not match your link ID.

Link ID and the DQ Metastore

No personal data is stored in the Metastore when using link ID. The Metastore only stores:

- The rule that is applied to your DQ Job.
- The data set used for your DQ Job.
- The column of reference.
- The link ID.

For further reading on sensitive information, refer to Data Discovery in the Rule Discovery section.

Viewing break records

To view rule break records, navigate to the Breaks tab on the Rule Builder page. Rules with break records have associated link IDs that link back to the original data set. All remediation for data quality issues is performed outside the Collibra Data Quality app.

Steps

1. In 🧭 Explorer, select a table and create a DQ Job. >> The DQ Job page opens.
2. In the Scope section, select the **Add Link Back to Source** checkbox. >> A new column, Link ID, appears.
3. Select the columns that represent the **primary key(s)** of your data set. >> By selecting multiple checkboxes, you can create a composite key.
4. Run your DQ Job.
   a. Click **Build Model**.
   b. Click **Save/Run**.
   c. Verify the information on the **Register** page.
   d. Click **Estimate Job** and then click **Run**. >> Your DQ Job is sent to the Jobs page.
5. Open your DQ Job.
   a. Open the **Jobs** page.
   b. Select your **DQ Job** from the list. >> Your DQ Job opens.
6. Apply a rule.
   a. In the metadata box, click **Rules**. >> The Rule Builder opens.
   b. Select a **rule type**. **Note:** All Simple and Freeform rules are eligible for Link ID.
7. Re-run your DQ Job.
   a. On the Findings page, click the **DQ Job** tab.
   b. Verify the **run command**.
   c. Click **Run DQ Job**. >> Your DQ Job is submitted to the Jobs queue.
8. Open your DQ Job.
   a. Open the **Jobs** page.
   b. Select your **DQ Job** from the list. >> Your DQ Job opens.
9. View your rule breaks.
   a. In the metadata box, click **Rules**. >> The Rule Builder opens.
   b. Click the **Breaks** tab. >> A table displays a row for each record in violation of the rule you set. The Link ID column lets you identify broken records within your data

set and mark them for remediation outside the DQ application.

c. Export the break records. Supported file formats include Excel and CSV.

Notebook

```
val opt = new OwlOptions()
opt.runId = "2018-02-24"
opt.dataset = "orders"
opt.linkId = Array("transaction_id", "trans_time")
```

Command Line

```
./owlcheck -ds orders \
-rd "2018-02-24" \
-linkid transaction_id,trans_time
```

> **Note** For rules to use linkID, the columns need to be present in the select statement (either select * or select specific column names). All Simple rules are eligible for linkID and Freeform rules need to contain the columns in the projection part of the SQL statement.

Activity Usage

Activity	Supported	Description
SHAPE	YES	One example of each shape issue will have a link back to the corrupt record for remediation.
OUTLIER	YES	Each outlier will have a link back to the detected record for remediation. If you apply a limit you will only get the limited amount. Not on categorical.
DUPE	YES	Each duplicate or fuzzy match will have a link back to the record for remediation.

Activity	Supported	Description
SOURCE	PARTIAL	Each source record that has a cell value that doesn't match to the target will have a link for remediation. SOURCE will not have links for row counts and schema as these are not record level findings.
RULE	YES	Break records for Freeform and Simple rule types will be stored (any records that did not meet the condition of the RULE will be provided with the linkID columns). These are stored as delimited strings in the rule_breaks table along with the dataset, run_id and rule name. Please note when using Freeform SQL the linkID columns should be part of the select statement. LinkID columns should be unique identifiers.
BEHAVIOR	NO	This class of data change is when a a section of your data is drifting from its normal tendency there is no 1 record to link.
SCHEMA	NO	This class of data change is at a schema/data set level there are no records to link.
RECORD	PARTIAL	In some cases when a record is added or removed it may be available for linking.
PATTERN	NO	Patterns are not always a direct link. This item is still under performance review.

Notebook API Example

```
+------------+----------+-------+-------+-----+-----------------
+----------------+
|     dataset|     runId|fieldNm|
format|count|           percent| transaction_id|
+------------+----------+-------+-------+-----+-----------------
+----------------+
|       order |2018-02-
24|   fname|xxxx'x.|    1|7.142857142857142|t-1232         |
+------------+----------+-------+-------+-----+-----------------
+----------------+
```

```
owl.getShapesDF
```

Rest API Example

When supplying a linkID, Collibra naturally excludes this field from most activities, meaning a unique ID or primary key column can not be duplicative or it would not be the primary key. Because of this, it is not evaluated for duplicates. The same is true for Outliers and Shapes, as a large sequence number or other variations might trigger a false positive when this column is denoted to be simply for the purpose of linking uniquely back to the source. If you also want to evaluate this column and link it, create a derived column with a different name and Collibra Data Quality will naturally handle both cases.

```
owl.getShapes
owl.getDupes
owl.getOutliers
owl.getRuleBreaks
owl.getSourceBreaks
```

getRules()

```
----Rules----
+-----------------+----------+--------------------+-------------
-----+-------+
|          dataset|     runId|              ruleNm|         rule-
Value|linkId|
+-----------------+----------+--------------------+-------------
-----+-------+
|dataset_outlier_3|2018-02-24|     fname_like_Kirk|fname like
'Kirk' |  c-41|
|dataset_outlier_3|2018-02-24|     fname_like_Kirk|fname like
'Kirk' |  c-42|
|dataset_outlier_3|2018-02-24|     fname_like_Kirk|fname like
'Kirk' |  c-43|
|dataset_outlier_3|2018-02-24|     fname_like_Kirk|fname like
'Kirk' |  c-44|
|dataset_outlier_3|2018-02-24|     fname_like_Kirk|fname like
'Kirk' |  c-45|
|dataset_outlier_3|2018-02-24|if_email_is_
valid...|             email|  c-31|
|dataset_outlier_3|2018-02-24|if_email_is_
valid...|             email|  c-33|
|dataset_outlier_3|2018-02-24|if_zip_is_valid_
Z...|               zip|  c-40|
+-----------------+----------+--------------------+-------------
-----+-------+
```

getDupes()

First split on ~~ then if you have a multiple part key split on ~|.

```
----Dupes----
+-----------------+----------+-----+--------------------+-------
---+
|          dataset|     runId|score|                 key|    lin-
kId|
+-----------------+----------+-----+--------------------+-------
---+
|dataset_outlier_3|2018-02-24|  100|9ec828d5194fa397b...|c-
45~~c-36|
|dataset_outlier_3|2018-02-24|  100|1f96274d1d10c9f77...|c-
45~~c-35|
|dataset_outlier_3|2018-02-24|  100|051532044be286f99...|c-
45~~c-44|
|dataset_outlier_3|2018-02-24|  100|af2e96921ae53674a...|c-
45~~c-43|
|dataset_outlier_3|2018-02-24|  100|ad6f04bf98b38117a...|c-
45~~c-42|
|dataset_outlier_3|2018-02-24|  100|1ff7d50a7a9d07d02...|c-
45~~c-41|
|dataset_outlier_3|2018-02-24|  100|6ed858ed1f4178bb0...|c-
45~~c-40|
|dataset_outlier_3|2018-02-24|  100|d2903703b348fb4cb...|c-
45~~c-39|
|dataset_outlier_3|2018-02-24|  100|24bf54412de1e720d...|c-
45~~c-38|
|dataset_outlier_3|2018-02-24|  100|7a7ce0beb41b39564...|c-
45~~c-37|
+-----------------+----------+-----+--------------------+-------
---+
```

getRuleBreaks()

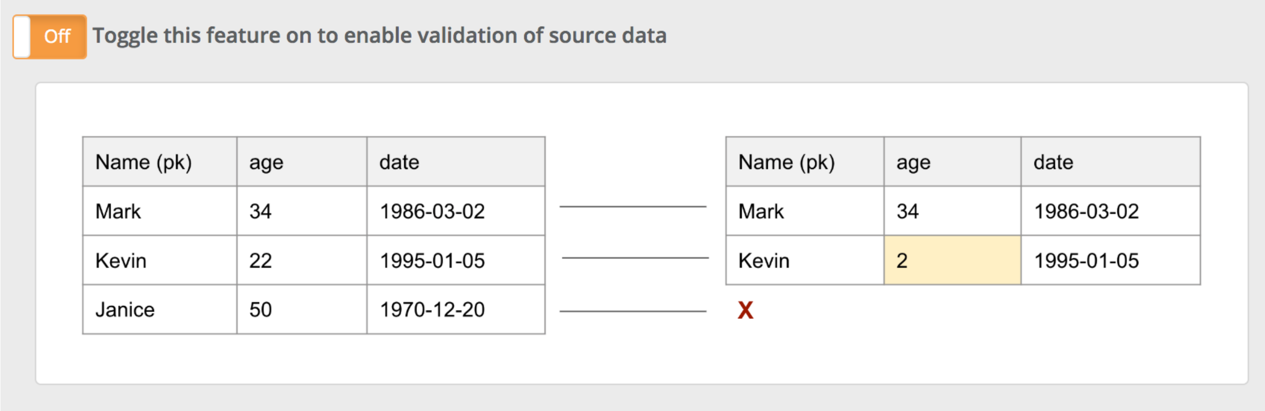
The getRuleBreaks endpoint retrieves all broken records within your data set. There is no size limit to this API.

```
----Rule-Breaks----
+-----------------+----------+--------------------+------+
|          dataset|     runId|              ruleNm|linkId|
+-----------------+----------+--------------------+------+
|dataset_outlier_3|2018-02-24|     fname_like_Kirk|  c-41|
|dataset_outlier_3|2018-02-24|     fname_like_Kirk|  c-42|
|dataset_outlier_3|2018-02-24|     fname_like_Kirk|  c-43|
|dataset_outlier_3|2018-02-24|     fname_like_Kirk|  c-44|
|dataset_outlier_3|2018-02-24|     fname_like_Kirk|  c-45|
|dataset_outlier_3|2018-02-24|if_email_is_valid...|  c-31|
|dataset_outlier_3|2018-02-24|if_email_is_valid...|  c-33|
|dataset_outlier_3|2018-02-24|if_zip_is_valid_Z...|  c-40|
+-----------------+----------+--------------------+------+
```

DQ Job Validate Source

Reconciliation

Commonly data driven organizations have a need to ensure that two tables or a table and file match. This match might be a daily reconciliation or any snapshot in time. Collibra DQ calls this Source to Target or Left to Right matching. It covers row differences, schema differences and all cell values.



Off Toggle this feature on to enable validation of source data

Name (pk)	age	date
Mark	34	1986-03-02
Kevin	22	1995-01-05
Janice	50	1970-12-20

Name (pk)	age	date
Mark	34	1986-03-02
Kevin	2	1995-01-05

Impala/Hive -> DB2

Below is an example of comparing a table in DB2 to the same table in Impala.

```
./owlcheck \
-lib "/home/install/owl/drivers/db2" \
-cxn db2 \
-q "select * from OWLDB2.NYSE_STOCKS where TRADE_DATE = '${rd}'
" \
-ds NYSE_STOCKS_VS \
-rd "2018-01-10" \
-vs \
-valsrckey SYMBOL \
-validatevalues \
-h $host/owltrunk \
-srcq "select * from nyse where TRADE_DATE = '${rd}' " \
-srccxn impala-jdbcuser \
-libsrc /home/isntall/owl/drivers/hivedrivers \
-jdbcprinc jdbcuser@CW.COM -jdbckeytab /tmp/jdbcuser.keytab \
-owluser admin \
-executorcores 4 -numexecutors 6 -executormemory 4g -driver-
memory 4g -master yarn -deploymode cluster \
-sparkkeytab /home/install/owl/bin/user2.keytab \
-sparkprinc user2@CW.COM
```

DB2 -> Hive (Native)

Most databases only expose data through a JDBC connection but Hive offers a second path which does not require a JDBC connection. Hive has the ability to push down its processing to the local worker nodes and read directly from disk in the case when the processing is happening locally on a cluster. If your processing is not happening local to the cluster then you must use HiveJDBC. Take note of the -hive flag.

```
./owlcheck \
-hive \
-q "select * from nyse" \
-ds hiveNativeNyse \
-rd "2019-10-01" \
-vs \
-valsrckey exch,symbol,trade_date \
-validatevalues \
-srcq "select * from OWLDB2.NYSE_STOCKS" \
-srccxn db2 -libsrc /home/install/owl/drivers/db2 \
-numexecutors 2 -executormemory 5g -drivermemory 4g -master yarn
-deploymode cluster \
-sparkkeytab /home/install/owl/bin/user2.keytab -sparkprinc
user2@CW.COM
```

MySQL -> Oracle

This example compares the entire table instead of just a single day. Notice the 3 part valsrckey EXCH,SYMBOL,TRADE_DATE. Adding the date field ensures our key is unique and won't create a cartesian product. If the goal was to compare day over day with Oracle make sure to add TO_DATE('YYYY-MM-DD', '2019-10-01') to the where clause.

```
./owlcheck \
-lib /home/install/owl/drivers/mysql/ \
-cxn mysql \
-q "select * from lake.nyse" \
-ds lake.nyse \
-rd 2019-10-01 \
-vs \
-valsrckey EXCH,SYMBOL,TRADE_DATE \
-validatevalues \
-sparkkeytab /home/install/owl/bin/user2.keytab \
-sparkprinc user2@CW.COM \
-srcq "select * from SYSTEM.NYSE" \
-srccxn oracle \
-libsrc /home/danielrice/owl/drivers/oracle/
-numexecutors 2 -executormemory 5g -drivermemory 4g -master yarn
-deploymode cluster \
```

File -> MySQL Table

Taking a file and loading it into a staging table or final table is a common part of every ETL process. However it is extremely common that the file values do not match or coherence into the table properly and these silent errors are usually not caught until a business user sees the data far long down stream.

```
./owlcheck \
-ds lake.nyse \
-rd 2019-10-01 \
-cxn "mysql" \
-q "select * from lake.nyse" \
-vs \
-valsrckey EXCH,SYMBOL,TRADE_DATE \
-validatevalues \
-srcfile "hdfs:///user/source/nyse.csv" \
-srcd "," \
-lib /home/install/owl/drivers/mysql/ \
-sparkkeytab /home/install/owl/bin/user2.keytab \
-sparkprinc user2@CW.COM \
-numexecutors 2 -executormemory 5g -drivermemory 4g -master yarn
-deploymode cluster \
```

File -> File

DQ compares a File to a File. This is common in landing zones and staging areas where a file might be moved or changed and you need to know if anything changed or is incorrect.

```
./owlcheck \
-ds lake.nyse \
-rd 2019-10-01 \
-f "hdfs:///user/target/nyse.csv" \
-d "," \
-vs \
-valsrckey EXCH,SYMBOL,TRADE_DATE \
-validatevalues \
-srcfile "hdfs:///user/source/nyse.csv" \
-srcd "," \
-sparkkeytab /home/install/owl/bin/user2.keytab \
-sparkprinc user2@CW.COM \
-numexecutors 2 -executormemory 5g -drivermemory 4g -master yarn
-deploymode cluster \
```

DQ Job 43M rows

Collibra DQ commonly benchmarks on large daily datasets. In this case, a 43 million row table with 12 columns completes in under 6 mins (5:30). The best balance for this dataset was 3 executors each with 10G of ram.

```
./owlcheck \
-u user -p password \
-c jdbc:mysql://owldatalake.chzid9w0hpyi.us-east-1.rd-
s.amazonaws.com:3306 \
-q "select * from silo.account_large where acc_upd_ts > '2018-
02-01 05:0:00'" \
-rd 2019-02-02 \
-ds account_large \
-dc acc_upd_ts \
-corroff \
-histoff \
-driver com.mysql.cj.jdbc.Driver \
-lib "/home/ec2-user/owl/drivers/mysql/" \
-master yarn \
-deploymode client \
-numexecutors 3 \
-executormemory 10g \
-histoff -corroff -loglevel DEBUG -readonly
```

> **Note** *Not all DQ features were turned on during this run. On large datasets it is worth it to consider limiting the columns, DQ-features, or lookbacks if they are not of interest.*

Add Date Column

Example

```
./owlcheck \
-ds "datataset_date_column" \
-rd "2019-07-01" \
-f "/Users/Downloads/csv2/2019010.csv" \
-adddc
```

> **Note** Add date column will use the run date supplied and add a date column named **DQ_RUN_ID**.

```
-adddc
```

This is used when you are using datasets that do not contain a date column or a malformed date string.

Known Limitations

This feature is only available for files, not for database tables.

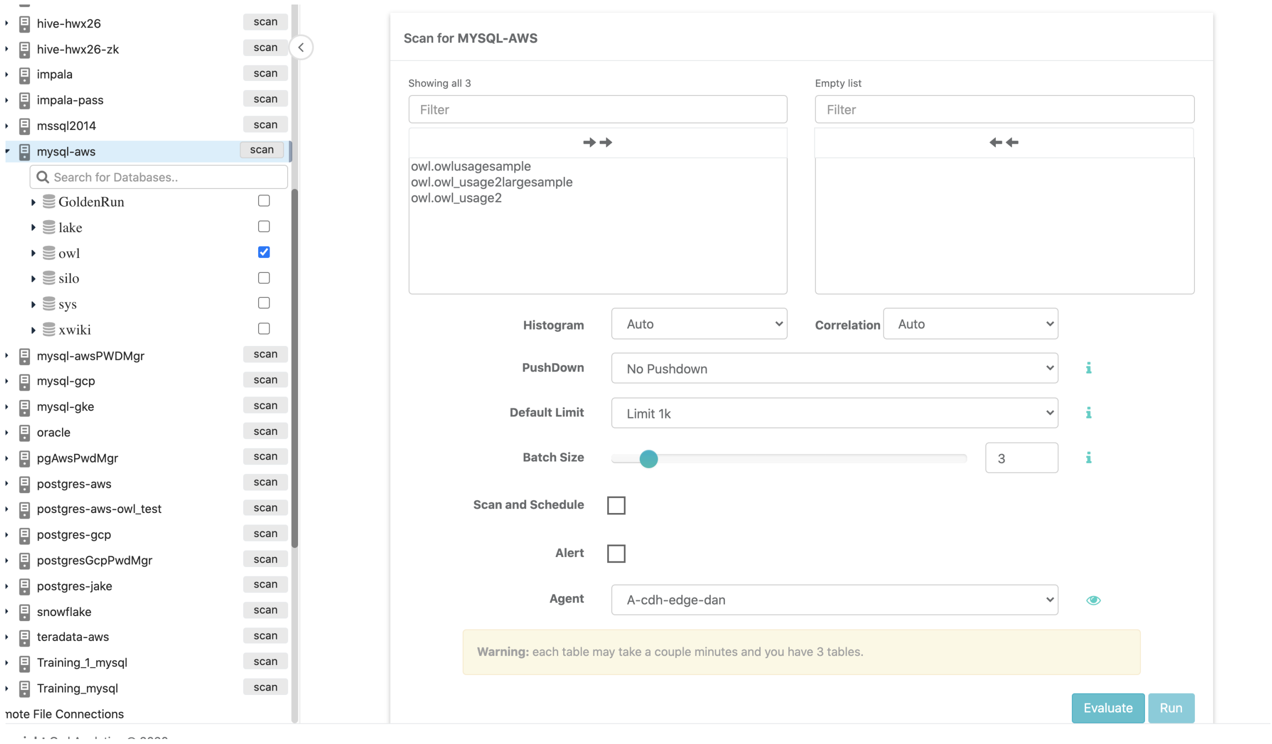
AutoProfile

AutoProfile allows you to select a set of databases and tables to quickly be cataloged. Each selected table will be profiled and added to the Collibra DQ Catalog via the selected agent. Various parameters like Alerts, Job Schedules, limits, and more can also be set.

When you expand a datasource in the **Explorer** page, you're given a list of possible databases and their associated tables. **AutoProfile** is triggered when you select the ones you want and hit scan. This will take you to a separate page that allows you to configure the various AutoProfile parameters.

A SparkSubmit will be launched for each table, so make sure the agent configuration is reasonable and the box has enough resources to handle each job.

Global Parameters



hive-hwx26 scan
hive-hwx26-zk scan
impala scan
impala-pass scan
mssql2014 scan
mysql-aws scan
Search for Databases..
GoldenRun □
lake □
owl ☑
silo □
sys □
xwiki □
mysql-awsPWDMgr scan
mysql-gcp scan
mysql-gke scan
oracle scan
pgAwsPwdMgr scan
postgres-aws scan
postgres-aws-owl_test scan
postgres-gcp scan
postgresGcpPwdMgr scan
postgres-jake scan
snowflake scan
teradata-aws scan
Training_1_mysql scan
Training_mysql scan
note File Connections

Scan for MYSQL-AWS

Showing all 3
Filter
owl.owlusagesample
owl.owl_usage2largesample
owl.owl_usage2

Empty list
Filter

Histogram: Auto
Correlation: Auto
PushDown: No Pushdown
Default Limit: Limit 1k
Batch Size: 3
Scan and Schedule □
Alert □
Agent: A-cdh-edge-dan

Warning: each table may take a couple minutes and you have 3 tables.

Histogram and **Correlation**: Enable or Disable

PushDown: Set metrics that will be run against the entire table, ignoring limit values.

Default Limit: The default row limit to set for each table to be scanned.

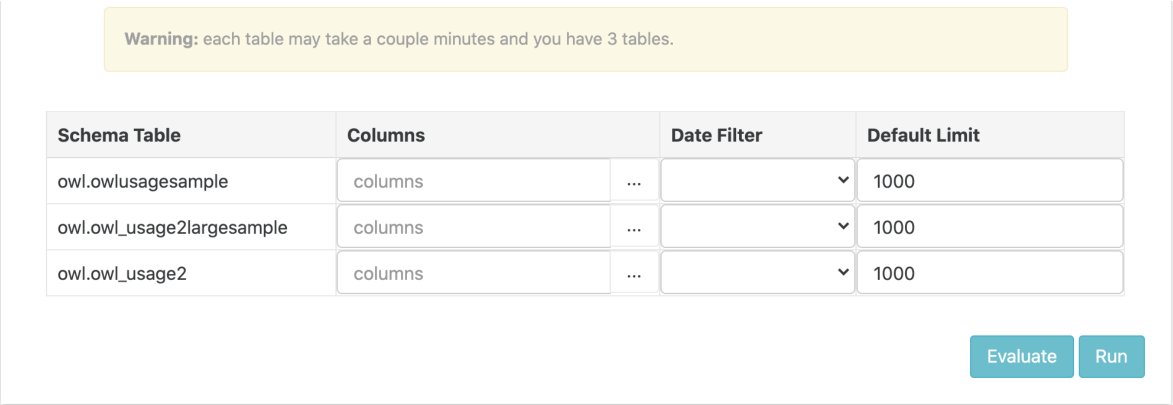
Batch Size: The number of concurrent SparkSubmit jobs the agent will be allowed to run.

Scan and Schedule : Enable scheduling.

Alert: Enable email alerts.

Agent: The agent under which jobs will run.

Per Table Parameters



Warning: each table may take a couple minutes and you have 3 tables.

Schema Table	Columns		Date Filter	Default Limit
owl.owlusagesample	columns	...		1000
owl.owl_usage2largesample	columns	...		1000
owl.owl_usage2	columns	...		1000

Columns: The columns to select from (if none are specified, we assume all columns to be selected).

Date Filter: The date column to be used as the `runDate` parameter when the job runs.

Default Limit: Per table limits.

Cloudera CLASSPATH

What is a CLASSPATH?

A CLASSPATH is essentially a list of jars that get injected into a JVM on the start of a job execution. Like many applications, Spark can have jars injected when a job is run. Cloudera has defined a list of predefined jars (rightfully called classpath.txt):

```
/etc/spark2/conf/classpath.txt
```

That will get injected whenever Spark is called. Here is an example list of jars as defined within a cluster we have stood up @ Collibra DQ:

```
[danielrice@cdh-edge ~]$ cat /etc/spark2/conf/classpath.txt
/opt/cloudera/parcels/CDH-5.16.1-1.cd-
h5.16.1.p0.3/jars/activation-1.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cd-
h5.16.1.p0.3/jars/aopalliance-1.0.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/apacheds-
i18n-2.0.0-M15.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/apacheds-
kerberos-codec-2.0.0-M15.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/api-asn1-
api-1.0.0-M20.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/api-util-
1.0.0-M20.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/asm-3.2.-
jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/avro-
1.7.6-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/aws-java-
sdk-bundle-1.11.134.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/azure-
data-lake-store-sdk-2.2.9.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/commons-
beanutils-1.9.2.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/commons-
beanutils-core-1.8.0.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/commons-
codec-1.4.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/commons-
codec-1.9.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/commons-
configuration-1.6.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/commons-
daemon-1.0.13.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/commons-
digester-1.8.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/commons-
el-1.0.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/commons-
logging-1.2.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/commons-
math-2.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/commons-
math3-3.1.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/commons-
net-3.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/core-
3.1.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/curator-
client-2.7.1.jar
```

```
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/curator-
framework-2.7.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/curator-
recipes-2.7.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cd-
h5.16.1.p0.3/jars/disruptor-3.3.0.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/findbugs-
annotations-1.3.9-1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/guava-
11.0.2.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/guava-
12.0.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/guice-
3.0.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
annotations-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
ant-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
archive-logs-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
archives-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
auth-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
aws-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
azure-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
azure-datalake-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
common-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
datajoin-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
distcp-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
extras-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
gridmix-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
hdfs-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
hdfs-nfs-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
mapreduce-client-app-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
mapreduce-client-common-2.6.0-cdh5.16.1.jar
```

```
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
mapreduce-client-core-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
mapreduce-client-hs-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
mapreduce-client-hs-plugins-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
mapreduce-client-jobclient-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
mapreduce-client-nativetask-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
mapreduce-client-shuffle-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
mapreduce-examples-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
nfs-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
openstack-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
rumen-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
sls-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
streaming-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
yarn-api-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
yarn-applications-distributedshell-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
yarn-applications-unmanaged-am-launcher-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
yarn-client-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
yarn-common-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
yarn-registry-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
yarn-server-applicationhistoryservice-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
yarn-server-common-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
yarn-server-nodemanager-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
yarn-server-resourcemanager-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hadoop-
yarn-server-web-proxy-2.6.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hamcrest-
core-1.3.jar
```

```
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hbase-annotations-1.2.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hbase-client-1.2.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hbase-common-1.2.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hbase-examples-1.2.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hbase-external-blockcache-1.2.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hbase-hadoop-compat-1.2.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hbase-hadoop2-compat-1.2.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hbase-it-1.2.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hbase-prefix-tree-1.2.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hbase-procedure-1.2.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hbase-protocol-1.2.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hbase-resource-bundle-1.2.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hbase-rest-1.2.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hbase-rsgroup-1.2.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hbase-server-1.2.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hbase-shell-1.2.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hbase-thrift-1.2.0-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/high-scale-lib-1.1.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hsqldb-1.8.0.10.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/htrace-core-3.2.0-incubating.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/htrace-core4-4.0.1-incubating.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/httpclient-4.2.5.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/httpcore-4.2.5.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/hue-plugins-3.9.0-cdh5.16.1.jar
```

```
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/jackson-
annotations-2.2.3.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/jackson-
core-2.2.3.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/jackson-
core-asl-1.8.10.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/jackson-
databind-2.2.3-cloudera.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/jackson-
jaxrs-1.8.10.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/jackson-
mapper-asl-1.8.10-cloudera.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/jackson-
xc-1.8.10.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/jamon-
runtime-2.4.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/jasper-
compiler-5.5.23.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/jasper-
runtime-5.5.23.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/java-xml-
builder-0.4.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cd-
h5.16.1.p0.3/jars/javax.inject-1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/jaxb-api-
2.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/jaxb-api-
2.2.2.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/jaxb-
impl-2.2.3-1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/jcodings-
1.0.8.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/jets3t-
0.9.0.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/jettison-
1.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/jettison-
1.3.3.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/jline-
2.11.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/joni-
2.1.2.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/jruby-
cloudera-1.0.0.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/jsch-
0.1.42.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/jsp-2.1-
6.1.14.jar
```

```
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/jsp-api-
2.1-6.1.14.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/jsp-api-
2.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/jsr305-
3.0.0.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cd-
h5.16.1.p0.3/jars/leveldbjni-all-1.8.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/log4j-
1.2.16.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/log4j-
1.2.17.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/metrics-
core-2.2.0.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/metrics-
core-3.0.2.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cd-
h5.16.1.p0.3/jars/microsoft-windowsazure-storage-sdk-0.6.0.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/mockito-
all-1.8.5.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/netty-
3.10.5.Final.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/netty-
all-4.0.50.Final.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/okhttp-
2.4.0.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/okio-
1.4.0.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cd-
h5.16.1.p0.3/jars/paranamer-2.3.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/protobuf-
java-2.5.0.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/slf4j-
api-1.7.5.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/slf4j-
log4j12-1.7.5.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/snappy-
java-1.0.4.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/spark-
1.6.0-cdh5.16.1-yarn-shuffle.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cd-
h5.16.1.p0.3/jars/spymemcached-2.11.6.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/stax-api-
1.0-2.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cd-
h5.16.1.p0.3/jars/xercesImpl-2.9.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/xml-apis-
1.3.04.jar
```

```
/opt/cloudera/parcels/CDH-5.16.1-1.cdh5.16.1.p0.3/jars/xmlenc-
0.52.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cd-
h5.16.1.p0.3/jars/zookeeper-3.4.5-cdh5.16.1.jar
/opt/cloudera/parcels/CDH-5.16.1-1.cd-
h5.16.1.p0.3/lib/hadoop/LICENSE.txt
/opt/cloudera/parcels/CDH-5.16.1-1.cd-
h5.16.1.p0.3/lib/hadoop/NOTICE.txt
/usr/java/jdk1.8.0_131/lib/tools.jar
```

At each execution of any Spark job (including the use of spark-submit) this list of jars above will automatically get loaded.

What is a JAR?

A jar file is essential a compressed list of classes and methods. It is important to note that when jar files are built they will typically have an associated version number.

Someone can look at the contents of a jar file by executing:

```
jar -tvf phoenix-4.13.1-HBase-1.3-client.jar
```

Or you can wrap the above in a for loop that will look at the contents of every jar that might contain a method you are looking for.

```
for i in `ls -1 *.jar`;do jar -tvf $i | grep -i
htrace/trace;echo $i;done;
```

Common issues that can occur with CLASSPATH's

> **Note** **Caused by: java.lang.NoClassDefFoundError: org/apache/htrace/Trace** at org.apache.hadoop.hbase.zookeeper.RecoverableZooKeeper.exists (RecoverableZooKeeper.java:218) at org.apache.hadoop.hbase.zookeeper.ZKUtil.checkExists(ZKUtil.java:481) at org.apache.hadoop.hbase.zookeeper.ZKClusterId.readClusterIdZNode (ZKClusterId.java:65) at org.apache.hadoop.hbase.client.ZooKeeperRegistry.getClusterId (ZooKeeperRegistry.java:86) at org.apache.hadoop.hbase.client.ConnectionManager$HConnectionImplementation.retrieveClusterId(ConnectionManager.java:850) at org.apache.hadoop.hbase.client.ConnectionManager$HConnectionImplementation.<init>(ConnectionManager.java:635)

When a situation like this occurs it means that a method cannot be found in the classpath for the job that is trying to execute. This can indicate a couple things:

1. The job cannot find a jar file that contains the method flagged (in the example above the org/apache/htrace/Trace method).
2. Sometimes different versions of the same jar file gets loaded and the first jar loaded will always win. Older jars that get loaded first may not have a method defined in new jars.

At DQ, we have solved CLASSPATH / CLASSLOAD issues by automatically injecting jars defined in our ***owl/libs*** directory, and allowing users the ability to simply toggle loading them or not.

Column Matching

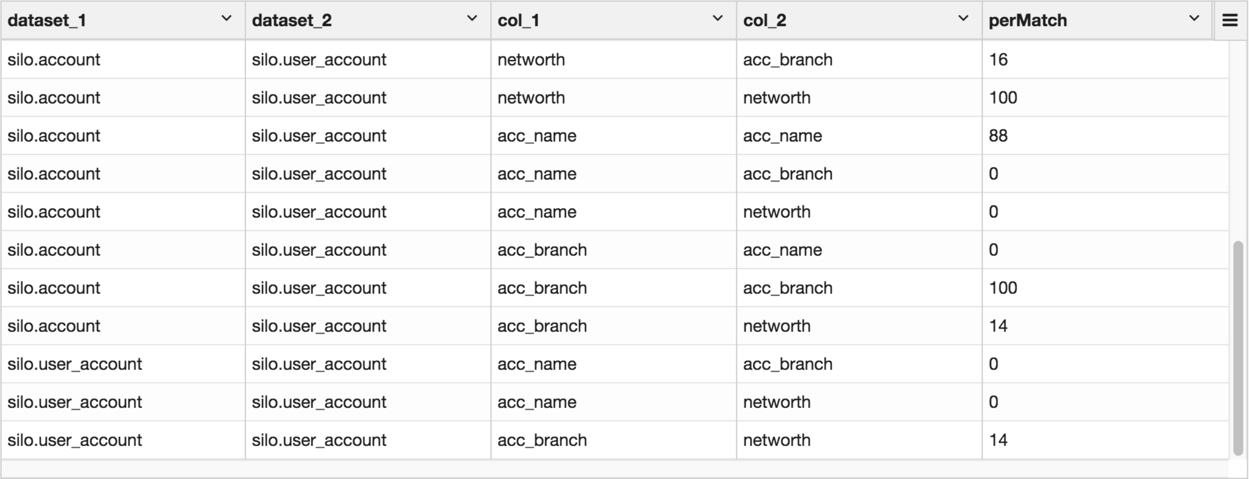
How much is your redundant data costing you?

Reclaim Gigabytes of Redundant Data

As data engineers, first we copy files into a landing zone, next we load the files into a staging area. After that we transform (ETL) the data into the final table. Soon that same data is copied to a lake for other groups to run analytics on. Eventually a group of analysts will need the data in another format and a data engineer will copy the data in a newly joined or transposed fashion. Sounds familiar?

The result is the same data or similar columns of the same data being copied many times. **The answer**: *Buy more hardware*... could be OR *run a Collibra DQ health report* and gain an understanding of how much data could be removed, reclaiming disk space and instantly seeing a return on investment after clicking the button.

Tabular breakdown of percentage of fingerprint matches

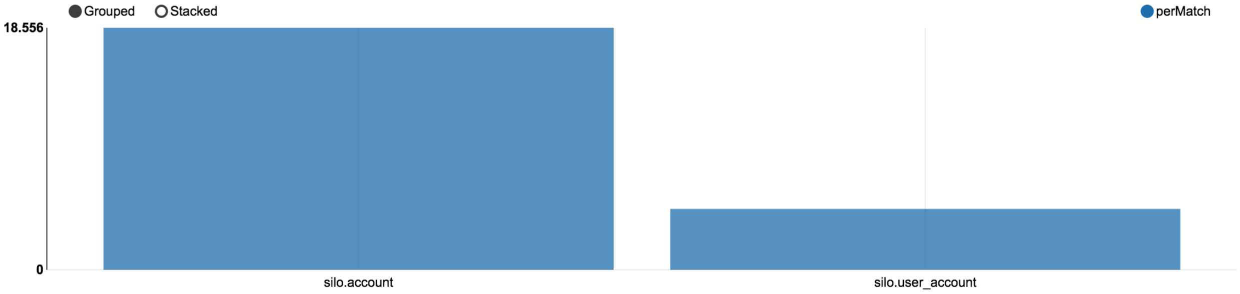


dataset_1	dataset_2	col_1	col_2	perMatch
silo.account	silo.user_account	networth	acc_branch	16
silo.account	silo.user_account	networth	networth	100
silo.account	silo.user_account	acc_name	acc_name	88
silo.account	silo.user_account	acc_name	acc_branch	0
silo.account	silo.user_account	acc_name	networth	0
silo.account	silo.user_account	acc_branch	acc_name	0
silo.account	silo.user_account	acc_branch	acc_branch	100
silo.account	silo.user_account	acc_branch	networth	14
silo.user_account	silo.user_account	acc_name	acc_branch	0
silo.user_account	silo.user_account	acc_name	networth	0
silo.user_account	silo.user_account	acc_branch	networth	14

Sometimes its not as simple as comparing two tables from the same database. DQ allows a technical user to setup multiple DB connections before executing an owl health check.

```
import com.owl.common.Props
import com.owl.core.Owl

val c1 = new Connection()
c1.dataset = "silo.account"
c1.user = "user"
c1.password = "pass"
c1.query = "select id, networth, acc_name, acc_branch from silo.account limit 200000"
c1.url = "jdbc:mysql://owldatalake.chzid9w0hpyi.us-east-1.rds.amazonaws.com:3306"

val c2 = new Connection()
c2.dataset = "silo.user_account"
c2.user = "user"
c2.password = "pass"
c2.query = "SELECT acc_name, acc_branch, networth FROM silo.account limit 200000"
c2.url = "jdbc:mysql://owldatalake.chzid9w0hpyi.us-east-1.rds.amazonaws.com:3306"

val props = new Props()
props.dataset = "colMatchTest1"
props.runId = "2017-02-04"
props.connectionList = List(c1,c2).asJava
props.colMatchBatchSize = 2
props.colMatchDurationMins = 3

val matchDF = new Owl(props).colMatchDF
matchDF.show

matchDF.createOrReplaceTempView("matches")
```

High level view of data overlap



Date Time Variable Options

Benefit: Enhanced query and file date templating and variable options. This allows easier scheduling and programmatic templating for common date variables.

Key	Function
$	replaces with -rd values in CMD, e.g. 2021-09-01
$	replaces with -rdEnd values in CMD
$	replaces with 4 digit year portion of -rd values in CMD, e.g. 2021
$	replaces with 2 digit year portion of -rd values in CMD, e.g. 21
$	replaces with 1 digit month portion of -rd values in CMD
$	replaces with 2 digit month portion of -rd values in CMD
$	replaces with 3 letter month name portion of -rd values in CMD, e.g. Jan, Jul, Dec
$	replaces with long month name portion of -rd values in CMD, e.g. January, July, December
$	replaces with 1 digit day portion of -rd values in CMD
$	replaces with 2 digit day portion of -rd values in CMD
$	replaces with 2 digit hour portion of -rd values in CMD
$	replaces with 1 digit hour portion of -rd values in CMD
$	replaces with 2 digit minute portion of -rd values in CMD
$	replaces with 2 digit second portion of -rd values in CMD

Deploy Mode

Yarn and Cluster

Deploy Mode Client

```
--deploy-mode client
```

Deploy Mode Cluster

```
--deploy-mode cluster
```

Job Stuck in ACCEPTED State

yarn.Client: Application report for application_1557720962505_0085 (state: ACCEPTED)
yarn.Client: Application report for application_1557720962505_0085 (state: ACCEPTED).

If running in cluster mode make sure you are passing in the below.

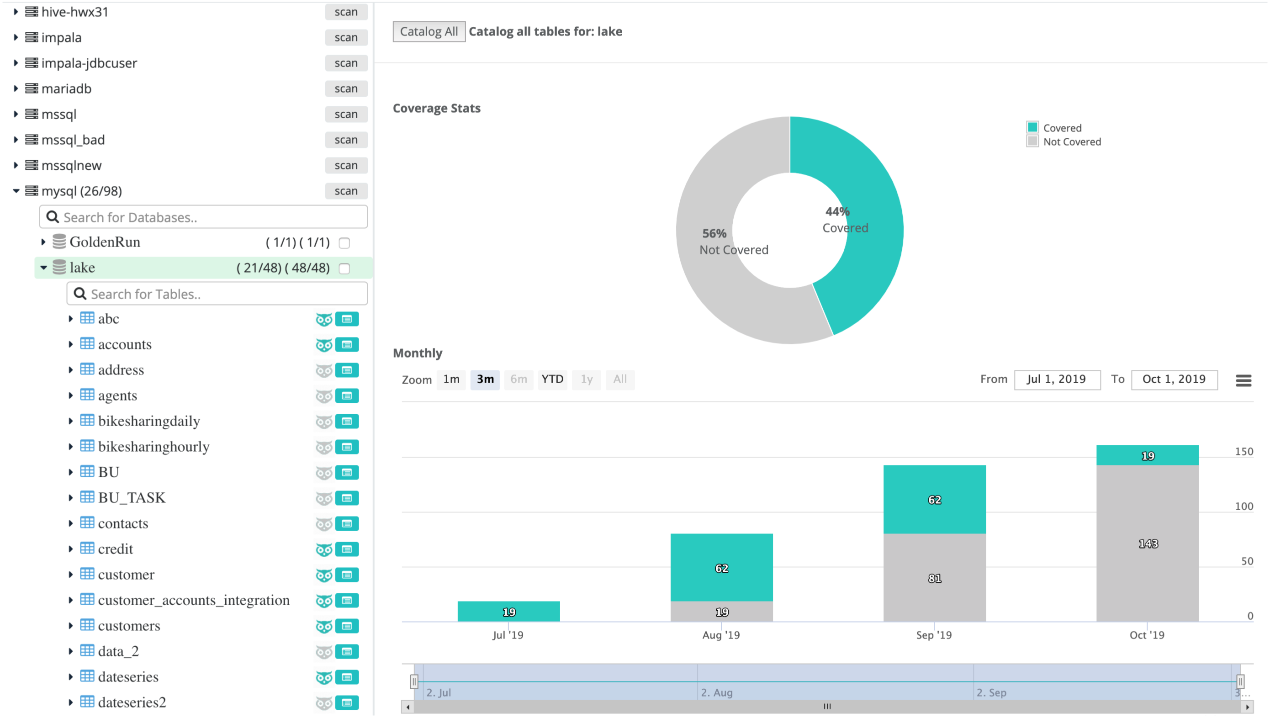
```
--deploy-mode cluster
--master yarn          # or spark master
-h 123.45.6.77:2181    # host to owl metastore
```

Explorer (advanced)

Explore Database Connections and File Systems

Use the explorer tab to quickly see which tables are cataloged with Collibra DQ (the square catalog icon) and which have DQ's quality protection (the DQ icon).

Below you will see 48/48 database tables have been cataloged with DQ but only 21/48 have an DQCheck. This means that this particular database schema is 44 percent protected from future DQ issues.



DQ coverage over time

As you add more datasets to Collibra DQ, you will see your bar chart increase over time and the donut chart fill in with more coverage.

Job Estimator

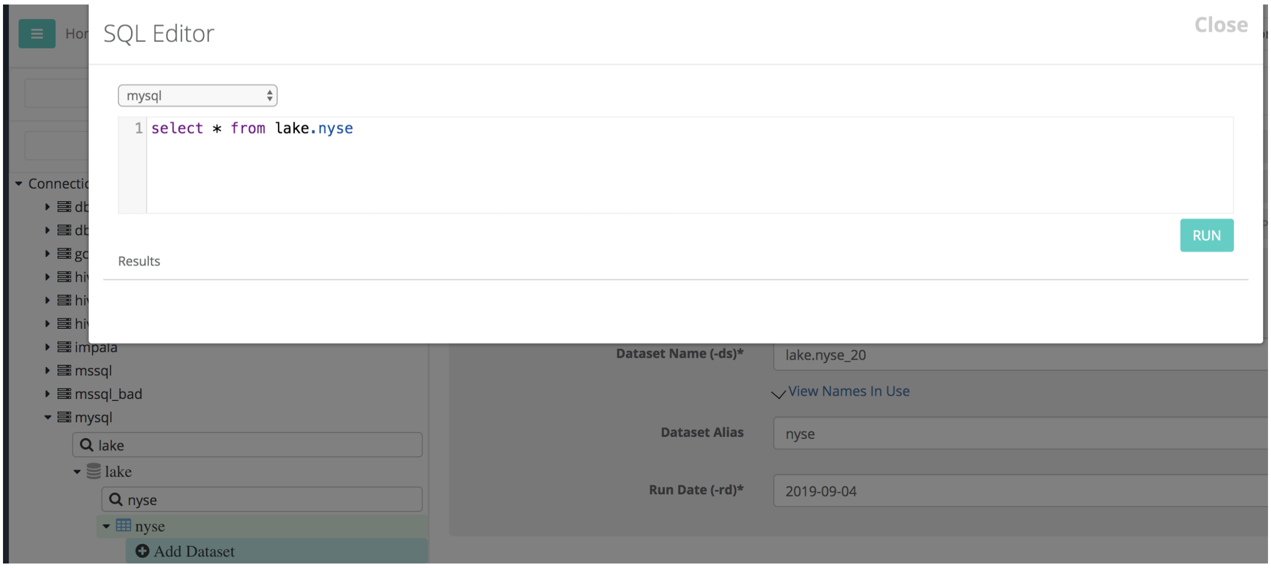
Before firing off a large ML job it can be helpful to understand the amount of cores and ram that the job requires to run efficiently. Right sizing jobs is often the best way to get the best performance out of each run. Click the [Auto Estimate] button for quick stats for both sizing and estimated runtime information.

Dynamic allocation

Many clusters offer the ability to scale up and down job containers. If Dynamic Allocation is turned on you may not need or desire DQ's recommended `num-executors` or `executor-memory`. However, in our testing right sizing the job before executing is both faster and a healthy habit. Faster, because there is less orchestration and context switching while the job is doing work; we've minimized time spent running out of space and having to reallocate and shuffle to a new container. Healthier, because it give the user real-time feedback on the cost of each feature and the ability to control the cost benefit analysis.

SQL Editor

Automatically tracks to the connection, database and table in the explorer and provides a quick way to ask the database simple questions like, counts, groupings and specific clauses.



```
select * from lake.nyse
```

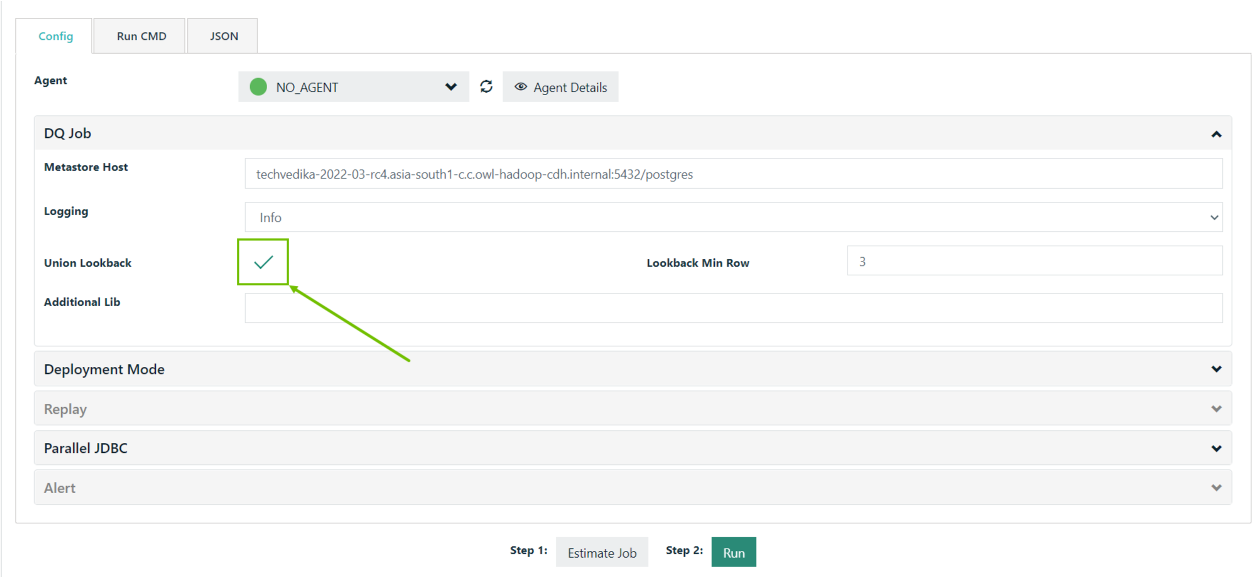
Dataset Name (-ds)* lake.nyse_20

Dataset Alias nyse

Run Date (-rd)* 2019-09-04

File Look Back

As of 2021.11, this option is exposed in the Explorer under the Collibra DQ Job section. Users can persist (save) this option by clicking the Union Lookback checkbox.



Metastore Host: techvedika-2022-03-rc4.asia-south1-c.c.owl-hadoop-cdh.internal:5432/postgres

Logging: Info

Union Lookback: ✓

Lookback Min Row: 3

Additional Lib:

Union Lookback (-fllb)

Union Lookback, or File Lookback (-fllb) as it is also known, is used with deep learning or pattern matching. In the example below, it is used with deep learning.

File Lookback is used to check DQ Check history for previous files.

```
-fllb
```

This is often used with files and in conjunction with -adddc in cases where a date column is not in an ideal format or you do not have a date column on the given dataset.

Despite the name, this can be used with file or database storage formats.

> **Note** File look back (-fllb) should only be used when a SQL layer is not available. This is considered for advanced use cases, but may not be suitable for all file types and folder structures. Best practice is to expose a date signature somewhere in the file or directory naming convention.

Example

```
-ds "demo_lookback" \
-rd "2017-07-29" \
-lib "/opt/owl/drivers/mysql" \
-cxn "mysql" \
-q "select  * from lake.dateseries where DATE_COL = '2017-07-29'
" \
-dc DATE_COL \
-dl \
-dlkey sym \
-dllb 4 \
-fllb
```

> **Note** This look back will load your past 4 runs as your historical training set

Fullfile Lookback (-fullfile)

Like Union Lookback, Fullfile Lookback (-fullfile) is used with deep learning and pattern matching.

Fullfile Lookback uses the entire file for lookbacks instead of just filequery.

—

Filter & Filter Not

Filter & Filter Not is similar to a grep for limiting a dataframe to rows containing a substring.

> **Note** This feature should only be used when -q (query) and -fq (filequery) are not applicable. This feature is primarily used with raw files for limited filtering and not advanced conditional logic.

Example

```
./owlcheck \
-ds "dataset_name" \
-rd "2018-07-23 10" \
-d "," \
-f "/Users/Documents/file.csv" \
-filter "2018-07-23"
```

> **Note** **-filter "2018-07-23"**
> If file.csv contained multiple strings, but you only wanted rows containing "2018-07-23".

The inverse

> **Note** **-filternot "2018-07-23"**
> To exclude rows containing "2018-07-23".

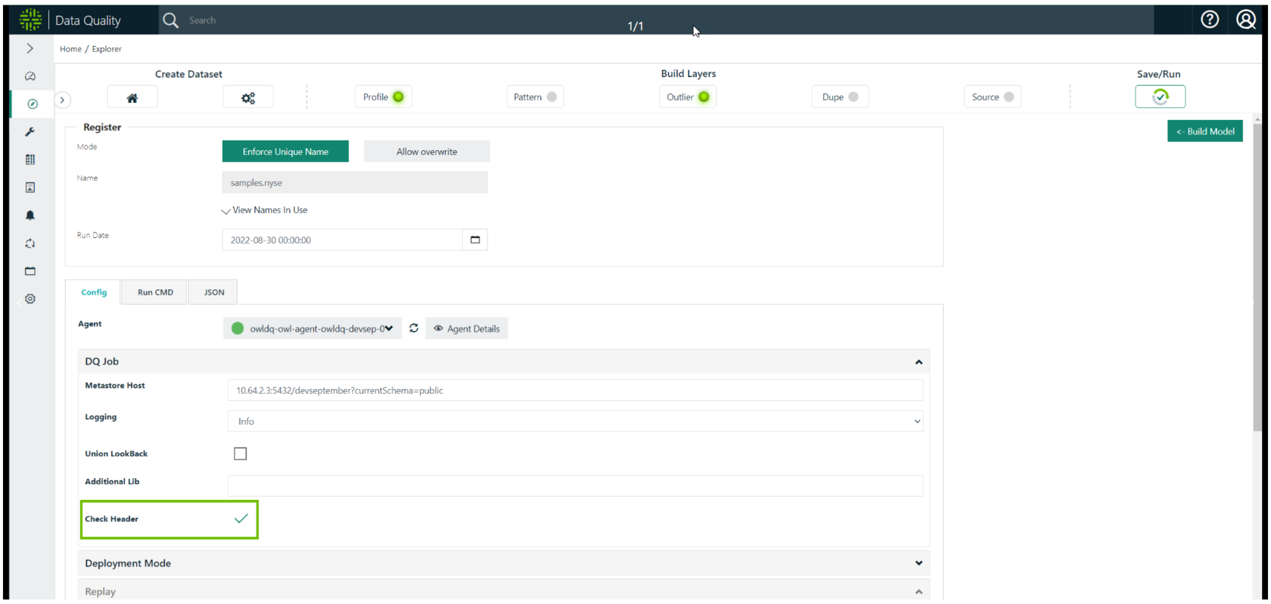
Header Check

Header Check lets you toggle column name detection on and off so column names containing special characters are not detected as schema changes. This is configurable with the **Check Header** checkbox or from the command line.

Configuring with the Check Header checkbox

The Check Header checkbox is checked by default. When it is checked, schema findings do not display when detected.

To disable the header check, uncheck the Check Header checkbox. This allows the schema findings to display when detected.



Register

Mode: Enforce Unique Name

Name: samples.nyse

Run Date: 2022-08-30 00:00:00

Agent: owldq-owl-agent-owldq-devsep-0

DQ Job

Metastore Host: 10.64.2.3:5432/devseptember?currentSchema=public

Logging: Info

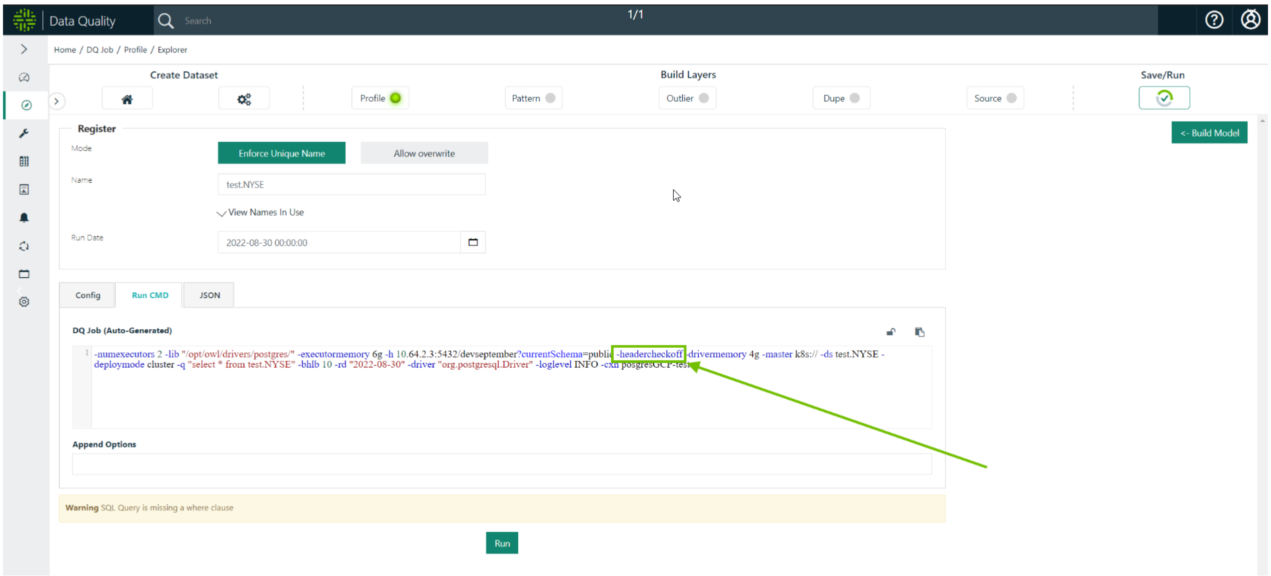
Union LookBack: □

Additional Lib:

Check Header: ✓

Configuring from the command line

Header checks are enabled by default and do not appear in the command line when enabled. To disable header checks from the command line, click the lock icon to unlock the command line and use the -headercheckoff variable, as shown in the screenshot below. When you are done editing the command line, click the lock icon again to lock the command line; then, click **Run**.



Register

Mode: Enforce Unique Name

Name: test.NYSE

Run Date: 2022-08-30 00:00:00

DQ Job (Auto-Generated)

```
-numexecutors 2 -lib "/opt/owl/drivers/postgres/" -executormemory 6g -h 10.64.2.3:5432/devseptember?currentSchema=public -headercheckoff -drivermemory 4g -master k8s:// -ds test.NYSE -deploymode cluster -q "select * from test.NYSE" -bhlb 10 -rd "2022-08-30" -driver "org.postgresql.Driver" -loglevel INFO -cxn posgresGCP-test
```

Append Options

Warning SQL Query is missing a where clause

Multiple Pattern Relationships

Run more than one relationship through pattern matching.

Example

```
./owlcheck \
-ds "fpg_multiple" \
-rd "2018-10-04" \

-cxn "postgres" \
-lib   "/opt/owl/drivers/postgres/" \
-q "select * from public.fpg_accounts where d_date = '2018-10-
04'" \

-fpgon \
-fpgdc "d_date" \
-fpglb "4" \
-fpgmulti "id,ssn_num=first_name,email|id,ssn_num=first_name,-
gender|id,ssn_num=last_name"
```

> **Note** Instead of -fpgkey and -fpgcol
> key1=cols1|keys2=cols2
> Enter multiple key=cols combinations separated by a pipe.

```
-fpgmulti "id,ssn_num=first_name,email|id,ssn_num=first_name,-
gender"
```

Nulls in Datasets

Example

```
./owlcheck \
-ds "datataset_date_column" \
-rd "2019-07-01" \
-f "/Users/Downloads/csv2/2019010.csv" \
-zfn \
-nulls "N.A."
```

Zero if null will replace null values with zero.

```
-zfn
```

To replace characters that represent a null to actual null values.

```
-nulls "N.A."
```

Spark-shell Sample

```
./bin/spark-shell --jars /opt/owl/bin/owl-core-trunk-jar-with-dependencies.jar,/opt/owl/drivers/postgres/postgresql-42.2.5.jar --deploy-mode client --master local[*]
```

Import lib's, if you get a dependency error, please import a second time.

```
import com.owl.core.util.{OwlUtils, Util}

import com.owl.common.domain2.OwlCheckQ

import com.owl.common.options._
```

Set up connection parameters to the database we want to scan if you don't already have a dataframe.

```
val`` ``url`` ``= "jdbc:postgresql://xxx.xxx.xxx.xxx:xxxx/db?currentSchema=schema"
val`` ``connProps``=``Map("driver" -> "org.postgresql.Driver","user" -> "user","password" -> "pwd","url" ->`` ``url,"dbtable" -> "db.table")
```

Create a new OwlOptions object so we can assign properties.

```
val opt = new OwlOptions()
```

Set up variables for ease of re-use.

```
val dataset = "nyse_notebook_test_final"

val runId = "2017-12-18"
```

```
var date = runId
```

```
var query = s"""select * from <table> where <date_col> = '$date' """
```

```
val pgDatabase = "dev"val pgSchema = "public"
```

Set OwlOptions values to the metastore.

```
opt.dataset`` ``= datasetopt.runId`` ``= runIdopt.host`` ``=
"xxx.xxx.xxx.xxx"opt.pgUser`` ``= "xxxxx"opt.pgPassword`` ``=
"xxxxx"opt.port`` ``= s"5432/$pgDatabase?currentSchema=$pgSchema"
```

Create a connection, build the dataframe, register and run.

With inline processing you will already have a dataframe so you can skip down to setting the OwlContext.

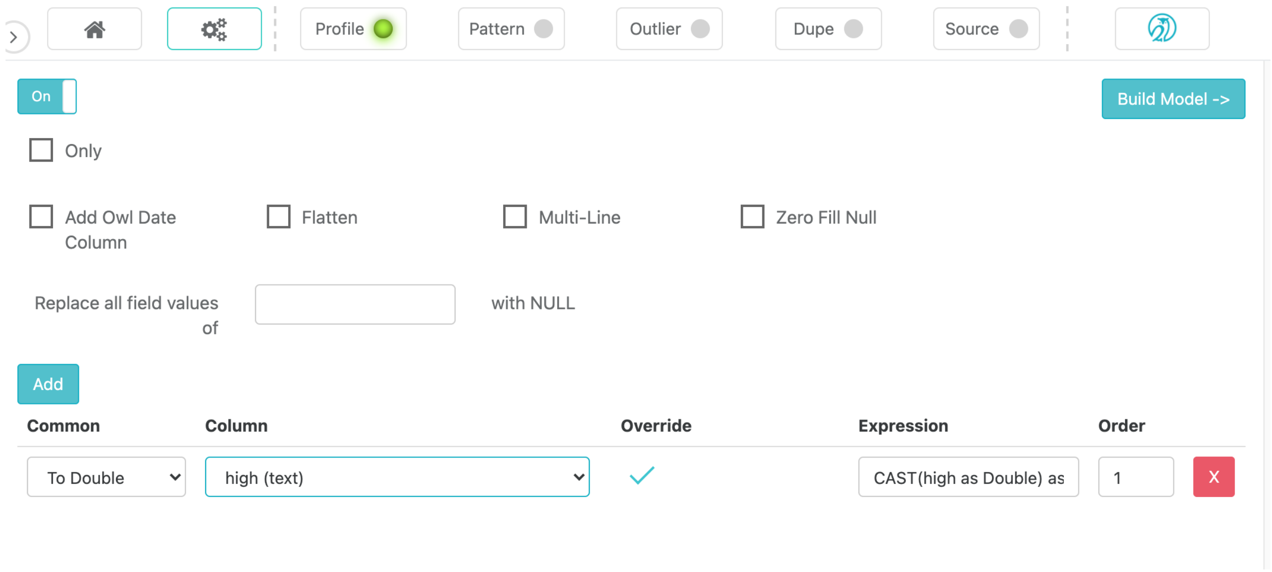
```
val conn =`` ``connProps`` ``+ ("dbtable" -> s"($query)``
``$dataset")val df =`` ``spark.read.format("jdbc").options
(conn).load
```

```
val owl = OwlUtils.OwlContext(df, opt)owl.register(opt)owl.owlCheck
```

Transform

Transform Date

During Collibra DQ setup, you can transform columns such as Dates and Numbers to preferred formats. It is a common need to replace N.A. with nulls or empty white space.



☐ Only

☐ Add Owl Date Column ☐ Flatten ☐ Multi-Line ☐ Zero Fill Null

Replace all field values of with NULL

Common	Column	Override	Expression	Order
To Double	high (text)	✓	CAST(high as Double) as	1

Example

```
./owlcheck \
-ds  "dataset_transform" \
-rd  "2018-01-31" \
-f   "/Users/Documents/file.csv" \
-transform "purch_amt=cast(purch_amt as double)|return_amt=cast
(return_amt as double)"
```

> **Note** Submit an expression to transform a string to a particular type. In this example, transform the purch_amt column to a double.

```
-transform "purch_amt=cast(purch_amt as double)"
```

> **Note** Example of converting a string to a date.

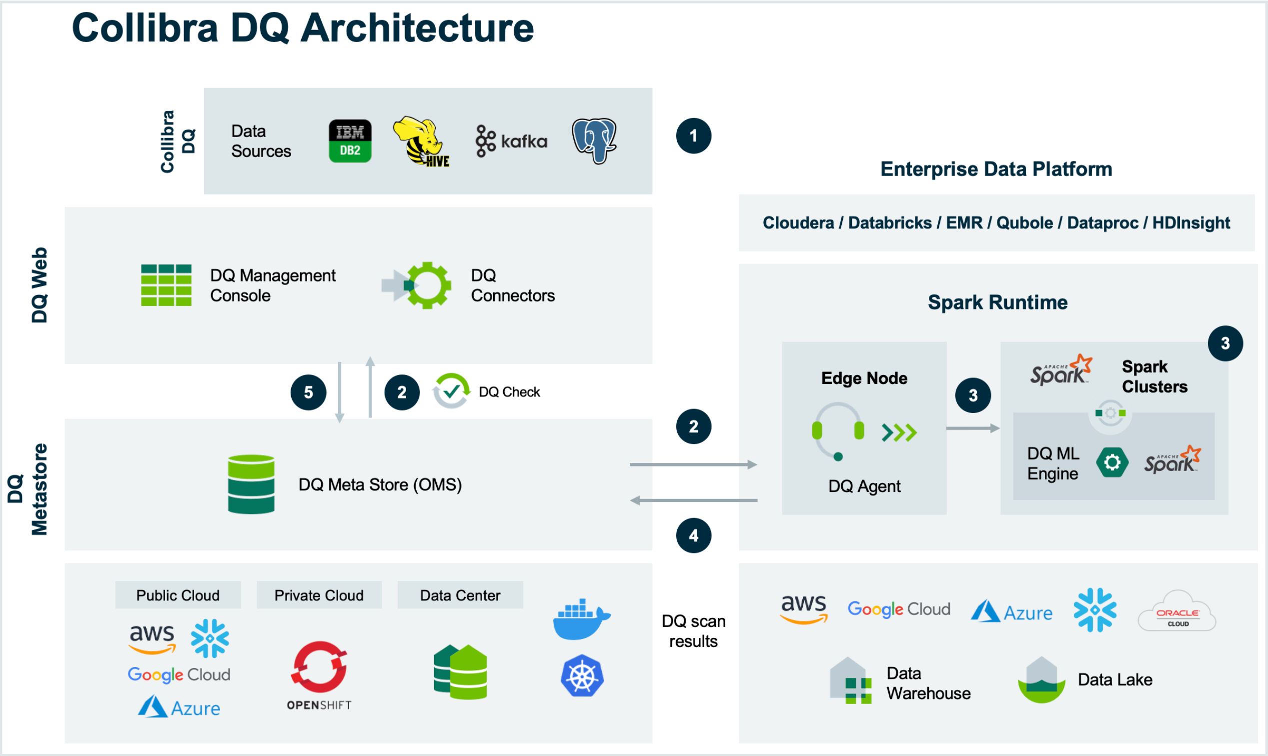
```
-transform "RECEIVED_DATE=to_date(CAST(RECEIVED_DATE AS STRING),
'yyyyMMdd') as RECEIVED_DATE"
```

Chapter 18

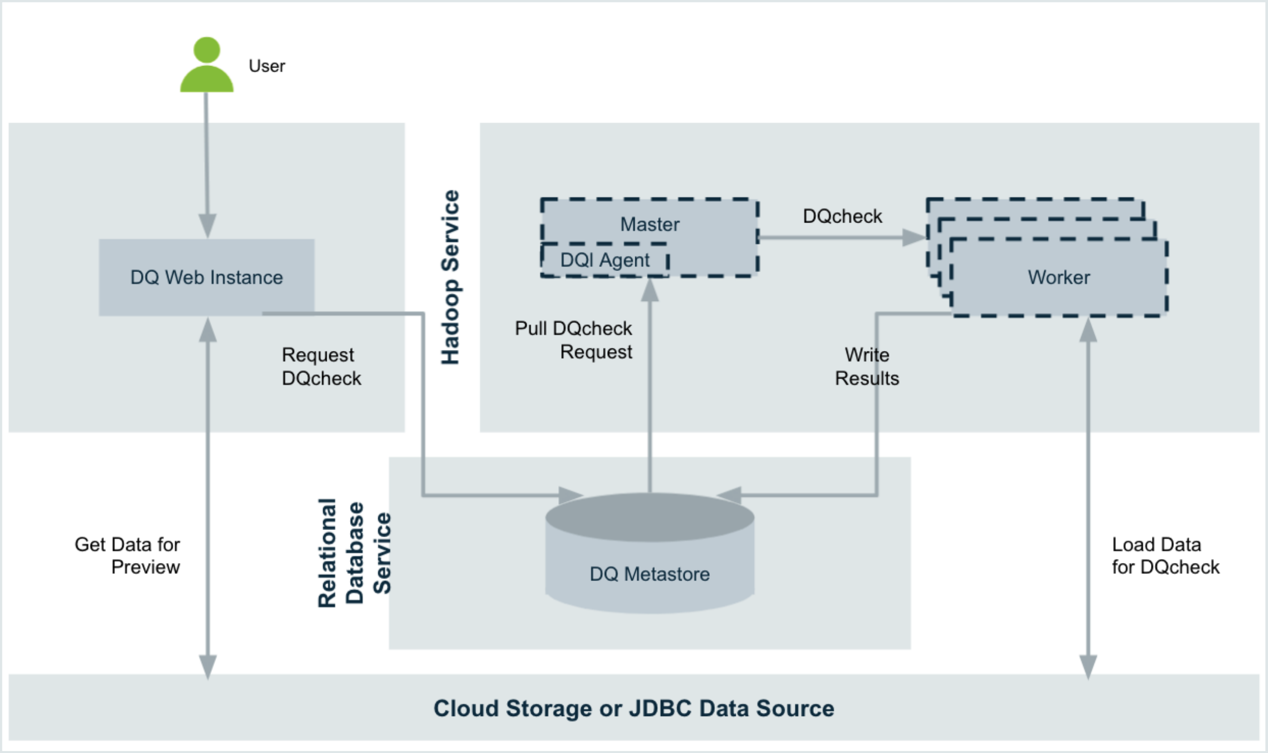
Collibra DQ Architecture

Architecture Diagram

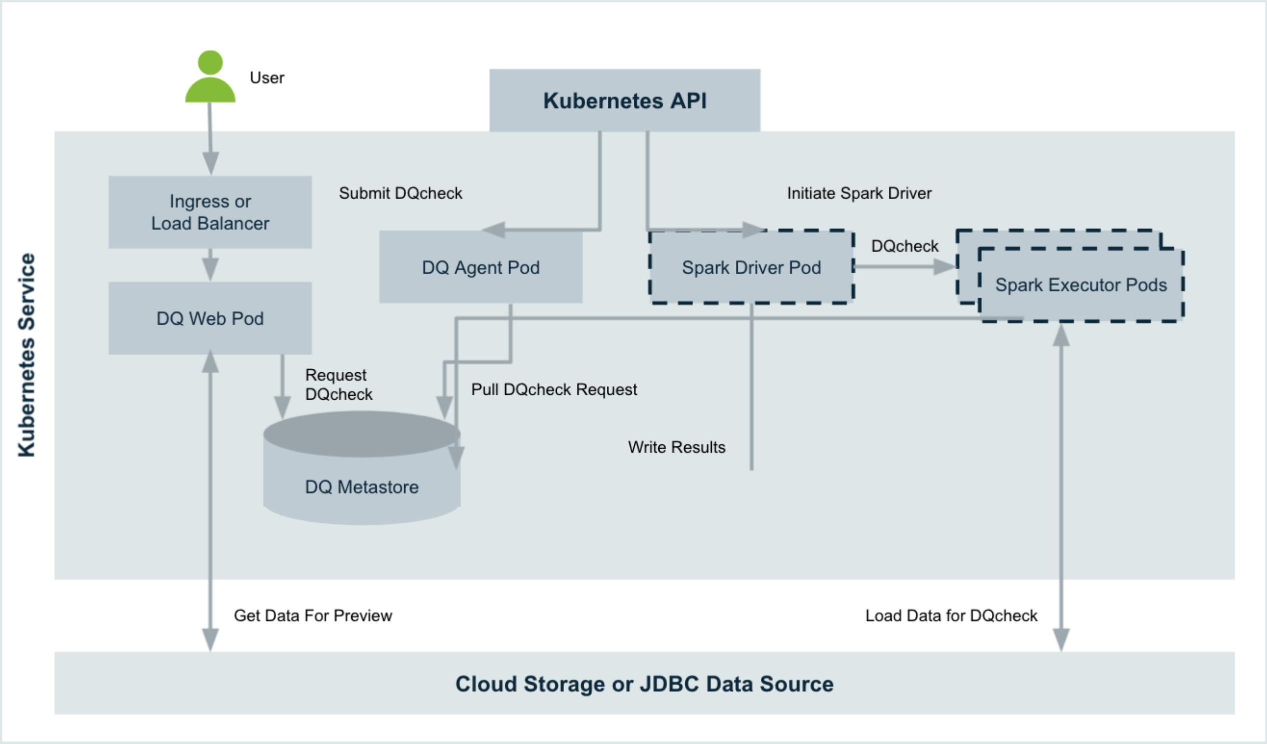
Collibra DQ Architecture



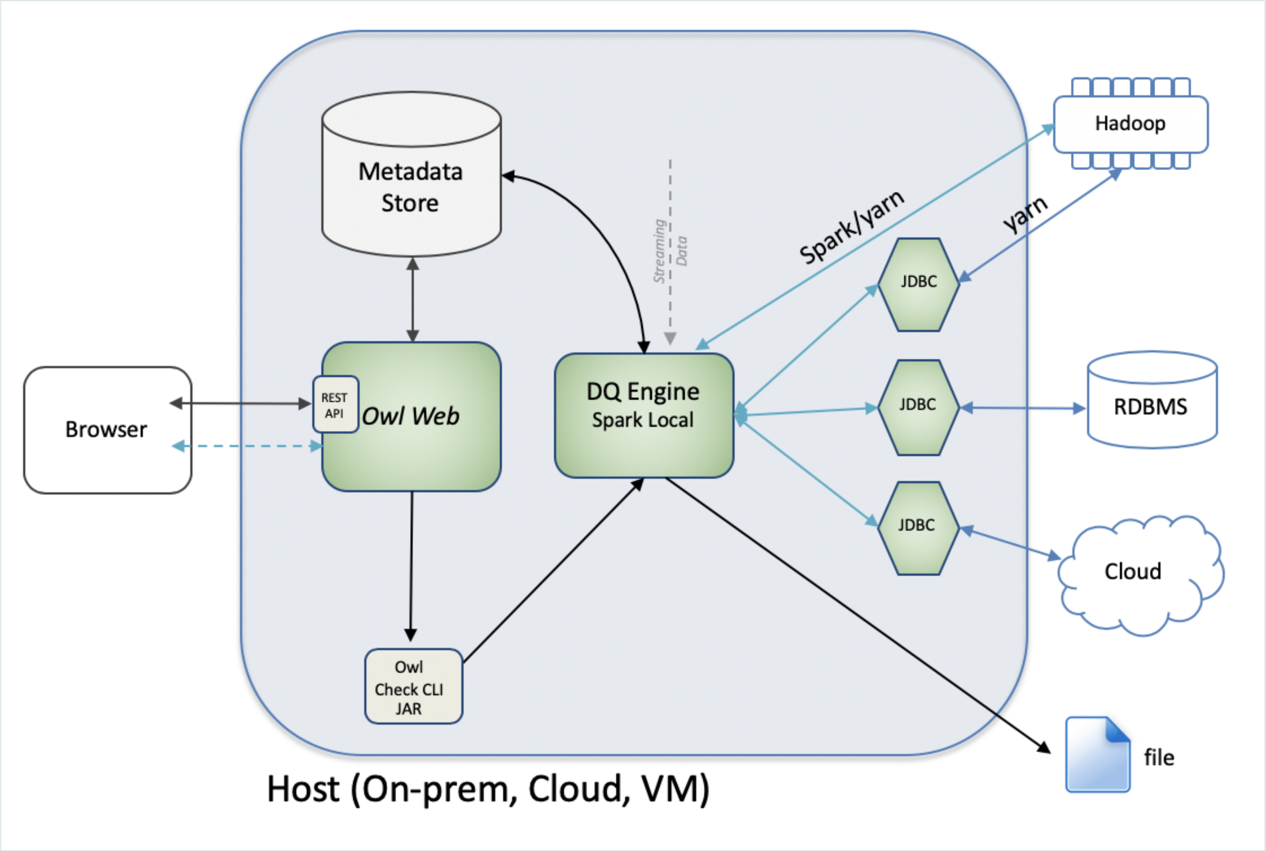
High-Level Diagram



Kubernetes Diagram

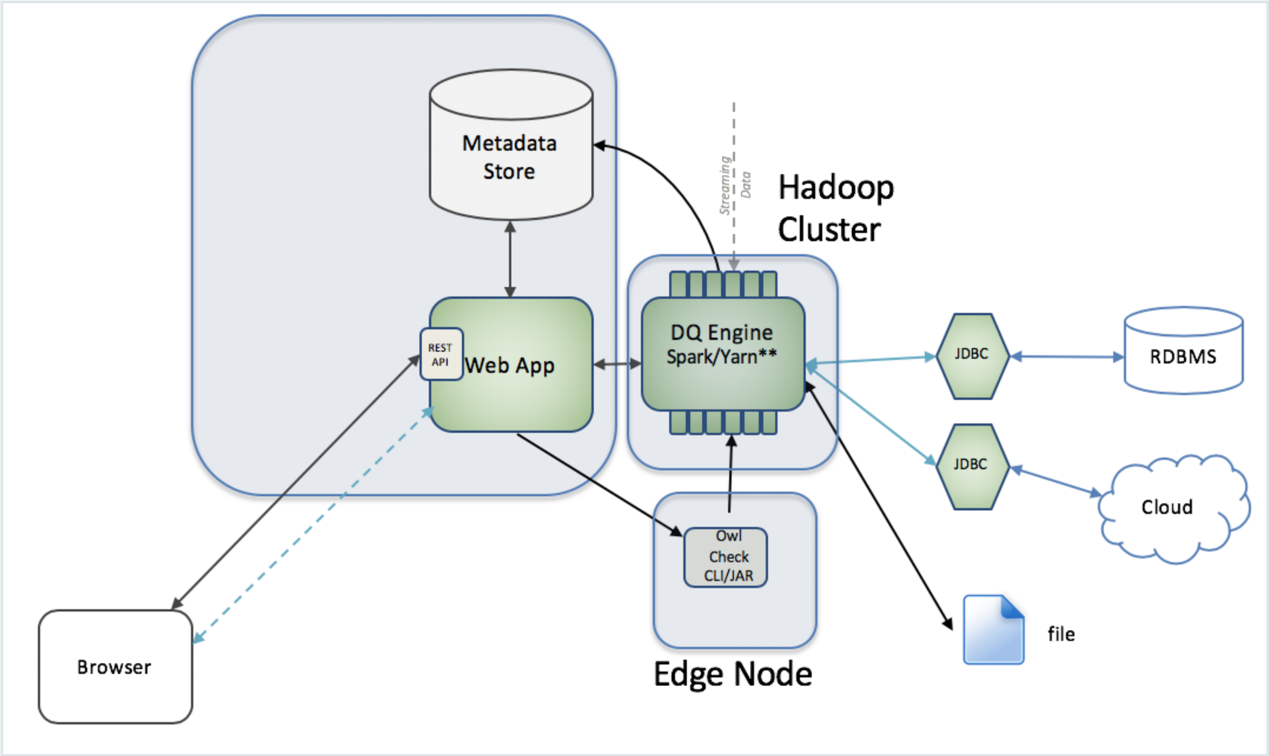


Collibra DQ Standalone



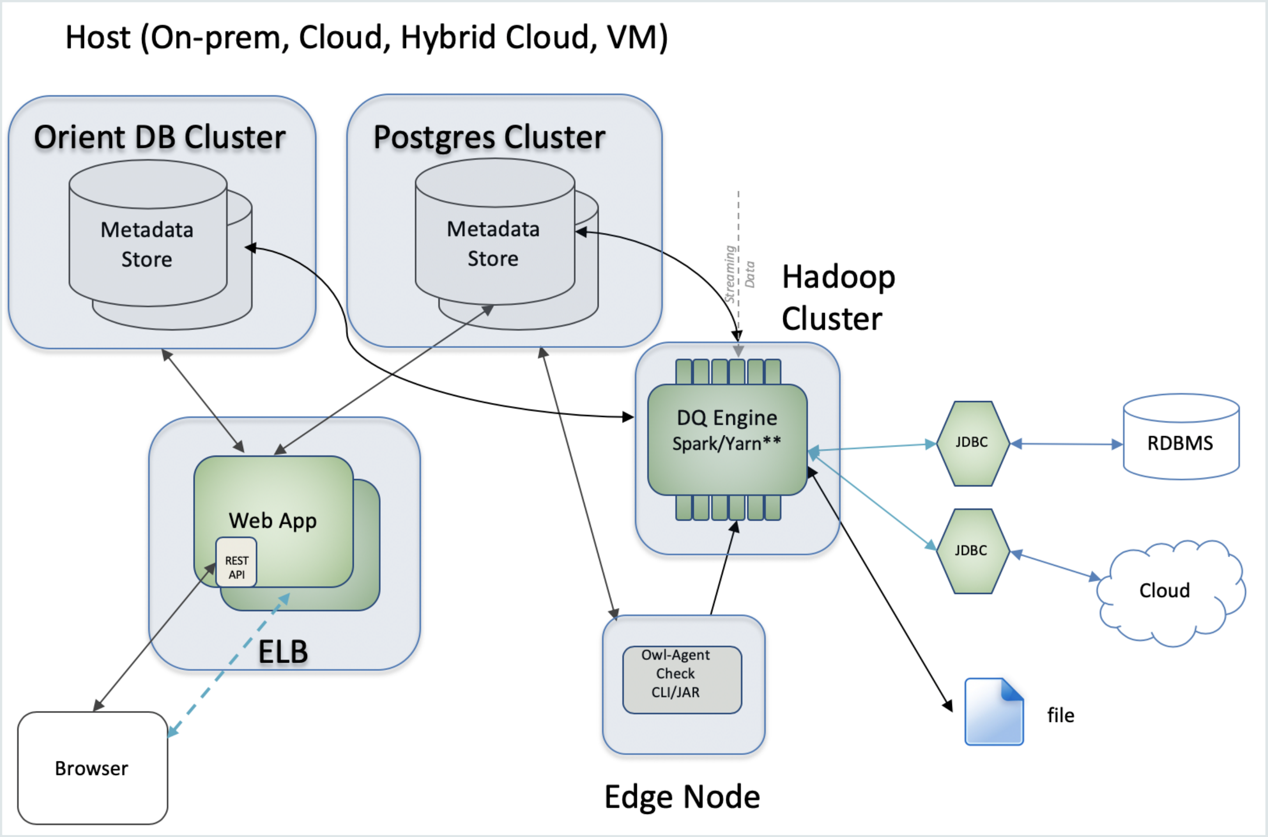
The image above depicts owl-web, owl-core, postgres and orient all deployed on the same server. This can be an edge node of a Hadoop cluster or a server that has access to run spark-submit jobs to the hadoop cluster. This server could also have JDBC access to other DB engines interested in being quality scanned by Collibra Data Quality & Observability. Looking at this depiction from left to right the client uses their browser to connect to Owl's Web Application running on port 9000 (default port). The Collibra DQWeb Application communicates with the two metastores (Postgres and Orient). The Web Application can run a local owlcheck job, or the Data script can be launched from the CLI natively. The owlcheck will launch a job using Collibra DQ's built in Spark Local DQ Engine. Depending on the options supplied to the owlcheck command the DQ job can scan a file or database with JDBC connectivity.

Collibra DQ Distributed

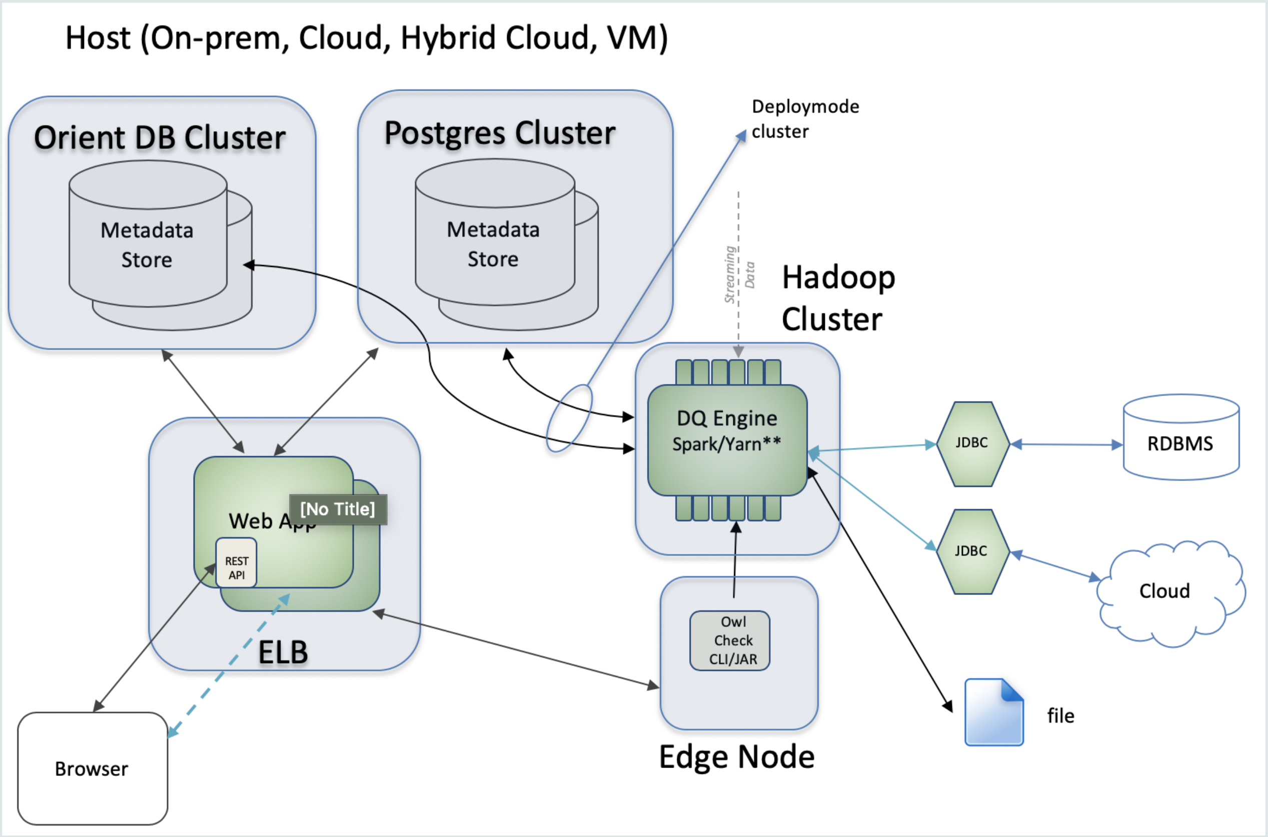


The image above depicts owl-web and owl-core deployed on different servers. Example Owl-web would NOT be deployed on the edge node. Owl-core would be installed on the edge node and write Owlcheck results back to the metastore that Owl-web points to (NOTE in this scenario the metastore and the web-app are running on the same host). The other change is that the owlcheck job will distribute the work on top of a Hadoop cluster in order to leverage spark and use the parallel processing that comes with the Hadoop engine itself.

Collibra DQFully Distributed



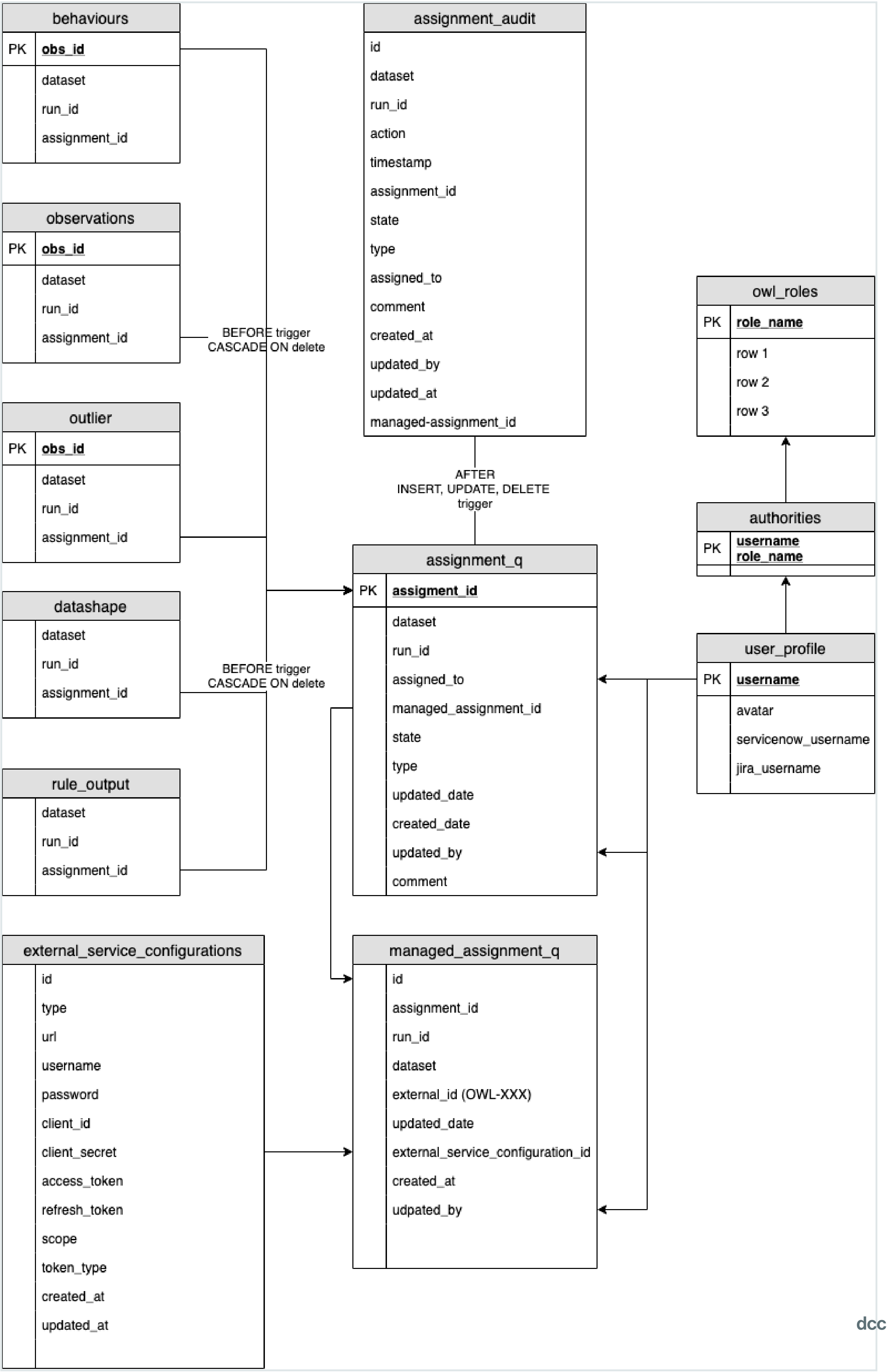
The image above depicts all components deployed on different servers. OrientDB setup as a cluster which provides fault tolerance in case there is an issue with a single machine (NOTE: starting with version 1.1.0 of Owl, Orient is an optional service – or Owl-Web and Owlcheck do not rely on Orient being Available). Postgres setup in a cluster in case one server fails. Multiple owl-web deployed behind a load balancer yet communicating with the same Metadata. Owl-core would be installed on the edge node and write Owlcheck results back to the metastores that Owl-web points to. In this depiction the owlcheck driver runs on the Edge Node while the majority of the work gets pushed to the cluster (deploymode = client flag was sent), so all communication connects from the edge node to the metastores.



In this depiction the owlcheck driver and job gets pushed to the cluster (deploymode = cluster flag was sent), so all communication connects from any node on the cluster back to the metastore.

ERD

Please note there are over 110 tables in the underlying Postgres database and many are for application settings. Please contact us to receive a complete list.


behaviours
PK obs_id
dataset
run_id
assignment_id
observations
PK obs_id
dataset
run_id
assignment_id
BEFORE trigger
CASCADE ON delete
outlier
PK obs_id
dataset
run_id
assignment_id
datashape
dataset
run_id
assignment_id
BEFORE trigger
CASCADE ON delete
rule_output
dataset
run_id
assignment_id
external_service_configurations
id
type
url
username
password
client_id
client_secret
access_token
refresh_token
scope
token_type
created_at
updated_at
assignment_audit
id
dataset
run_id
action
timestamp
assignment_id
state
type
assigned_to
comment
created_at
updated_by
updated_at
managed-assignment_id
AFTER
INSERT, UPDATE, DELETE
trigger
assignment_q
PK assigment_id
dataset
run_id
assigned_to
managed_assignment_id
state
type
updated_date
created_date
updated_by
comment
managed_assignment_q
id
assignment_id
run_id
dataset
external_id (OWL-XXX)
updated_date
external_service_configuration_id
created_at
udpated_by
owl_roles
PK role_name
row 1
row 2
row 3
authorities
PK username
role_name
user_profile
PK username
avatar
servicenow_username
jira_username

System Requirements

The following pages include the system requirements for installing Collibra Data Quality.

Supported Operating Systems

> **Note** Only 64-bit Linux operating systems are supported.

Standalone operating systems

- Red Hat Enterprise Linux 7.x
- CentOS 7.x

Container operating system

- Red Hat Universal Base Image 8 Micro (ubi8-micro)

Hardware Sizing

Hardware Sizing (Standalone Install)

Small Tier - 16 Core, 128G RAM (r5.4xlarge / E16s v3)

Component	RAM	Cores
Web	2g	2
Postgres	2g	2
Spark	100g	10
Overhead	10g	2

Medium Tier - 32 Core, 256G RAM (r5.8xlarge / E32s v3)

Component	RAM	Cores
Web	2g	2
Postgres	2g	2
Spark	250g	26
Overhead	10g	2

Large Tier - 64 Core, 512G RAM (r5.16xlarge / E64s v3)

Component	RAM	Cores
Web	4g	3
Postgres	4g	3
Spark	486g	54
Overhead	18g	4

Estimates

Sizing should allow headroom and based on peak concurrency and peak volume requirements. If concurrency is not a requirement, you just need to size for peak volume (largest tables). Best practice to efficiently scan is to scope the job by selecting critical columns. See Performance Tuning for more information.

Bytes per Cell	Rows	Columns	Gigabytes	Gigabytes for Spark (3x)
16	1,000,000.00	25	0.4	1.2
16	10,000,000.00	25	4	12
16	100,000,000.00	25	40	120

Bytes per Cell	Rows	Columns	Gigabytes	Gigabytes for Spark (3x)
16	1,000,000.00	50	0.8	2.4
16	10,000,000.00	50	8	24
16	100,000,000.00	50	80	240
16	1,000,000.00	100	1.6	4.8
16	10,000,000.00	100	16	48
16	1,000,000,000.00	100	1600	4800
16	100,000,000.00	100	160	480
16	1,000,000.00	200	3.2	9.6
16	10,000,000.00	200	32	96
16	100,000,000.00	200	320	960
16	1,000,000,000.00	200	3200	9600

Cluster

If your program requires more horsepower or (Spark) workers than the example tiers above which is fairly common in Fortune 500 companies than you should consider the horizontal and ephemeral scale of a cluster. Common examples include Amazon EMR and Cloudera CDP. Collibra DQis built to scale up horizontally and can scale to hundreds of nodes.

Minimum System Requirements

Hardware based on role

Standalone, distributed, or fully-distributed.

- Please see Hardware Sizing for minimum resources for each component.

Java version

- Oracle JDK version 1.8.0_152.x
- Open JDK version 1.8.0.x

Encryption

- Java Cryptography Extension (JCE) Unlimited Strength Jurisdiction

Postgres Version

- Collibra Data Quality comes prepackaged with version 11.4 of Postgres.
- Version 9.6.5 and above is supported if wanting to use an external metastore.

User Privileges

- Installation is completed via tarball.
- You must be able to create directories, launch scripts, and start processes (java processes).
- SUDO is not required.
- ULIMIT settings of 4096 or higher
    - All owl services typically consume about 428 threads.
    - During each owlcheck, about 400 additional threads are consumed.
    - Thus 4096 threads can allow for about 9 concurrent owlcheck jobs (on a standalone install). If more are needed, plan accordingly.

Planning the installation

It is always best to consult the Collibra Data Quality team for more information about what options make the most sense for your environment.

1. Determine how you plan to install Collibra DQ (standalone or distributed), as shown in the Architecture Diagram.
2. Plan your infrastructure, scale, and HA.
3. Validate your system prerequisites.
4. Obtain the packages from Collibra DQ.

Installation Packages/Files (BOM)

- demoscripts.tar.gz
- log4j*
- owlcheck
- owl-core-2.1.0-jar-with-dependencies.jar
- owl-webapp-2.1.0.jar
- owl-agent-2.1.0.jar
- setup.sh
- owl-postgres.tar.gz
- notebooks.tar.gz
- owlmanage.sh

Default Ports used by Collibra DQ

- 5432 – Postgres
- 9000 – Owl-web

Supported Web Browsers

Browser	Version
Google Chrome (recommended)	70.0.3538.102 or newer
Mozilla Firefox	52.8.0 or newer
Safari	12.0.1 or newer

Build Versions

Generally Available Build Versions

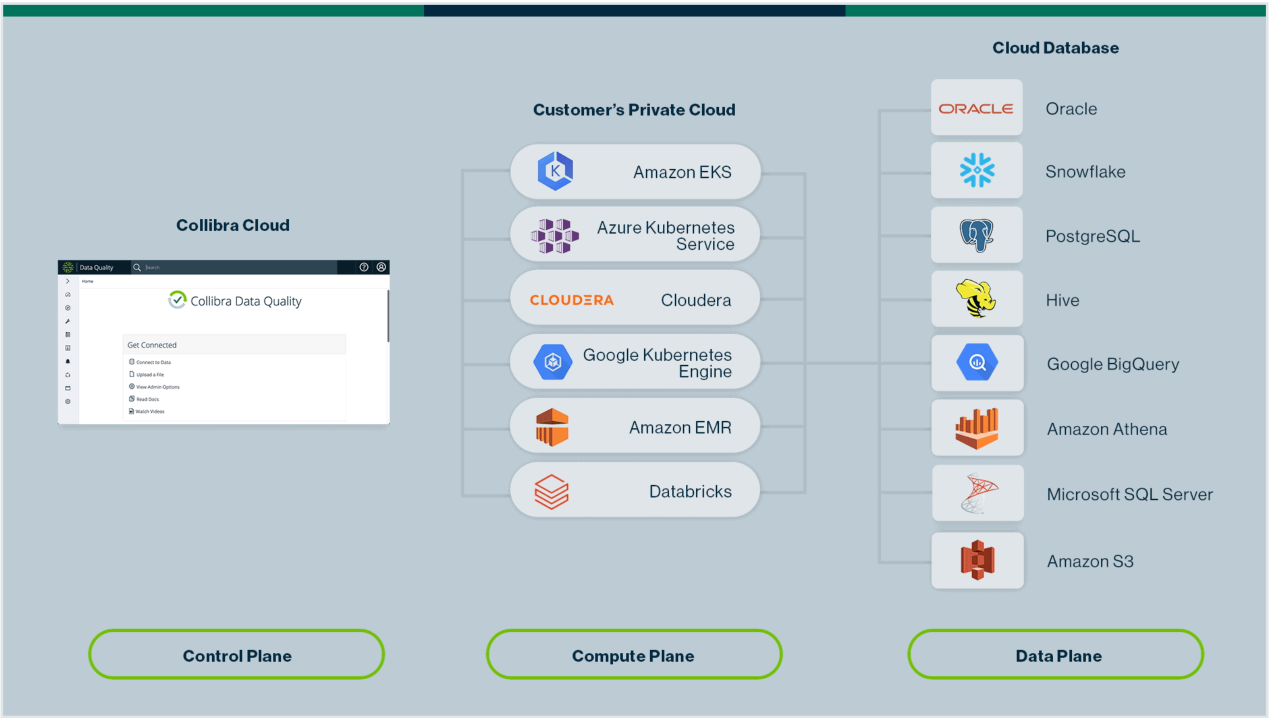
- Default Build = Spark 2.3.0
- Spark 2.4.5
- Spark 3.0.1
- HDP 3

- CDH5
- CDH6-NOLOG
- K8s

Diagrams

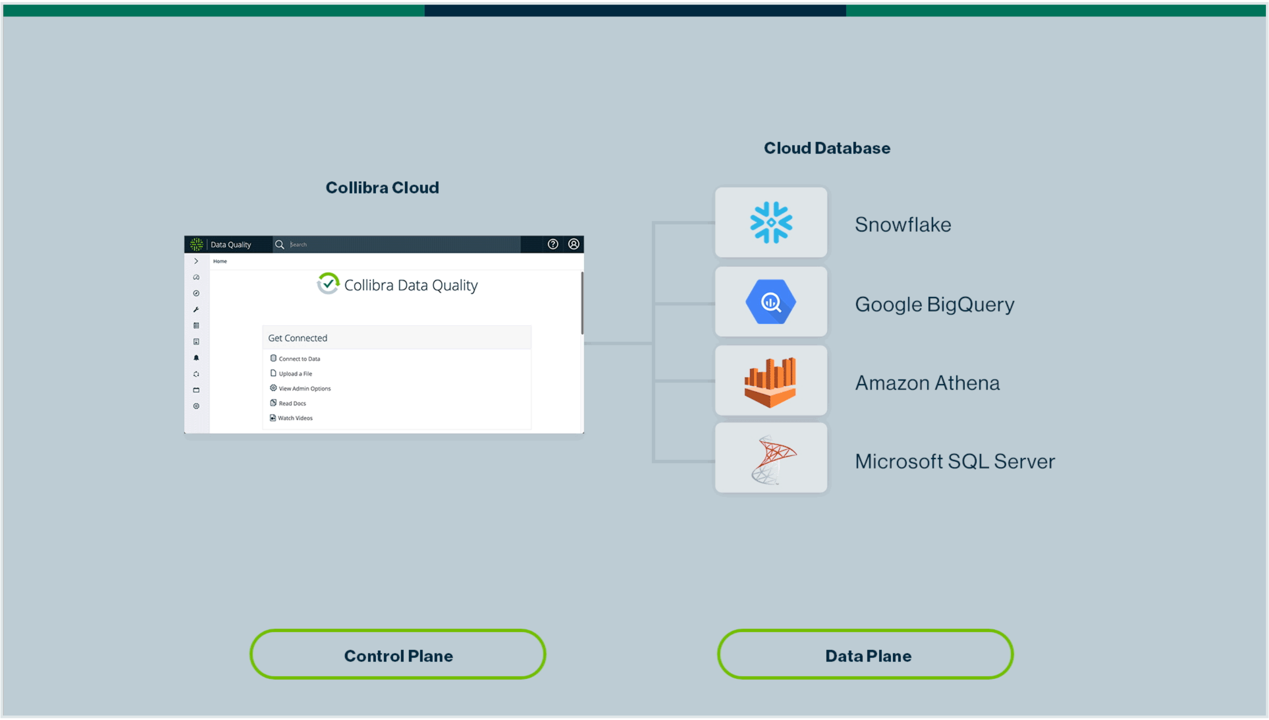
DQ Control to Compute to Data

As of March 2022, DQ Cloud is in private beta for select customers. General availability is expected in Q4 2022. Available compute plane options will start with Collibra Edge submitting jobs to Rancher K3s and Hadoop platforms (Cloudera, Dataproc, and EMR). Additional compute plane options will be added over time.



Pushdown DQ Control to Data

As of Q3 2022, Steps is in private beta for select customers. Some features may be limited.



Collibra Cloud

Cloud Database

Snowflake

Google BigQuery

Amazon Athena

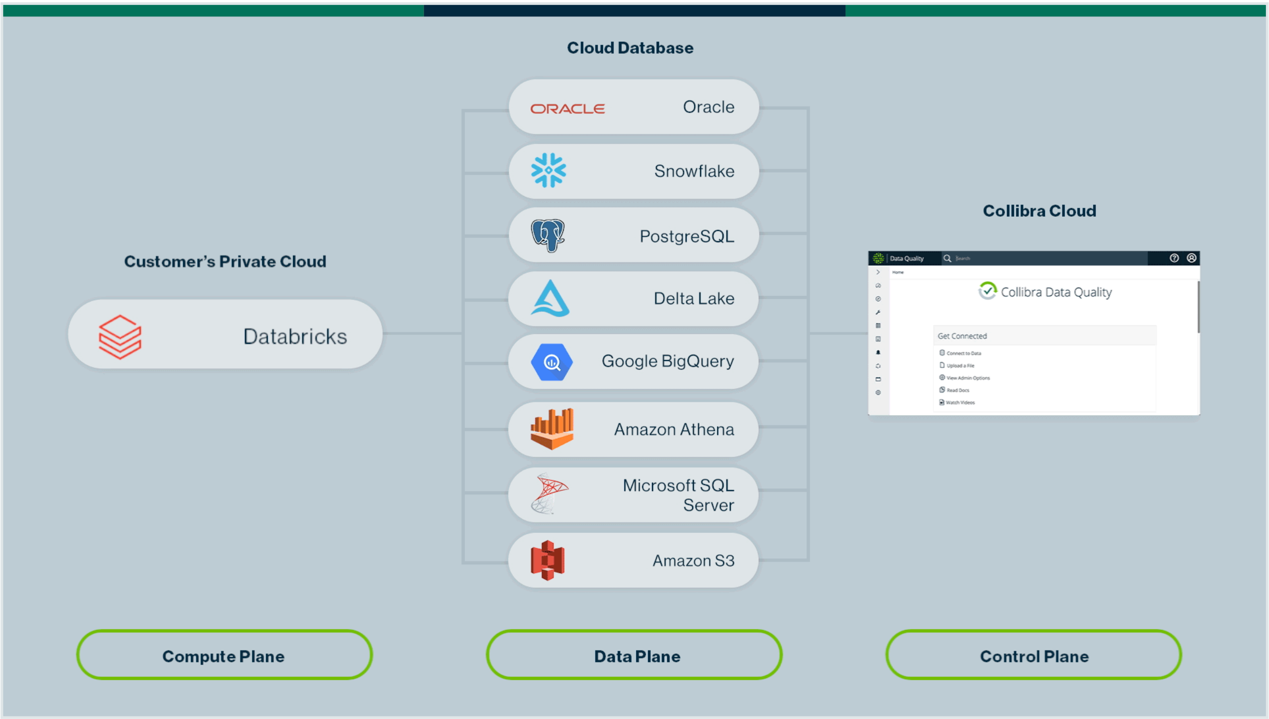
Microsoft SQL Server

Control Plane

Data Plane

Databricks to Data to DQ Control

Running DQ jobs from Scala and Pyspark notebooks is generally available.



Cloud Database

Customer's Private Cloud

Databricks

Oracle

Snowflake

PostgreSQL

Delta Lake

Google BigQuery

Amazon Athena

Microsoft SQL Server

Amazon S3

Collibra Cloud

Compute Plane

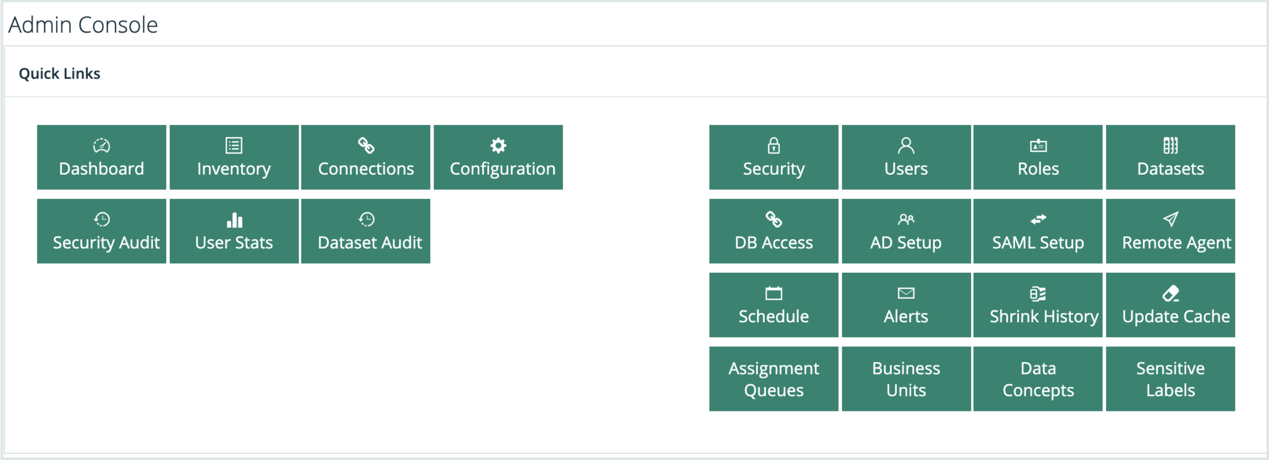
Data Plane

Control Plane

Chapter 19

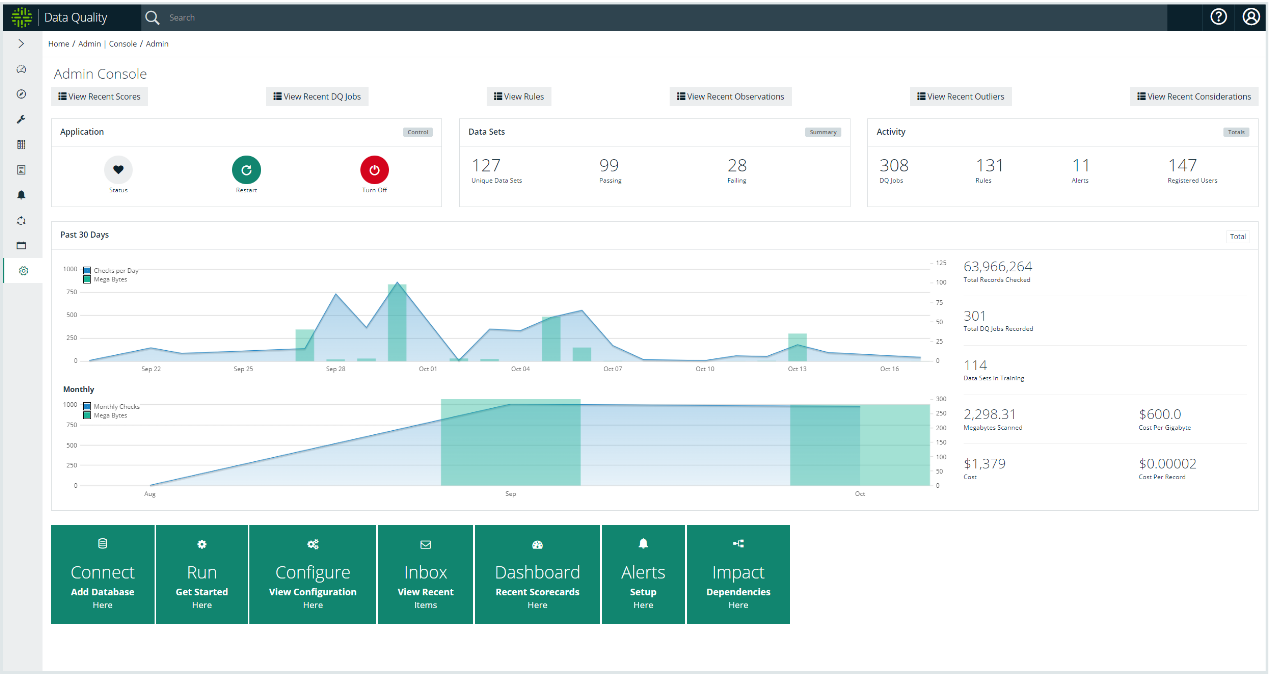
Collibra DQ Admin

Overview



Dashboard, Inventory, Connections, and Configuration are shortcut links to different operations within Collibra Data Quality & Observability.

- Dashboard
    - Shows an overall number of DQ Checks scanned the MB's, total jobs, total records scanned.
    - Total number of data sets, including passing and failed jobs (quality fails), number of alerts, and number of rules.
    - A list of messages on specific DQ Checks and what was found.



- Inventory
  - All DQ Jobs ever executed including Run Date, Data Set, Command Line, Type, Query, and Connection.
- Connections
  - Connect to a data source via the Admin Console.
- Configuration
  - Apply administrative override limits. For example, you can limit the amount of DataShapes recorded on a specific data set with the `datashapelimit` field.
  - If a duplicate record is found have a 1 point (negative) score per record. Allows administrators to increase or decrease the impact of different DQ issues found.
  - Display limits in order to improve performance of the UI.
- Audit Trail
  - List all security related changes by user, action, description and timestamp in a searchable, sortable table.

Configuration

Multi-Tenancy

Divide and conquer your data quality.

MultiTenancy allows a company the ability to instantiate different organizations within one entity. For example say your organization is called Acme and inside of Acme there are two divisions AcmeTraders and AcmeInsurance and each organization is not allowed to see one another's owlcheck results. You would simple segregate them into 2 different Tenants within the overarching Collibra DQ web application.

Prerequisite(s)

- DNS entry for owl web server IP = example below we call it hub (existing for single tenant setup)
- DNS entry for multiTenantSchemaHub = example below we call it owlhub.hub

Prerequisites For URL Based tenancy: tenant.host

A DNS entry for each tenant

- DNS entry for every tenant you want to create = example below we call it tenant1.hub

Each record above points to the same IP address.

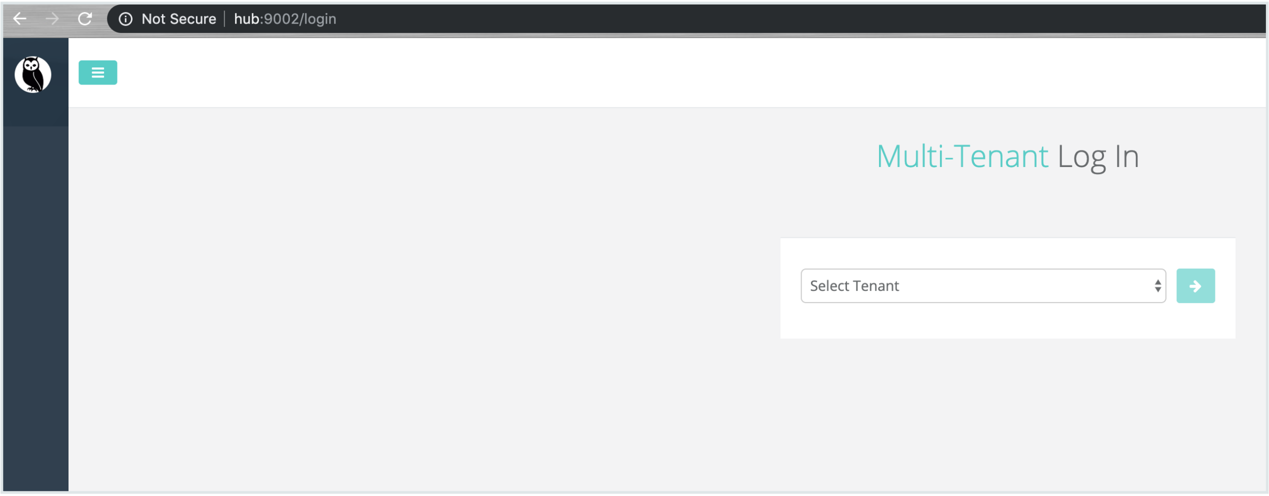
Setup

In order to setup multi-tenancy follow these steps

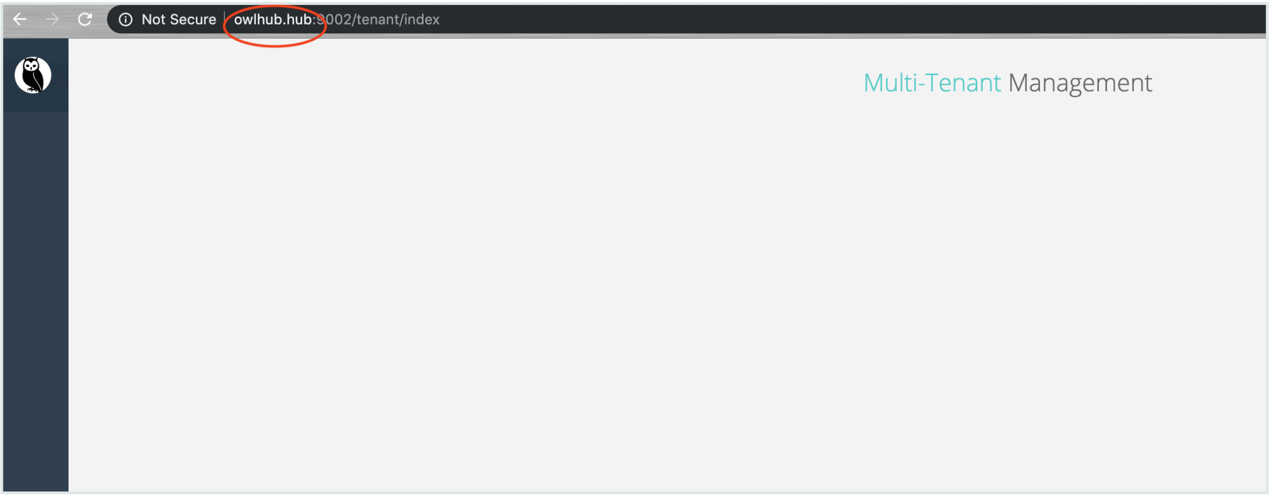
- If this is an upgrade please make sure to follow the steps outlined in the "Upgrading to latest Version"
- Make sure the web application has started up one time and you successfully logged into it with the default credentials.
- Then stop all the components using ./owlmanage.sh stop
- Modify the owl-env.sh file to include these to new parameters
    a. **export multiTenantSchemaHub=owlhub** (this is a new schema that will get created on owlweb start, note the name of the TenantSchemaHub can be changed to the desired name at setup time)
    b. **export MULTITENANTMODE=TRUE** (this enabled multi-tenancy to be used).
    c. **export URLBASEDMULTITENANTMODE=TRUE/FALSE**
        i. TRUE (default) means you are using the tenant name as a sub-domain (see prerequisites)
        ii. FALSE means you will let owl manage tenants via sessions/tokens
- If using agents as part of the operation of owl please be sure to modify the owl.properties file to include the following.

   a. spring.agent.datasource.url=jdbc:postgresql://cdh-edge-dan.us-east4-c.c.owl-hadoop-cdh.internal:5432/postgres**?currentSchema=owlhub** (matching the name of the schema set on step 3-1 above).
   b. jdbc:postgresql://cdh-edge-dan.us-east4-c.c.owl-hadoop-cdh.internal:5432/postgres**?currentSchema=owlhub** (matching the name of the schema set on step 3-1 above).

- Once the settings have been configured for multi-tenancy please start up the owlweb host first using ./owlmanage.sh start=owlweb. Once the web is up and you can hit the page please start up the agents using ./owlmanage.sh start=owlagent.
- In order to use multi-tenancy in URLBASEDMULTITENANTMODE=TRUE you'll have to make sure we have DNS entries to the tenant endpoints, otherwise click the tenant management link from the login page. Example:
   a. If I have a DNS alias named hub. I should be able to point me browser at hub:9002 (or your respective owlweb port) to get to the main Multi-Tenant login page as depicted below

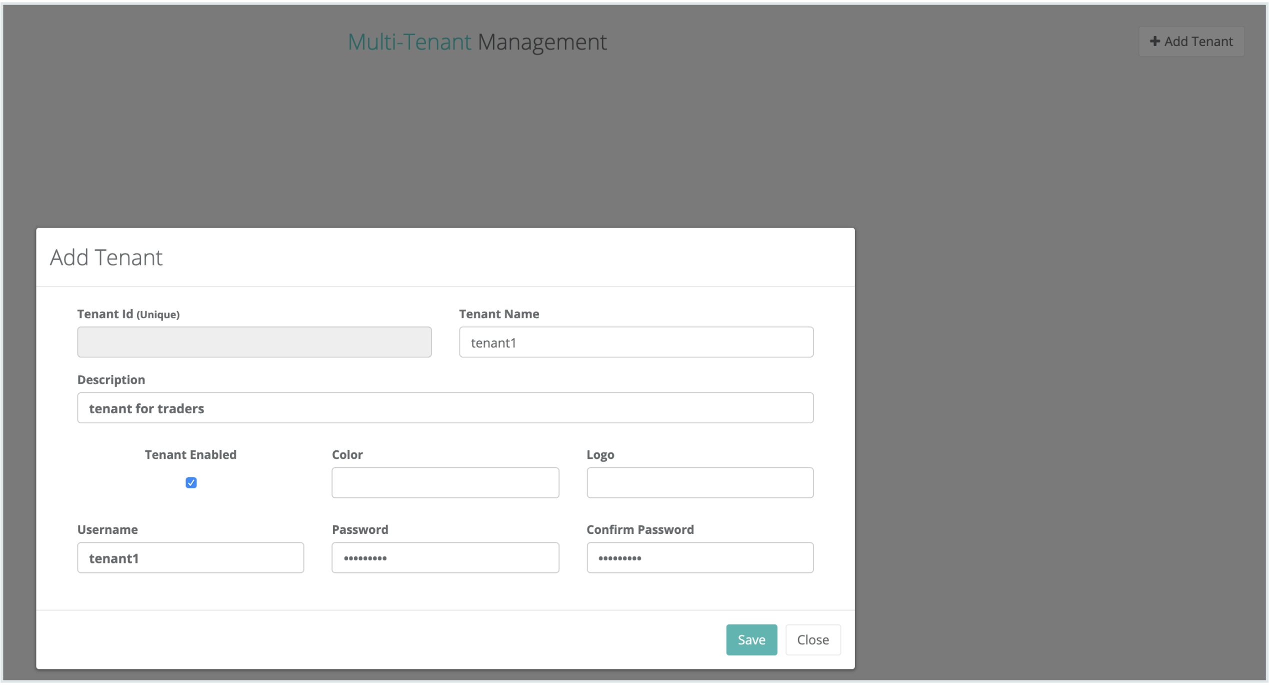


- This is where DNS alias come into place. Assuming we left the owlhub as the multiTenantSchemaHub name we hit the drop down and select owlhub and click the arrow it will place owlhub.hub into the url. This means there also has to be a DNS Alias name for your selected multiTenantSchemaHub name. NOTE: Username and password for tenant management is mtadmin / mtadmin123



Not Secure | owlhub.hub:9002/tenant/index

- Now that you logged into the Tenant Management screen using the hub DNS alias we can create our first tenant. In this example below I'm going to create a tenant named tenant1. First click the "+ Add Tenant" button in the top right part of the screen.



Add Tenant

Tenant Id (Unique):

Tenant Name: tenant1

Description: tenant for traders

Tenant Enabled: ☑

Color:

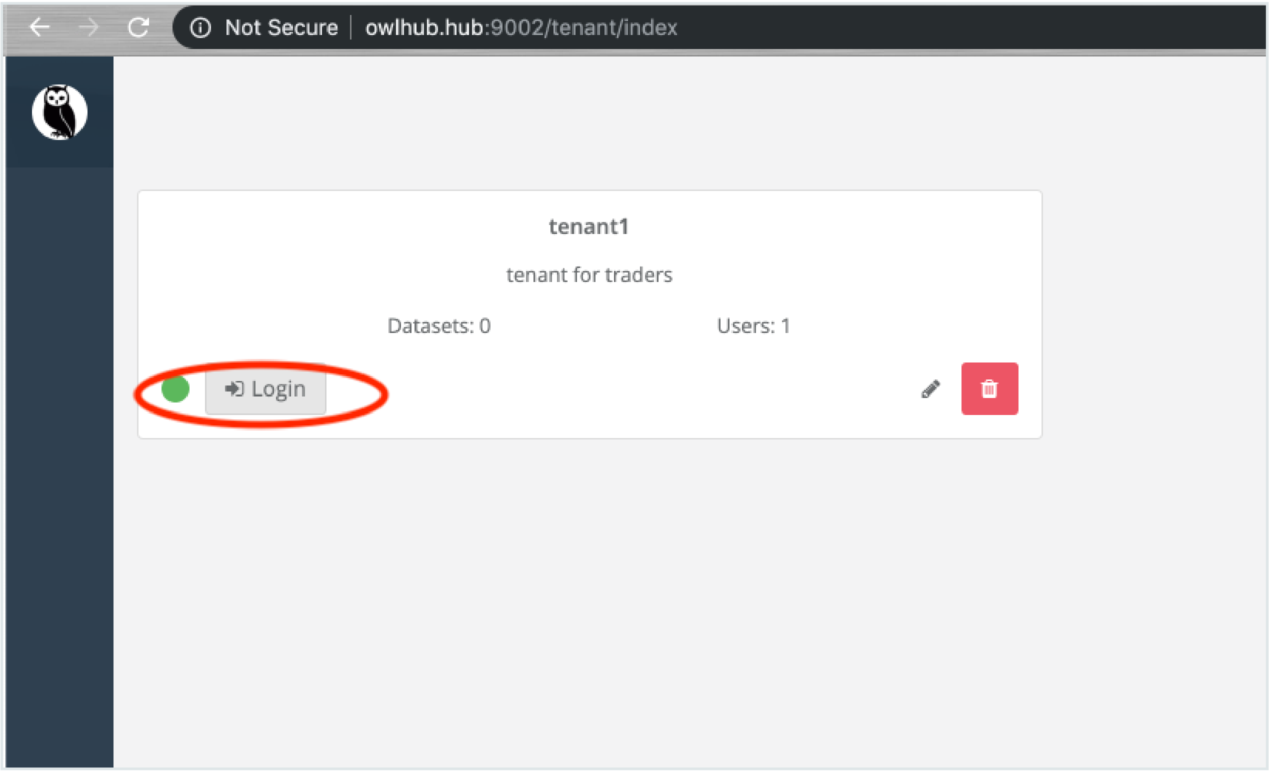
Logo:

Username: tenant1

Password: •••••••••

Confirm Password: •••••••••

Click Save. Your tenant shows up in the list and now you can click the login button as shown below.



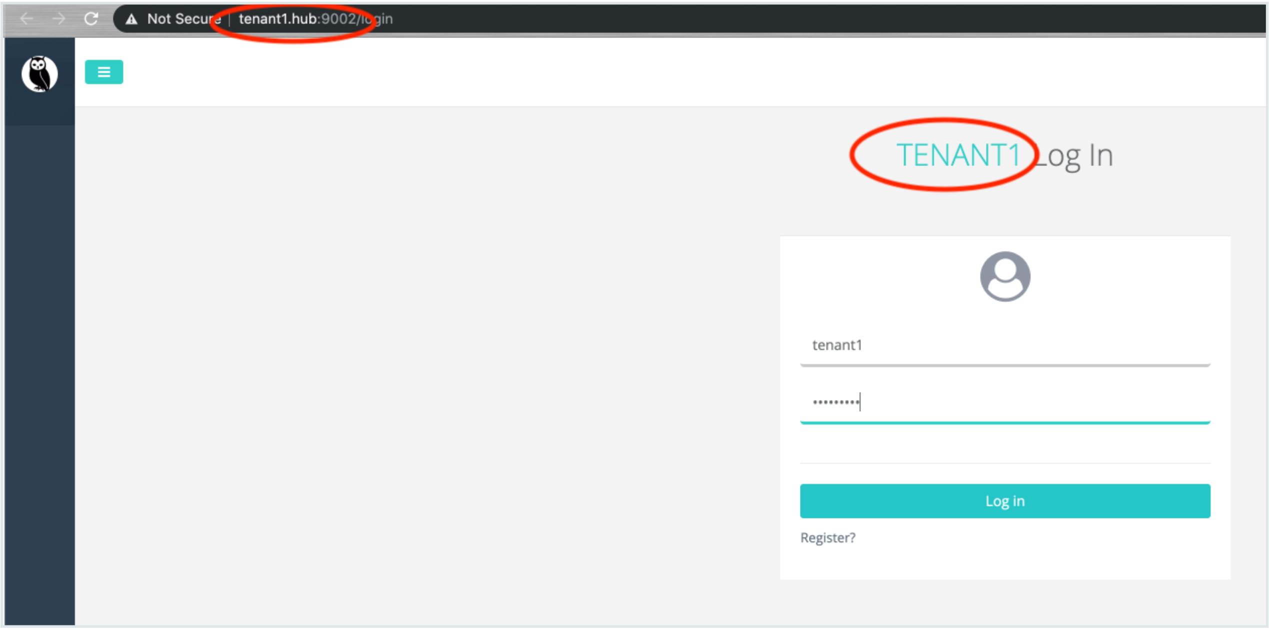
tenant1

tenant for traders

Datasets: 0

Users: 1

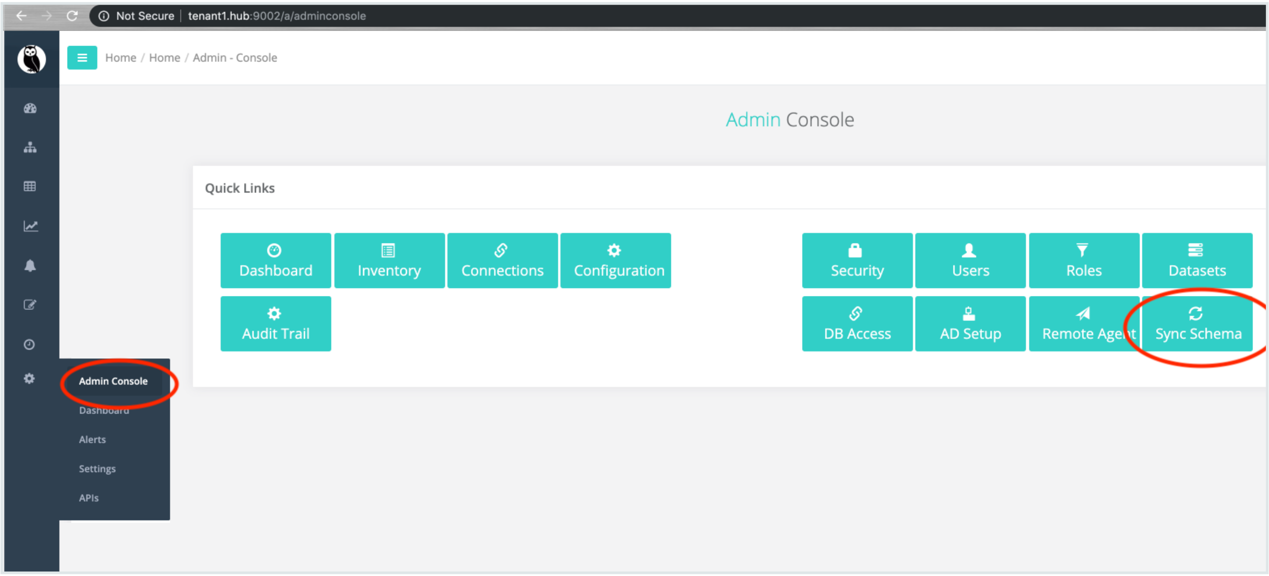
Clicking the Login button will redirect your browser to the tenant1.hub:9002 url (DNS entry needs to be in place for tenant1 as shown below).



tenant1

Enter the admin username and password that you created for the tenant1 (refer to figure 3 about) and login to the tenant as the admin.

While logged in as a tenant admin the last step is to go to the Admin Console and click on "Sync Schema" this will generate the tables under the tenant called tenant1.



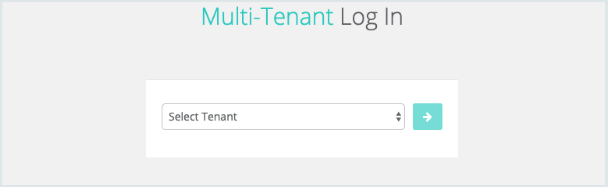
At this point you are ready to start administrating your tenant1 as you did with the owl web application in the past.

Supplemental: Adding and Editing a Tenant

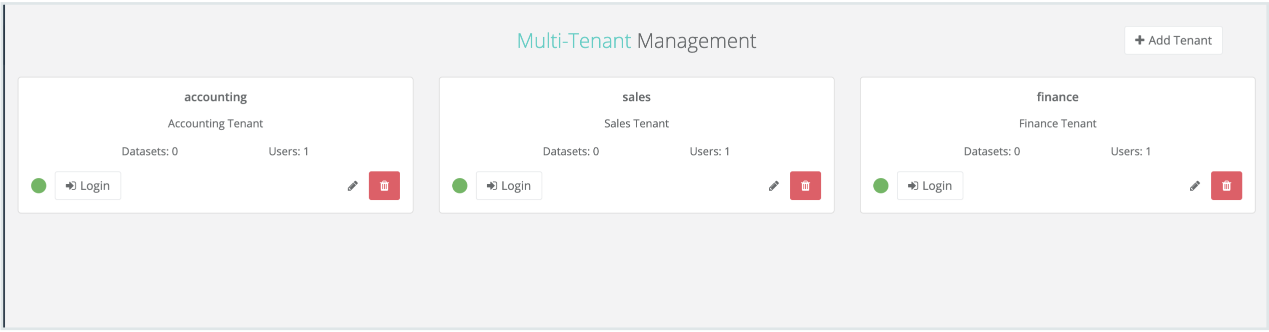
In many cases it may make sense to have isolated environments to check data quality. This need could be driven by a number of factors including data access rights, organization and business models, reporting needs, and/or other security requirements.

Regardless of the need,Collibra DQ will support dynamically creating tenants via our Collibra DQ Hub Management portal as part of the Collibra DQ Web Application. That's it, there is nothing else to install, simply enable Multi-Tenant mode in the application configuration properties and you are on your way.

Once enabled you will have a tenant selection screen prior to login where you can chose any of your configured tenants or access the Owl Hub (with the TENANT_ADMIN role)



After selecting the owlHub tenant, you will have the ability to manage each tenant, as well as create new tenants from the management console.



Multi-Tenant Management

+ Add Tenant

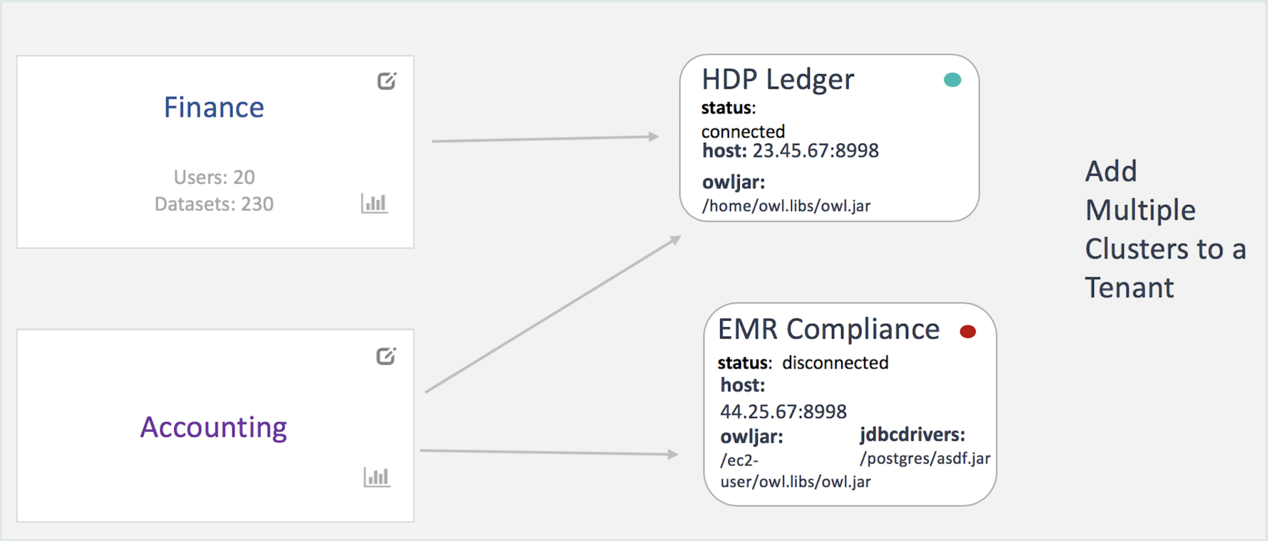
accounting
Accounting Tenant
Datasets: 0 Users: 1
● Login

sales
Sales Tenant
Datasets: 0 Users: 1
● Login

finance
Finance Tenant
Datasets: 0 Users: 1
● Login

All enabled tenants will be listed in the multi-tenant drop down menu. Access to tenants are handled by the administrator(s) within each tenant individually.

Access to agents are also handled by the administrator(s) within each tenant individually.



Finance
Users: 20
Datasets: 230

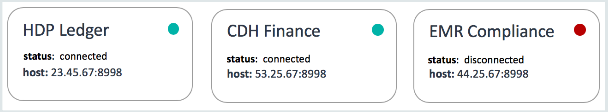
Accounting

HDP Ledger ●
status: connected
host: 23.45.67:8998
owljar: /home/owl.libs/owl.jar

EMR Compliance ●
status: disconnected
host: 44.25.67:8998
owljar: /ec2-user/owl.libs/owl.jar
jdbcdrivers: /postgres/asdf.jar

Add Multiple Clusters to a Tenant

Each agent is visible and editable as an Admin from the UI.



HDP Ledger ●
status: connected
host: 23.45.67:8998

CDH Finance ●
status: connected
host: 53.25.67:8998

EMR Compliance ●
status: disconnected
host: 44.25.67:8998

Time-Based Data Retention

Setting up Retention Based Data Purge

Retention based purge of data can be turned on to allow data to automatically be cleaned based on an organization's data retention policy.

Benefit

Once enabled, what type of data is removed?

- data_preview *(Drill-in records for rules, outliers, shapes, etc.)*
- dataset_field *(profiling stats)*
- rule_breaks *(Rule Exception records)*
- dataset_scan *(Job Ledger)*

Setup

In order to set up retention based data purge, three (3) environment variables need to be set up in the owl-env.sh configuration script. Note: a restart of the webapp is required for this configuration to take place.

- **cleaner_retention_enabled**
  - TRUE or FALSE on whether this feature is enabled
- **cleaner_retention_days**
  - Number of days to retain data
- **cleaner_retention_field**
  - Controls which field to use to select eligible data set runs
  - Potential values
    - updt_ts: consider the last time a data set run was updated
    - run_id: consider the run id field of the data set

Configuration

Example configuration in owl-env.sh

Organization wants to purge data where the updt_ts is more than 1 year old

In owl-env.sh, add the following lines

```
export cleaner_retention_enabled=TRUE
export cleaner_retention_days=365
export cleaner_retention_field="updt_ts"
```

Config Map

```
autoClean: "false"
cleaner_retention_days: "180"
cleaner_retention_field: updt_ts
cleaner_retention_enabled: "true"
```

Defaults for Auto Clean Process

> **Note** This is a separate rolling purge that is distinct **time-based retention**. This is **on by default** and uses the predefined limits below. You will see audit records for this clean-up process in Audit History of the Admin Console.

Separate from the time-based retention there is also a default auto clean mechanism that actively purges your old records. This is enabled by default and can be modified by use of the autoClean (AUTOCLEAN) boolean parameter.

```
AUTOCLEAN=false or autoClean="false"

### Depending whether this is part of owl-env.sh
### or the configMap of the web pod
```

These are the defaults. The row count threshold is the global limit when this is triggered. This is based on the records in the data_preview table. The runs threshold and the dataset per row threshold are data set-level limits that require a data set to have at least 4 scans and at least 1000 rows.

This is an example using the owl-env.sh file to control these settings.

```
export AUTOCLEAN=true
export DATASETS_PER_ROW=1000
export RUNS_THRESHOLD=4
export ROW_COUNT_THRESHOLD=200000
```

For example (using the settings above):

When data_preivew table has 200k rows
Look for data sets with 1000+ rows in data_prevew table
And have at least 4 scans
Then delete the oldest scan for those data sets

Auto clean and time-based retention run on a routine thread that triggers while the web application is running. It looks for clean-up candidates every few minutes when AUTOCLEAN=true or cleaner_retention_enabled=TRUE.

Set up SMTP

Simple Mail Transport Protocol, or SMTP, is an internet standard for email transmission. Collibra DQ allows you to configure a single SMTP server to send alerts to the attention of the data set owner in case a specific condition is met, such as:

- Data Quality Score is below a specific threshold.
- Row Count is below a specific threshold.
- If a rule is triggered.

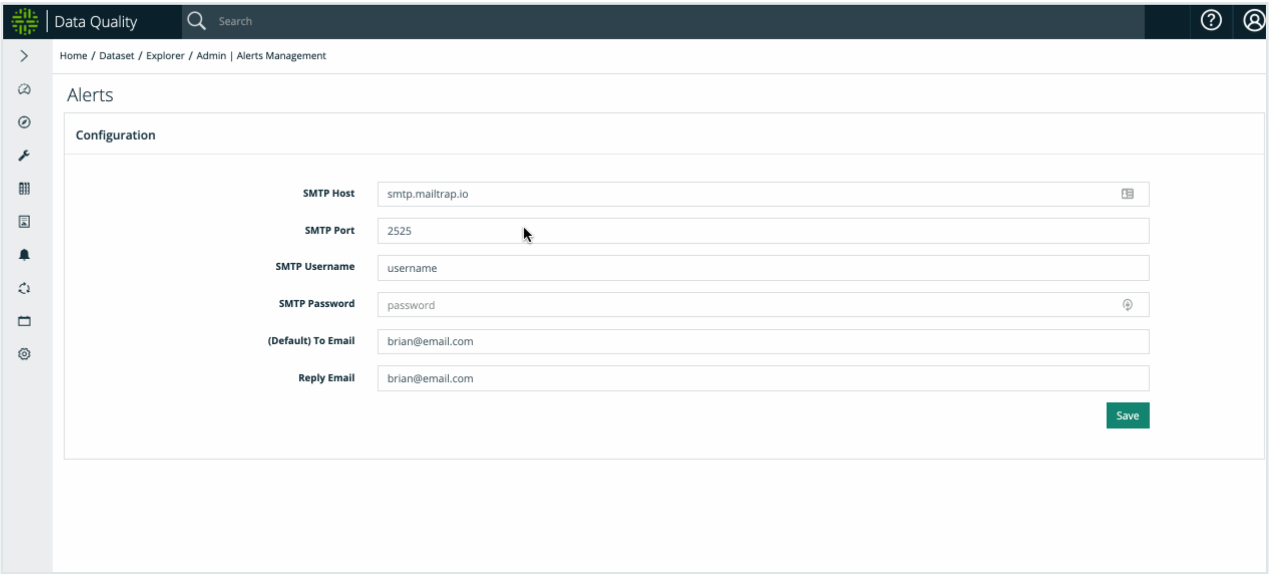
Steps

1. In the **Admin Console**, click **Alerts**.
2. In the **Configuration** section, enter the required information:

Option	Description
SMTP Host	The name or the IP address of the SMTP server.
SMTP Port	The port used by the SMTP server.
SMTP Username	The username or the account that is configured on the SMTP server for use.

Option	Description
SMTP Password	The password of the SMTP server username or account.
(Default) To Email	The sender email address.
Reply Email	The reply-to email address.

Save your changes.



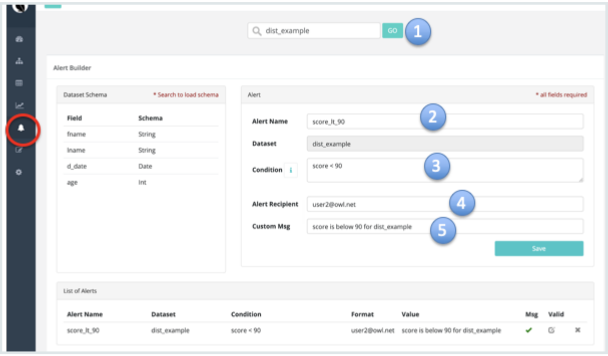
SMTP Host	smtp.mailtrap.io
SMTP Port	2525
SMTP Username	username
SMTP Password	password
(Default) To Email	brian@email.com
Reply Email	brian@email.com

See screenshot below for example of configuration.

When completed, click the **Add** button.

Once the information has been populated and added, the grey box above the form will get populated with the content supplied. If the data ever has to be changed clicking the Alerts icon will repopulate the form in order to be modified and re added.

Now that configuration of the SMTP Email Server has been completed let’s create an alert and see that the alert triggers an email. In this example, we will use the dist_example dataset that we ran earlier from the demo.sh script.



dist_example

Alert Builder

Dataset Schema * Search to load schema

Field	Schema
fname	String
lname	String
d_date	Date
age	Int

Alert * all fields required

Alert Name	score_lt_90
Dataset	dist_example
Condition	score < 90
Alert Recipient	user2@owl.net
Custom Msg	score is below 90 for dist_example

List of Alerts

Alert Name	Dataset	Condition	Format	Value	Msg	Valid	
score_lt_90	dist_example	score < 90	user2@owl.net	score is below 90 for dist_example	✓		✖

In the above screen shot we:

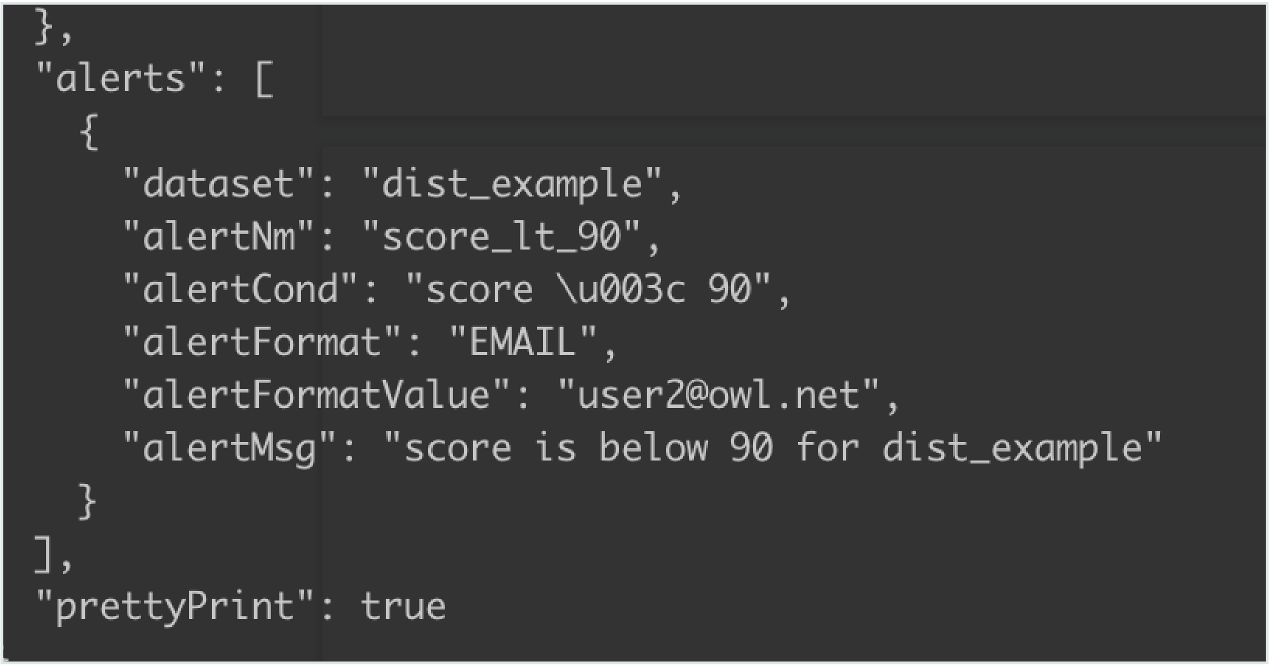
1. Searched for the “dist_example” dataset
2. Provided an alert named “score_lt_90”
3. Provided a condition that we know will be met “score < 90”
4. Provided who the recipient of this alert should be mailed to in this sample “user-2@owl.net”
5. Custom Message = “score is below 90 for dist_exampe”

Clicking the “Save” button will move the contents of the form above to the List of Alerts for this particular dataset.

From the terminal on this install if you run the below command (which is just an extract out of the demo.sh file). We should see the alert get triggered

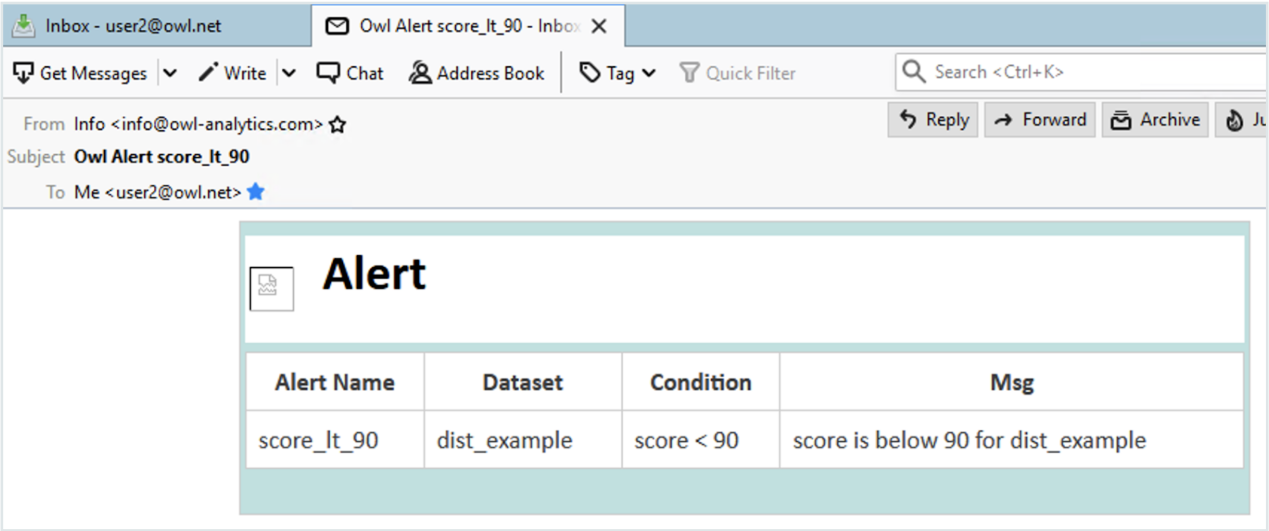
```
./owlcheck -ds dist_example -rd 2018-10-07 -d , -f /opt/owl/bin/demos/distribution_change.csv -fq "select * from dataset where d_date ='2018-10-07'"
```

At the end of this command we should see the “Alert was triggered” as shown in the screenshot below.



```
},
"alerts": [
  {
    "dataset": "dist_example",
    "alertNm": "score_lt_90",
    "alertCond": "score \u003c 90",
    "alertFormat": "EMAIL",
    "alertFormatValue": "user2@owl.net",
    "alertMsg": "score is below 90 for dist_example"
  }
],
"prettyPrint": true
```

And the recipient <valued.user@example.com> received the email.



From Info <info@owl-analytics.com>

Subject **Owl Alert score_lt_90**

To Me <user2@owl.net>

Alert

Alert Name	Dataset	Condition	Msg
score_lt_90	dist_example	score < 90	score is below 90 for dist_example

Advanced

Allow/Disallow Using the catalog feature from Wizard: BULK_CATALOG_ON = **TRUE**/FALSE

Preset Wizard Config for showing views: DB_VIEWS_ON = **TRUE**/FALSE

Preset Wizard Config for showing stats: DB_STATS_ON = **TRUE**/FALSE

Set File Search Path From Wizard: UPLOAD_PATH = <Path on Web Server>

Set/Unset -p/-srcp masking in UI: MASK_P_FLAG = **TRUE**/FALSE

Allow/Disallow Zeppelin Notebooks: ZEPPELIN_ENABLED = **TRUE**/FALSE

Allow/Disallow Using the orient DB: ORIENT_ENABLED = **TRUE**/FALSE

Pendo

> **Warning** The Pendo integration is active by default.

> **Note** As of the 2022.06 release, all new customers receive a new license.

Pendo is an analytics application embedded in Collibra that helps us analyze, develop, and improve our product. No sensitive information is ever collected, we only leverage high-level usage statistics to improve our offerings. If no modifications are made to the default settings, Pendo will not block or impair the intended functionality of Collibra Data Quality in any way.

Pendo in a standalone environment

If you install a standalone environment, modify the <install-dir>/config/owl-env.sh file by adding your license name

```
export DQ_INTEGRATION_PENDO_ACCOUNTID=<your-license-name>
```

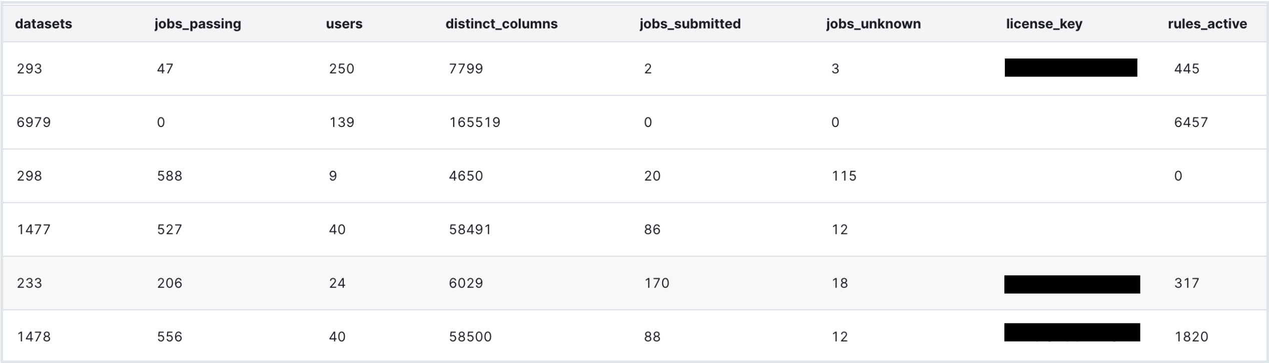
> **Note** For more information on Collibra's subprocessors, please review Collibra's Subprocessors page.

Usage

> **Note** You must have admin privileges to access usage metrics.

The Usage page lets you analyze your monthly usage statistics from the Admin Console. Key monthly metrics tracked on the Usage page include:

- Total number of users.
- Total number of DQ Jobs run.
- Total number of rules applied.
- Total number of data sets.
- Total number of columns.



datasets	jobs_passing	users	distinct_columns	jobs_submitted	jobs_unknown	license_key	rules_active
293	47	250	7799	2	3	[redacted]	445
6979	0	139	165519	0	0		6457
298	588	9	4650	20	115		0
1477	527	40	58491	86	12		
233	206	24	6029	170	18	[redacted]	317
1478	556	40	58500	88	12	[redacted]	1820

Viewing the Usage page

To view the Usage page

1. Click the gear icon and then click Admin Console.
   >> The Admin Console opens.
2. Click the Usage tile.
   >> The Usage page opens.
3. Analyze your usage statistics if they are available.

React

> **Note** As of the 2022.11 Release, React MUI is on by default.

You can toggle React MUI on or off, depending on your preference.

Toggling React MUI

1. Hover over the Admin Console icon and select **Settings**.
   >> The Limit Settings page opens.

2. At the top right of the Settings page, select **App Config**.
   >> The App Config page opens.

3. Enter the required information.

Option	Description
REACT_MUI	Enter **TRUE** to turn the React MUI on for all non-Admin pages. Enter **FALSE** to turn the React MUI off for all non-Admin pages.
UX_REACT_ON	Enter **TRUE** to turn the React MUI on for all Admin pages. Enter **FALSE** to turn the UX React off for all Admin pages.

4. Click **Save**.

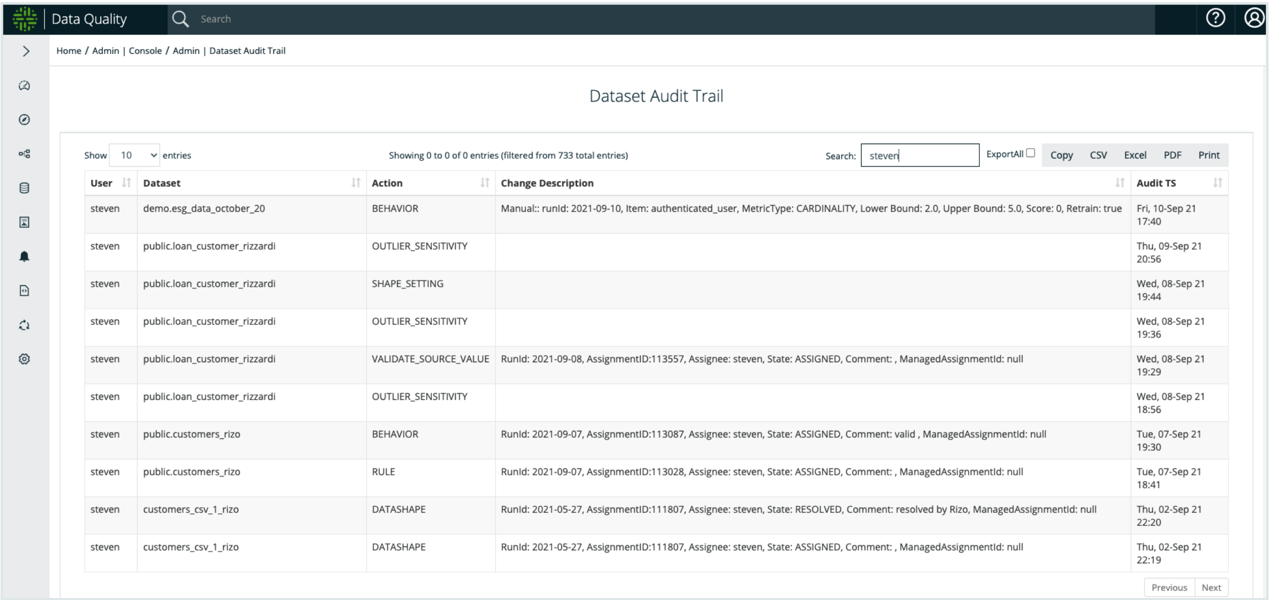
Audit

Built-in auditing allows you to track usage and modifications across data set, security, and user levels.

Dataset Audit Trail

Available Data

- User
- Data Set
- Selected Features
- runID
- Assignments
- Comments
- Timestamp



Home / Admin | Console / Admin | Dataset Audit Trail

Dataset Audit Trail

Show 10 entries

Showing 0 to 0 of 0 entries (filtered from 733 total entries)

Search: steven

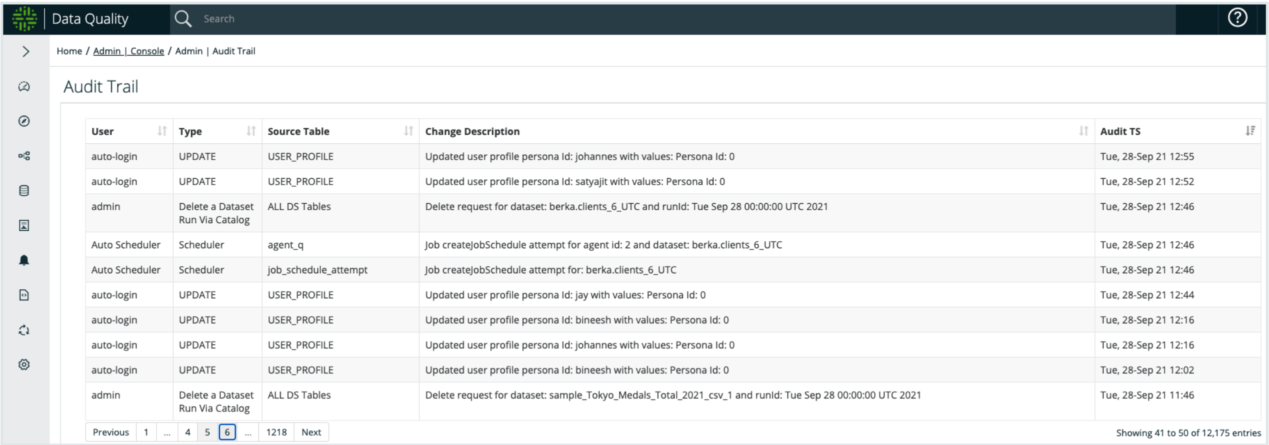
ExportAll □

User	Dataset	Action	Change Description	Audit TS
steven	demo.esg_data_october_20	BEHAVIOR	Manual:: runId: 2021-09-10, Item: authenticated_user, MetricType: CARDINALITY, Lower Bound: 2.0, Upper Bound: 5.0, Score: 0, Retrain: true	Fri, 10-Sep 21 17:40
steven	public.loan_customer_rizzardi	OUTLIER_SENSITIVITY		Thu, 09-Sep 21 20:56
steven	public.loan_customer_rizzardi	SHAPE_SETTING		Wed, 08-Sep 21 19:44
steven	public.loan_customer_rizzardi	OUTLIER_SENSITIVITY		Wed, 08-Sep 21 19:36
steven	public.loan_customer_rizzardi	VALIDATE_SOURCE_VALUE	RunId: 2021-09-08, AssignmentID:113557, Assignee: steven, State: ASSIGNED, Comment: , ManagedAssignmentId: null	Wed, 08-Sep 21 19:29
steven	public.loan_customer_rizzardi	OUTLIER_SENSITIVITY		Wed, 08-Sep 21 18:56
steven	public.customers_rizo	BEHAVIOR	RunId: 2021-09-07, AssignmentID:113087, Assignee: steven, State: ASSIGNED, Comment: valid , ManagedAssignmentId: null	Tue, 07-Sep 21 19:30
steven	public.customers_rizo	RULE	RunId: 2021-09-07, AssignmentID:113028, Assignee: steven, State: ASSIGNED, Comment: , ManagedAssignmentId: null	Tue, 07-Sep 21 18:41
steven	customers_csv_1_rizo	DATASHAPE	RunId: 2021-05-27, AssignmentID:111807, Assignee: steven, State: RESOLVED, Comment: resolved by Rizo, ManagedAssignmentId: null	Thu, 02-Sep 21 22:20
steven	customers_csv_1_rizo	DATASHAPE	RunId: 2021-05-27, AssignmentID:111807, Assignee: steven, State: ASSIGNED, Comment: , ManagedAssignmentId: null	Thu, 02-Sep 21 22:19

Security Audit Trail

Available Data

- User profile updates
- Role updates
- Reference table from metastore
- Data set deletion requests
- Job schedule attempts



Home / Admin | Console / Admin | Audit Trail

Audit Trail

User	Type	Source Table	Change Description	Audit TS
auto-login	UPDATE	USER_PROFILE	Updated user profile persona Id: johannes with values: Persona Id: 0	Tue, 28-Sep 21 12:55
auto-login	UPDATE	USER_PROFILE	Updated user profile persona Id: satyajit with values: Persona Id: 0	Tue, 28-Sep 21 12:52
admin	Delete a Dataset Run Via Catalog	ALL DS Tables	Delete request for dataset: berka.clients_6_UTC and runId: Tue Sep 28 00:00:00 UTC 2021	Tue, 28-Sep 21 12:46
Auto Scheduler	Scheduler	agent_q	Job createJobSchedule attempt for agent id: 2 and dataset: berka.clients_6_UTC	Tue, 28-Sep 21 12:46
Auto Scheduler	Scheduler	job_schedule_attempt	Job createJobSchedule attempt for: berka.clients_6_UTC	Tue, 28-Sep 21 12:46
auto-login	UPDATE	USER_PROFILE	Updated user profile persona Id: jay with values: Persona Id: 0	Tue, 28-Sep 21 12:44
auto-login	UPDATE	USER_PROFILE	Updated user profile persona Id: bineesh with values: Persona Id: 0	Tue, 28-Sep 21 12:16
auto-login	UPDATE	USER_PROFILE	Updated user profile persona Id: johannes with values: Persona Id: 0	Tue, 28-Sep 21 12:16
auto-login	UPDATE	USER_PROFILE	Updated user profile persona Id: bineesh with values: Persona Id: 0	Tue, 28-Sep 21 12:02
admin	Delete a Dataset Run Via Catalog	ALL DS Tables	Delete request for dataset: sample_Tokyo_Medals_Total_2021_csv_1 and runId: Tue Sep 28 00:00:00 UTC 2021	Tue, 28-Sep 21 11:46

Showing 41 to 50 of 12,175 entries

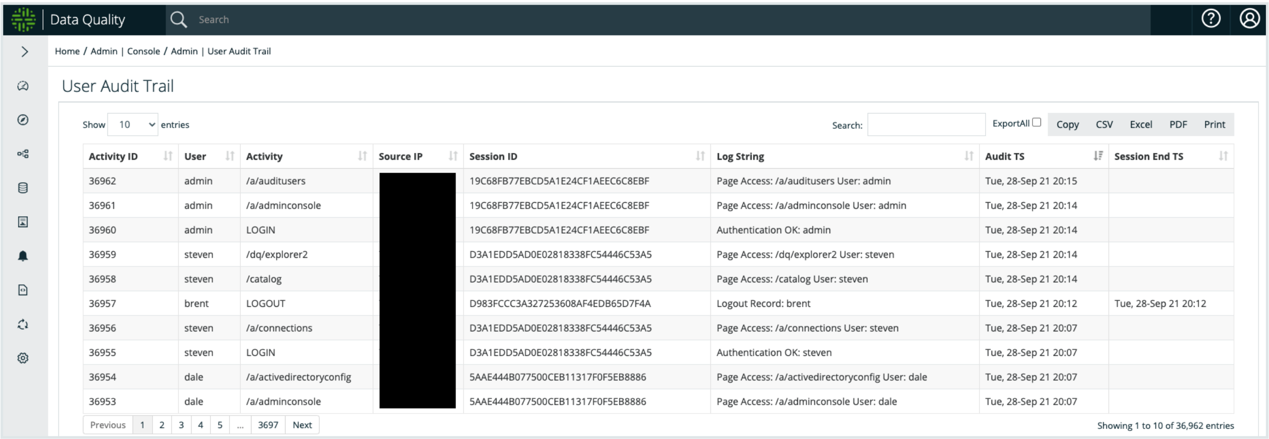
When administrators modify roles mapped to data sets or data sets mapped to roles, changes are documented automatically in the Audit Trail. The information in the entry log includes

- New and original data sets added or removed during the modification.
- New and original roles added or removed during the modification.
- A timestamp of when the modification occurs.
- Type of modification.
- Username by which the modifications are made.

User Audit Trail

Available Data

- Logins: Successful / Failed
- Privileged User Access
- User Actions / Activities
- Account Actions
- Source IP
- Timestamps



User Audit Trail

Show 10 entries

Search: ExportAll ☐ Copy CSV Excel PDF Print

Activity ID	User	Activity	Source IP	Session ID	Log String	Audit TS	Session End TS
36962	admin	/a/auditusers	[redacted]	19C68FB77EBCD5A1E24CF1AEEC6C8EBF	Page Access: /a/auditusers User: admin	Tue, 28-Sep 21 20:15	
36961	admin	/a/adminconsole	[redacted]	19C68FB77EBCD5A1E24CF1AEEC6C8EBF	Page Access: /a/adminconsole User: admin	Tue, 28-Sep 21 20:14	
36960	admin	LOGIN	[redacted]	19C68FB77EBCD5A1E24CF1AEEC6C8EBF	Authentication OK: admin	Tue, 28-Sep 21 20:14	
36959	steven	/dq/explorer2	[redacted]	D3A1EDD5AD0E02818338FC54446C53A5	Page Access: /dq/explorer2 User: steven	Tue, 28-Sep 21 20:14	
36958	steven	/catalog	[redacted]	D3A1EDD5AD0E02818338FC54446C53A5	Page Access: /catalog User: steven	Tue, 28-Sep 21 20:14	
36957	brent	LOGOUT	[redacted]	D983FCCC3A327253608AF4EDB65D7F4A	Logout Record: brent	Tue, 28-Sep 21 20:12	Tue, 28-Sep 21 20:12
36956	steven	/a/connections	[redacted]	D3A1EDD5AD0E02818338FC54446C53A5	Page Access: /a/connections User: steven	Tue, 28-Sep 21 20:07	
36955	steven	LOGIN	[redacted]	D3A1EDD5AD0E02818338FC54446C53A5	Authentication OK: steven	Tue, 28-Sep 21 20:07	
36954	dale	/a/activedirectoryconfig	[redacted]	5AAE444B077500CEB11317F0F5EB8886	Page Access: /a/activedirectoryconfig User: dale	Tue, 28-Sep 21 20:07	
36953	dale	/a/adminconsole	[redacted]	5AAE444B077500CEB11317F0F5EB8886	Page Access: /a/adminconsole User: dale	Tue, 28-Sep 21 20:07	

Showing 1 to 10 of 36,962 entries

Chapter 20

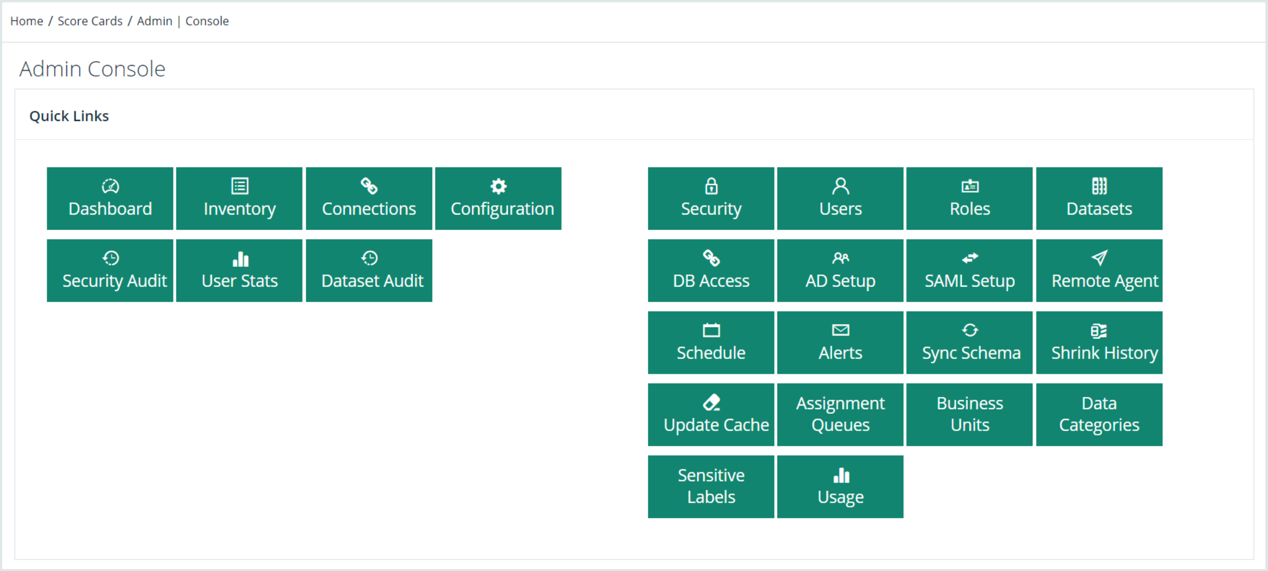
Collibra DQ Security Configuration

Overview

Collibra Data Quality offers multiple methods of user authentication, including a local user store and Active Directory or generic LDAP integration.

Security can be configured to meet your needs. Advanced options to segment groups and roles are available. Additionally, options for SAML and SSO are available.

You can control configurations at the Web (UI), Postgres, and Application layers depending on your security requirements. Encryption is available for data in-transit or at-rest.



Configuration

Configuring Active Directory (AD/LDAP)

Prerequisites

You have Admin permissions (ROLE ADMIN) assigned to your User Profile.

Configure Connectivity from Collibra Data Quality to Active Directory

Steps

1. From the Admin Console, click the **AD Setup** tile.
   >> The **Active Directory Security Settings page** opens.
2. Check the **AD Enabled** checkbox.

3. Enter the required information.
4.

Setting	Description
AD Enabled	AD is enabled when checked.
LDAP Enabled	LDAP is enabled when checked. In most cases, LDAP should be unchecked.
Page Size	Set a value greater than 0 to control query page size. Since some LDAP providers do not support page sizing, this field can either be left blank or set to 0.
Host	The hostname or URL of your LDAP or LDAPS server, for example, ldap://12.345.678.90
Port	The port to connect to your LDAP or LDAPS server. The default ports are **389** for LDAP and **636** for LDAPS.
Base Path	The value entered is the base domain information, for example, **DC=,DC=**.
Group Search Path	The value entered is the domain object path where the groups are located, for example, **OU=OwlGroups,OU=Groups**. A Group Search Path value should not include the value of the Base Path. **Note** After Group Search Path is configured, it is recommended that you restart the DQ Web App.
Domain	Optional. The domain name used to signify when non-local users log in. Only used for AD configurations.
User Search Base	Optional. The base DN of where the LDAP users for Collibra DQare located, for example, **CN=Users**. This is the lowest level container (OU) of user objects. When set, it is used to narrow down user search at login. A User Search Base value should not include the value of the Base Path. **Note** In order to use User Search Base to properly sign in, it is required that you restart the DQ Web App.

Setting	Description
User Search Filter	Optional. When set, this LDAP filter is used to locate users at login. This filter is based on your LDAP configurations. **Note** In order to use User Search Filter to properly sign in, it is required that you restart the DQ Web App.
Group Search Base	Optional. The base DN where all the groups are located. Only used for LDAP configurations.
Group Search Filter	Optional. The LDAP filter used to narrow down group objects located under a base DN. Only used for LDAP configurations.
Bind User	The DN of an admin user that is used for authentication, for example, *admin@collibra.com*.
Bind Password	The password of an admin user. Enter a **Bind Password** for the bind account.

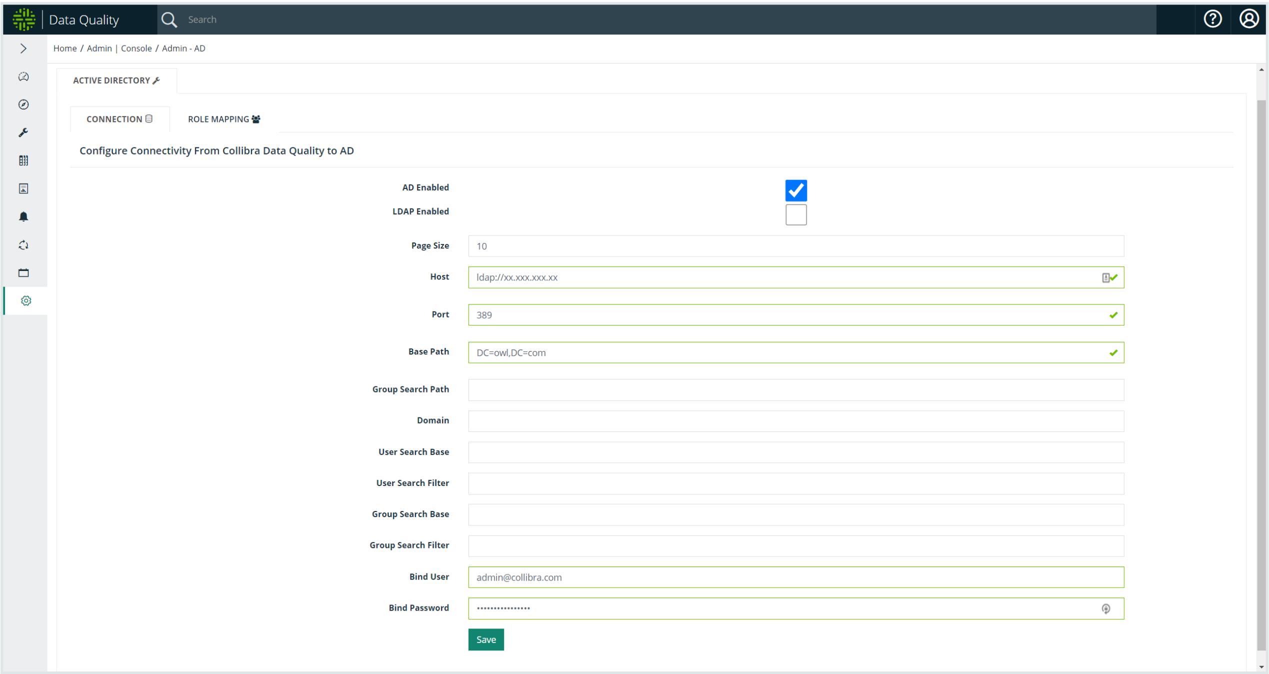
Click **Save**.

Configuration / ENV settings within owl-env.sh

Be sure to add the following script settings when configuring LDAP and Active Directory.

> **Note** This configuration occurs at start-up of the DQ web app. See Standalone Install for a complete list of the owl-env.sh scripts.

OWL-ENV.SH Scripts	Meaning
export LDAP_GROUP_RESULT_DN_ATTRIBUTE	The attribute to the full path of the group object, for example, **CN=OwlAppAdmin** , **OU=OwlGroups** **,OU=Groups,DC=owl,** **DC=com.** Default is **distinguishedname.**
export LDAP_GROUP_RESULT_NAME_ATTRIBUTE	The attribute to the simple name of the group, for example, **OwlAppAdmin.** Default is **CN.**
export LDAP_GROUP_RESULT_CONTAINER_BASE	Property used in the scenario where the LDAP_GROUP_RESULT_DN_ATTRIBUTE does not return a value. In this case, the LDAP_GROUP_RESULT_NAME_ATTRIBUTE prepends to this value, which creates a fully qualified LDAP path. For example, **OU=OwlGroups** , **OU=Groups** **,DC=owl,DC=com.** Default is <**null**>.



Configure Connectivity From Collibra Data Quality to AD

AD Enabled ☑

LDAP Enabled □

Page Size: 10

Host: ldap://xx.xxx.xxx.xx

Port: 389

Base Path: DC=owl,DC=com

Group Search Path:

Domain:

User Search Base:

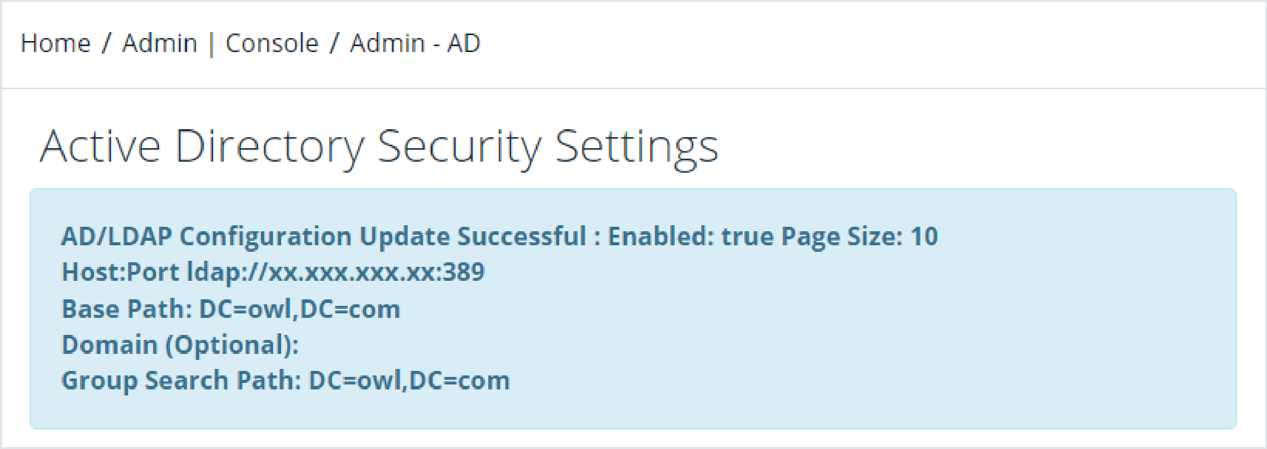
User Search Filter:

Group Search Base:

Group Search Filter:

Bind User: admin@collibra.com

Bind Password: ••••••••••••••••



Active Directory Security Settings

AD/LDAP Configuration Update Successful : Enabled: true Page Size: 10
Host:Port ldap://xx.xxx.xxx.xx:389
Base Path: DC=owl,DC=com
Domain (Optional):
Group Search Path: DC=owl,DC=com

When binding to Active Directory, you do not need a special Bind User and Password. Collibra Data Quality only requires an admin user account with which to bind in order to run a read-only query on the groups. Collibra Data Quality uses AD credentials dynamically to understand what groups you want to map, but the credentials are never stored.

See AD Group to Role Mapping to learn how to map an AD Group to a Collibra Data Quality role.

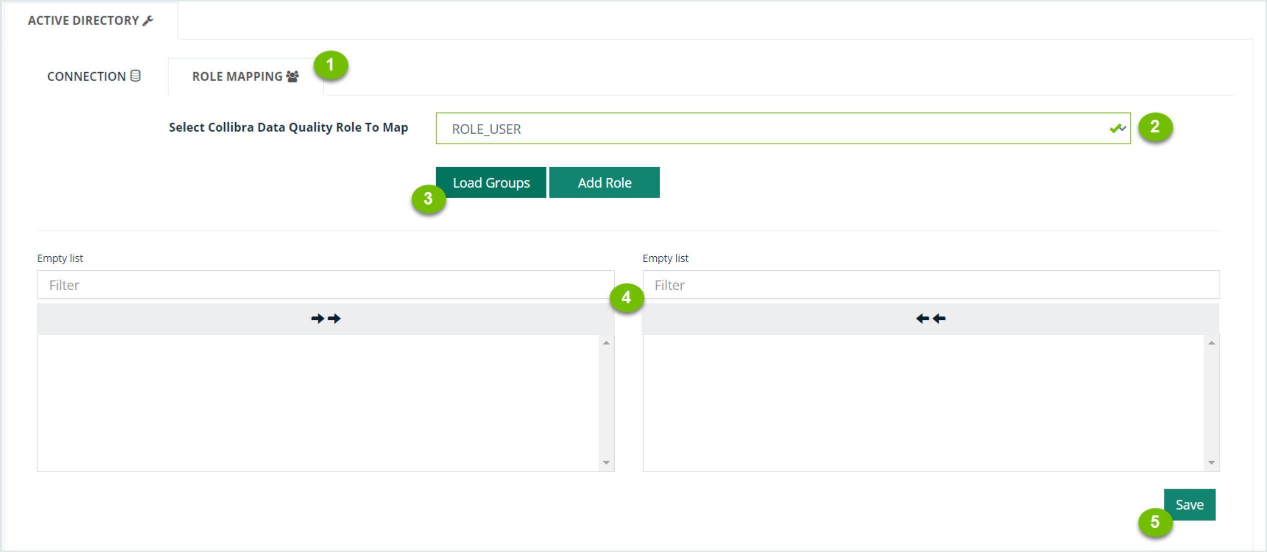
AD Group to Role Mapping

When you map an AD Group to a Collibra Data Quality role, you grant all users from the selected AD Group role-based access to the selected Collibra Data Quality role outlined in the steps below. You can find additional information on creating custom application roles on the Role-Based Access Control page.

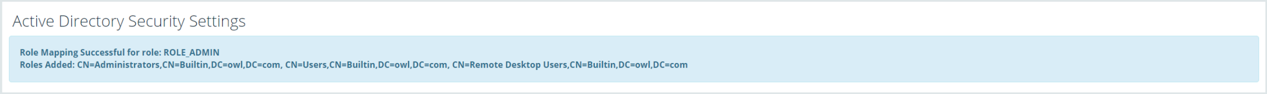
Application properties set in owl-env.sh can be set to determine which LDAP properties correspond to LDAP query results. For group mapping, you need the **full path** (unique) and the **display name**.

For example:

```
LDAP_GROUP_RESULT_DN_ATTRIBUTE=distinguishedname
LDAP_GROUP_RESULT_NAME_ATTRIBUTE=CN
```



1. Click the **Role Mapping** tab.
2. **Select a role** from the dropdown. Alternatively, you can add a new Collibra Data Quality Role to map the AD Group(s) you want to include by clicking the **Add Role** button.
3. Click **Load Groups**. The list box on the left will populate with roles in the group you selected.
4. **Click a role** from the list box on the left to move it to the selection box on the right. You can use the Filter field to filter the lists in either box.
5. Click **Save**.



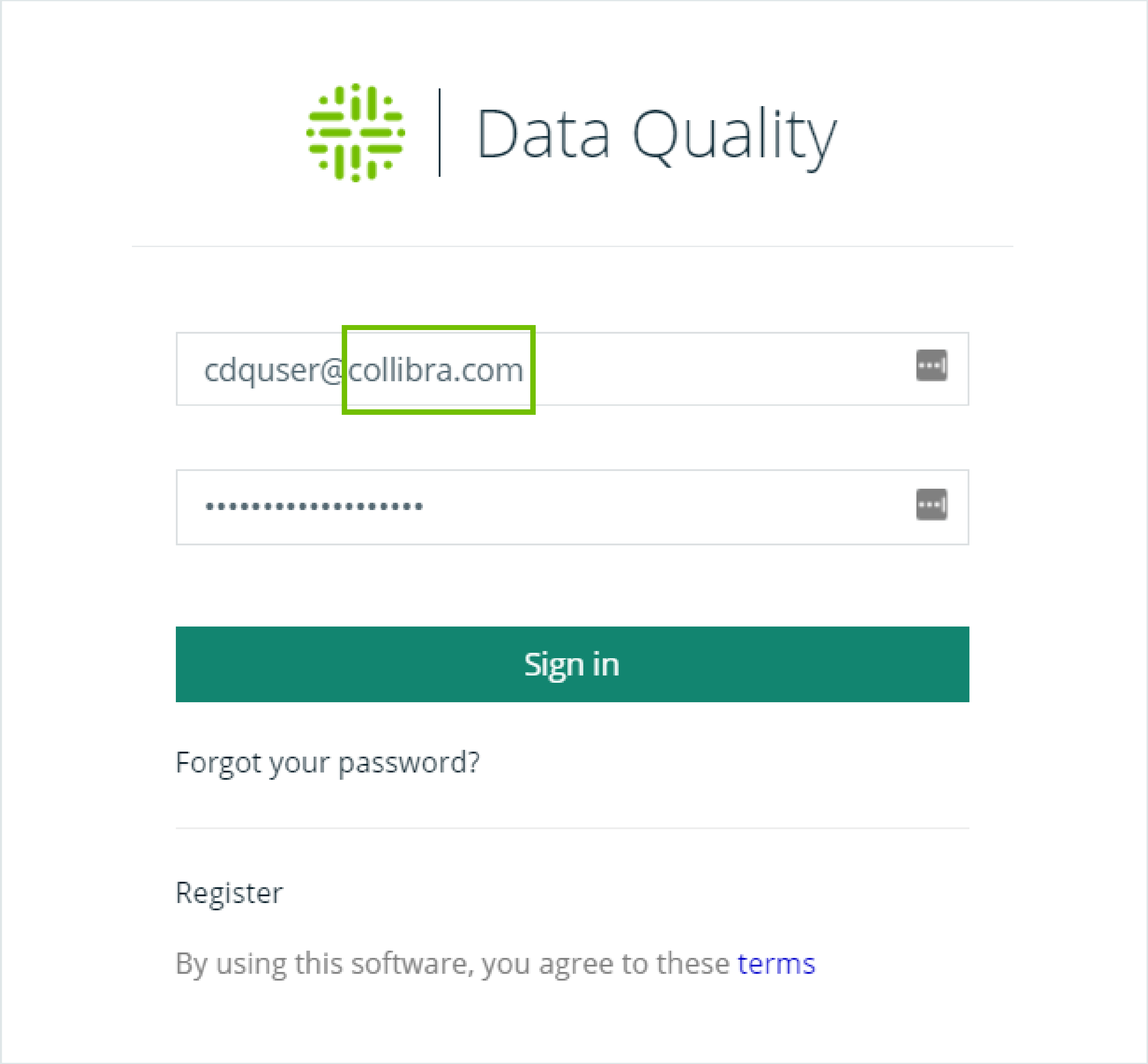
Active Directory Security Settings

Role Mapping Successful for role: ROLE_ADMIN
Roles Added: CN=Administrators,CN=Builtin,DC=owl,DC=com, CN=Users,CN=Builtin,DC=owl,DC=com, CN=Remote Desktop Users,CN=Builtin,DC=owl,DC=com

Once you successfully map an AD Group to an AD Role, log out of Collibra Data Quality and log in again as a domain user.

> **Note** You must restart Collibra Data Quality by running ./owlmanage.sh restart_owlweb when toggling AD Enabled.

When logging into the Collibra Data Quality web application, make sure to append the domain to the end of the username.



Connection Security

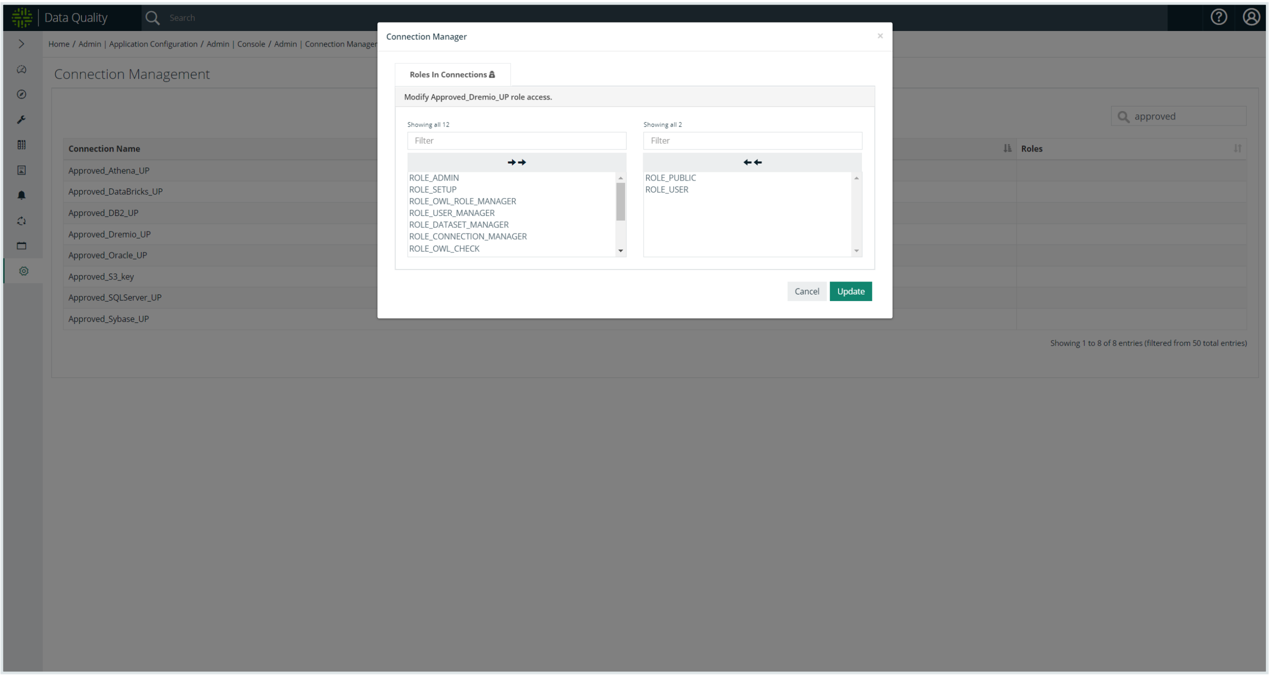
With an admin account, go to the Admin Console.

Click **Security** and toggle on **DB Connection Security**.

With an admin account, go to the Admin Console.

Click **DB Access**.

You can then select your connection from the **Connection Name** column and map roles to your connection. Any user in those mapped roles will be able to see the connection in the UI.


Data Quality
Search
Home / Admin | Application Configuration / Admin | Console / Admin | Connection Manager
Connection Management
approved

Connection Name	Roles
Approved_Athena_UP	
Approved_DataBricks_UP	
Approved_DB2_UP	
Approved_Dremio_UP	
Approved_Oracle_UP	
Approved_S3_key	
Approved_SQLServer_UP	
Approved_Sybase_UP	

Showing 1 to 8 of 8 entries (filtered from 50 total entries)

Connection Manager

Roles In Connections

Modify Approved_Dremio_UP role access.

Showing all 12

ROLE_ADMIN
ROLE_SETUP
ROLE_OWL_ROLE_MANAGER
ROLE_USER_MANAGER
ROLE_DATASET_MANAGER
ROLE_CONNECTION_MANAGER
ROLE_OWL_CHECK

Showing all 2

ROLE_PUBLIC
ROLE_USER

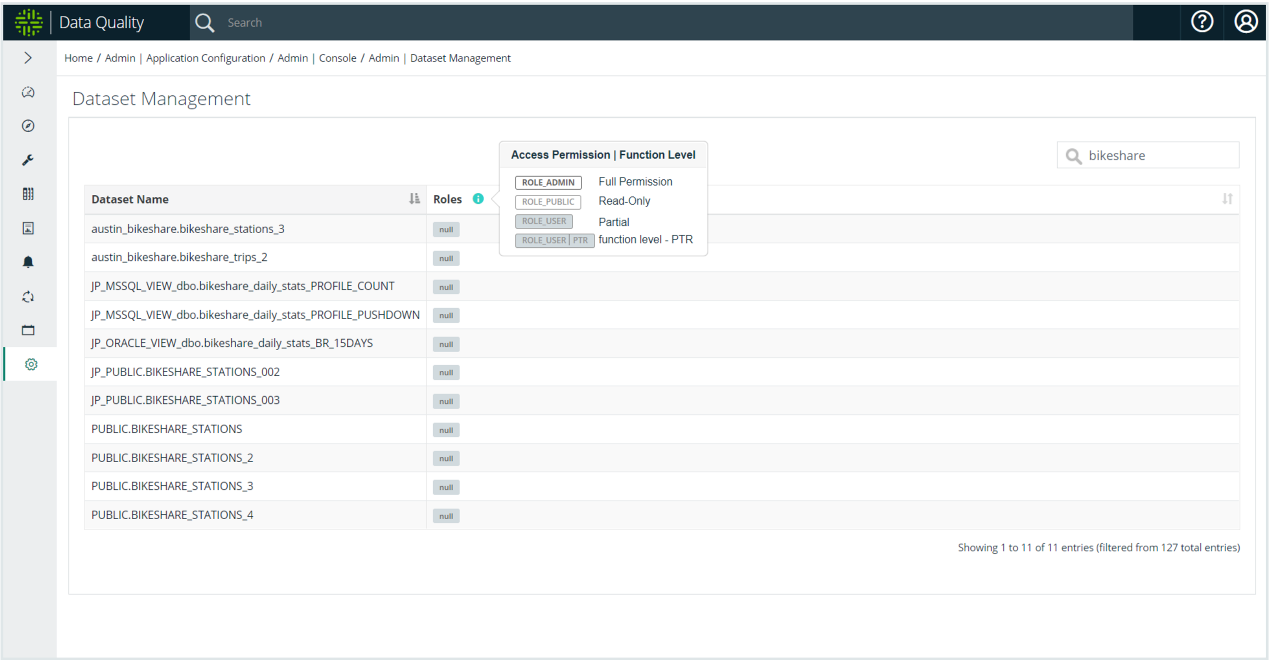
Data Set Security Settings

Security

To configure Data Set Security settings, follow these steps.

Steps

1. Log into the Admin Console Page as an Administrator of Collibra Data Quality.
2. Click the **Gear** icon in the left navigation pane.
3. Click **Admin Console.**
4. Click **Security** on the Quick Links page and toggle on **Dataset Security**.
5. Click **Save.**
6. Click the **Gear** icon in the left navigation pane.
7. Click **Admin Console.**
8. Click **Datasets** on the Quick Links page.


Data Quality
Search
Home / Admin | Application Configuration / Admin | Console / Admin | Dataset Management

Dataset Management

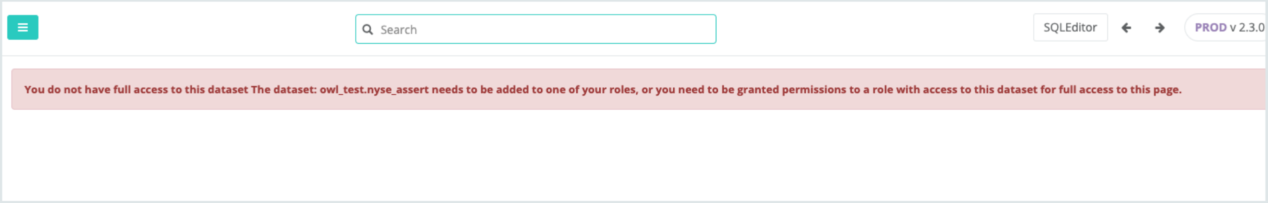
bikeshare

Access Permission | Function Level	
ROLE_ADMIN	Full Permission
ROLE_PUBLIC	Read-Only
ROLE_USER	Partial
ROLE_USER | PTR	function level - PTR

Dataset Name	Roles
austin_bikeshare.bikeshare_stations_3	null
austin_bikeshare.bikeshare_trips_2	null
JP_MSSQL_VIEW_dbo.bikeshare_daily_stats_PROFILE_COUNT	null
JP_MSSQL_VIEW_dbo.bikeshare_daily_stats_PROFILE_PUSHDOWN	null
JP_ORACLE_VIEW_dbo.bikeshare_daily_stats_BR_15DAYS	null
JP_PUBLIC.BIKESHARE_STATIONS_002	null
JP_PUBLIC.BIKESHARE_STATIONS_003	null
PUBLIC.BIKESHARE_STATIONS	null
PUBLIC.BIKESHARE_STATIONS_2	null
PUBLIC.BIKESHARE_STATIONS_3	null
PUBLIC.BIKESHARE_STATIONS_4	null

Showing 1 to 11 of 11 entries (filtered from 127 total entries)

Note all the Datasets from the demo script we launched at the beginning of this document have been added to ROLE_PUBLIC ROLE defined in Collibra Data Quality except the row_count Dataset. At this point, we already have the odemo@owl.com user created and mapped to the ROLE_PUBLIC ROLE which has access to those Datasets. Lets login as odemo@owl.com and try to access row_count DatasetStats page (for an understanding on how to access the DatasetStats page see the section entitled “Understanding the DQ DatasetStats Page” in this document…..doing so will result in the error message below.



You do not have full access to this dataset The dataset: owl_test.nyse_assert needs to be added to one of your roles, or you need to be granted permissions to a role with access to this dataset for full access to this page.

However, the other DatasetStats that are part of the PUBLIC_ROLE as odemo@owl.com is a member of that ROLE.

The last thing to notice is that, as the user odemo@owl.com cannot access the Admin pages the AD Group odemo is a part of the ADMIN_ROLE.

ACL Security

When ACL is enabled/disabled, an administrator can configure the following options in the Dataset Security pane to limit usage/permissions on data sets:

- Data_Preview role limit (role that can view source data)
- Dataset_train role limit (role that can train data sets)
- Dataset_rules role limit (role that can add / edit / delete rules)

> **Note** This configuration is tied to data sets and not connections or jobs.

Data Set Masking

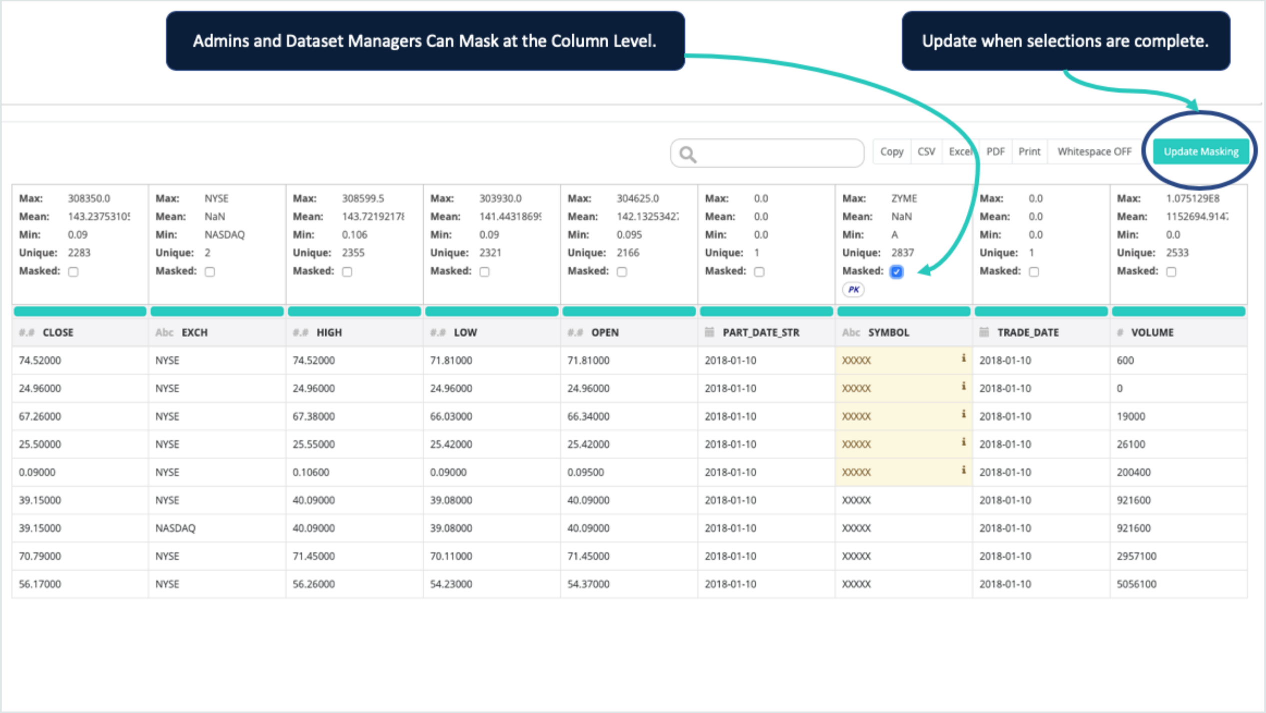
Add column level masking for sensitive data in a data set.

Masking from the UI

After an DQ check runs, you can perform column level masking from the findings page if you have ROLE_ADMIN or ROLE_DATASET_MANAGER assigned to your user.

> **Note** Masking updates will take effect for all existing and future runs of the selected dataset.

> **Note** ROLE_ADMIN and ROLE_DATASET_MANAGER also have the ability to unmask.



Admins and Dataset Managers Can Mask at the Column Level.

Update when selections are complete.

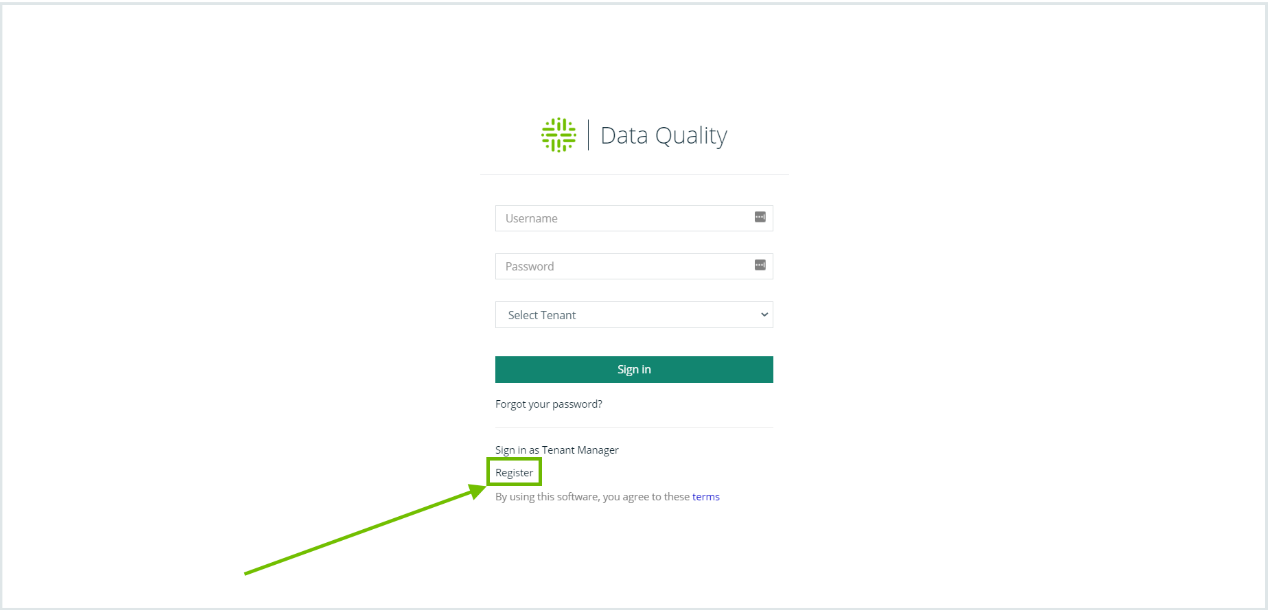
#.# CLOSE	Abc EXCH	#.# HIGH	#.# LOW	#.# OPEN	PART_DATE_STR	Abc SYMBOL	TRADE_DATE	# VOLUME
Max: 308350.0 Mean: 143.23753105 Min: 0.09 Unique: 2283 Masked: □	Max: NYSE Mean: NaN Min: NASDAQ Unique: 2 Masked: □	Max: 308599.5 Mean: 143.72192178 Min: 0.106 Unique: 2355 Masked: □	Max: 303930.0 Mean: 141.44318699 Min: 0.09 Unique: 2321 Masked: □	Max: 304625.0 Mean: 142.13253427 Min: 0.095 Unique: 2166 Masked: □	Max: 0.0 Mean: 0.0 Min: 0.0 Unique: 1 Masked: □	Max: ZYME Mean: NaN Min: A Unique: 2837 Masked: ☑ PK	Max: 0.0 Mean: 0.0 Min: 0.0 Unique: 1 Masked: □	Max: 1.075129E8 Mean: 1152694.9147 Min: 0.0 Unique: 2533 Masked: □
74.52000	NYSE	74.52000	71.81000	71.81000	2018-01-10	XXXXX ℹ	2018-01-10	600
24.96000	NYSE	24.96000	24.96000	24.96000	2018-01-10	XXXXX ℹ	2018-01-10	0
67.26000	NYSE	67.38000	66.03000	66.34000	2018-01-10	XXXXX ℹ	2018-01-10	19000
25.50000	NYSE	25.55000	25.42000	25.42000	2018-01-10	XXXXX ℹ	2018-01-10	26100
0.09000	NYSE	0.10600	0.09000	0.09500	2018-01-10	XXXXX ℹ	2018-01-10	200400
39.15000	NYSE	40.09000	39.08000	40.09000	2018-01-10	XXXXX	2018-01-10	921600
39.15000	NASDAQ	40.09000	39.08000	40.09000	2018-01-10	XXXXX	2018-01-10	921600
70.79000	NYSE	71.45000	70.11000	71.45000	2018-01-10	XXXXX	2018-01-10	2957100
56.17000	NYSE	56.26000	54.23000	54.37000	2018-01-10	XXXXX	2018-01-10	5056100

Local User Store Authentication

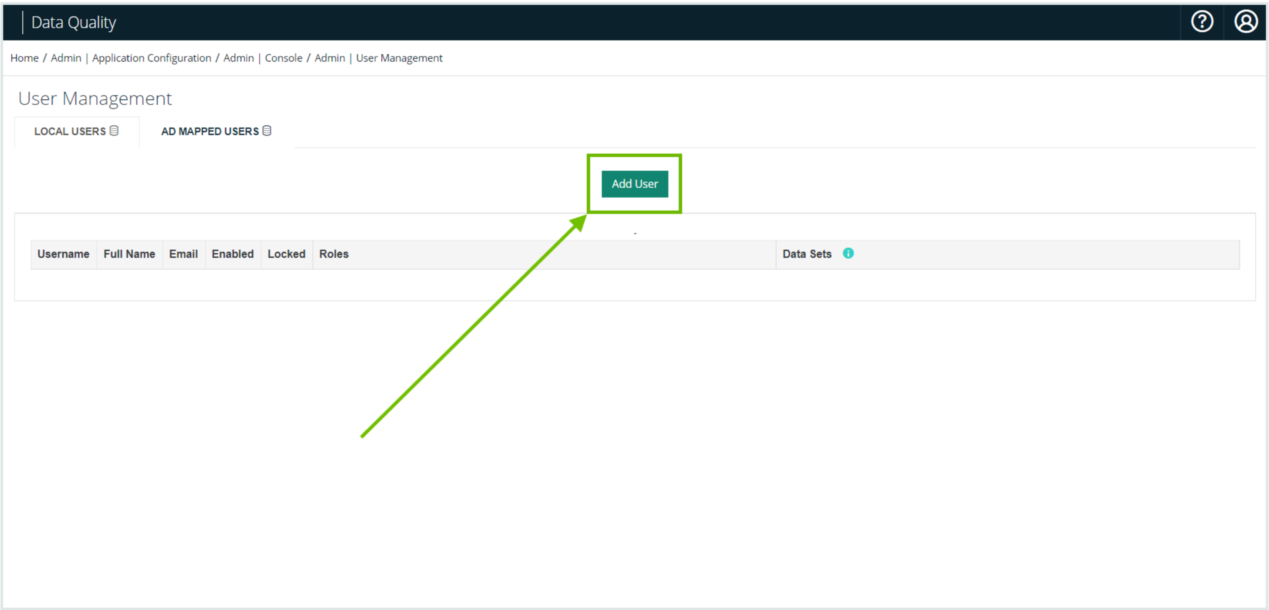
Local user store authentication is enabled by default, and the Collibra Data Quality & Observabilityships with a default user with admin privileges. If you should need to toggle this mechanism on/off you can find the setting by navigating to the Admin Console and clicking on the Security icon. The setting labeled **Local User Store Enabled** when checked will allow your company to create and administer users stored in Collibra Data Quality's internal database user store. Toggling this feature requires a restart of the web application.

Adding Local Users

Users can request access to the application from the login page by clicking the register link beneath the Sign in button.



Application administrators can also create user accounts by navigating to the Admin Console and clicking on the Users icon.


Data Quality
Home / Admin | Application Configuration / Admin | Console / Admin | User Management
User Management
LOCAL USERS
AD MAPPED USERS
Add User

Username	Full Name	Email	Enabled	Locked	Roles	Data Sets

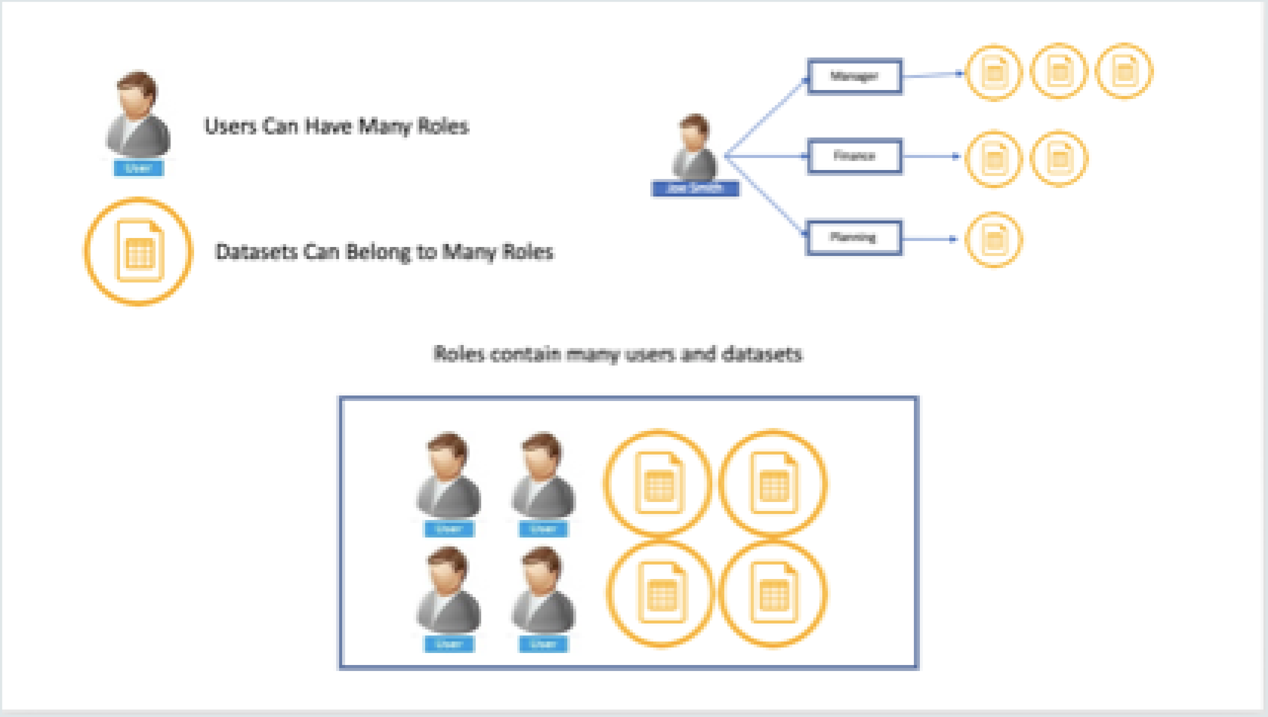
In either case, simply fill out the account form and a user record will be created. The user account at this stage will not have access to the application until an application administrator grants that user access to an owl role or multiple roles.

Granting Local User Roles

Application administrators can manage user accounts and role access by navigating to the Admin Console and clicking on the Users Icon. On that page locate the user you would like to modify and click on their username in the table of users. This will load a pop-up window that allows you to modify the user account including Enabled/Disabled as well as the roles they belong to. Click on the Roles tab to begin granting roles to the selected user. The available roles established will be listed on the left, click a role from the left-hand side to apply that role to the user. You can also add all roles by clicking the double arrow icon above the list. When you are satisfied with the role listings on the right-hand side for that user, click the Update button. There will be more on creating custom application roles in the RBAC Section of this document.

Role Based Access Control (RBAC)

The image below depicts Collibra Data Quality's security architecture.


User
Users Can Have Many Roles
Datasets Can Belong to Many Roles
Joe Smith
Manager
Finance
Planning
Roles contain many users and datasets
User
User
User
User

Whether leveraging a Local User Store, Active Directory, or using the out of the box user accounts that come with Collibra Data Quality via LDIF, security stays the same. An admin can create many ROLEs. A user, whether local user, LDIF user, or AD user can be part of one or many roles. And a ROLE maps to a data set within Collibra Data Quality.

Whether leveraging a Local User Store, Active Directory, or using the out of the box user accounts that come with Collibra Data Quality via LDIF, security stays the same. An admin can create many ROLE's. A user, whether local user, LDIF user, or AD user can be part of one or many roles. And a ROLE maps to a Dataset within Collibra Data Quality.

When dataset security is enabled and you want to access a dataset, or want to see, add, or remove an existing business unit for a dataset, you must have a role that is attached to that dataset.

For datasets, when dataset security and default dataset owner access is enabled, a user with a role attached to a dataset **or** the dataset owner can:

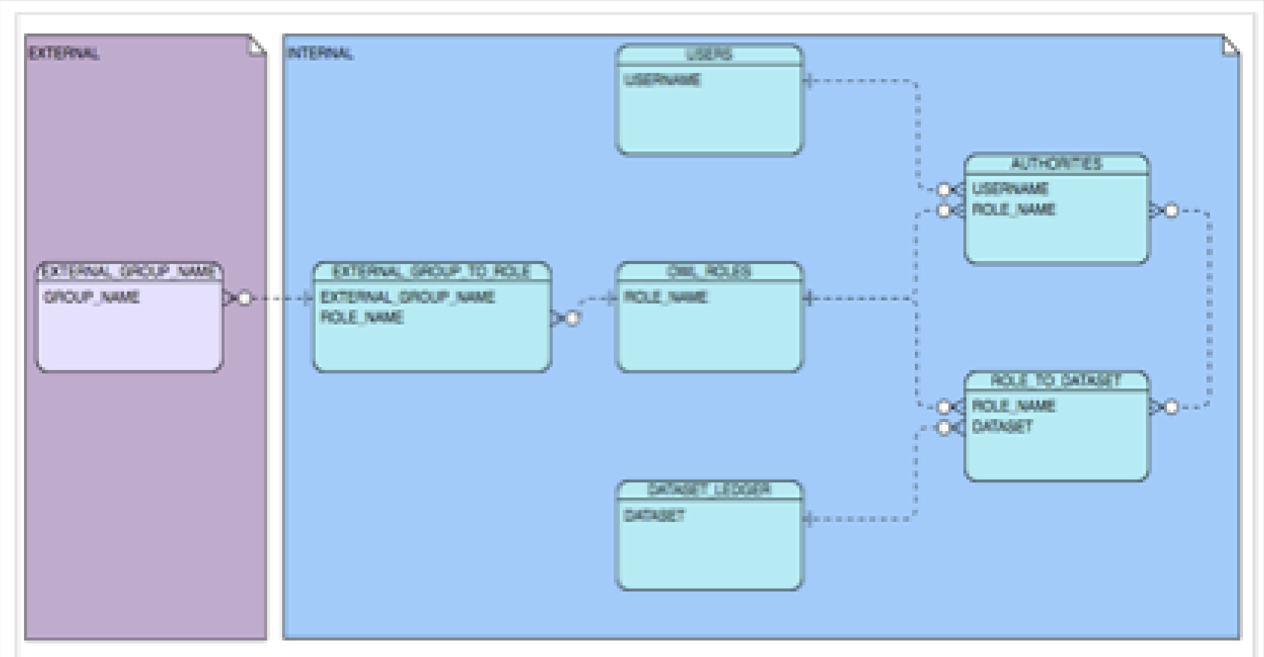
- **Add** - User with no dataset access (with no role attached to any existing dataset) can still create a dataset. After creating it, this user (who is the default dataset owner) can see the dataset, profile, and business units, and add and remove business units to their (owned) dataset.
- **Retrieve/See** - User can retrieve/see datasets, based on dataset access.
- **Edit** - User can edit datasets, based on dataset access.
- **Remove** - User can remove datasets, based on dataset access.

For business units, when dataset security and default dataset owner access is enabled, a user can:

- **Retrieve/See** - User can retrieve/see business units, based on dataset access.
- **Edit** - User can edit business units, based on dataset access.
- **Remove** - User can remove business units, based on dataset access.

> **Note** You must be an admin to create a business unit, which can then be added to a dataset.

A unique feature within Collibra Data Quality is the fact that we do not store information about external user accounts. This avoids the need to sync external users from an external user store such as AD to Collibra Data Quality. Instead, Collibra Data Quality will map the external group to an internal role. From here the ROLE can be mapped to the different functionality within Collibra Data Quality whether they are Admins / Users / and have access to different datasets and future functionality. The other benefit is that if a specific userid within the external user store is terminated, when the user is purged from the external user store such as AD they will immediately not have access to Collibra Data Quality's web application. This is because when the user logs into Collibra Data Quality's web application that is backed by AD their login will interrogate AD to authenticate the user account. See logical flow below for how the group to role mappings work.



RBAC Usages

Collibra Data Quality supports RBAC configuration with both core roles and custom roles. Core roles include the following:

Role	Access Description
ROLE ADMIN	Modify any access, config settings, connections, role delegation
ROLE DATA GOVERNANCE MANAGER	Ability to manage (create / update / delete) Business Units and Data Concepts
ROLE USER MANAGER	Create / modify users, add users to roles
ROLE OWL ROLE MANAGER	Create roles, edit role mappings to users / AD groups / datasets

Role	Access Description
ROLE DATASET MANAGER	Create / modify datasets to roles, masking of dataset columns
ROLE OWL CHECK	Only role that can run DQ scans if Owlcheck security is enabled
ROLE DATA PREVIEW	Only role that can view source data if data preview security is enabled
ROLE DATASET TRAIN	Only role that can train datasets if dataset train security is enabled
ROLE DATASET RULES	Only role that can add / edit / delete rules if dataset rules security is enabled
ROLE VIEW DATA	Controls which users can access the DQ SQL editor to run the SQL against the database
ROLE PUBLIC	Public: Access to scorecards, no dataset access when dataset security is enabled
ROLE USER	Do not use
ROLE SETUP	Do not use

Custom roles can be added via the Role Management page by navigating to the Admin Console and clicking on the Roles Icon. Custom roles can also be added 'on the fly' during the Active Directory Role Mapping step.

It is these custom roles that will determine the users that have access to data sets (including profile/rules/data preview/scoring), and database connections

Additional information regarding setting up Dataset and Connection security can be found in those documents respectively.

SAML Authentication

You can integrate Collibra DQ with an existing SAML solution and have your application act as a service provider. Once you set up the environment variables, you can access and configure SAML security settings as an administrator in the **SAML Setup** section of the **Admin Console**.

Set the SAML authentication properties

Before configuring SAML authentication, you must add the following required properties to your configuration

Standalone installation

1. Add the properties as environment variables to your **owl-env.sh** file located in **<installation_directory>/owl/config/**.
2. Prefix all properties with the `export` statement.
3. Restart the web app. {% endtab %}

Cloud native installation

1. Add the properties as environment variables to your **owl-web ConfigMap**.
2. Recycle the pod.

Required properties

Property	Description
SAML_ENABLED	Whether Collibra DQ uses SAML. If set to `false`, users sign in with a username and password. If set to `true`, SAML handles the authentication request.
SAML_ENTITY_ID	The name of the application for the identity provider, for example *Collibra DQ*. It is an immutable unique identifier of the service provider for the identity provider (IDP).

> **Warning** Please see CORS_ALLOWED_ORIGINS in the **Optional properties** section below if you have SAML configured in DQ, or if the app sits behind a load balancer.

Optional properties: general

You can further configure your SAML setup with the following optional properties.

Property	Description
CORS_ ALLOWED_ ORIGINS	Allows cross-origin requests between DQ and SAML. Replace {IDP-BASE-URL} with the value of the actual IdP URL. For example, https://ping.auth.com/ Replace with the value of the actual DQ Base URL. For example, https://dq-env.com.
SAML_ ENTITY_ BASEURL	The base URL that is provided in the service provider metadata. Set this property when you use DNS.
SAML_LB_ EXISTS	Whether the application needs to configure a load balancer. You generally need this setting only when the **Load Balancer** is set for **SSL Termination**. The default value is `false`. If set to `true`, you must also provide a value for **SAML_LB_SERVER_NAME**.
SAML_ METADATA_ USE_URL	Whether Collibra DQ uses an URL or a file for the identity provider metadata. The default value is `true`. If set to `false`, the file must be accessible to the owl-web and the path provided in the **Meta-Data URL** field of the **Meta Data Configurations** section under **Admin Console** --> **SAML Setup** --> **Connection**.
SAML_ ROLES_ PROP_NAME	The attribute in which the identity provider stores the role of the user authenticating in the SAML response. The default value is `memberOf`.
SAML_ GRANT_ALL_ PUBLIC	Whether any user authenticated by the identity provider is allowed to login the Collibra DQ application. The default value is `true`.
SAML_USER_ NAME_PROP	The name of the attribute in the SAML response that contains the username of the user who is authenticating.
SAML_ TENANT_ PROP_NAME	If using multi-tenant mode, the variable in which the identity provider stores the tenant name of the user authenticating in the SAML response. The app will attempt to use the `RelayState` parameter to identify the tenant and then fall back on this property.

Property	Description
SAML_KEYSTORE_FILE	The path to the keystore for SSL validation. The store should contain the keypair of the identity provider for SSL verification.
SAML_KEYSTORE_PASS	The password for the keystore provided in `SAML_KEYSTORE_FILE`.
SAML_KEYSTORE_ALIAS	The alias of the keypair (private and public) in the keystore used for SSL verification.

> **Note** While CORS is still an optional configuration, it is required if you have SAML configured in DQ, or if you have DQ behind a load balancer.

> **Note** CORS is also enforced for multi-tenancy.

Optional Properties: Metadata

When **SAML_METADATA_USE_URL** is set to `true` (default), the following additional properties are available.

Property	Description
SAML_METADATA_TRUST_CHECK	Whether to enable Collibra DQ to do trust verification of the identity provider. The default value is `false`.
SAML_METADATA_REQUIRE_SIGNATURE	Whether Collibra DQ signs authentication requests to the identity provider. The default value is `false`.
SAML_INCLUDE_DISCOVERY_EXTENSION	Whether to enable Collibra DQ to indicate in the SAML metadata that it's able to consume responses from an IDP Discovery Service. The default value is `false`.

Optional Properties: Load Balancer

When **SAML_LB_EXISTS** is set to `true`, the following additional properties are available.

Property	Description
SAML_LB_INCLUDE_PORT_IN_REQUEST	Whether to include the port number in the request. The default value is `false`.
SAML_LB_PORT	The port number of the load balancer. The default value is `443`.
SAML_LB_SCHEME	The protocol of the load balancer. The default value is `https`.
SAML_LB_SERVER_NAME	The server or DNS name. Usually, the same as **SAML_ENTITY_BASEURL** without specifying the protocol, for example without *https://*. This property is required and has no default.
SAML_LB_CONTEXT_PATH	Any path that may be defined on the load balancer.

Example

```
#enable SAML & show the SAML SSO option on the login page
SAML_ENABLED=true

#set SSL communication properties for SAML
SAML_KEYSTORE_FILE=/keystore.p12
SAML_KEYSTORE_PASS=****
SAML_KEYSTORE_ALIAS=****

#in multi-tenant mode set the name of the IDP variable to hold
the tenat name
SAML_TENANT_PROP_NAME=tenant

#set the name of the IDP variable to hold the user roles in the
response
SAML_ROLES_PROP_NAME=memberOf
```

```
#allow login if authenticated to the IDP
SAML_GRANT_ALL_PUBLIC=true

#set the EntityId of the application to be supplied to the IDP
SAML_ENTITY_ID=OwlOneLogin

#optinally set a property that contains the username in the
response
SAML_USER_NAME_PROP=""

#optionally use a file for the IDP metadata vs a URL (default
is true)
SAML_METADATA_USE_URL=false

#optional security settings to
SAML_METADATA_TRUST_CHECK=false
SAML_METADATA_REQUIRE_SIGNATURE=false
SAML_INCLUDE_DISCOVERY_EXTENSION=false
```

Download service provider metadata for the IDP

Once you have enabled and configured SAML authentication, you can download the service provider metadata that is required by your identity provider from `https://<your_dq_environment_url>/saml/metadata`.

Enable the SAML sign in option

When you are ready with your IDP settings, add the final configuration settings in the **Admin Console**:

1. Sign in as an existing administrator with a username and password to the tenant you want to configure.
2. In the **Admin Console**, click **SAML Setup**.
3. In the **Connection** tab, select the **SAML Enabled** checkbox.
4. In the **Meta Data Configurations** section, click **+Add**.

5. Enter the required information.

Option	Description
Meta-Data URL	The URL of the identity provider metadata XML file or the location of the downloaded XML file, depending on how you configured the SAML_METADATA_USE_URL property.
Meta-Data Label	The name for this specific configuration.
IDP URL	The URL of the Collibra DQ application that is provisioned by the identity provider.

6. Click **Save**.

Tip Once you complete this setup, restart your application and sign in using the SAML SSO option.

Note SAML SSO authentication via the /v3/auth/signin API is not supported.

Multi-tenancy support through SAML RelayState

As of Collibra DQ version 2021.11, in a multi-tenant environment, you can help route SSO to the proper tenant with the SAML provided **RelayState** property.

When set, the property is sent to the IDP and then returned to the consumer service, such as /saml/SSO. The application checks that value to ensure the correct tenant is set up.

You can set the **RelayState** property in the in the **SAML Setup** section of the **Admin Console**.

Securing Passwords

Security is of the utmost importance for Collibra DQ and our customers. To avoid sending plain text passwords when you run DQ Jobs from the command line, you can encrypt passwords instead. To encrypt your password, execute the following command:

```
owlmanage.sh encrypt=password
```

The output password should look similar to the following example:

```
Q+Ri1S+ljpG+fDefXLY4/vXtUosspAoL
```

You can use this password in any DQ Job from the command line where you would normally use a plain text password.

The following is an example of a DQ Job with an encrypted password instead of a plain text password:

```
./owlcheck -q "SELECT id, browser->'$.name' browser FROM events"
-c "jdbc:mysql://54.212.36.218:2212/test" -u "owl" -p
"Q+Ri1S+ljpG+fDefXLY4/vXtUosspAoL" -driver "com.mysql.cj.jd-
bc.Driver" -lib "/opt/owl/drivers/mysql8" -ds jsonremotemysql -
rd "2022-07-25"
```

If you run a DQ Job from within the DQ Web UI, it automatically encrypts your password, eliminating the need to manually encrypt it. For added security, all passwords are masked in the logs and plain text passwords are never stored.

SSL Setup (HTTPS)

By Default Collibra DQ has plain HTTP enabled for testing. When you are ready to enable SSL for the web application you can set the following environment variables in owl-env.sh to enable HTTPS.

The settings listed at the bottom of this page will disable un-secure HTTP, enable secure HTTPS, and allow you to point to your certificate key store + credentials. *A restart of the web-application is required.

Before starting please have an accessible key store.

```
export SERVER_SSL_KEY_STORE: <path to your key store>
```

You can call Collibra DQ's built in 256-bit encryption for the SERVER_SSL_KEY_PASS value from the bin directory: ./owlmanage.sh encrypt=<sensitive plain text string>

Use the response value instead of the plain text value to secure your password.

```
export SERVER_SSL_KEY_PASS:<secure result from owl encryption
script>
```

```
export SERVER_HTTP_ENABLED:false
export SERVER_HTTPS_ENABLED:true
export SERVER_REQUIRE_SSL:true

####START KEYSTORE SETTINGS####
export SERVER_SSL_KEY_TYPE:PKCS12
#SET PATH TO KEYSTORE
export SERVER_SSL_KEY_STORE:KeystorePathHere
export SERVER_SSL_KEY_PASS:*******
export SERVER_SSL_KEY_ALIAS:keystoreAliasNameHere
```

The most common SSL types are JKS and PKCS12

Warning Don't forget to restart the web application from the bin directory: `./owlmanage.sh restart=owlweb`

Appendix 21

Collibra DQ Legal

Agreements

This section contains legal agreements specific to Collibra.

Collibra Evaluation Agreement

For the full Collibra Evaluation Agreement document, follow the link below.

Collibra Click-Through Evaluation Agreement

BY ACCEPTING THESE TERMS OR OTHERWISE USING OR ACCESSING THE EVALUATION OFFERINGS, YOU ACCEPT AND AGREE TO BE BOUND BY THE TERMS AND CONDITIONS IN THIS COLLIBRA EVALUATION AGREEMENT ("EVALUATION AGREEMENT”). COLLIBRA GRANTS YOU ACCESS TO AND USE OF THE EVALUATION OFFERINGS ONLY IF YOU ACCEPT THE TERMS AND CONDITIONS OF THIS EVALUATION AGREEMENT. IF YOU ARE ENTERING INTO THIS EVALUATION AGREEMENT ON BEHALF OF A COMPANY OR OTHER LEGAL ENTITY, YOU REPRESENT THAT YOU HAVE THE AUTHORITY TO BIND SUCH ENTITY TO THIS EVALUATION AGREEMENT, IN WHICH CASE THE TERMS “YOU,” OR “YOUR” SHALL REFER TO SUCH ENTITY. IF YOU DO NOT HAVE SUCH AUTHORITY, OR IF YOU DO NOT AGREE WITH THESE TERMS AND CONDITIONS, YOU MAY NOT ACCESS OR USE THE EVALUATION OFFERING.

This Evaluation Agreement is entered into between you (the individual and any entity for which you are acting, and your permitted successors and assigns) and Collibra, meaning Collibra Inc., if you are located in the United States, Mexico or Canada; or Collibra UK Limited, if you are located in a country other than the United States, Mexico or Canada (in each case, referred to herein as “**Collibra**”).

1. Grant and Use Rights for Evaluation

1. **Evaluation Grant.** Subject to your compliance with this Evaluation Agreement, Collibra grants you, at no cost, a non-exclusive, non-transferable, non-sublicensable, temporary and limited (i) right to access and use Collibra’s software-as-a-service cloud offering including any relevant accompanying software components and documentation

("**Service**") and/or (ii) license to install, copy and use the object code form of Collibra's proprietary installed software product including any relevant accompanying documentation ("**Software**"), as applicable to your evaluation ("**Evaluation Offering**"), solely on an evaluation basis for non-production, internal, test and demonstration purposes (the "**Purpose**") during the Evaluation Term. There is no commitment to purchase the Evaluation Offering at the end of the Evaluation Term. Collibra may provision the Evaluation Offering with the assistance of its affiliates and suppliers, and during the Evaluation Term, Collibra may update the Evaluation Offering and/or limit certain features and functionality of the Evaluation Offering at its discretion.

2. **Evaluation Term.** You may use the Evaluation Offering subject to this Evaluation Agreement only for a period of twenty (20) days ("**Evaluation Term**"). Any extension of the Evaluation Term must be agreed to by both parties, in writing.

2. Restrictions

You will not (and will not permit anyone else to) do any of the following: (a) use the Evaluation Offering for anything other than the Purpose; (b) use the Evaluation Offering under this Evaluation Agreement to avoid incurring fees or exceeding any limitations agreed to in an order form entered into by and between you and Collibra; (c) provide access to, distribute or sublicense the Evaluation Offering to a third-party, (d) use the Evaluation Offering on behalf of, or to provide any product or service to, third parties, (e) use or reference the Evaluation Offering to develop a similar or competing product or service, (f) reverse engineer, decompile, disassemble, or seek to access the source code, algorithms, programming interfaces, or non-public APIs to the Evaluation Offering, except to the extent expressly permitted by applicable law (and then only with prior notice to Collibra), (g) circumvent any established usage limits, including restrictions on number of authorized users, whether through the use of APIs or other means (h) modify or create derivative works of the Evaluation Offering, or copy any element of the Service (other than authorized copies of the software components), (i) remove or obscure any product identification or proprietary notices in the Evaluation Offering, (j) publish benchmarks or performance information about the Evaluation Offering, (k) interfere with the Service's operation, circumvent its access restrictions or conduct any security or vulnerability test of the Service, or (l) transmit any viruses or other harmful materials to the Service.

3. Ownership

You will retain all right, title and interest to, and all intellectual property rights in your Content (as defined below) sent to the Evaluation Offering. Except for the limited right to use the Evaluation Offering under this Evaluation Agreement, this Evaluation Agreement does not give you any title, interest or rights, including intellectual property rights, in any component of the Evaluation Offering. The Evaluation Offering and all copyright, patent, and other proprietary rights therein are and shall remain the sole property of Collibra. This includes any information that Collibra collects and analyzes in connection with the Evaluation Offering, such as Usage Data (defined below), user feedback and other information to improve and evolve Collibra's products and services offerings.

4. Your Content

You are solely responsible for any and all applications, files, information, materials, data, software, or other content uploaded to, stored, published or displayed by you through the Service ("**Content**"). You acknowledge that the Service is provisioned for the Purpose only, and therefore you will not use any production or regulated data (including personal information) as part of your Content in the use of the Service. You are responsible for protecting the security of your Content, including any access you might provide to your Content by your employees, customers or other third parties. You will take and maintain appropriate security, protection and backup for your Content. You are responsible for complying with any laws or regulations applicable to your Content. You are solely responsible for any consequences if your Content is inadvertently exposed or lost, whether or not you have encrypted, backed up or otherwise taken steps required by the relevant laws or regulations to protect your Content. To the extent Collibra process Personal Data, as defined in the DPA, each party agrees to comply with the terms of the data processing addendum, which can be found here: www.collibra.com/data-processing-addendum ("**DPA**"), and which is hereby incorporated by reference.

5. Usage Data

Collibra collects information related to your use of the Services so that Collibra can analyze usage, support the Service, and maintain and improve its products and services, and for other lawful business purposes ("**Usage Data**"). Collibra may also use and store this Usage Data in an aggregated, anonymized form for Collibra's own purposes. You hereby expressly agree that Collibra may collect Usage Data during the Evaluation Term.

6. Support Services

Collibra does not provide support services or service level commitments of any kind in connection with the Evaluation Offering.

7. Term and Termination; Suspension

1. **Term.** This Evaluation Agreement and your use to the Evaluation Offering will commence when you click to accept it as part of the sign-up process or, if earlier, when you use any of the Evaluation Offering (the "**Effective Date**"), and will be effective through the Evaluation Term, unless terminated earlier as permitted under this Section 7.
2. **Termination for Convenience.** This Evaluation Agreement may be terminated effective immediately by Collibra or you for any or no reason and at any time by providing notice of termination to the other party.
3. **Suspension.** Collibra may temporarily suspend your use of the Evaluation Offering if Collibra determines in its sole discretion: (i) you or your use of the Evaluation Offering is in breach of this Evaluation Agreement; (ii) Your use of the Evaluation Offering poses a security risk to the Evaluation Offering, or interferes with, disrupts, damages, or accesses in an unauthorized manner the servers, networks, or other properties or services of any other party; or (iii) suspension is required pursuant to Collibra's receipt of a subpoena, court order or other request by a law enforcement agency.
4. **Effect of Termination or Suspension.** Upon the termination or suspension of this Evaluation Agreement for any reason: (i) all rights and licenses granted to you under this Evaluation Agreement, including your ability to access any of your Content, will immediately terminate; (ii) you must promptly discontinue all access or use of the Evaluation Offering and delete or destroy any of Collibra's Confidential Information; and (iii) Collibra will have no obligation to retain your Content or configurations generated during the Evaluation Term by your use of the Evaluation Offering.

8. Disclaimer of Warranty

TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, COLLIBRA PROVIDES THE EVALUATION OFFERING AS-IS WITHOUT ANY WARRANTIES OF ANY KIND, EXPRESS, IMPLIED, STATUTORY, OR IN ANY OTHER PROVISION OF THIS EVALUATION AGREEMENT OR COMMUNICATION WITH YOU, AND COLLIBRA SPECIFICALLY DISCLAIMS ANY IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, NON-INFRINGEMENT, TITLE, AND ANY WARRANTIES ARISING FROM THE COURSE OF DEALING OR COURSE OF PERFORMANCE REGARDING OR RELATING TO THE EVALUATION OFFERING, THE DOCUMENTATION, OR ANY MATERIALS FURNISHED OR PROVIDED TO YOU UNDER THIS EVALUATION AGREEMENT. COLLIBRA DOES NOT WARRANT THAT THE EVALUATION OFFERING WILL OPERATE UNINTERRUPTED, OR THAT IT WILL BE FREE FROM DEFECTS OR THAT THE EVALUATION OFFERING WILL MEET (OR IS DESIGNED TO MEET) YOUR REQUIREMENTS.

9. Limitation of Liability

TO THE MAXIMUM EXTENT MANDATED BY LAW, IN NO EVENT SHALL COLLIBRA BE LIABLE FOR ANY LOST PROFITS OR BUSINESS OPPORTUNITIES, LOSS OF USE, LOSS OF REVENUE, LOSS OF GOODWILL, BUSINESS INTERRUPTION, LOSS OF DATA, INABILITY TO USE THE EVALUATION OFFERING, INCLUDING AS A RESULT OF ANY TERMINATION, DISCONTINUATION, MODIFICATION OR SUSPENSION OF THIS EVALUATION AGREEMENT OR THE EVALUATION OFFERING, OR ANY OTHER INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES UNDER ANY THEORY OF LIABILITY, WHETHER BASED IN CONTRACT, TORT, NEGLIGENCE, PRODUCT LIABILITY OR OTHERWISE. COLLIBRA'S LIABILITY UNDER THIS EVALUATION AGREEMENT SHALL NOT, IN ANY EVENT, EXCEED USD $100. THE FOREGOING LIMITATIONS SHALL APPLY REGARDLESS OF WHETHER COLLIBRA HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES AND REGARDLESS OF WHETHER ANY REMEDY FAILS OF ITS ESSENTIAL PURPOSE. YOU MAY NOT BRING A CLAIM UNDER THIS EVALUATION AGREEMENT MORE THAN EIGHTEEN (18) MONTHS AFTER (i) THE END OF THE EVALUATION TERM, OR (ii) THE DATE THE CLAIM FIRST ARISES, WHICHEVER IS EARLIEST.

10. Confidentiality

1. **Confidential Information.** Each party acknowledges that it or its employees may, in the course of performing its responsibilities under this Evaluation Agreement, be exposed to or acquire information which is proprietary or confidential to the other party. "**Confidential Information**" means information disclosed under this Evaluation Agreement that is designated by the disclosing party as proprietary or confidential or that should be reasonably understood to be proprietary or confidential due to its nature and the circumstances of its disclosure. Collibra's Confidential Information includes any technical or performance information about the Evaluation Offering. Confidential Information excludes information that the receiving party can document (a) is or becomes public knowledge through no fault of the receiving party, (b) it rightfully knew or possessed prior to receipt under this Evaluation Agreement, (c) it rightfully received from a third-party without breach of confidentiality obligations or (d) it independently developed without using the disclosing party's Confidential Information. As receiving party, each party will (a) hold in confidence and not disclose Confidential Information to third parties except as permitted in this Evaluation Agreement, and (b) only use Confidential Information to fulfill its obligations and exercise its rights in this Evaluation Agreement. Each party will use reasonable care to protect the Confidential Information in the same manner as it would protect its own Confidential Information of a similar nature, but in no event with less than reasonable care. The receiving party may disclose Confidential Information to its employees, agents, contractors and other representatives having a legitimate need to know, provided it remains responsible for their compliance with this Section 10 and they are bound to confidentiality obligations no less protective than this Section 10. Unauthorized use or disclosure of Confidential Information may cause substantial harm for which damages alone are an insufficient remedy. Each party may seek appropriate equitable relief, in addition to other available remedies, for breach or threatened breach of this Section 10.

2. **Required Disclosures.** Nothing in this Evaluation Agreement prohibits either party from making disclosures, including Content and other Confidential Information, if required by applicable law, subpoena or court order, provided (if permitted by applicable law) it notifies the other party in advance and reasonably cooperates in any effort to obtain confidential treatment at disclosing party's expense.

11. General

1. **Governing Law, Jurisdiction and Venue.** This Evaluation Agreement is governed by the laws of the State of New York without regard to conflicts of laws provisions and without regard to the United Nations Convention on the International Sale of Goods, and the jurisdiction and venue for actions related to this Evaluation Agreement will be the state and United States federal courts located in New York, New York, and both parties submit to the personal jurisdiction of those courts.

2. **Compliance with Laws**. You will comply with all applicable laws and regulations in the use of the Evaluation Offering under this Evaluation Agreement.

3. **Assignment**. You may not assign this Evaluation Agreement without Collibra's prior written consent, and any such action in violation of this provision, is null and void, and a breach of this Evaluation Agreement. Collibra may assign or transfer this Evaluation Agreement to an affiliate or in connection with a merger, reorganization, acquisition or other transfer of all or substantially all its assets or voting securities. This Evaluation Agreement will bind and inure to the benefit of the party's permitted successors and assigns.

4. **Independent Contractors.** The parties are independent contractors, not agents, partners or joint venturers.

5. **Third-Party Beneficiaries**. Except as expressly provided in this Evaluation Agreement, this Evaluation Agreement does not create or establish any rights or beneficiaries for any person or entity that is not a party to this Evaluation Agreement.

6. **Export**. You acknowledge that the Evaluation Offering is subject to export control and economic sanctions restrictions imposed by the U.S. government and import restrictions by certain foreign governments (collectively "**Trade Laws**"). In using or accessing the Evaluation Offering, you will not and will not allow any third party to use the Evaluation Offering in violation if any Trade Laws or remove or export from the U.S. or allow the export or re-export of any part of the Evaluation Offering or any direct product thereof to any location, party or end-use which the U.S. government or any agency thereof requires an export license or other governmental approval at the time of export or re-export without first obtaining such license or approval. You represent and warrant that you and any of your users: (i) are not listed on any U.S. government list of prohibited or restricted

parties, including the U.S. Treasury Department list of Specially Designated Nationals and Blocked Persons, or the U.S. Commerce Department Denied Persons List or Entity List; (ii) are not an entity or person who is organized under the laws of, ordinarily resident in, or controlled by the government of, any country or region (1) that is subject to a U.S. government embargo or comprehensive sanction, (2) to which the U.S. has prohibited export transactions or (3) that has been designated by the U.S. government as a "terrorist supporting" country; (iii) will not use the Evaluation Offering for the manufacture, design or development of nuclear, chemical or biological weapons or missile technology, or for terrorist activity; and (iv) will not submit to the Evaluation Offering any information controlled under the U.S. International Traffic in Arms Regulations or listed on the Commerce Control List unless approved in writing by Collibra. You will notify Collibra promptly if you or your users become subject to any order or restriction listed in this Section.

7. **Government End-Users**. Elements of the Evaluation Offering are commercial computer software. If the user or licensee of the Evaluation Offering is an agency, department, or other entity of the United States Government, the use, duplication, reproduction, release, modification, disclosure, or transfer of the Evaluation Offering or any related documentation of any kind, including technical data and manuals, is restricted by the terms of this Evaluation Agreement in accordance with Federal Acquisition Regulation 12.212 for civilian purposes and Defense Federal Acquisition Regulation Supplement 227.7202 for military purposes. The Evaluation Offering was developed fully at private expense. All other use is prohibited.

8. **Amendments**. Except as otherwise provided herein, any amendments, modifications or supplements to this Evaluation Agreement must be in writing and signed by each party's authorized representatives or, as appropriate, agreed through electronic means provided by Collibra.

9. **Waivers and Severability**. Waivers must be signed by the waiving party's authorized representative and cannot be implied from conduct. If any provision of this Evaluation Agreement is held invalid, illegal or unenforceable, it will be limited to the minimum extent necessary, so the rest of this Evaluation Agreement remains in effect.

10. **Entire Agreement**. This Evaluation Agreement is the parties' entire agreement regarding its subject matter and supersedes any prior or contemporaneous agreements or communications regarding its subject matter, whether written or oral. Notwithstanding

the foregoing, to the extent a separate written agreement has been signed between you and Collibra in connection with the subject matter hereof, such separate written agreement will supersede this Evaluation Agreement. In this Evaluation Agreement, headings are for convenience only and "including" and similar terms are to be construed without limitation.