
metatron-doc-user Documentation

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metatron team

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METATRON DISCOVERY

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Part I

Metatron Discovery

CHAPTER
ONE

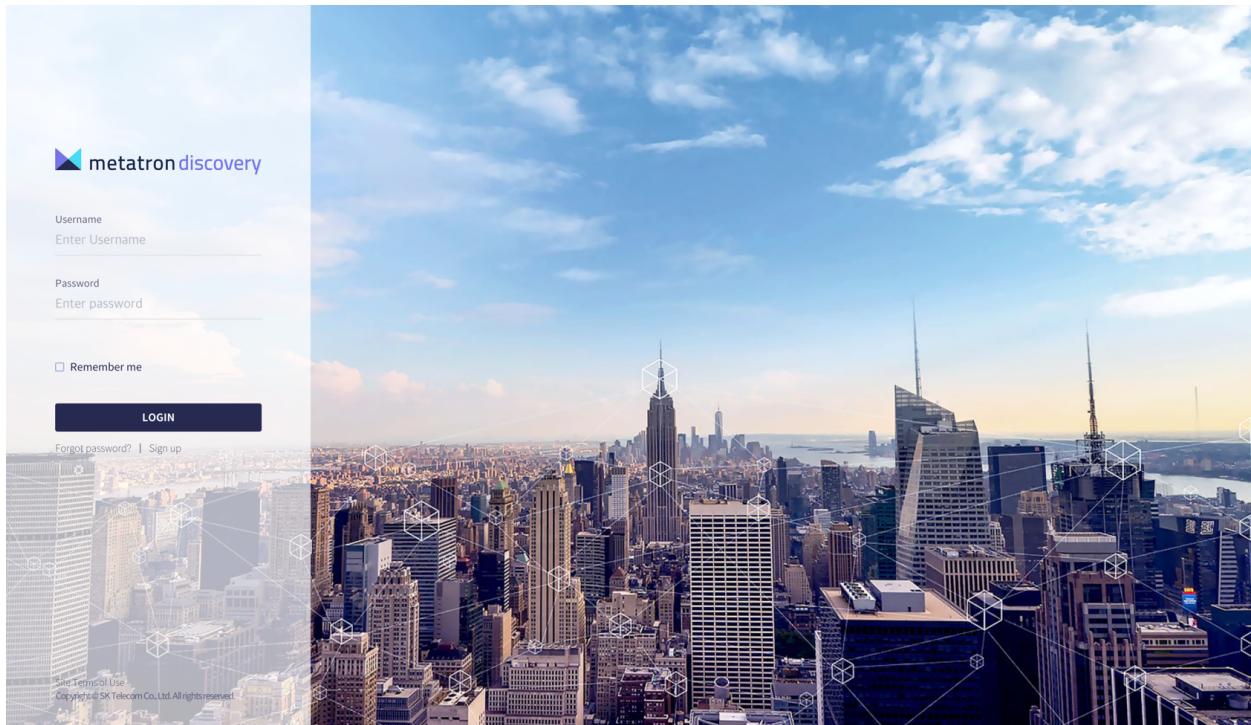
DISCOVERY QUICK GUIDE

Metatron Discovery is an all-in-one solution that enables rapid loading, pre-processing, and analysis of large amounts all together. With Metatron Discovery, business users without technical knowledge can directly work with data and gain insights from rapid visualization.

You can perform data analysis with Metatron Discovery using the two methods below:

- **Method 1:** Run [Metatron Discovery demo site](#). Enter “metatron” as your ID and password.
- **Method 2:** Download the single-mode Metatron Discovery to your local PC. [Download](#) is provided in three ways.
 - **Custom install:** Download the source code from the Github repository, or directly run the build file.
 - **Virtual machine:** Run the virtual machine image. This is also available in the Windows OS.
 - **Docker:** Run the Docker image for a quick installation.

Do you see the screen below? Congratulations! You are now ready for quick and easy data analysis with Metatron Discovery.



For a quick start, follow the three-step tutorial below:

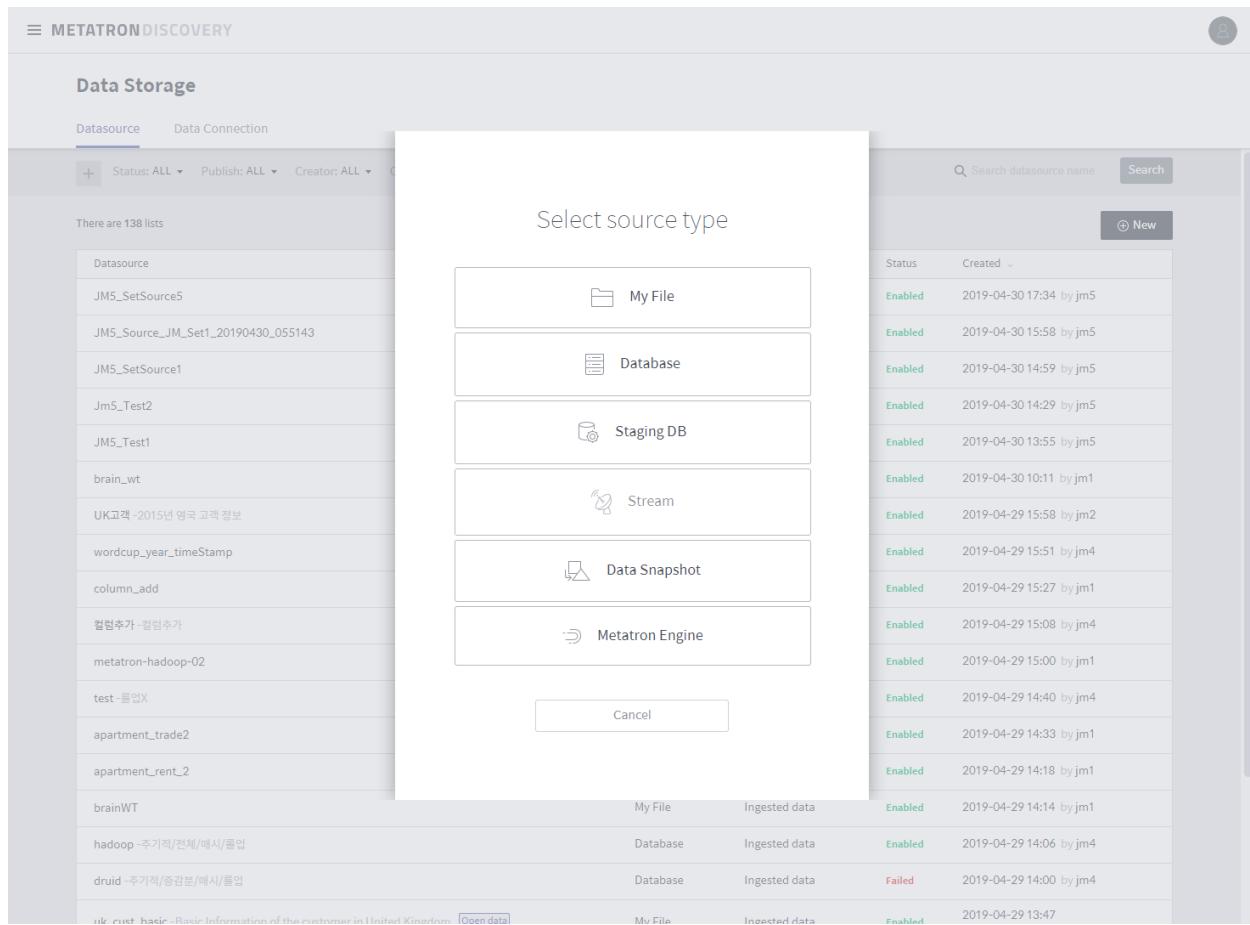
1.1 Step 1. Create a data source

The first step in data analysis is ingesting your data into the system. Metatron Discovery allows you to easily ingest various data sources.

The example in this tutorial shows you how to ingest data from your local directory. First, prepare data. An Excel file (.xls, .xlsx) or .csv file will suffice. This tutorial uses sales data. Download it from the link below:

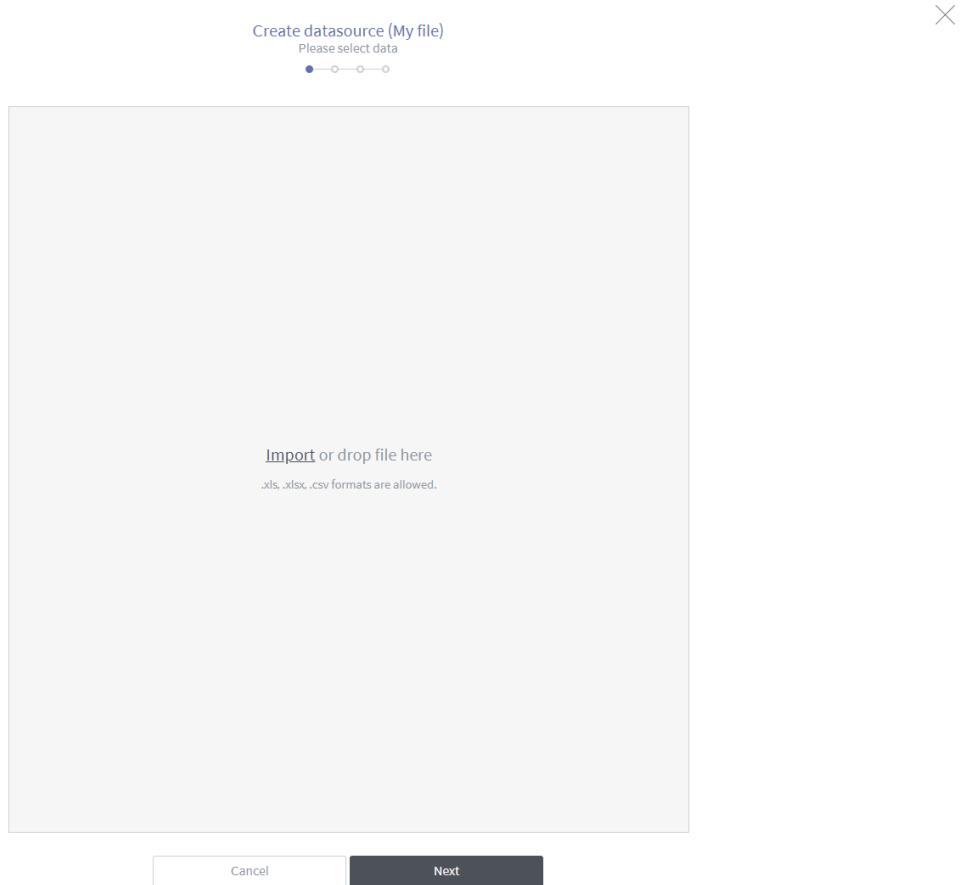
[sample data \(.csv\)](#)

Data sources can be viewed and ingested from **Management** > **Data Storage** > **Data Source**. To create a new data source, click the **New** button on the upper right of the data source list.



In this tutorial, click **File** to retrieve the data from your local directory. See [Create a data source](#) for details on creating a data source from other sources.

Drag and drop the data you wish to analyze, or retrieve it from the directory.



Drag your cursor over the sales data to view up to 100 rows of data with detection of the column delimiter and line separator. This data is properly displayed using the default delimiter and separator. Click **Next**.

Create datasource (My file)
Please select data

sales-data-sample.csv Import or drop file here

	3369920 byte	28 Columns	100	/ 9876 Row	1 Types		
ab OrderDate	ab Category	ab City	ab Country	ab CustomerName	ab Discount	ab OrderID	ab Pos
2011-01-04T00:...	Office Supplies	Houston	United States	Darren Powers	0.2	CA-2011-103...	770
2011-01-05T00:...	Office Supplies	Naperville	United States	Phillina Ober	0.2	CA-2011-112...	605
2011-01-05T00:...	Office Supplies	Naperville	United States	Phillina Ober	0.8	CA-2011-112...	605
2011-01-05T00:...	Office Supplies	Naperville	United States	Phillina Ober	0.2	CA-2011-112...	605
2011-01-06T00:...	Office Supplies	Philadelphia	United States	Mick Brown	0.2	CA-2011-141...	191
2011-01-07T00:...	Furniture	Henderson	United States	Maria Etezadi	0.0	CA-2011-167...	424
2011-01-07T00:...	Office Supplies	Athens	United States	Jack OBriant	0.0	CA-2011-106...	306
2011-01-07T00:...	Office Supplies	Henderson	United States	Maria Etezadi	0.0	CA-2011-167...	424
2011-01-07T00:...	Office Supplies	Henderson	United States	Maria Etezadi	0.0	CA-2011-167...	424
2011-01-07T00:...	Office Supplies	Henderson	United States	Maria Etezadi	0.0	CA-2011-167...	424
2011-01-07T00:...	Office Supplies	Henderson	United States	Maria Etezadi	0.0	CA-2011-167...	424
2011-01-07T00:...	Office Supplies	Los Angeles	United States	Lycoris Saunders	0.0	CA-2011-130...	900
2011-01-07T00:...	Technology	Henderson	United States	Maria Etezadi	0.0	CA-2011-167...	424
2011-01-07T00:...	Technology	Henderson	United States	Maria Etezadi	0.0	CA-2011-167...	424
2011-01-08T00:...	Furniture	Huntsville	United States	Vivek Sundaresam	0.6	CA-2011-105...	773
2011-01-08T00:...	Office Supplies	Huntsville	United States	Vivek Sundaresam	0.8	CA-2011-105...	773

Column delimiter ,

Line separator \n

Use the first row as the head column. (If not checked, a new row is created and is used as the head column)

Cancel Next

While viewing the data, adjust the column types properly. This task is called **data schema configuration**.

Create datasource (My file)

Configure schema

Role All Dimension Measure Type All Add column

Search by column name

	Column
<input type="checkbox"/>	Dimension ab OrderDate
<input type="checkbox"/>	Dimension ab Category
<input type="checkbox"/>	Dimension ab City
<input type="checkbox"/>	Dimension ab Country
<input type="checkbox"/>	Dimension ab CustomerName
<input type="checkbox"/>	Dimension ab Discount
<input type="checkbox"/>	Dimension ab OrderID
<input type="checkbox"/>	Dimension ab PostalCode
<input type="checkbox"/>	Dimension ab ProductName
<input type="checkbox"/>	Dimension ab Profit
<input type="checkbox"/>	Dimension ab Quantity
<input type="checkbox"/>	Dimension ab Region
<input type="checkbox"/>	Dimension ab Sales
<input type="checkbox"/>	Dimension ab Segment
<input type="checkbox"/>	Dimension ab ShipDate
<input type="checkbox"/>	Dimension ab ShipMode
<input type="checkbox"/>	Dimension ab State
<input type="checkbox"/>	Dimension ab Sub_Category
<input type="checkbox"/>	Dimension ab DaystoShipActual
<input type="checkbox"/>	Dimension ab SalesForecast
<input type="checkbox"/>	Dimension ab ShipStatus
<input type="checkbox"/>	Dimension ab DaystoShipScheduled
<input type="checkbox"/>	Dimension ab OrderProfitable
<input type="checkbox"/>	Dimension ab SalesperCustomer

OrderDate

Data	Setting
2011-01-04T00:00:00.000Z	Role <input checked="" type="radio"/> Dimension <input type="radio"/> Measure
2011-01-05T00:00:00.000Z	Type <input type="radio"/> String
2011-01-05T00:00:00.000Z	Missing <input type="radio"/> Replace with
2011-01-05T00:00:00.000Z	<input type="radio"/> Discard
2011-01-06T00:00:00.000Z	<input checked="" type="radio"/> Do not apply
2011-01-07T00:00:00.000Z	
2011-01-08T00:00:00.000Z	
2011-01-08T00:00:00.000Z	
2011-01-10T00:00:00.000Z	
2011-01-10T00:00:00.000Z	
2011-01-11T00:00:00.000Z	
2011-01-11T00:00:00.000Z	
2011-01-12T00:00:00.000Z	
2011-01-14T00:00:00.000Z	

One of the time-type columns or current time must be specified as a Timestamp

Current time Time-type column No selected time-type column

Previous Next

Each column functions as a “dimension” or “measure.” See “Dimensions” and “Measures” for further details. In this data, the Discount, Profit, Quantity, Sales, DaystoShipActual, SalesForecast, DaystoShipScheduled, SalesperCustomer, and ProfitRatio columns must be converted into measures.

Next, the data types of columns must be adjusted properly. The string type is the default setting for dimensions, and the integer type for measures. While viewing the sample, change the data type settings properly. Below is a list of items to be modified in this data.

- Orderdate : Date/Time
 - Discount : Decimal
 - ShipDate : Date/Time (Change the time format to yyyy, MM, dd, and click the checkbox to validate)

- SalesperCustomer : Decimal
- ProfitRatio : Decimal
- latitude : Latitude
- longitude : Longitude

Lastly, you should create a new column. Since we already have columns for latitude and longitude, we can create a point type column. Click the **Add column** button on the upper right. Select the latitude column for the **Latitude** column, and the longitude column for the **Longitude** column. Name the columns appropriately, and click **Add**. A new point type column is created!

The screenshot shows the 'Create datasource (My file)' configuration interface. On the left, a list of columns is shown, including CustomerName, Discount, OrderID, PostalCode, ProductName, Profit, Quantity, Region, Sales, Segment, ShipDate, ShipMode, State, Sub_Category, DaystoShipActual, SalesForecast, ShipStatus, DaystoShipScheduled, OrderProfitable, SalesperCustomer, ProfitRatio, SalesaboveTarget, latitude, and longitude. The 'longitude' column is currently selected. A modal dialog is open for this column, titled 'longitude'. It contains the following settings:

- Method:** Point (selected)
- Data:** latitude and longitude
- Column name:** GeoPoint
- Type:** Longitude (selected)
- Missing:** Do not apply (selected)

At the bottom of the interface, there is a note: "One of the time-type columns or current time must be specified as a Timestamp". Below this, there is a 'Time-type column' dropdown set to 'OrderDate'. Navigation buttons 'Previous' and 'Next' are at the bottom.

Once you are done with schema configuration, click **Next**. If necessary, you can change the settings for ingestion into Druid. The default settings are sufficient for now.

X

Create datasource (My file)
Please complete ingestion settings

Timestamp settings

Query Granularity ⓘ

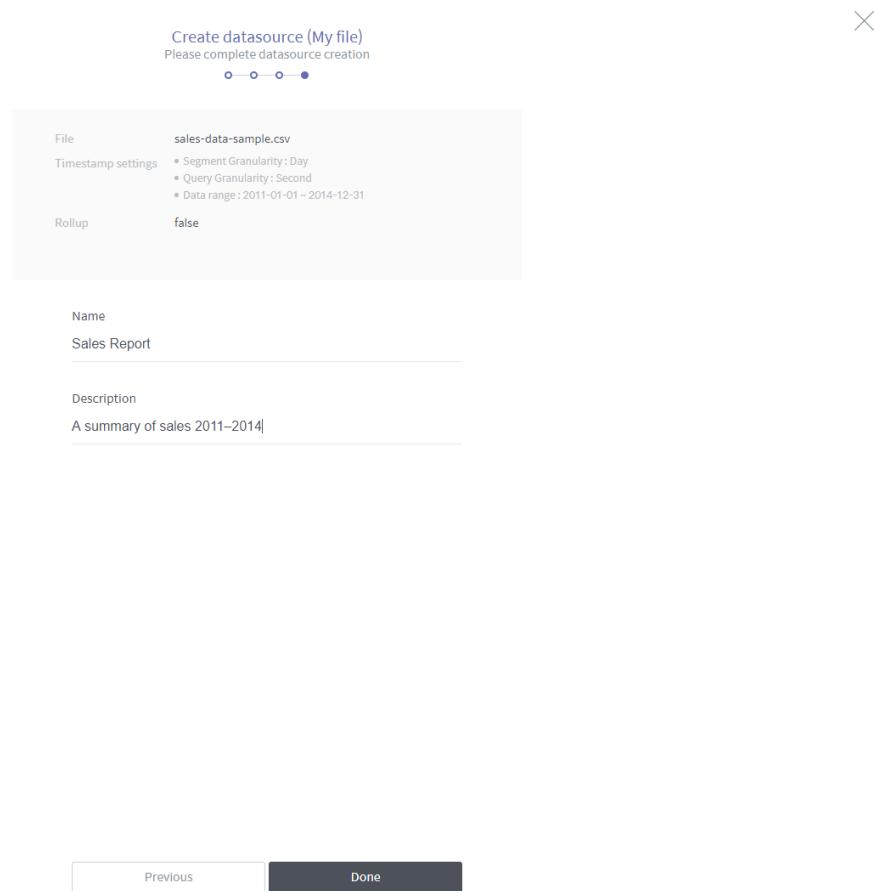
Segment Granularity ⓘ

Data range
 ~ 1,461 segment granularity units
(ⓘ The interval should set equal to or greater than the range of data values in the timestamp column, and the number of segments units cannot exceed 10,000.)

Rollup ⓘ
 true false

Advanced setting ▾

Lastly, enter the **Name** and **Description** for the data source. Click **Done** to proceed to the data source details page.



In the data source details page, you can view the ingestion status in real time. The screen below appears after a few minutes, indicating success. A histogram is displayed. If you encounter an error while ingesting another data source, click **Details** to view the Druid ingestion log. Ingestion may be unsuccessful due to a duplicate column name or mismatch between column types and their data. Try ingestion again after addressing the issue.

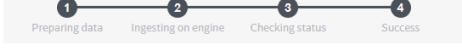
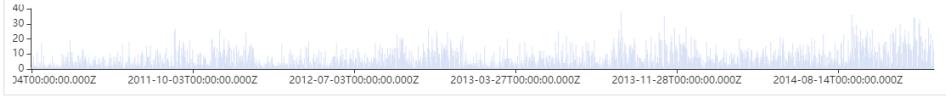
≡ METATRON DISCOVERY 

← Sales Report Updated on 2019-05-06 15:15 | Administrator ⋮

Information Data Column details Monitoring

Data Information [Go to Metadata](#)

Description A summary of sales 2011–2014

Ingestion type Ingested data
Status **ENABLED**

Timestamp settings Query Granularity SECOND
Segment Granularity DAY
Data range 2011-01-01 ~ 2014-12-31
Histogram 

Publish Allow all workspaces to use this datasource [Edit](#)
 1 workspaces

Ingestion information

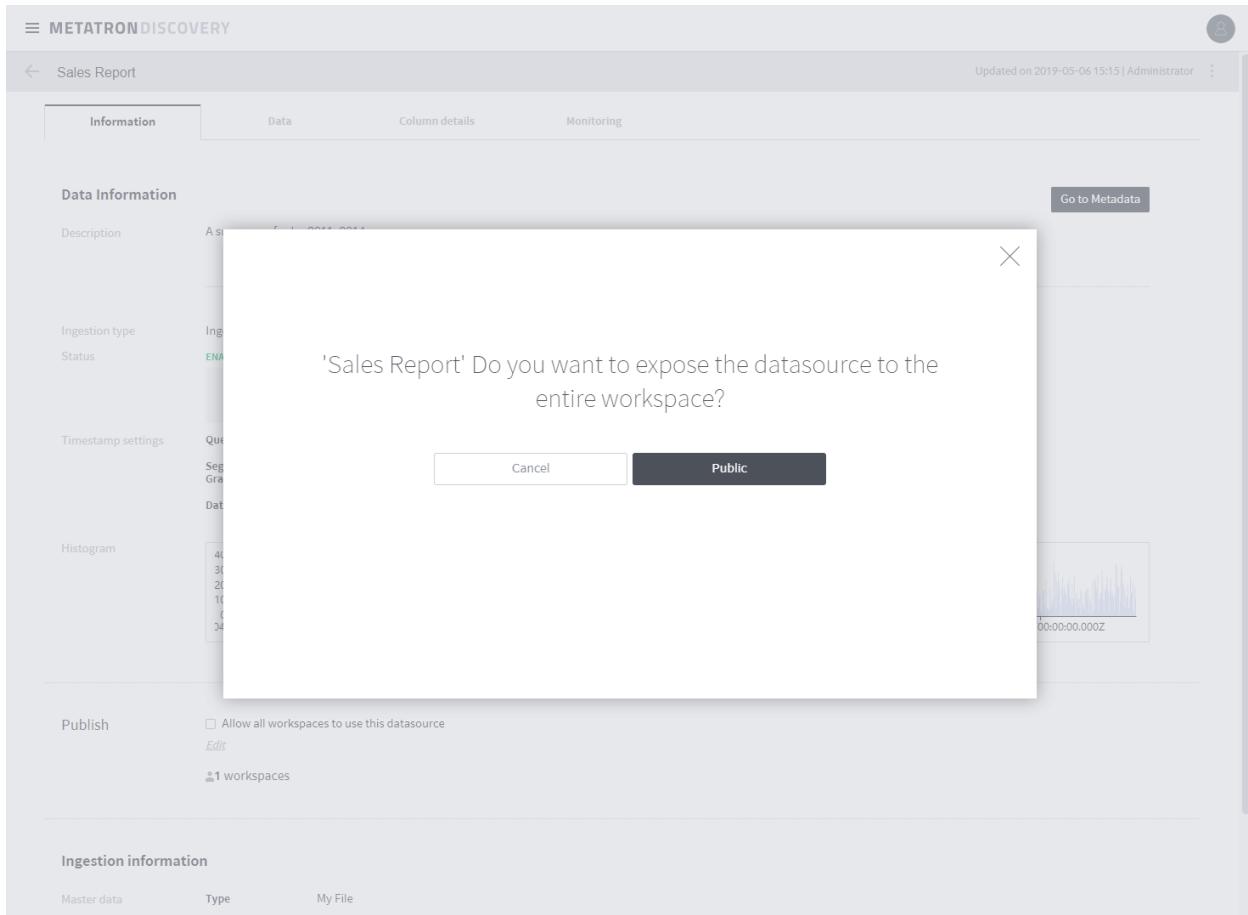
Master data Type My File
...
...

To make the data source available to other users, check the checkbox next to **Allow all workspaces to use this datasource** under **Publish**. To make the data source available only to specific users, click **Edit** and select individual users' or teams' workspaces as desired.

The screenshot shows the METATRON DISCOVER interface with a 'Sales Report' selected. On the left, there's a sidebar with sections like 'Data Information', 'Ingestion type', 'Timestamp settings', 'Histogram', 'Publish', and 'Ingestion information'. The 'Publish' section is active, displaying a list of workspaces to choose from. On the right, there's a histogram visualization and a timestamp range from '00:00:00.000Z' to '00:00:00.000Z'.

Workspace	Owner (Username)
한정현 Workspace	한정현 (kazikai)
조민정 Workspace	조민정 (heesoo)
장지영 Workspace	장지영 (ijangdotcom)
이정은 Workspace	이정은 (arther720)
이정룡 Workspace	이정룡 (i1befree)
윤준수 Workspace	윤준수 (yjscass)
유승호 Workspace	유승호 (shryu415)
송세리 Workspace	송세리 (srssong)
성승현 Workspace	성승현 (sshzozo)
박종호 Workspace	박종호 (tajitaji)
문형권 Workspace	문형권 (sysmoon)
김상호 Workspace	김상호 (bboradoli)
김병길 Workspace	김병길 (jobofgod)
tim-metatron Workspace	tim-metatron (tim-metatron)
test Workspace	test (test)
star Workspace	jm4 (jm4)

In this example, we will choose **Open Data** to make it available to all users.



The ingested data can be viewed under the **Data** tab.

The screenshot shows the Metatron Discovery interface. At the top, there's a navigation bar with a logo, a search bar, and a user icon. Below it, a breadcrumb trail says "Sales Report". The main area is a data grid with the following columns:

GeoPoint	OrderDate	Category	City	Country	CustomerName	Discount	OrderID	PostalCode	ProductName	Profit	Quantity	Region
29.8941-9...	2011-01-04T...	Office Supp...	Houston	United States	Darren Powers	0.2	CA-2011-1...	77095	Message Book...	6	2	C
41.7662-8...	2011-01-05T...	Office Supp...	Naperville	United States	Phillina Ober	0.2	CA-2011-1...	60540	Avery 508	4	3	C
41.7662-8...	2011-01-05T...	Office Supp...	Naperville	United States	Phillina Ober	0.8	CA-2011-1...	60540	GBC Standard Pi...	-5	2	C
41.7662-8...	2011-01-05T...	Office Supp...	Naperville	United States	Phillina Ober	0.2	CA-2011-1...	60540	SAFCO Boltless ...	-65	3	C
39.9448-7...	2011-01-06T...	Office Supp...	Philadelphia	United States	Mick Brown	0.2	CA-2011-1...	19143	Avery Hi-Liter Ev...	5	3	E
37.8274-8...	2011-01-07T...	Furniture	Henderson	United States	Maria Etezadi	0	CA-2011-1...	42420	Global Deluxe Hi...	746	9	S
33.9321-8...	2011-01-07T...	Office Supp...	Athens	United States	Jack OBriant	0	CA-2011-1...	30605	Dixon Prang Wat...	5	3	S
37.8274-8...	2011-01-07T...	Office Supp...	Henderson	United States	Maria Etezadi	0	CA-2011-1...	42420	Alliance Super-S...	0	4	S
37.8274-8...	2011-01-07T...	Office Supp...	Henderson	United States	Maria Etezadi	0	CA-2011-1...	42420	Ibico Hi-Tech Ma...	274	2	S
37.8274-8...	2011-01-07T...	Office Supp...	Henderson	United States	Maria Etezadi	0	CA-2011-1...	42420	Rogers Handhel...	1	2	S
37.8274-8...	2011-01-07T...	Office Supp...	Henderson	United States	Maria Etezadi	0	CA-2011-1...	42420	Southworth 25%...	3	1	S
34.066-11...	2011-01-07T...	Office Supp...	Los Angeles	United States	Lycoris Saunders	0	CA-2011-1...	90049	Xerox 225	9	3	W
37.8274-8...	2011-01-07T...	Technology	Henderson	United States	Maria Etezadi	0	CA-2011-1...	42420	GE 30524EE4	114	2	S
37.8274-8...	2011-01-07T...	Technology	Henderson	United States	Maria Etezadi	0	CA-2011-1...	42420	Wireless Extende...	204	4	S
30.6448-9...	2011-01-08T...	Furniture	Huntsville	United States	Vivek Sundaresam	0.6	CA-2011-1...	77340	Howard Miller 14...	-54	3	C
30.6448-9...	2011-01-08T...	Office Supp...	Huntsville	United States	Vivek Sundaresam	0.8	CA-2011-1...	77340	Acco Four Pocke...	-18	7	C
27.5569-9...	2011-01-10T...	Office Supp...	Laredo	United States	Melanie Seite	0.2	CA-2011-1...	78041	Newell 312	1	2	C
27.5569-9...	2011-01-10T...	Technology	Laredo	United States	Melanie Seite	0.2	CA-2011-1...	78041	Memorex Micro ...	10	3	C
38.7449-7...	2011-01-11T...	Furniture	Springfield	United States	Anthony Jacobs	0	CA-2011-1...	22153	Howard Miller 11...	21	1	S
38.7449-7...	2011-01-11T...	Office Supp...	Springfield	United States	Anthony Jacobs	0	CA-2011-1...	22153	Avery 482	1	1	S
39.1564-7...	2011-01-12T...	Furniture	Dover	United States	Seth Vernon	0	CA-2011-1...	19901	DAX Value U-Ch...	3	2	E
32.8473-7...	2011-01-14T...	Furniture	Mount Plea...	United States	Natalie DeCherney	0	CA-2011-1...	29464	Global Highback ...	87	6	S

Congratulations! Now, it's time to use the data source. Let's proceed to the next step.

- Step 2. Create a workbook

1.2 Step 2. Create a workbook

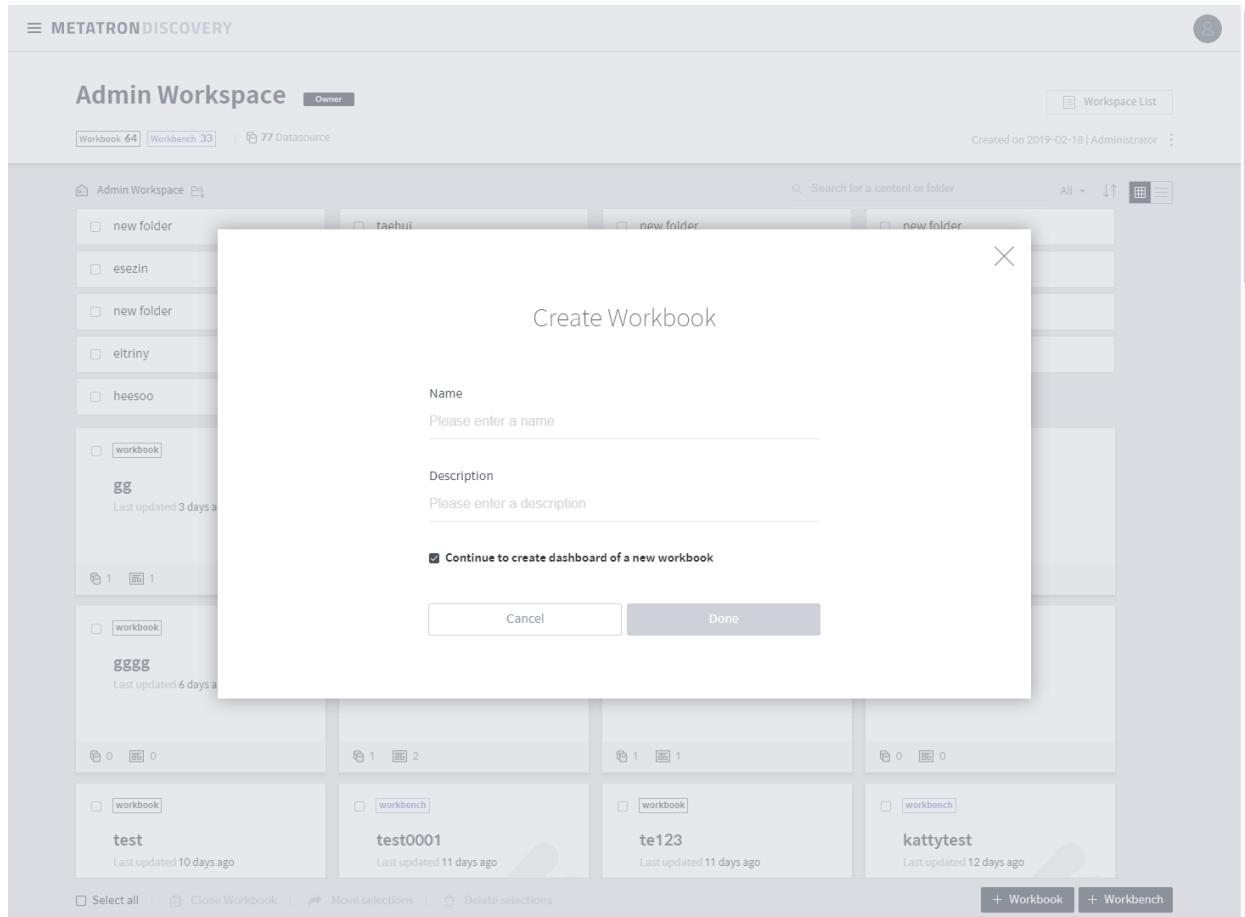
Do you have the data ready for analysis? Now, it's time to create a workbook. The Workbook module supports the visualization of data. Click the Metatron Discovery logo on the upper left to enter your personal workspace.

The screenshot shows the 'Admin Workspace' interface in Metatron Discovery. At the top, there are navigation links for 'Workspace List', 'Created on 2019-02-18 | Administrator', and a three-dot menu. Below the header, the workspace contains a grid of items:

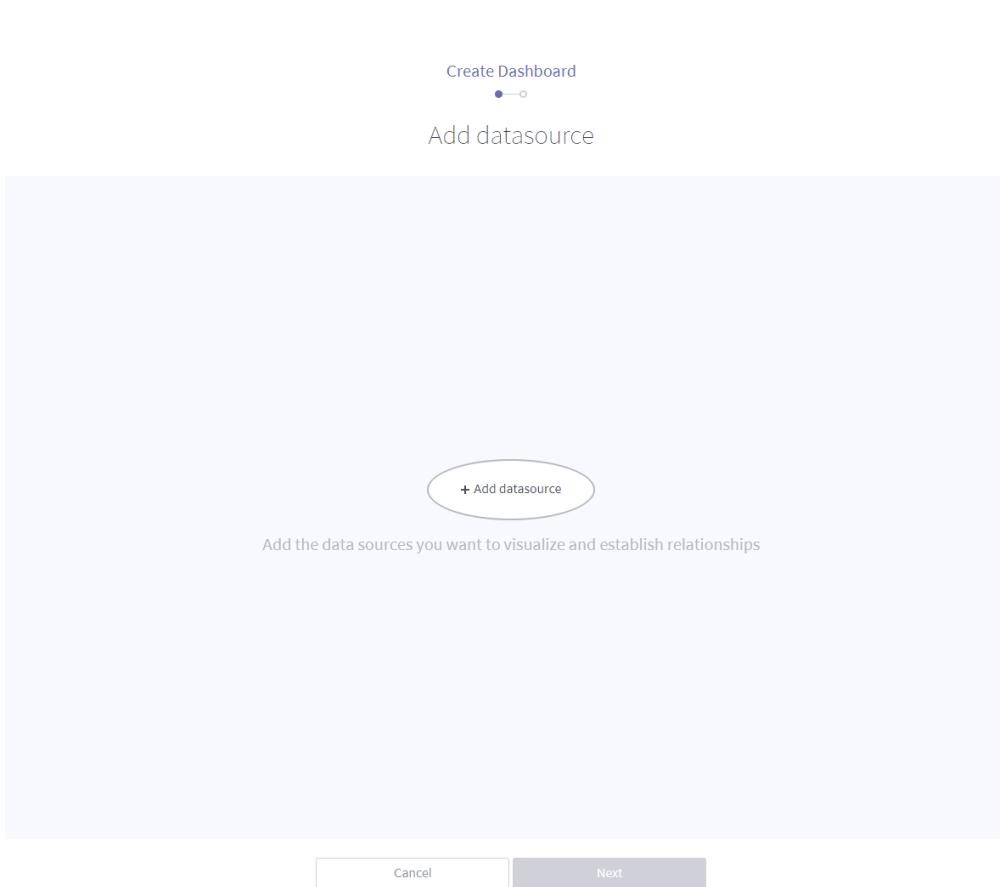
- Folders:** new folder, taehul, Ryan, new folder, KJ, new folder.
- Workbooks:**
 - taehul (Last updated 3 days ago)
 - 325 (Last updated 4 days ago)
 - comefeel (Last updated 4 days ago)
 - sting (Last updated 4 days ago)
 - sohncw (Last updated 4 days ago)
 - 연임 (Last updated 4 days ago)
 - gg (Last updated 3 days ago)
 - ggg (Last updated 4 days ago)
 - b (Last updated 4 days ago)
 - a (Last updated 4 days ago)
 - gggg (Last updated 6 days ago)
 - 3.2 집중테스트 통계 (Last updated 6 days ago)
 - asa (Last updated 6 days ago)
 - (Last updated 7 days ago)
 - test (Last updated 10 days ago)
 - test0001 (Last updated 11 days ago)
 - te123 (Last updated 11 days ago)
 - kattytest (Last updated 12 days ago)
- Workbenches:** (various entries like '1 1', '1 2', '1 1', '2 1', '0 0', etc.)

At the bottom of the workspace, there are buttons for 'Select all', 'Clone Workbook', 'Move selections', 'Delete selections', '+ Workbook', and '+ Workbench'.

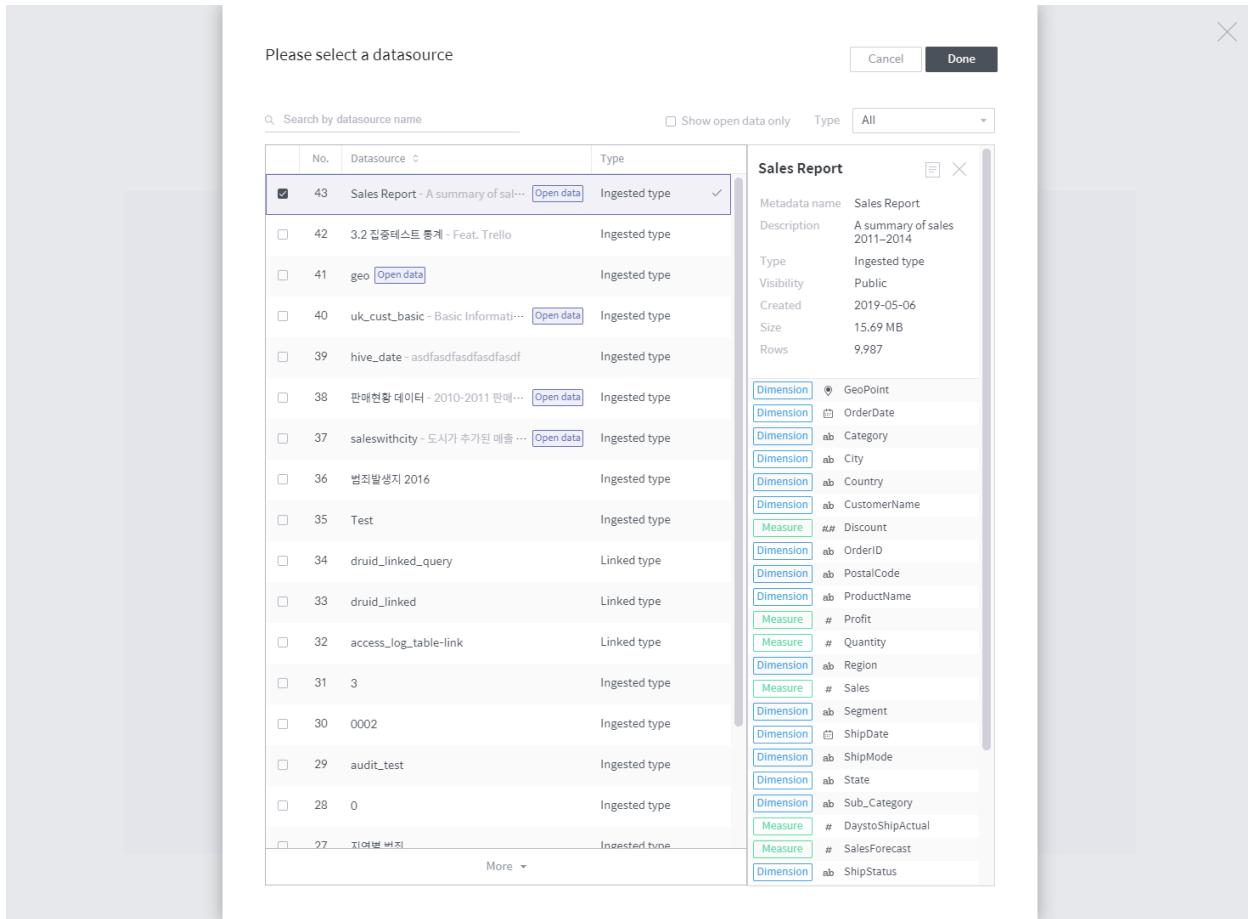
Let's begin by clicking the **+ Workbook** button on the bottom right. Enter the name and description for the workbook. The checkbox is marked by default for you to create a dashboard once a workbook is created. A single workbook contains multiple dashboards, and each single dashboard contains multiple charts.



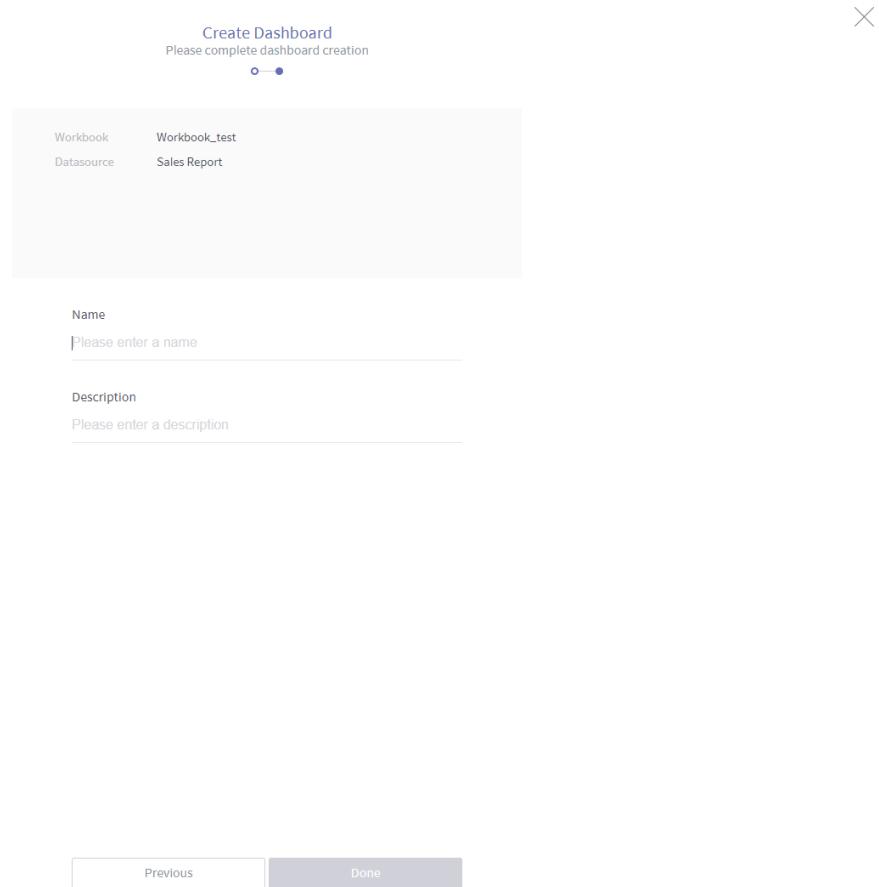
Proceed with creating a dashboard. A dashboard requires a data source for visualization. This data source can be either a single source, or joined data sources. See [Create a dashboard](#) for further details. This tutorial uses Sales Report, ingested previously in Step 1.



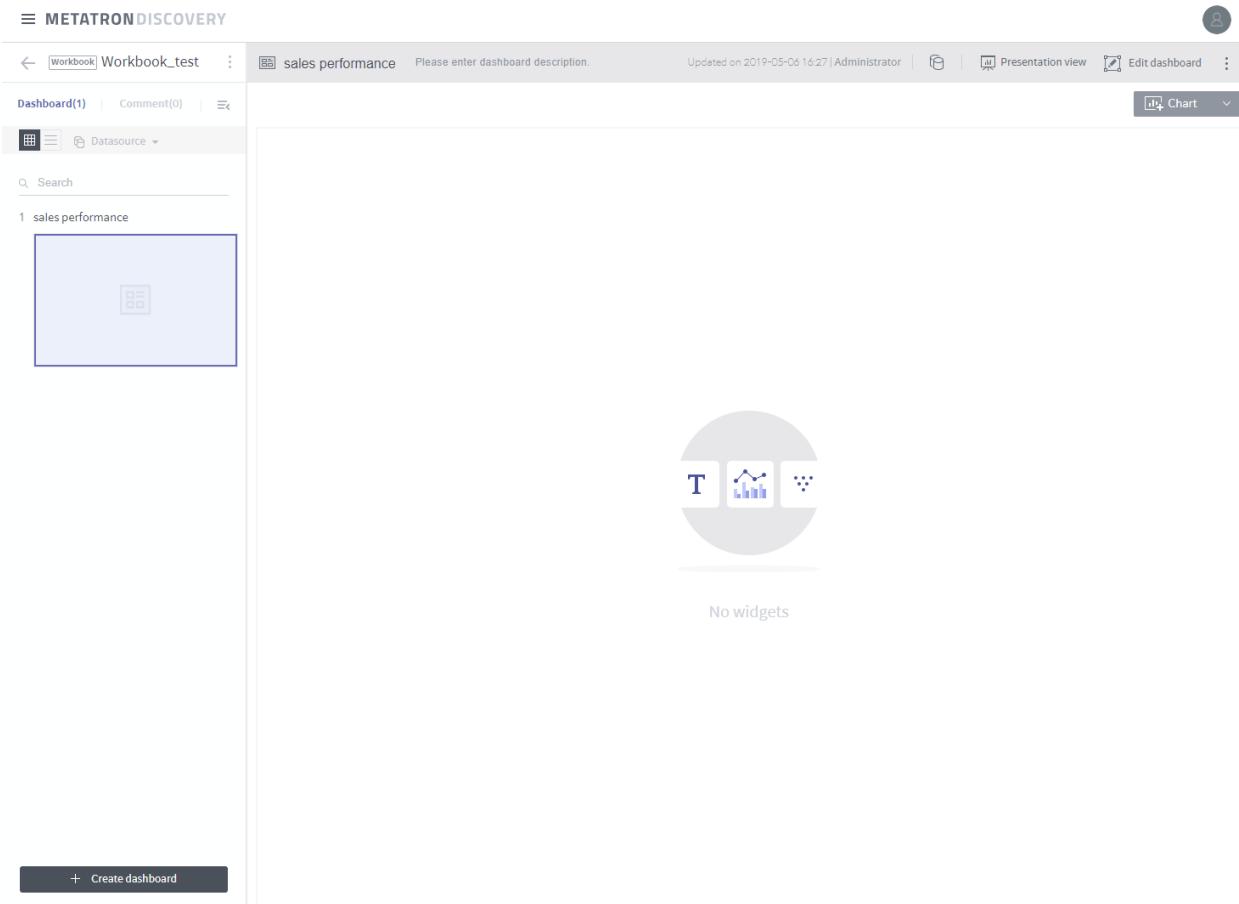
Click the **+ Add data source** button for the data source selection popup. Search Sales Report, or select the **Show open data only** checkbox and choose from the results.



Finally, enter the **Name** and **Description** for the dashboard.



You have created a dashboard in the workbook. Now, you can add widgets to the dashboard.

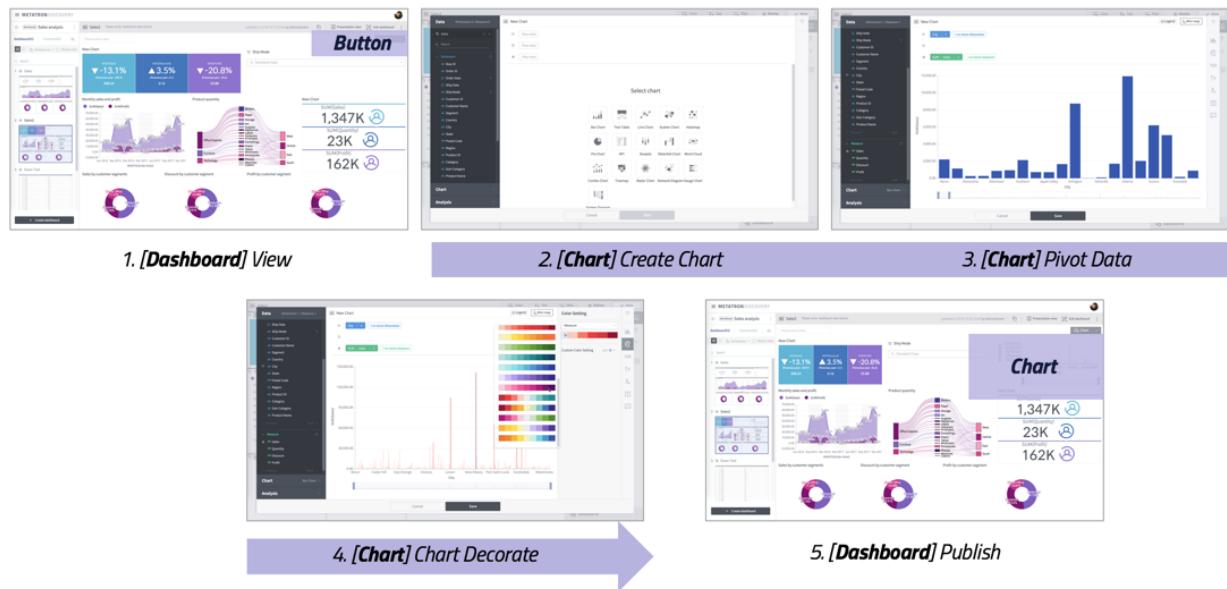


Let's proceed to the next step.

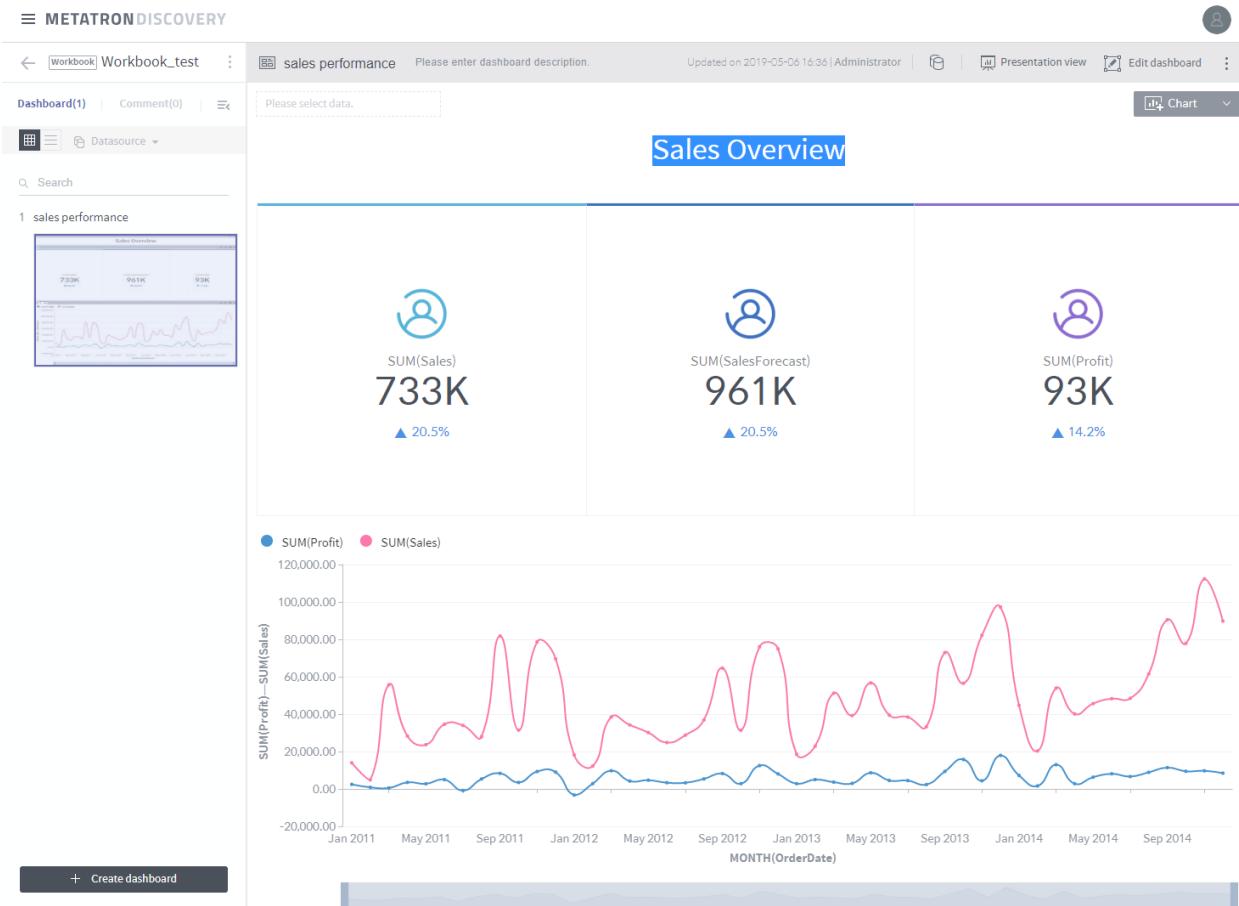
- [Step 3. Organize a dashboard](#)

1.3 Step 3. Organize a dashboard

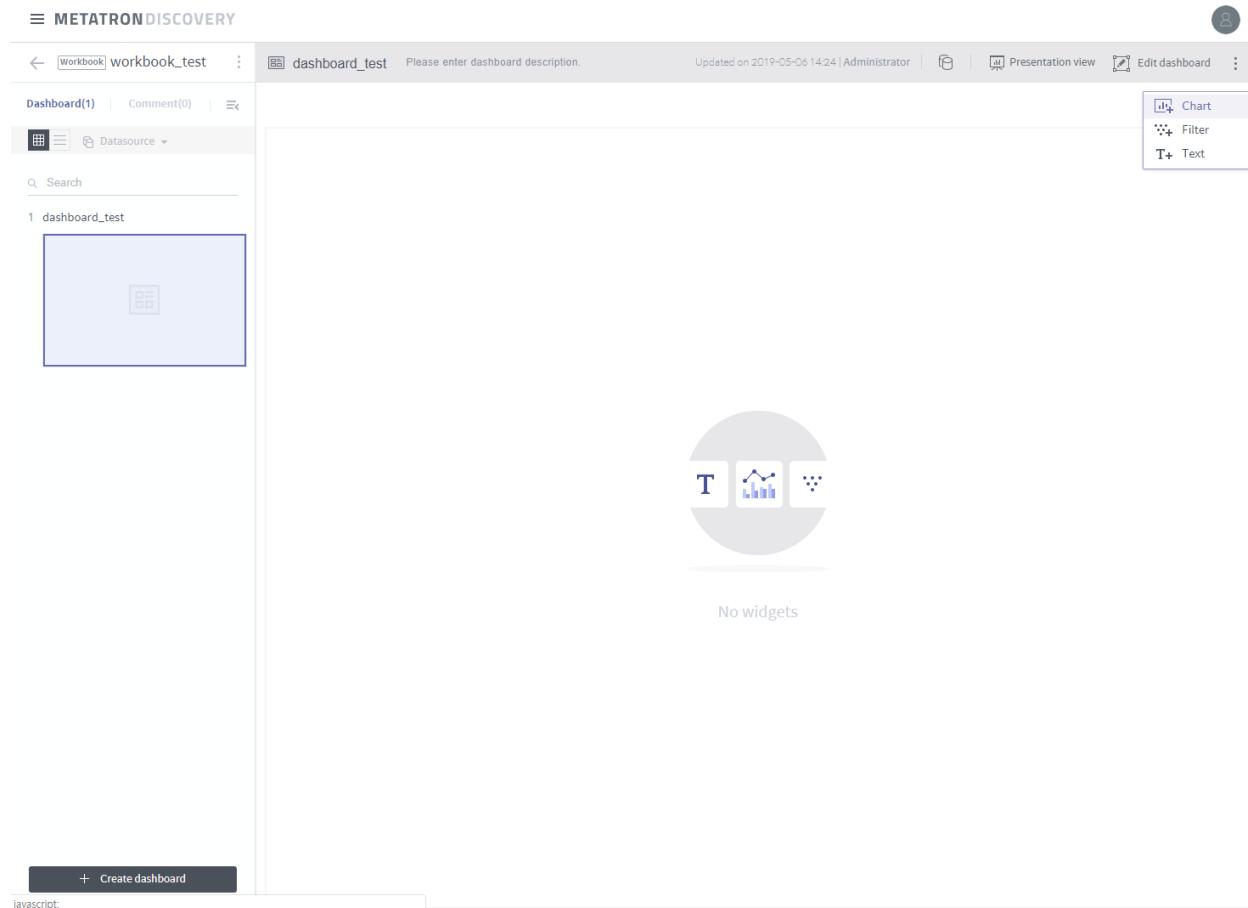
The final step is to create chart widgets, text widgets, and filter widgets to fill the empty dashboard. The dashboard can be edited in the following order:



Using the Sales Report created earlier, let's add a key performance indicator chart and a line chart to the dashboard.

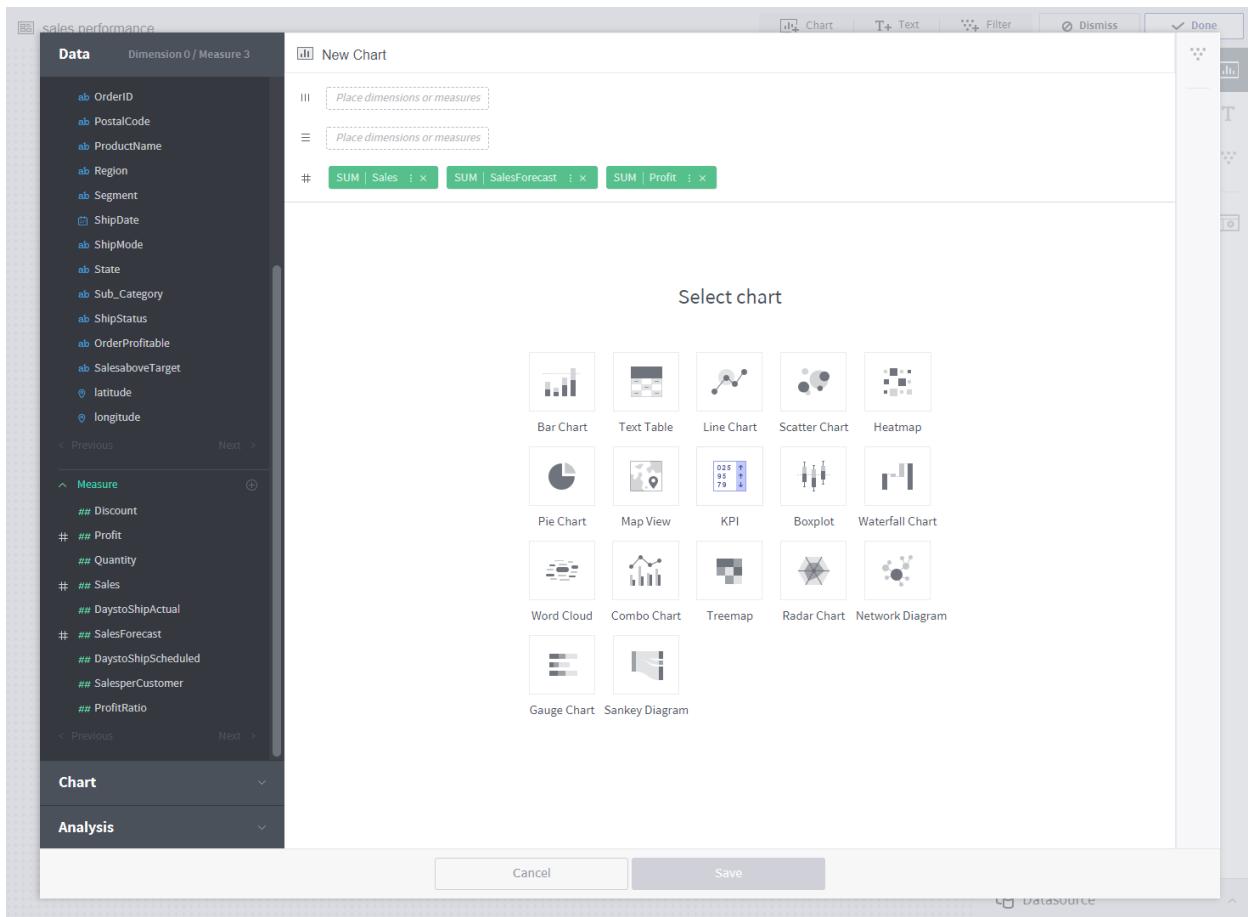


In the empty dashboard, click the **Chart** button to create a chart.



1.3.1 Creating a key performance indicator chart

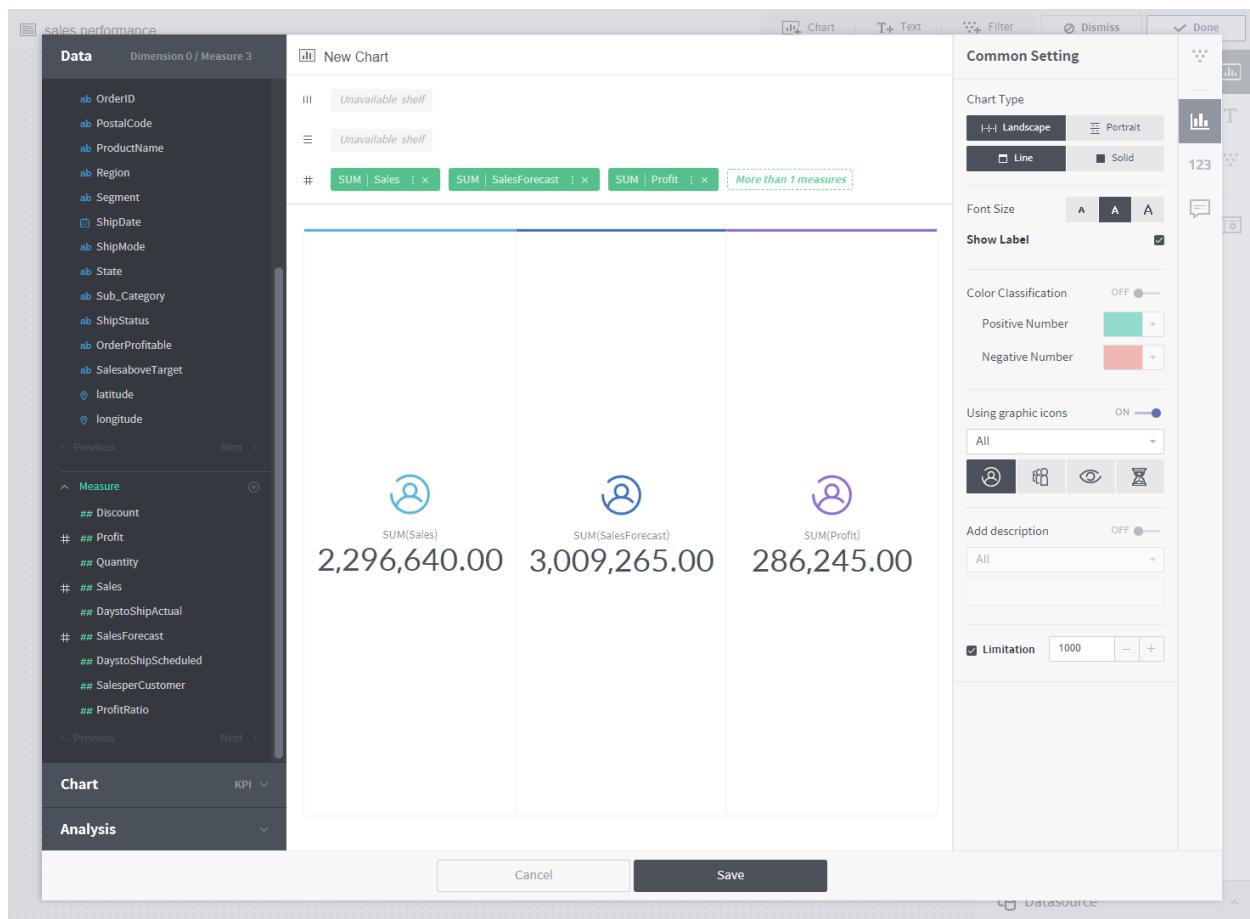
The first chart you will be creating is a key performance indicator (KPI) chart. The KPI chart is a simple yet powerful chart that displays the goals of an organization in an intuitive manner. The goal of our dashboard is to clearly present sales data. As such, the KPI chart should include total sales, sales forecast, and profit. What should we do? Simply click the three measurement columns named “Sales,” “SalesForecast,” and “Profit” under the Data menu. This task is called pivoting. The pivoted columns are automatically aggregated and placed on shelves. Once columns are on shelves, suitable charts are recommended. How about clicking the recommended KPI chart?



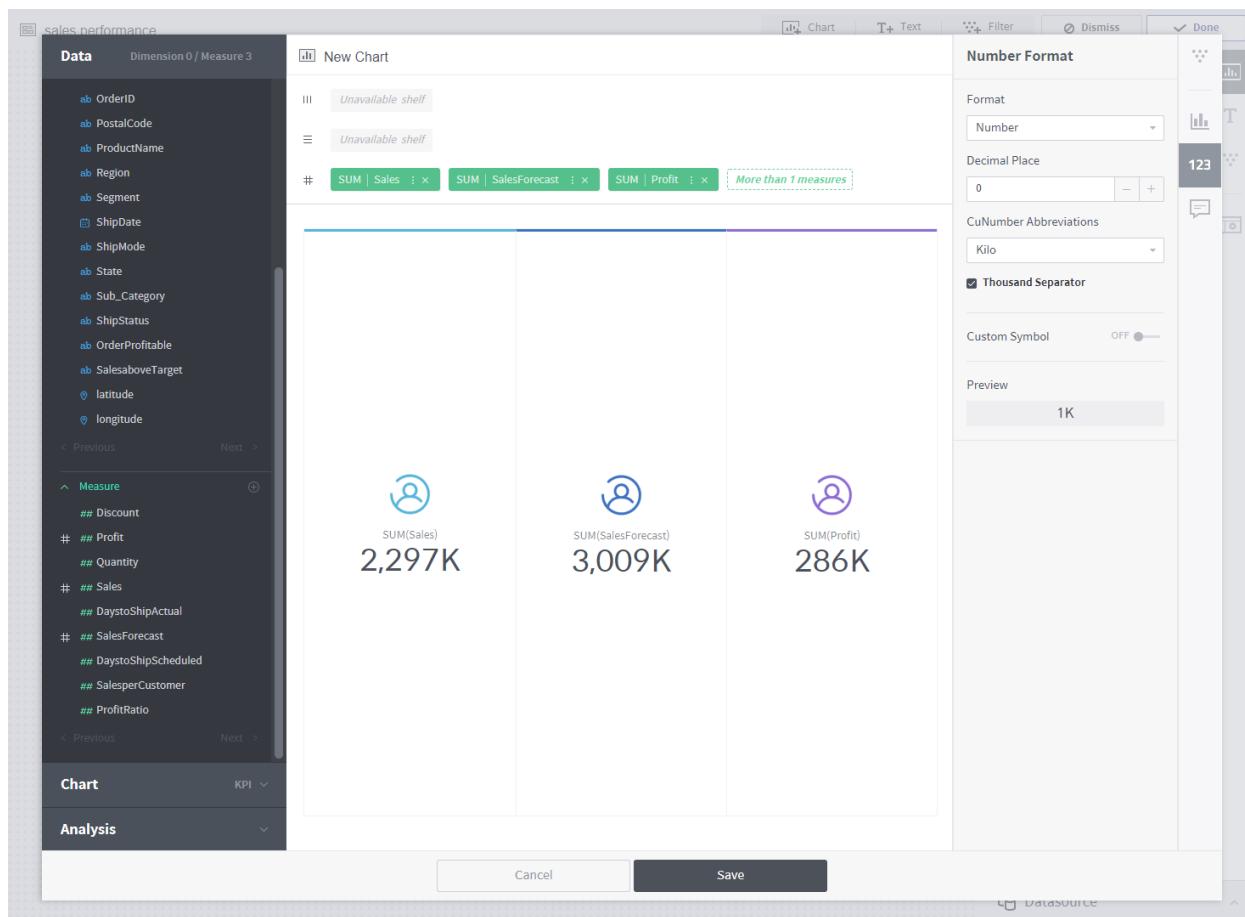
The KPI chart is created as follows: To make it more presentable, let's enter the chart properties menu on the right.

The screenshot shows the Metatron Discovery interface with a 'New Chart' dialog open. The left sidebar lists dimensions and measures, including OrderID, PostalCode, ProductName, Region, Segment, ShipDate, ShipMode, State, Sub_Category, ShipStatus, OrderProfitable, SalesaboveTarget, latitude, and longitude. The 'Measure' section lists SUM(Sales), SUM(SalesForecast), and SUM(Profit). The main area displays three large numerical values: 2,296,640.00, 3,009,265.00, and 286,245.00, corresponding to the respective measures. The top right of the dialog has buttons for 'Chart', 'Text', 'Filter', 'Dismiss', and 'Done'. A vertical toolbar on the right contains icons for chart, text, filter, and other functions.

Click to enter the **Common Setting** panel and add an icon to each measure column.

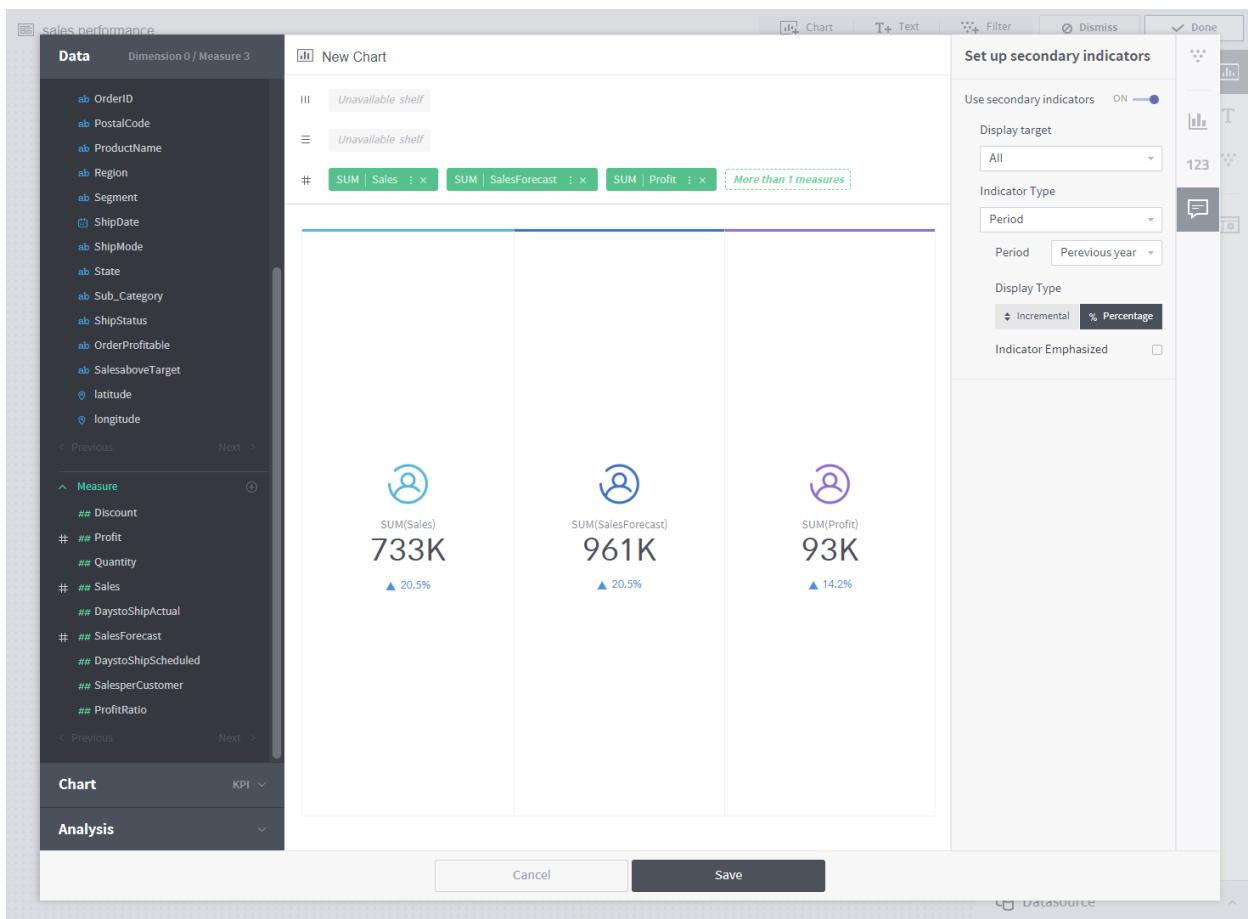


Click **123** to enter the Number Format panel and change the decimal place and abbreviation display.

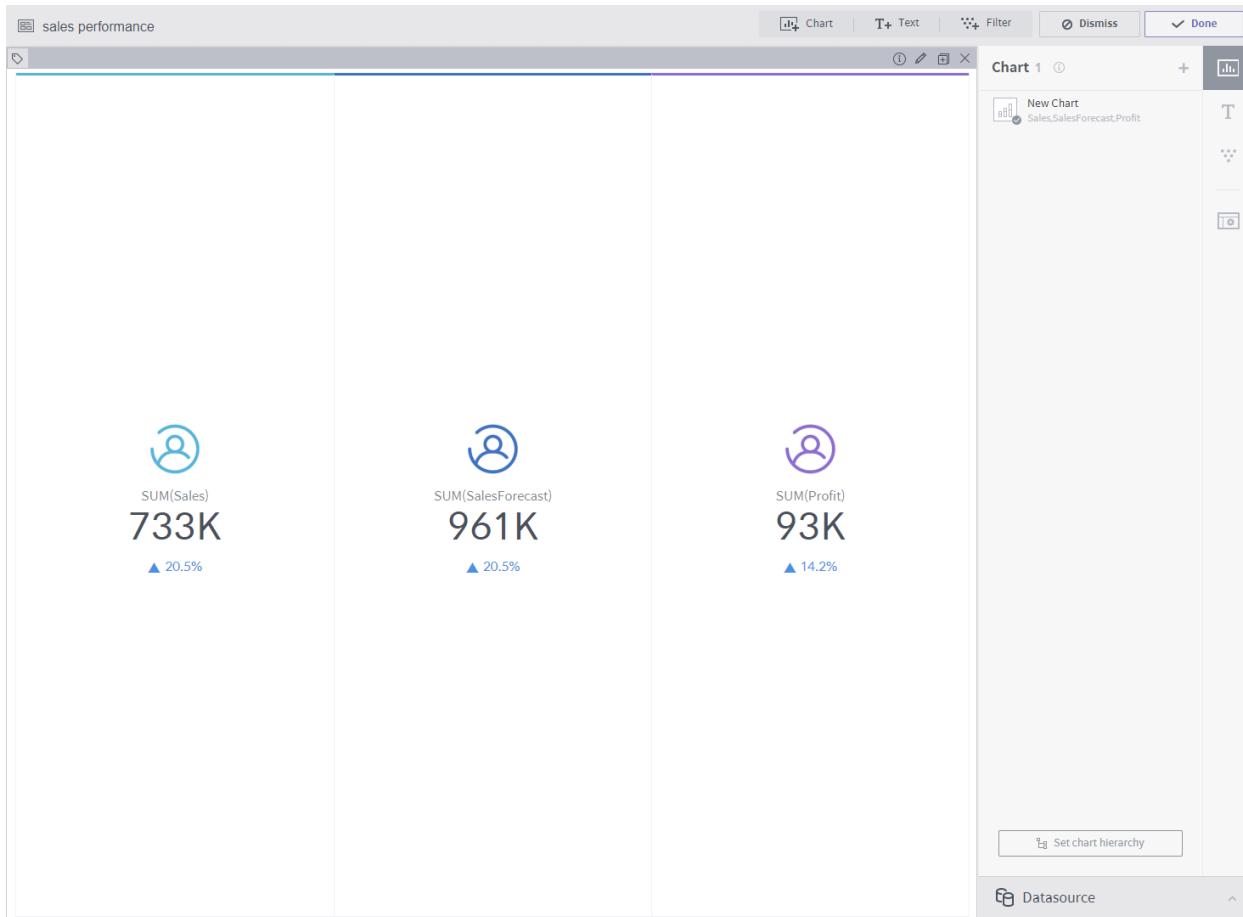


The most important feature of the KPI chart is comparing present achievements with past performance.

Click to enter the **Set up secondary indicators** panel. Set a secondary indicator, and check the % improvement in performance compared to the previous month. If you wish, you can emphasize the secondary indicator instead of the original indicator.

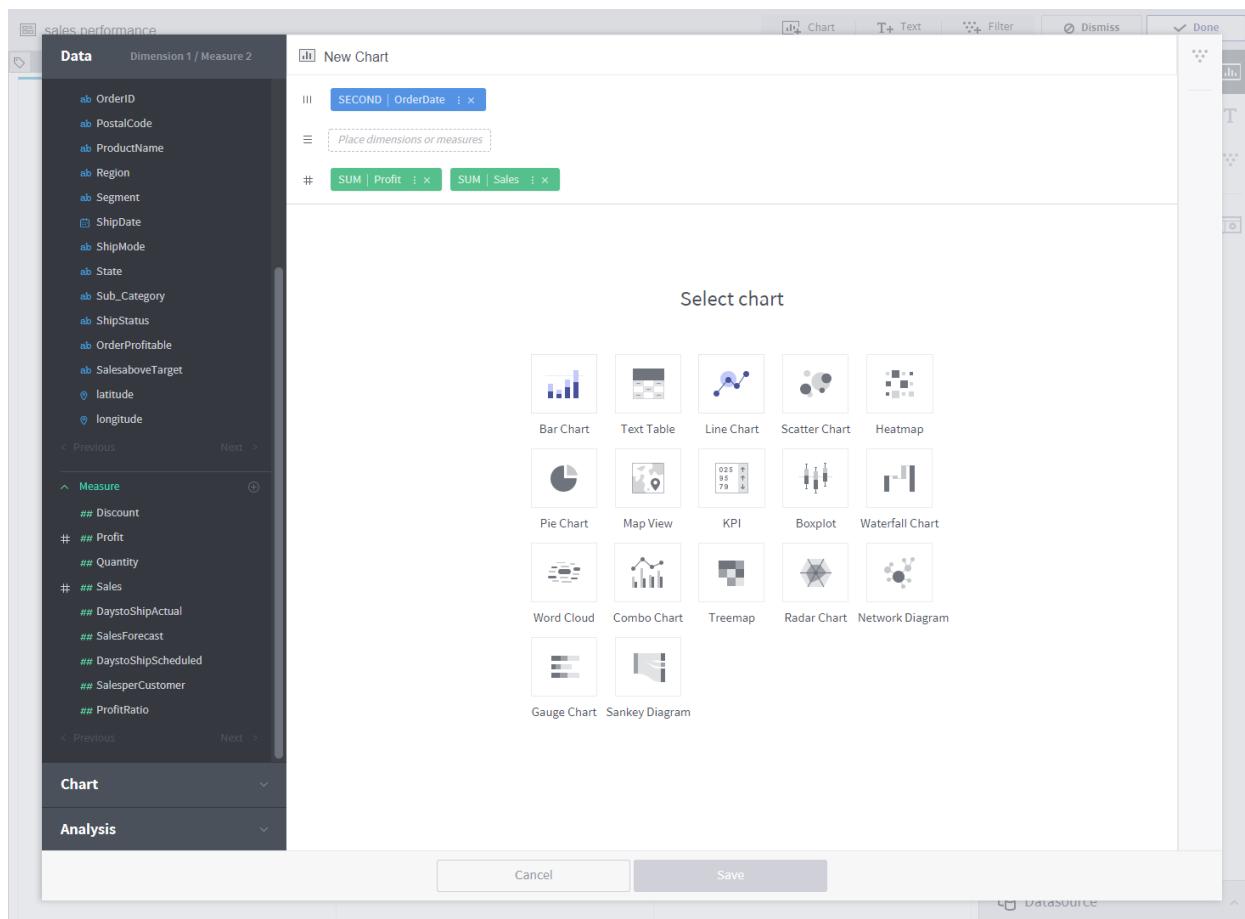


Click **Save** to display the chart in the dashboard.

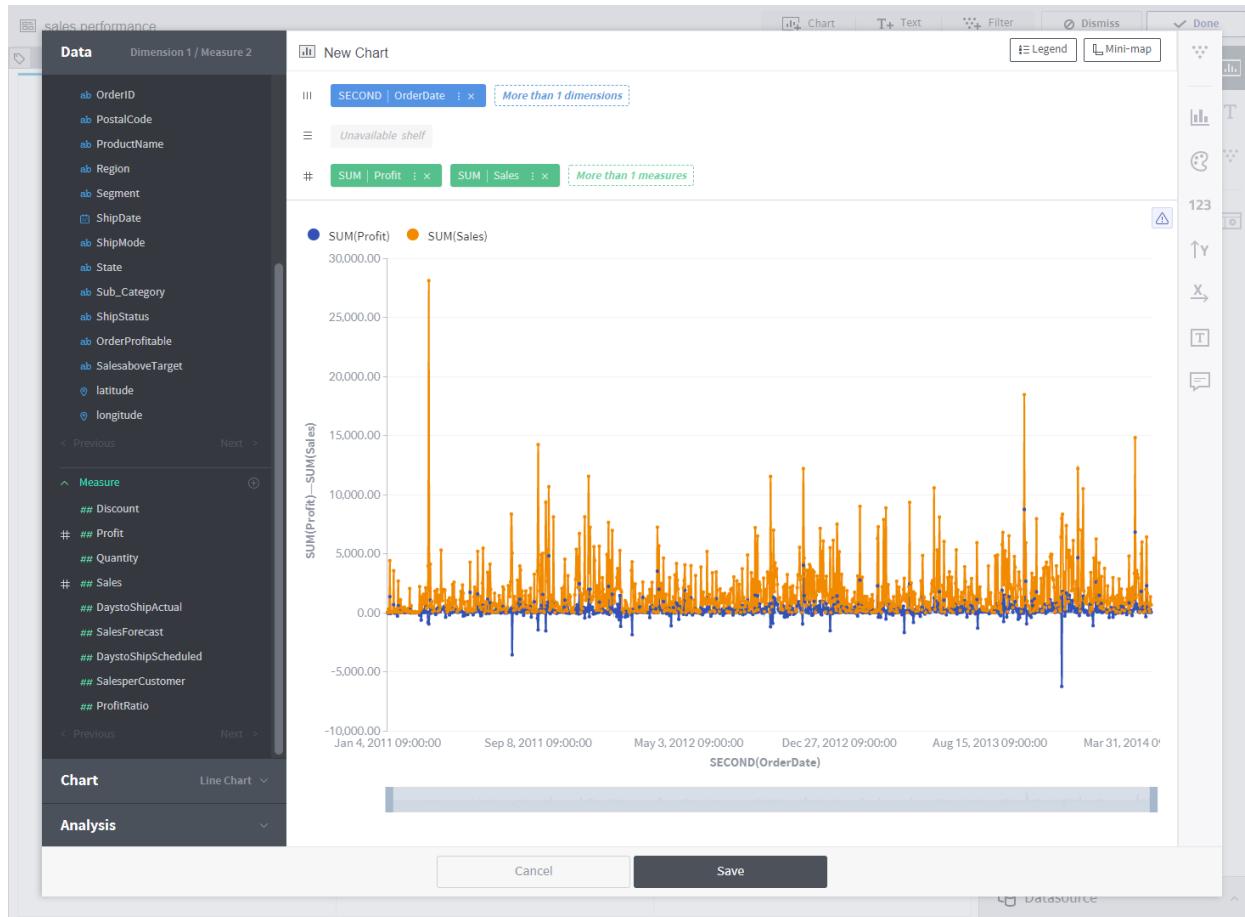


1.3.2 Creating a line chart

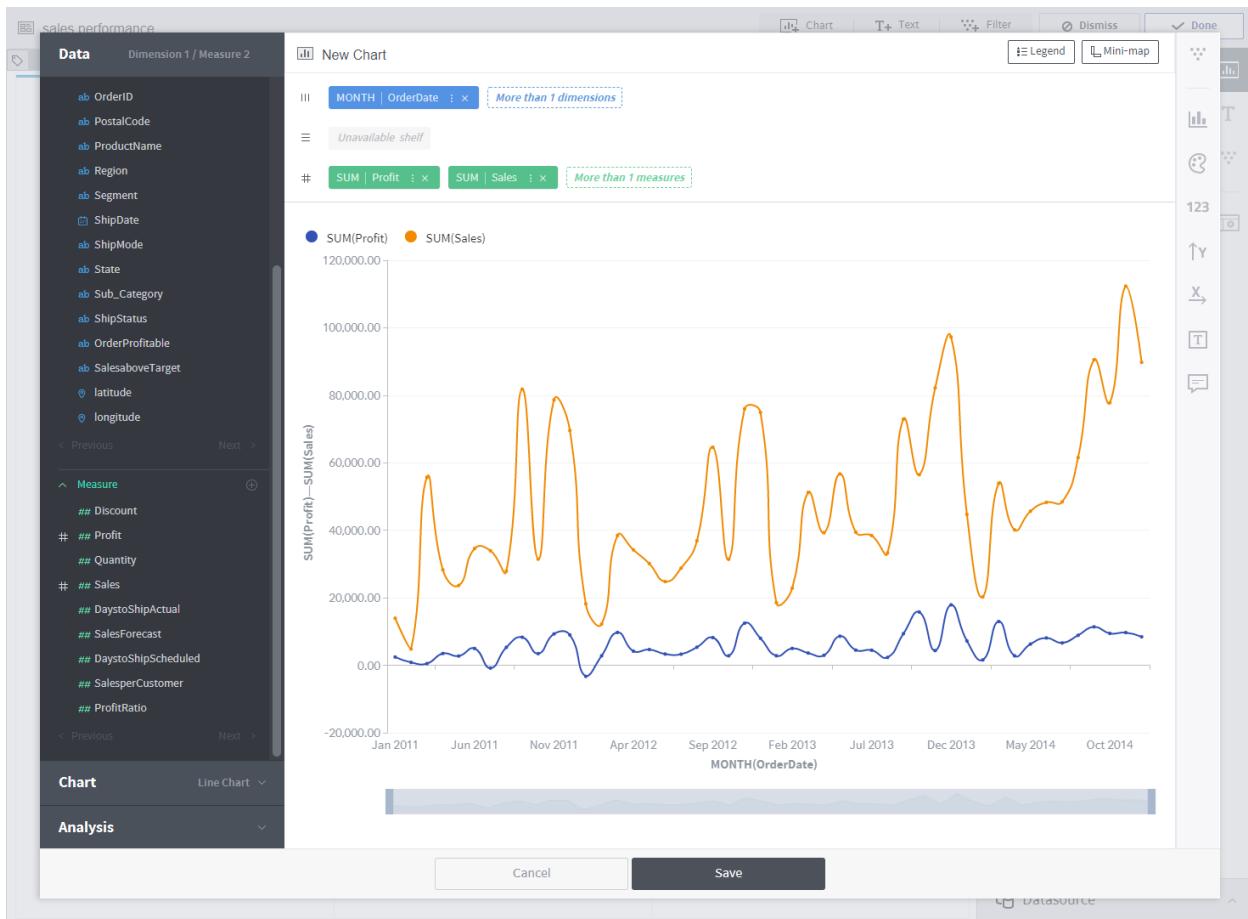
Next, let's create a line chart, the most basic type of chart. Shall we take a look at how sales and profit change over time? Again, click the **Chart** button to begin drawing a new chart. Click the OrderDate, Profit, and Sales columns to see how the values change over time. Click the recommended **Line Chart**.



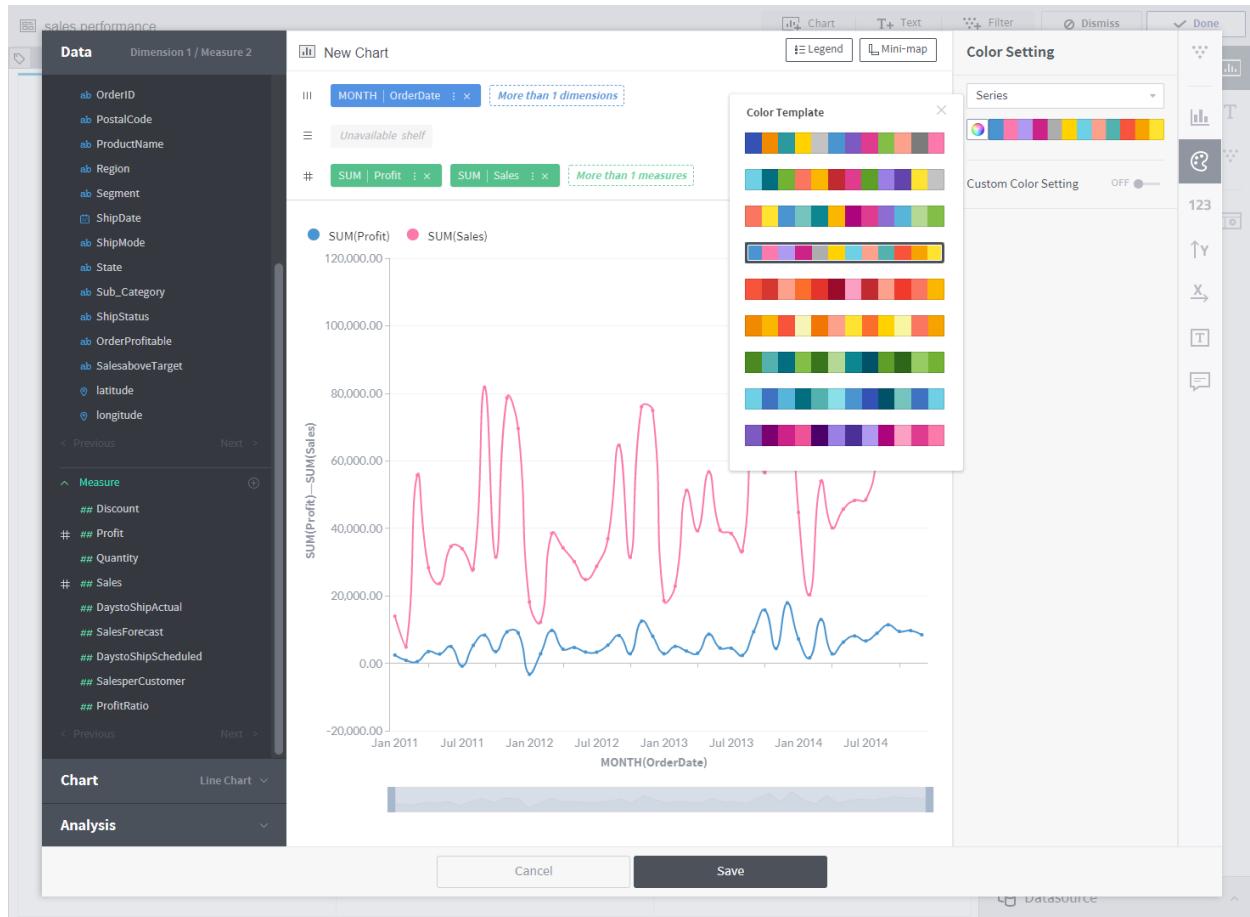
A line chart is drawn. Open the chart properties panel, and change the line shape to “round.”



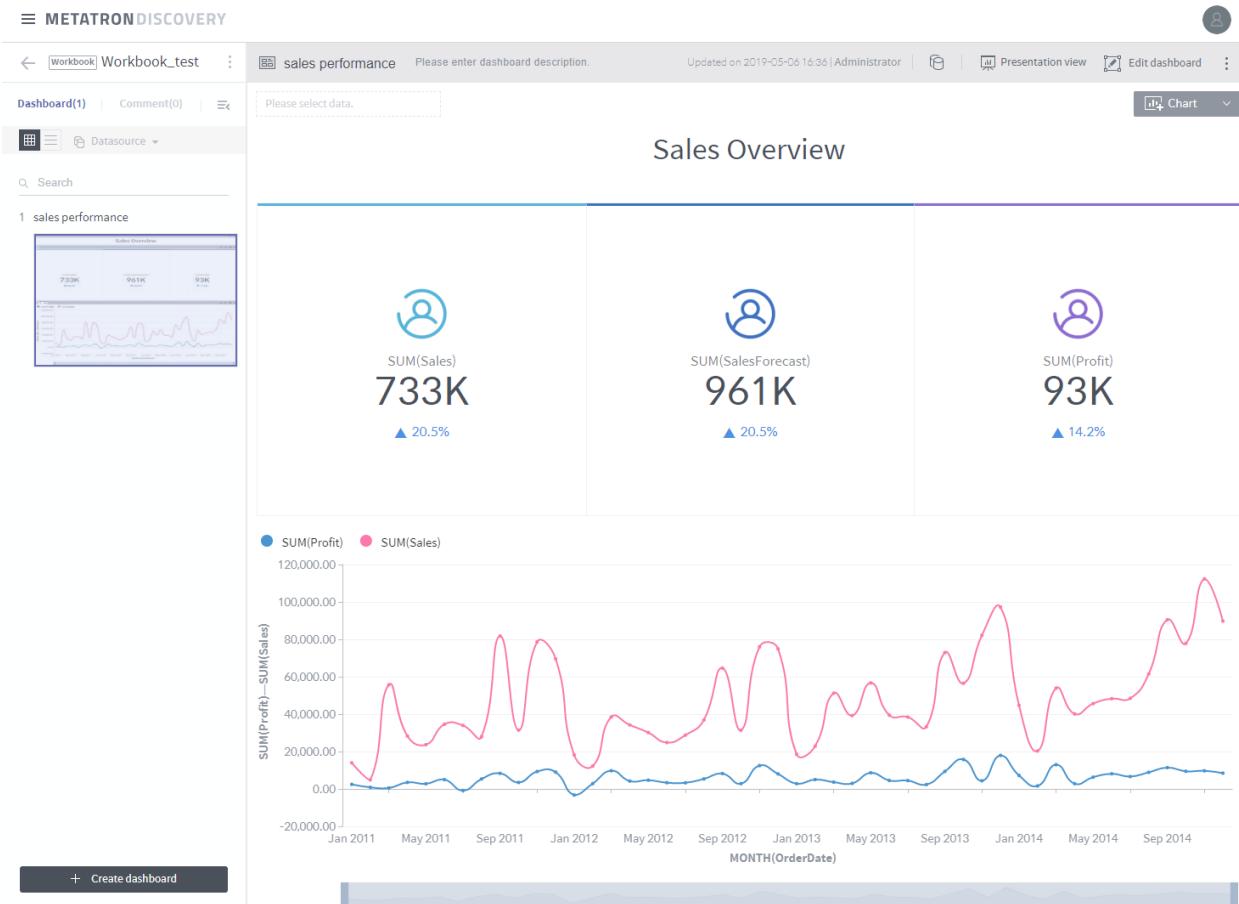
There is too much data as OrderDate is aggregated on an hourly basis. To view by month, go to the menu of the OrderDate column, and set **Granularity as Month**. The entire data is displayed now! Click **Mini Map** on the upper right to remove the mini map from the chart.



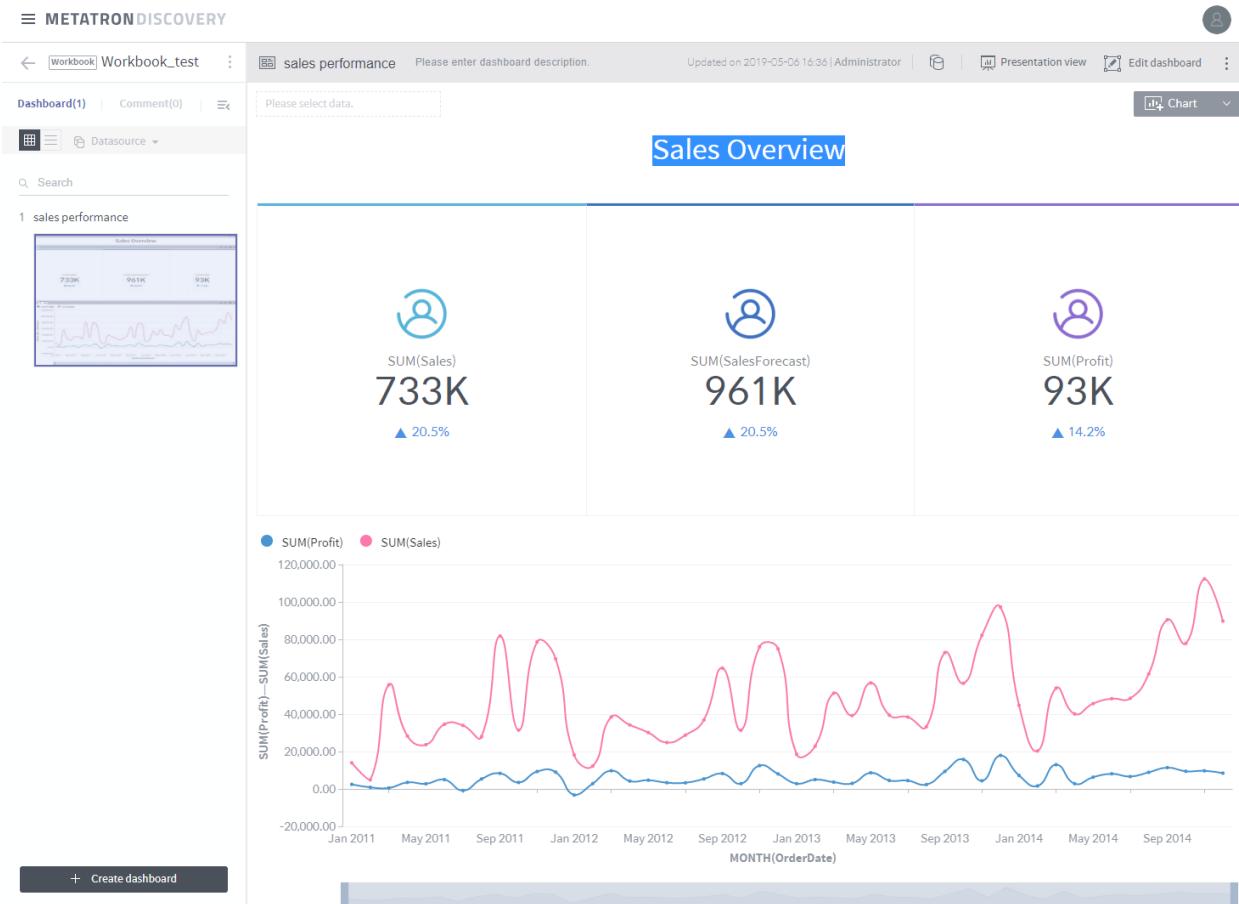
 Click  on the right menu, and change colors using the Color Setting panel.



Click Save, and drag and drop the chart to the desired position. Add information to the dashboard by adding a **text widget**. Click **Done** to finish dashboard editing.



In this tutorial, you learned how to draw two chart types. Using the interactive dashboard, you can select a chart or add filters to present data as desired. You can also modify, add, or delete charts if required.



Are you ready to learn more about Metatron Discovery?

- [Overview of Metatron Discovery](#)
- [Components of Metatron Discovery](#)
- [Metatron engine: Druid](#)

CHAPTER
TWO

INTRODUCTION OF METATRON DISCOVERY

Metatron Discovery is a solution that analyzes data ingested into the Metatron server cluster in a simple, sophisticated manner, and visualizes the results in the user PC in the form of charts and reports. A web-based application, it is highly accessible such that it can be remotely accessed by from any PC.

This section introduces the technical background and structure of Metatron Discovery, and the Druid engine powering Metatron.

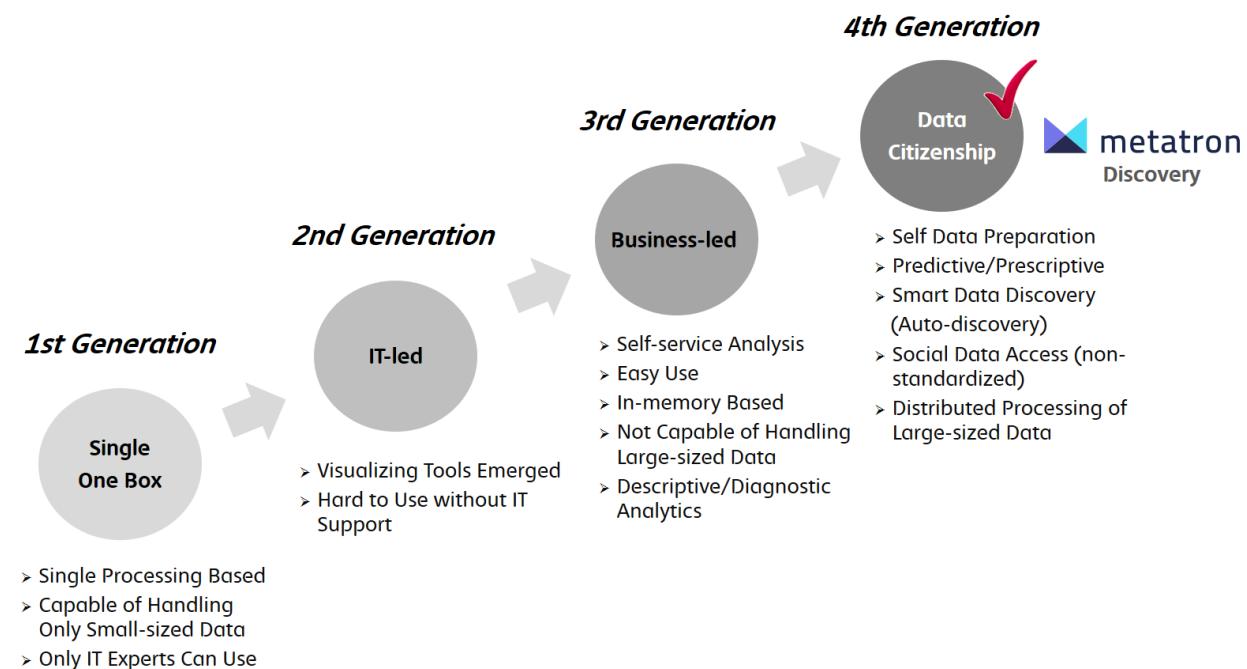
2.1 Overview of Metatron Discovery

Metatron Discovery is a 4th-generation OLAP-based business intelligence (BI) solution that combines OLAP, visualization, and machine learning technologies for even non-experts to quickly and easily derive higher-level value from data.



2.1.1 4th-generation BI solution

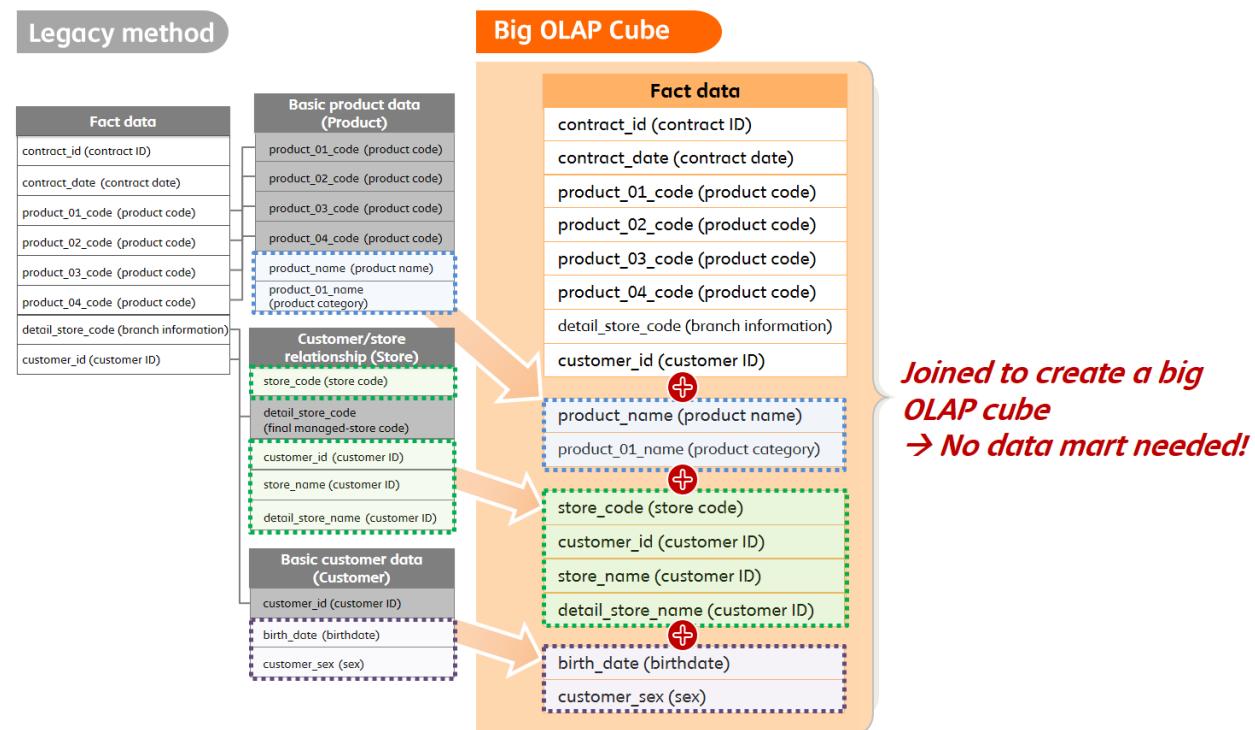
The figure below shows BI trends from the 1st to 4th generation.



The mainstream products in the current BI market belong to the 2nd and 3rd generations, and 4th generation products are beginning to come under the spotlight. As a 4th generation BI solution, Metatron Discovery supports self & ad-hoc data discovery and guarantees rapid response to big data.

2.1.2 Built on Big OLAP

Metatron Discovery combines data of various dimensions for large-sized fact data to produce a single big OLAP cube (data mart).



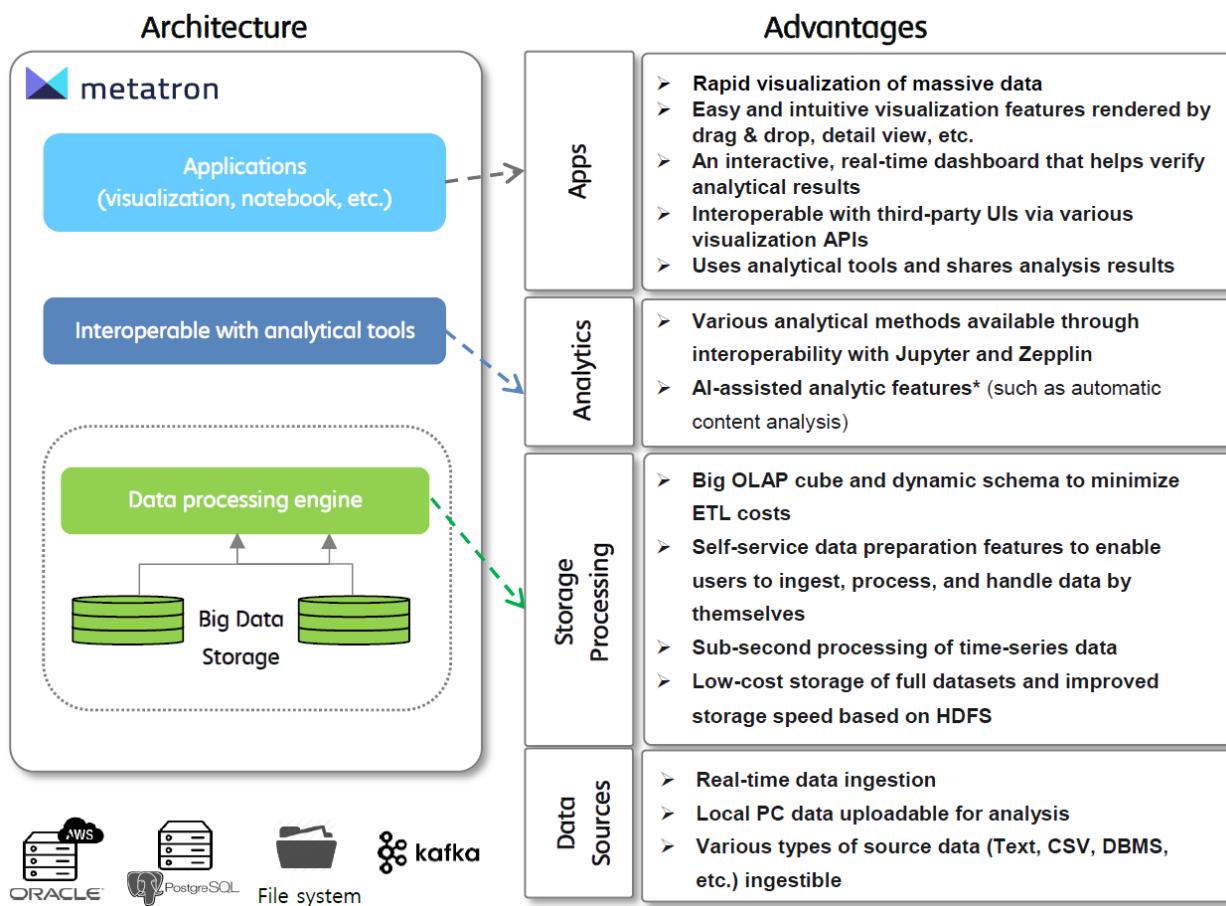
The use of a big OLAP cube offers the following advantages:

- Minimizes the number of data marts.
 - Lower ETL cost for data mart production.
 - Influence of structural change can be minimized.
 - Satisfies diverse demands by saving all fact data.
- Distributed architecture allows storing of large-scale data and ensures fast data processing.

- With a dynamic schema approach, schema changes do not require schema redefining.
- Data can be processed at the record level in real time as tables are saved with no data loss.

2.1.3 Architecture of Metatron Discovery

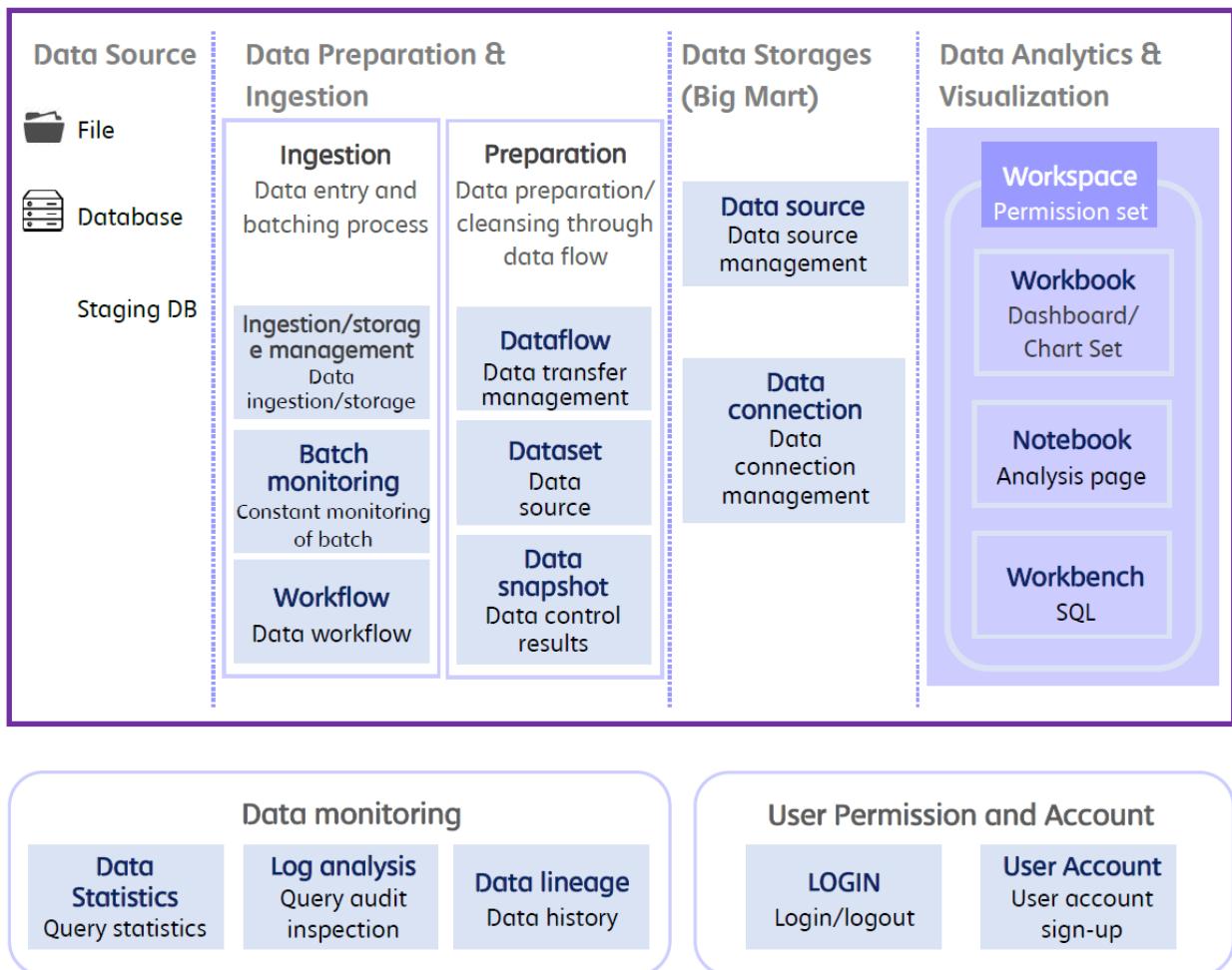
Metatron Discovery is an end-to-end solution that supports the entire process of data discovery, from preparation of large-scale data to data visualization and exploration and to advanced analytics. The figure below is a summary of Metatron's architecture and key features.



2.2 Components of Metatron Discovery

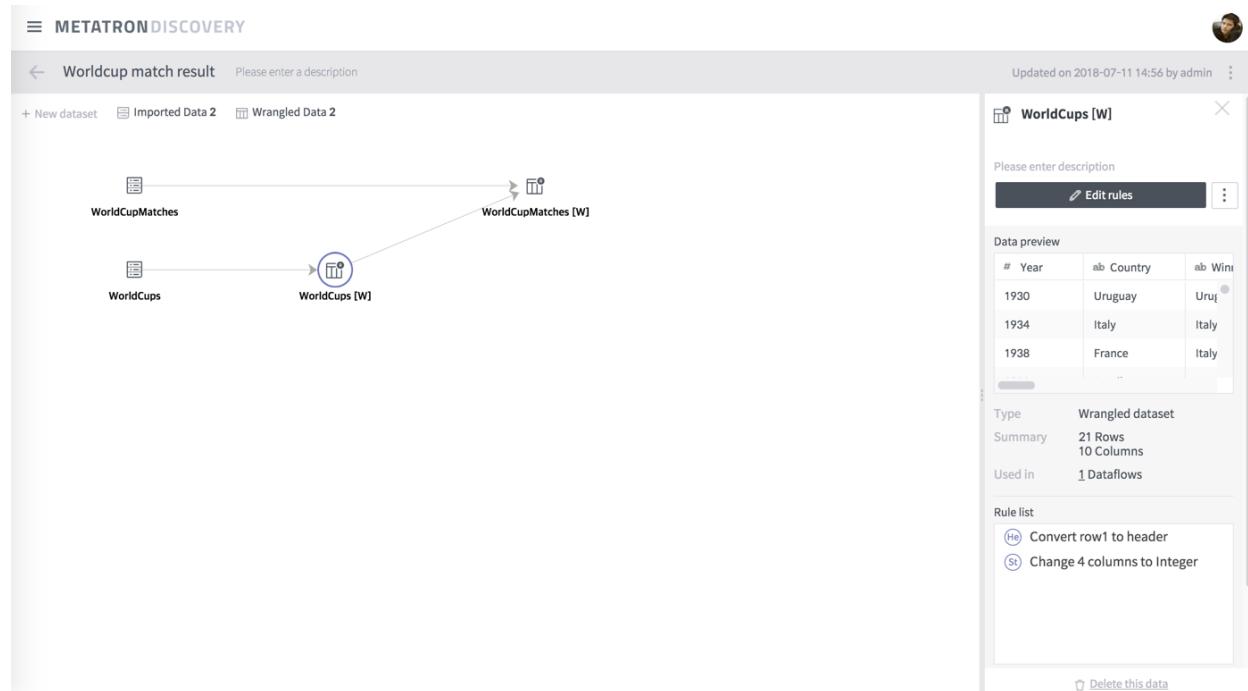
Metatron Discovery performs analytics on its ingested data sources or other external data sources using various analytical tools and outputs analytical results in charts and reports. To utilize this system, you

must understand its overall structure shown below:



2.2.1 Data Preparation

Data Preparation refines data from source data to be ingested into Metatron. See [Data Preparation](#) for details on data preparation.



This screenshot shows a detailed view of the "Order_data [W]" dataset. At the top left, it says "Data Preview" and "Dataflow". The main area has a summary table with "Valid: 100%", "Mismatched: 0%", and "Missing: 0%". Below this is a large table titled "Search by ID" with columns: No., S..., # o_orderkey, # o_custkey, ab o_orderpriority, # o_totalprice, ab o_orderdate, ab o_clerk. The table lists several order entries with their details.

To the right of the table is a sidebar with dataset metadata: Database (default), Table (Order_list_Snapshot_1103), Summary (300,000,000 Rows, 9 Columns), Size (10 GB), Elapsed Time (0:1:11.0), and Created (2017-11-17 14:19:50, 18:39 ...). Below this are sections for "Summary" (Analyze order lists by customer, 05:09 ...), "Dataset" (Order_data [W], 19:44 ...), and "Origin imported dataset" (Datasource Order_data, 14:34 ...; Querystatement SELECT * FROM tpch.orders, 12:47 ...). At the bottom of the sidebar, there are links for "Created at 2017-11-17 14:19:50" and "Last modified at 2017-11-17 14:19:50".

2.2.2 Data Storage

Data Storage manages data ingested into the Metatron engine for analysis and visualization. See [Data Management](#) for details on data management.

The screenshot shows the Metatron Discovery interface with the following details:

- Header:** METATRON DISCOVERY, Financial_data, SBC Financial ERP Data, Updated on 2018-08-16 18:15 by Administrator, profile icon.
- Information Tab:** Active tab, showing:
 - Data Information:**
 - Source type: FILE
 - Status: Enabled (Datasource available via engine rules)
 - Size: 115.09 KB
 - Duration: 2013-09-01T00:00:00.000Z - 2013-09-01T00:00:00.000Z
 - Timestamp settings: Segment Granularity: MONTH, Query Granularity: NONE
 - Histogram:** A bar chart showing data distribution over time. The x-axis represents dates from 2013-09-01 to 2014-09-01. The y-axis ranges from 0 to 80. The bars show peaks around 2013-09-01 (~60), 2014-01-01 (~60), 2014-05-01 (~60), and 2014-09-01 (~60). A 'Detail' link is at the top right of the chart area.
- Permission Tab:** Shows checked checkbox for "Allow all workspaces to use this datasource" and "All workspaces".
- Ingestion information Tab:** Shows Master data (checkbox), Type (excel).

The screenshot shows the 'Create data connection' interface for Oracle. At the top, there's a header with a close button (X) and a link to 'Create data connection'. Below the header, a message says 'Please set required items and complete data connection creation'. The interface is divided into several sections:

- DB type:** Oracle (selected), MySQL, PostgreSQL, Hive, presto, APACHE PHOENIX, Tibero.
- Server:** Host: http://192.10.20.85, Port: 3306, SID: (empty). A checked checkbox labeled 'URL only' is present.
- User ID for test:** polaris, Password for test: (redacted).
- Security:** Radio buttons for 'Always connect', 'Connect by user's account', and 'Connect with ID and password'. 'Always connect' is selected.
- Validation Check:** A button with the text 'Validation Check' and a message 'Invalid Connection. Please check server and account information'.
- Permission:** 1 Workspace (Edit), checked checkbox 'Allow all workspaces to use this datasource'.
- Advanced setting:** Socket timeout: 60 Sec.
- Connection name:** Enter connection name (text input field).

At the bottom are 'Previous' and 'Next' navigation buttons.

2.2.3 Data analysis and visualization

Each module below allows users to perform visualization-based exploration and analysis of stored data.

Workspace

Workspace provides an interface to manage its workbooks, workbenches, and notebooks used in an organization according to user access. See [Workspace](#) for details on the use of the workspace.

Datasource (23)

No.	Datasource	Type	Used in	Full size	Updated
16	The_2014_Inc_5000	Ingested type	Open data	1.19 MB	2018-07-10
17	EMSI_JobChange_UK	Ingested type	Open data	46.73 KB	2018-07-10
18	OECD_TAX_ALL_02	Ingested type	Open data	926.70 KB	2018-07-09
19	WorldCup_Matches	Ingested type	Open data	69.31 KB	2018-07-06
20	oecd_test	Ingested type	Open data	30.61 KB	2018-07-06
21	tour de france	Ingested type	Open data	27.94 KB	2018-07-06
22	cell_1h	Ingested type	2 Workspaces	90.79 MB	2018-07-06
23	FIFA_18_Player_Ratings	Ingested type	Open data	3.41 MB	2018-07-06

More ▾

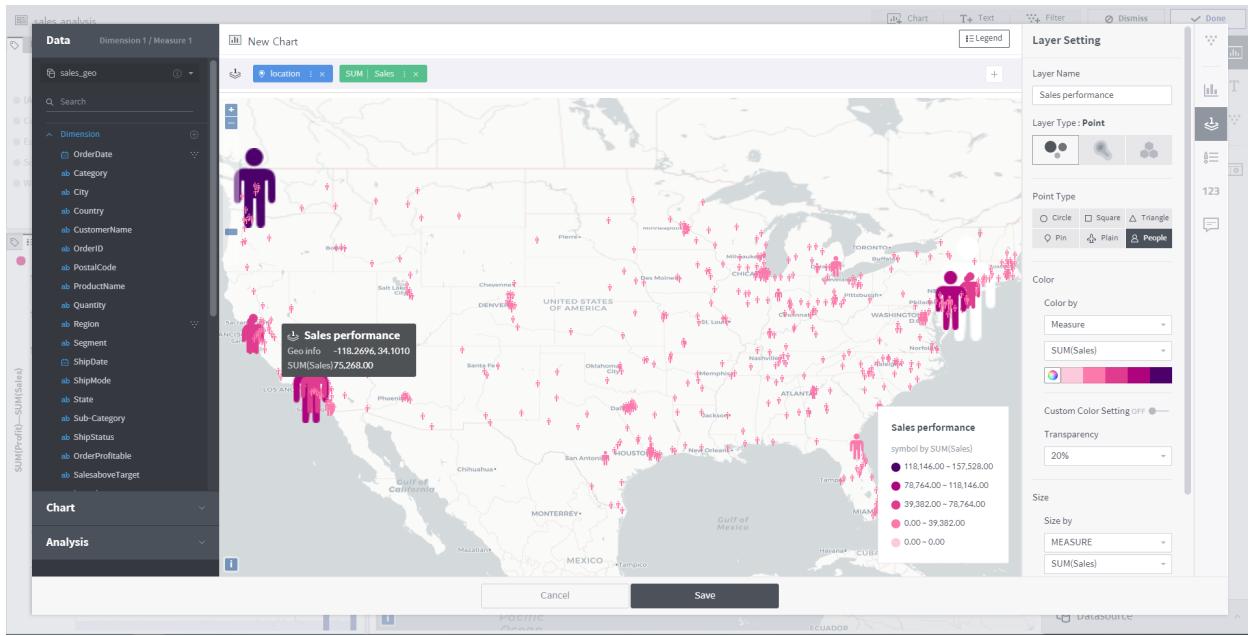
Close

Workbook, dashboard, chart

Workbook supports working on, sharing, and making a presentation with dashboards and charts using a PowerPoint-like interface. See [Workbook](#) for details on the workbook module.

The screenshot displays the Metatron Discovery interface, which includes:

- Sales analysis** dashboard (left): Contains a line chart showing Sales & Profit analysis over time, and a second chart showing Product analysis.
- Product analysis** dashboard (center): Features a scatter plot of Orders vs Profit for different products categorized by ShipMode (Shipped Early or Shipped Late) and Product Category (Technology, Office Supplies, Furniture).
- Product analysis** dashboard (right): A circular sunburst chart showing the hierarchy of product categories and their sales distribution across various regions.
- Sales Data for SKT** (bottom): A detailed view of a specific sales dataset. It shows a pie chart of Profit by City (New York City, Los Angeles, Seattle, San Francisco, San Diego, Springfield, San Diego). The data table lists 7 rows of sales data with columns: OrderID, DAY(OrderDate), ProductName, Quantity, State, ShipMode, Sales, Profit, and Day.



Notebook

Notebook enables advanced analytics based on machine learning. See [Notebook](#) for details on the notebook module.

The screenshot shows the Zeppelin Notebook interface with two code cells. The first cell contains Scala code for loading a dataset from a MetisClient:// 1. load dataset
import app.metatron.discovery.connector._;
val conf = new MetisClientSetting();
conf.setting("host", "metatron-web-01").setting("port", "8080");
val client = new MetisClient(conf);
val dataset = client.loadData(spark, "datasources", "ds-gis-37", "1000")
The second cell contains Scala code for displaying the dataset:// 2. analyze
dataset.show()
Both cells have a 'READY' status indicator at the bottom right.

Workbench

Workbench enables SQL data analytics. See [Workbench](#) for details on the workbench module.

The screenshot shows the Metatron Discovery interface. On the left, there's a sidebar with a tree view of tables under 'Hive(2.3) / default'. The main area has two tabs: '쿼리 01' (Query 01) and '쿼리 01 - 결과 1' (Query 01 - Result 1). The '쿼리 01' tab contains the following SQL code:

```

1 SELECT A.C_ONE,
2        A.C_TWO,
3        SUM(A.C_TEN)
4   FROM TB_NUM AS A
5  WHERE A.C_ONE = 5
6  GROUP BY A.C_ONE, A.C_TWO;
7
8 USING 'GROUP BY' QUERY EXAMPLE
9 COMMENT ON TABLE USER_INFO_EX
10 IS '고객 정보 확장'; -- USER_INFO_EX 테이블에 주석 추가
11
12 SELECT *
13   FROM USER_TAB_COMMENTS
14  WHERE TABLE_NAME = 'USER_INFO_EX'; -- USER_INFO_EX 테이블의 주석 확인
15
16 COMMENT ON COLUMN USER_INFO_EX.RNAME
17 IS '고객 실제 이름'; -- USER_INFO_EX 의 RNAME 컬럼에 주석 추가
18

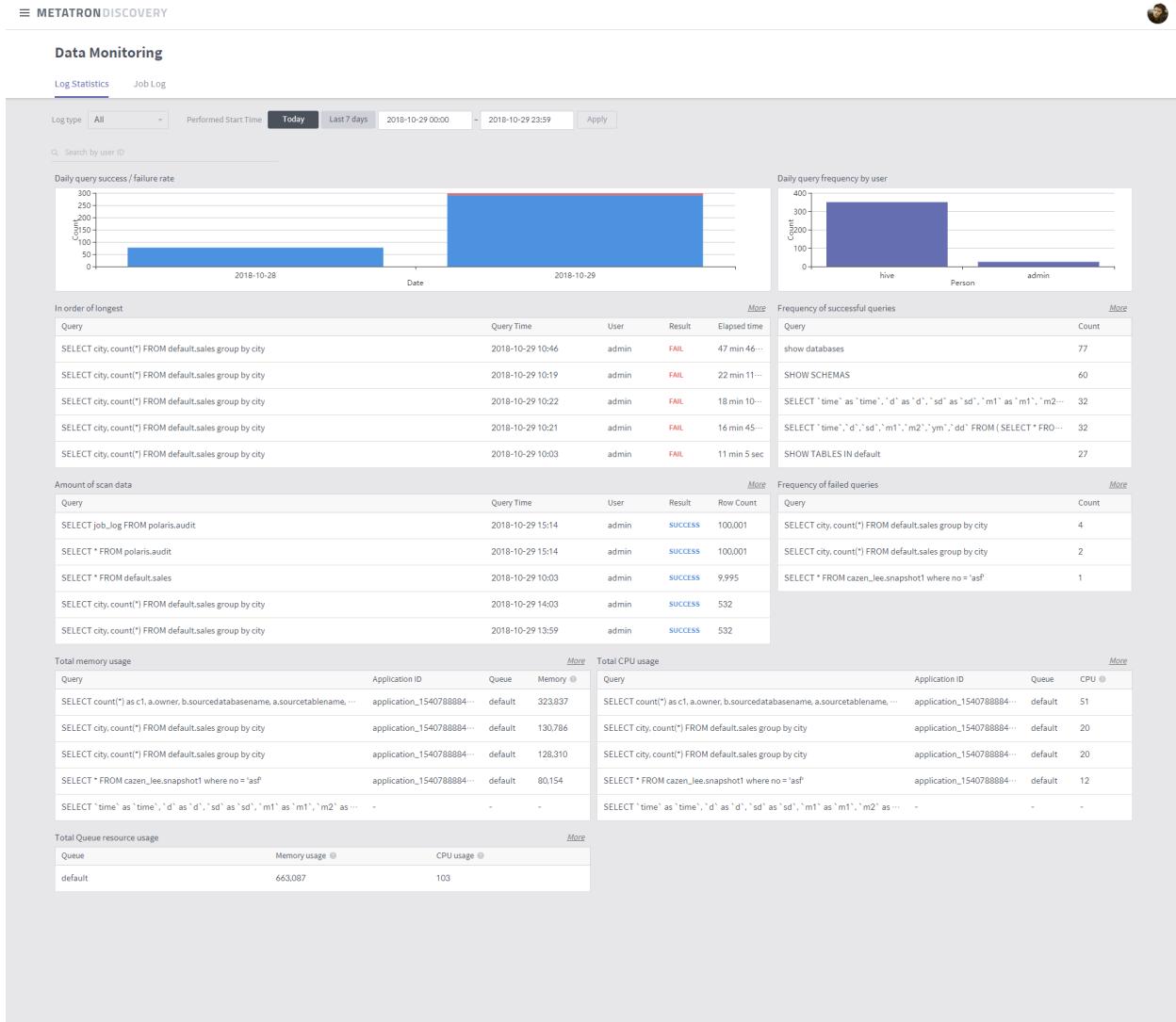
```

The '쿼리 01 - 결과 1' tab displays a table with 1000 rows of data:

SEQ	L_orderkey	L_partkey	L_suppkey	L_linenumber	L_quantity	L_extendedprice	L_discount
1	1	31037869	1537885	1	17.0	30690.27	0.04
2	1	13461816	1461817	2	36.0	63977.04	0.09
3	1	12739956	739957	3	8.0	15962.56	0.1
4	1	426299	926300	4	28.0	34307.56	0.09

2.2.4 Data Monitoring

This function monitors data use based on data query statistics and query logs. See [Data Monitoring](#) for details on the data monitoring functionality.



2.2.5 User permission and account administration

You can add/delete users or manage user permission.

2.2.6 Login/Logout

Users with accounts can login to Metatron Discovery and freely use within the assigned permission. Current login can be logged out from external systems as well.

2.3 Metatron engine: Druid

The development of information and communications technology has been accompanied by a rapid increase in the amount of data generated, highlighting the importance of efficient data collection, management, and utilization. However, RDBMS-based legacy tools are unable to process mass amounts of multidimensional data. This has led to the emergence of new methodologies and solutions aimed at satisfying the demand for big data.

Metamarkets, a technology startup based in Silicon Valley, launched a column-oriented distributed data store known as Druid in 2011, and open sourced it in October 2012. Many companies have turned to Druid for their backend technology because it offers various advantages, including fast and efficient data processing.

As a B2C telecommunications service provider, SK Telecom recognized the need to effectively manage and analyze the vast amounts of network data generated by its users every minute. Metatron, an end-to-end business intelligence solution with Druid as the underlying engine, was thus developed and launched in 2016.



The following sections discuss the features of Druid that make it suitable for time-series data processing, and introduce how they were adapted and improved by SK Telecom for Metatron.

2.3.1 Background of Druid development

Druid was originally designed to satisfy the following needs around ingesting and exploring large quantities of transactional events (log data):

- The developers wanted to be able to rapidly and arbitrarily slice and dice data and drill into that data effectively without any restrictions, along with sub-second queries over any arbitrary combination of dimensions. These capabilities were needed to allow users of their data dashboard to arbitrarily and interactively explore and visualize event streams.
- The developers wanted to be able to ingest events and make them exportable almost immediately after their occurrence. This was crucial to enable users to collect and analyze data in real time for timely situational assessments, predictions and business decisions. Popular open source data warehousing systems such as Hadoop were unable to provide the sub-second data ingestion latencies as required.
- The developers wanted to ensure multitenancy and high availability for their solution services. Their systems needed to be constantly up and be able to withstand all sorts of potential failures without going down or taking any downtime. Downtime is costly and many businesses cannot afford to wait if a system is unavailable in the face of software upgrades or network failure.

2.3.2 Druid features

Data table components

Data tables in Druid (called data sources) are collections of timestamped events designed for OLAP queries. A data source is composed of three distinct types of columns (here we use an example dataset from online advertising).

Timestamp column	Dimension columns					Metric columns	
timestamp	publisher	advertiser	gender	country	click	price	
2011-01-01T01:01:35Z	bieberfever.com	google.com	Male	USA	0	0.65	
2011-01-01T01:03:63Z	bieberfever.com	google.com	Male	USA	0	0.62	
2011-01-01T01:04:51Z	bieberfever.com	google.com	Male	USA	1	0.45	
2011-01-01T01:00:00Z	ultratrimfast.com	google.com	Female	UK	0	0.87	
2011-01-01T02:00:00Z	ultratrimfast.com	google.com	Female	UK	0	0.99	
2011-01-01T02:00:00Z	ultratrimfast.com	google.com	Female	UK	1	1.53	

Fig. 1: Source: <http://druid.io>

- **Timestamp column:** Druid treats timestamp separately in a data source because all its queries center around the time axis (If non-time series data is ingested in batch, all records are timestamped with the current time for use in Druid).
- **Dimension columns:** Dimensions are string attributes of an event, and the columns most commonly used in filtering the data. Four dimensions are involved in the example dataset: publisher, advertiser, gender, and country. They each represent an axis of the data chosen to slice across.
- **Metric columns:** Metrics are columns used in aggregations and computations. In the example, the metrics are clicks and price. Metrics are usually numeric values, and computations include operations such as count, sum, and mean (Metatron has extended supported Druid data types).

Data ingestion

Druid supports real-time and batch ingestion.

One major characteristic of Druid is real-time ingestion, which is enabled by real-time nodes (For details, see [Real-time nodes](#)). Events ingested in real-time from a data stream get indexed in seconds to become queryable in the Druid cluster.

Data roll-up

The individual events in our example dataset are not very interesting because there may be trillions of such events. However, summarizations of this type of data by time interval can yield many useful insights.

Druid summarizes this raw data when ingesting it using an optional process called “roll-up.” Below is an example of roll-up.

timestamp	domain	gender	clicked
2011-01-01T00:01:35Z	bieber.com	Female	1
2011-01-01T00:03:03Z	bieber.com	Female	0
2011-01-01T00:04:51Z	ultra.com	Male	1
2011-01-01T00:05:33Z	ultra.com	Male	1
2011-01-01T00:05:53Z	ultra.com	Female	0
2011-01-01T00:06:17Z	ultra.com	Female	1
2011-01-01T00:23:15Z	bieber.com	Female	0
2011-01-01T00:38:51Z	ultra.com	Male	1
2011-01-01T00:49:33Z	bieber.com	Female	1
2011-01-01T00:49:53Z	ultra.com	Female	0

timestamp	domain	gender	clicked
2011-01-01T00:00:00Z	bieber.com	Female	1
2011-01-01T00:00:00Z	ultra.com	Female	2
2011-01-01T00:00:00Z	ultra.com	Male	3

Fig. 2: Source: Interactive Exploratory Analytics with Druid | DataEngConf SF ‘17

The table on the left lists the domain click events that occurred from 00:00:00 to 01:00:00 on January 1, 2011. Since individual events recorded in seconds do not have much significance from the analyst’s perspective, the data was compiled at a granularity of one hour. This results in the more meaningful table on the right, which shows the number of clicks by gender for the same time period.

In practice, rolling up data can dramatically reduce the size of data that needs to be stored (up to a factor of 100), thereby saving on storage resources and enabling faster queries.

But, as data is rolled up, individual events can no longer be queried; the rollup granularity is the minimum granularity you will be able to explore data at and events are floored to this granularity. The unit of granularity can be set as desired by users. If necessary, the roll-up process may be disabled to ingest every individual event.

Data sharding

A data source is a collection of timestamped events and partitioned into a set of shards. A shard is called a segment in Druid and each segment is typically 5? 10 million rows. Druid partitions its data sources into well-defined time intervals, typically an hour or a day, and may further partition on values from other columns to achieve the desired segment size.

The example below shows a data table segmented by hour:

Segment sampleData_2011-01-01T01:00:00:00Z_2011-01-01T02:00:00:00Z_v1_0:

2011-01-01T01:00:00Z	ultratrimfast.com	google.com	Male	USA	1800	25	15.70
2011-01-01T01:00:00Z	bieberfever.com	google.com	Male	USA	2912	42	29.18

Segment sampleData_2011-01-01T02:00:00:00Z_2011-01-01T03:00:00:00Z_v1_0:

2011-01-01T02:00:00Z	ultratrimfast.com	google.com	Male	UK	1953	17	17.31
2011-01-01T02:00:00Z	bieberfever.com	google.com	Male	UK	3194	170	34.01

This segmentation by time can be achieved because every single event in a data source is timestamped.

Segments represent the fundamental storage unit in Druid and replication and distribution are done at a segment level. They are designed to be immutable, which means that once a segment is created, it cannot be edited. This ensures no contention between reads and writes. Druid segments are just designed to be read very fast.

In addition, this data segmentation is key to parallel processing in Druid's distributed environment: As one CPU can scan one segment at a time, data partitioned into multiple segments can be scanned by multiple CPUs simultaneously in parallel, thereby ensuring fast query returns and stable load balancing.

Data storage format and indexing

The way Druid stores data contributes to its data structures highly optimized for analytic queries. This section uses the Druid table below as an example:

Timestamp	Page	Username	Gender	City	Characters Added	Characters Removed
2011-01-01T01:00:00Z	Justin Bieber	Boxer	Male	San Francisco	1800	25
2011-01-01T01:00:00Z	Justin Bieber	Reach	Male	Waterloo	2912	42
2011-01-01T02:00:00Z	Ke\$ha	Helz	Male	Calgary	1953	17
2011-01-01T02:00:00Z	Ke\$ha	Xeno	Male	Taiyuan	3194	170

Fig. 3: Source: Druid: A Real-time Analytical Data Store

Columnar storage and indexing

Druid is a column store, which means each individual column is stored separately. Given that Druid is best used for aggregating event streams, column storage allows for more efficient CPU usage as only the columns pertaining to a query are actually loaded and scanned in that query. In a row oriented data store, all columns associated with a row must be scanned as part of an aggregation. The additional scan time can introduce significant performance degradations. In the example above, the page, user, gender, and city columns only contain strings. Storing strings directly is unnecessarily costly; instead, they can be mapped into unique integer identifiers. For example,

```
Justin Bieber -> 0
Ke$ha -> 1
```

This mapping allows the page column to be represented as an integer array where the array indices correspond to the rows of the original dataset. For the page column, we can represent the unique pages as follows:

```
[0, 0, 1, 1]
```

Thus, strings are replaced by fixed-length integers in storage, which are much easier to compress. Druid indexes data on a per-shard (segment) level.

Indices for filtering data

Druid creates additional lookup indices that facilitate filtering on string columns. Let us consider the above example table again. A query might be: “How many Wikipedia edits were done by users in San Francisco who are also male?” This example query involves two dimensions: City (San Francisco) and Gender (Male). For each dimension, a binary array is created where the array indices represent whether or not their corresponding rows match the query filter, as shown below:

```
San Francisco (City) -> rows [1] -> [1][0][0][0]
Male (Gender) -> rows [1, 2, 3, 4] -> [1][1][1][1]
```

And the query filter performs the AND operation between the two arrays:

```
[1][0][0][0] AND [1][1][1][1] = [1][0][0][0]
```

As a result, only row 1 is subject to scanning, which retrieves only the filtered rows and eliminates unnecessary workload. And these binary arrays are very easy to compress as well.

This lookup can be used for the OR operation too. If a query filters on San Francisco or Calgary, array indices will be for each dimension value:

```
San Francisco (City) -> rows [1] -> [1][0][0][0]
Calgary (City) -> rows [3] -> [0][0][1][0]
```

And then the OR operation is performed on the two arrays:

```
[1][0][0][0] OR [0][0][1][0] = [1][0][1][0]
```

Thus the query scans rows 1 and 3 only.

This approach of performing Boolean operations on large bitmap sets is commonly used in search engines.

Query languages

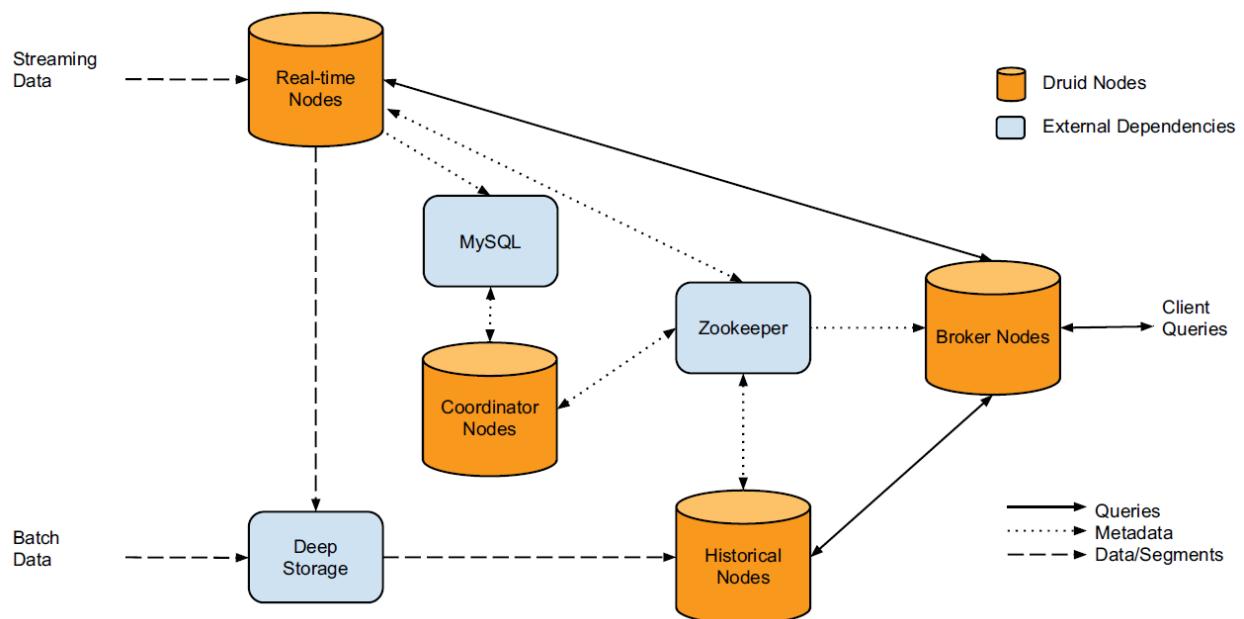
Druid's native query language is JSON over HTTP. Druid queries include:

- Group By
- Time-series roll-ups
- Arbitrary Boolean filters
- Sum, Min, Max, Avg and other aggregation functions
- Dimensional Search

In addition to these, query libraries in numerous languages, including SQL, are developed and shared.

2.3.3 Druid cluster architecture

A Druid cluster consists of different types of nodes and each node type is designed to perform a specific set of things:



Real-time nodes

Real-time nodes function to ingest and query event streams. The nodes are only concerned with events for some small time range and periodically hand them off to the deep storage in the following steps:

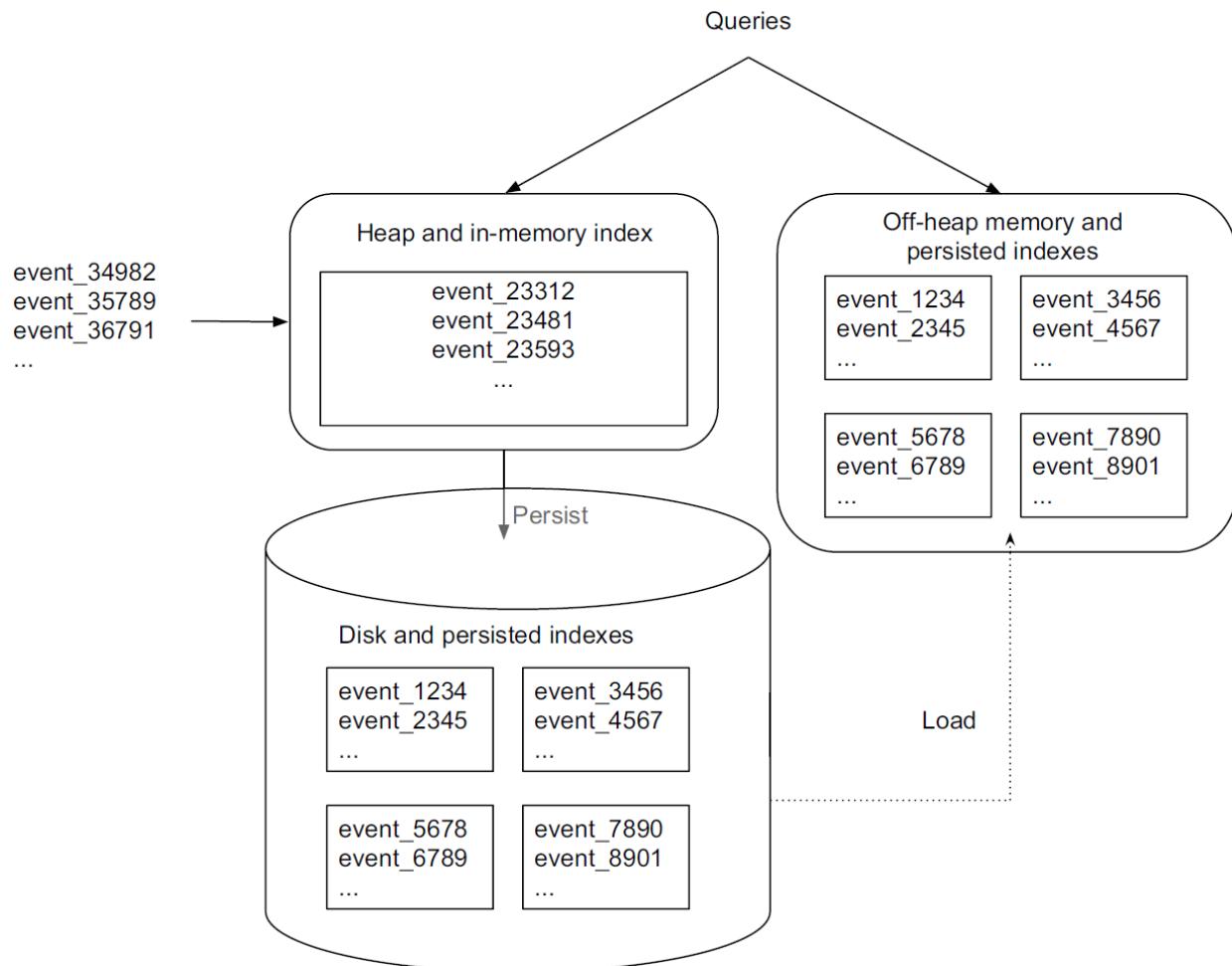


Fig. 4: Source: Druid: A Real-time Analytical Data Store

1. Incoming events are indexed in memory and immediately become available for querying.
2. The in-memory data is regularly persisted to disk and converted into an immutable, columnar storage format.
3. The persisted data is loaded into off-heap memory to be still queryable.
4. On a periodic basis, the persisted indexes are merged together to form a “segment” of

data and then get handed off to deep storage.

In this way, all events ingested into real-time nodes, regardless before or after persisted, are present in memory (either on- or off-heap) and thus can be queried (queries hit both the in-memory and persisted indexes). This functionality of real-time nodes enables Druid to conduct real-time data ingestion meaning that events can be queried almost as soon as they occur. In addition, there is no data loss during these steps. In addition, there is no data loss during these steps.

Real-time nodes announce their online state and the data they serve in Zookeeper (see [External dependencies](#)) for the purpose of coordination with the rest of the Druid cluster.

Historical nodes

Historical nodes function to load and serve the immutable blocks of data (segments) created by real-time nodes. These nodes download immutable segments locally from the deep storage and serve queries over those segments (e.g., data aggregation/filtering). The nodes are operationally simple based on a shared-nothing architecture; they have no single point of contention and simply load, drop, and serve segments as instructed by Zookeeper.

A historical node's process of serving a query is as follows:

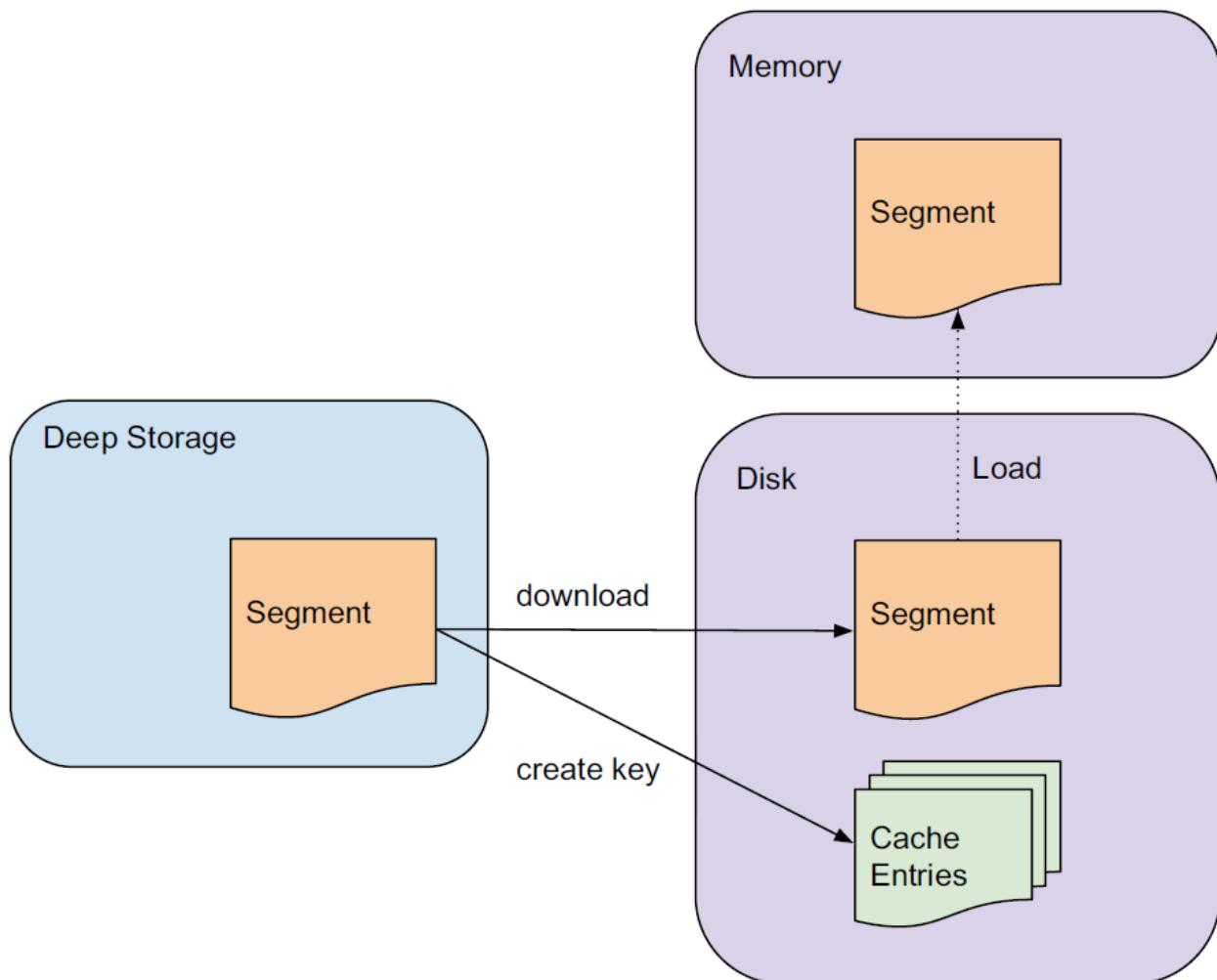


Fig. 5: Source: Druid: A Real-time Analytical Data Store

Once a query is received, the historical node first checks a local cache that maintains information about what segments already exist on the node. If information about a segment in question is not present in the cache, the node will proceed to download the segment from deep storage. On the completion of the processing, the segment is announced in Zookeeper to become queryable and the node performs the requested query on the segment.

Historical nodes can support read consistency because they only deal with immutable data. Immutable data blocks also enable a simple parallelization model: historical nodes can concurrently scan and aggregate immutable blocks without blocking.

Similar to real-time nodes, historical nodes announce their online state and the data they are serving in Zookeeper.

Broker nodes

Broker nodes understand the metadata published in Zookeeper about what segments are queryable and where those segments are located. Broker nodes route incoming queries such that the queries hit the right historical or real-time nodes. Broker nodes also merge partial results from historical and real-time nodes before returning a final consolidated result to the caller.

Broker nodes use a cache for resource efficiency as follows:

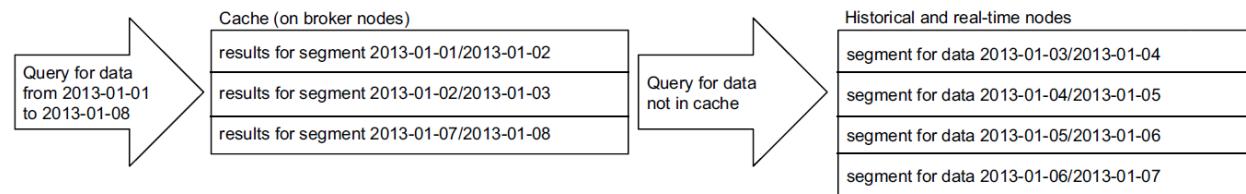


Fig. 6: Source: Druid: A Real-time Analytical Data Store

Once a broker node receives a query involving a number of segments, it checks for segments already existing in the cache. For any segments absent in the cache, the broker node will forward the query to the correct historical and real-time nodes. Once historical nodes return their results, the broker will cache these results on a per-segment basis for future use. Real-time data is never cached and hence requests for real-time data will always be forwarded to real-time nodes. Since real-time data is perpetually changing, caching the results is unreliable.

Coordinator nodes

Coordinator nodes are primarily in charge of data management and distribution on historical nodes. The coordinator nodes determine which historical nodes perform queries on which segments and tell them to load new data, drop outdated data, replicate data, and move data to load balance. This enables fast, efficient, and stable data processing in a distributed group of historical nodes.

As with all Druid nodes, coordinator nodes maintain a Zookeeper connection for current cluster information. Coordinator nodes also maintain a connection to a MySQL database that contains additional operational parameters and configurations, including a rule table that governs how segments are created, destroyed, and replicated in the cluster.

Coordinator nodes undergo a leader-election process that determines a single node that runs the coordinator functionality. The remaining coordinator nodes act as redundant backups.

External dependencies

Druid has a couple of external dependencies for cluster operations.

- **Zookeeper:** Druid relies on Zookeeper for intra-cluster communication.
- **Metadata storage:** Druid relies on a metadata storage to store metadata about segments and configuration. MySQL and PostgreSQL are popular metadata stores for production.
- **Deep storage:** Deep storage acts as a permanent backup of segments. Services that create segments upload segments to deep storage and historical nodes download segments from deep storage. S3 and HDFS are popular deep storages.

High availability characteristics

Druid is designed to have no single point of failure. The different node types operate fairly independent of each other and there is minimal interaction among them. Hence, intra-cluster communication failures have minimal impact on data availability. To run a highly available Druid cluster, you should have at least two nodes of every node type running.

Architecture extensibility

Druid features a modular, extensible platform that allows various external modules to be added to its basic architecture. An example of how Druid's architecture can be extended with modules is shown below:

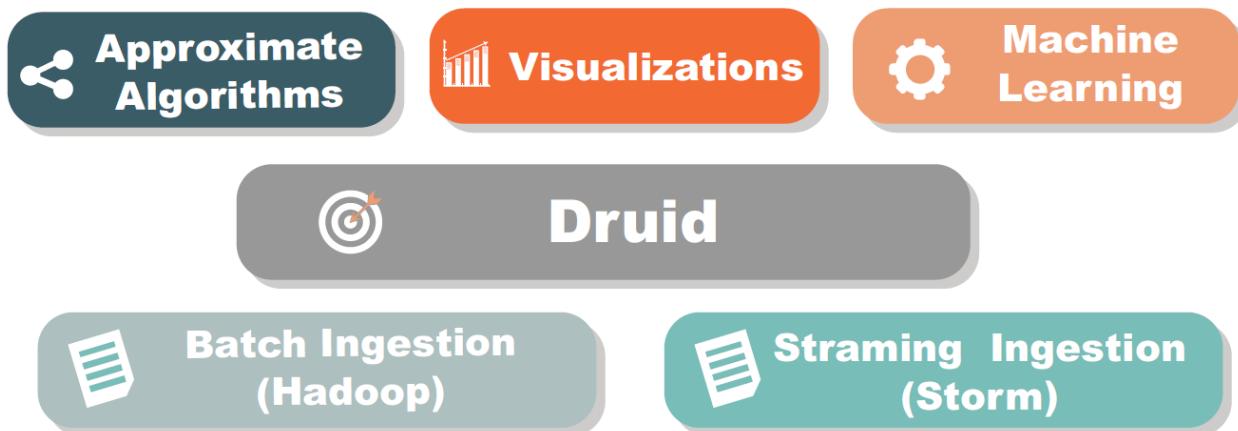


Fig. 7: Source: MetaMarkets – Introduction to Druid by Fangjin Yang

Metatron, an end-to-end business intelligence solution to be introduced in this paper, was also built by adding various modules to the Druid engine.

2.3.4 Druid performance assessments

With Druid being a data store that supports real-time data exploration, its quantitative assessments are focused on two key aspects:

- Query latency
- Ingestion latency

This is because the key to achieving “real-time” performance is to minimize the time spent on query processing and ingestion. A number of organizations and individuals, including the developers of Druid, have established benchmarks for Druid performance assessment based on the two key aspects, and shared how Druid compares to other database management systems.

Self-assessment by Druid developers

Druid: A Real-time Analytical Data Store¹ was published by the developers in 2014. Chapter 6. Performance contains details of Druid assessment, with a particular focus on query and ingestion latencies. The benchmarks of Druid performance are briefly introduced in the following sections.

Query latency

Regarding Druid’s query latency, the paper discusses two performance assessments? one was conducted on eight data sources that had been most queried at Metamarkets and the other was on TPC-H datasets. In this section, we review the latter assessment. The latencies from querying on TPC-H datasets were measured by comparing with MySQL, and the cluster environment was as follows:

- **Druid historical nodes:** Amazon EC2 m3.2xlarge instance types (Intel® Xeon® E5-2680 v2 @ 2.80GHz)
- **Druid broker nodes:** c3.2xlarge instances (Intel® Xeon® E5-2670 v2 @ 2.50GHz)
- **Pledged mountain draw converting** (subtract soft a3.2analysed repurchase pairs)

¹

F. Yang, E. Tschetter, X. Léauté, N. Ray, G. Merlino, and D. Ganguli. (2014). Druid: a real-time analytical data store. Retrieved from <http://druid.io/docs/0.12.1/design/index.html>.

The figure below shows the query latencies resulting from Druid and MySQL when tested on the 1GB and 100GB TPC-H datasets:

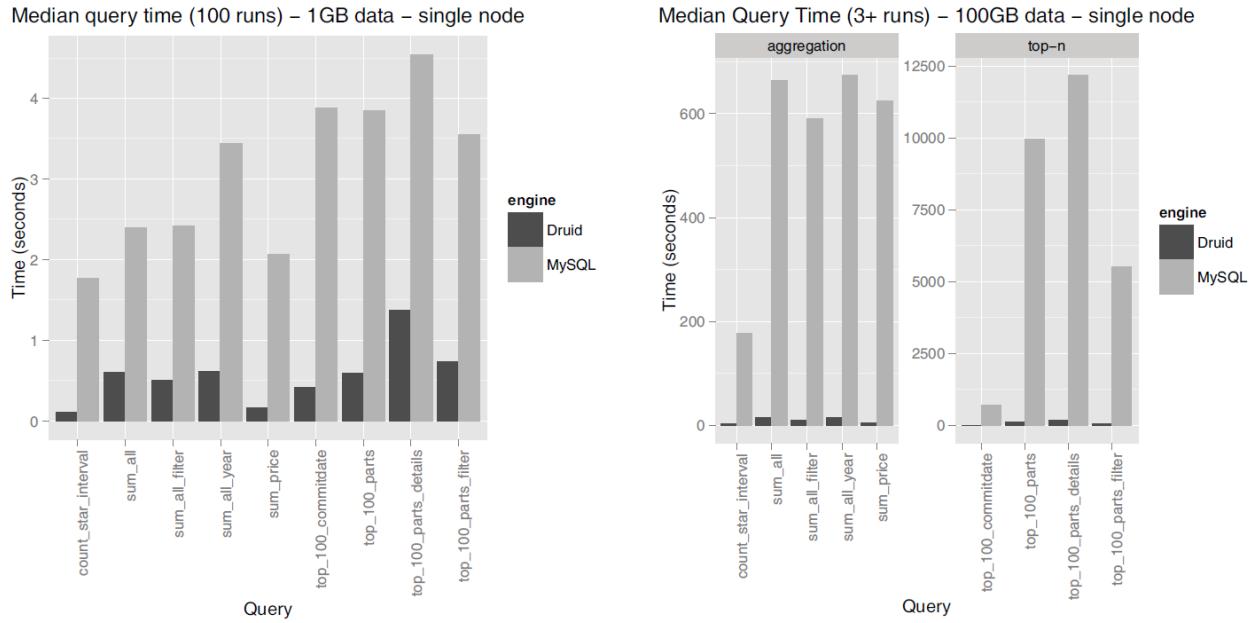


Fig. 8: Source: Druid: A Real-time Analytical Data Store

By showcasing these results, the paper suggests that Druid is capable of extremely faster query returns compared to legacy relational database systems.

The Druid paper also presents how faster query returns are achieved when multiple nodes are joined together in a cluster. When tested on the TPC-H 100 GB dataset, the performance difference between a single node (8 cores) and six-node cluster (48 cores) was as follows:

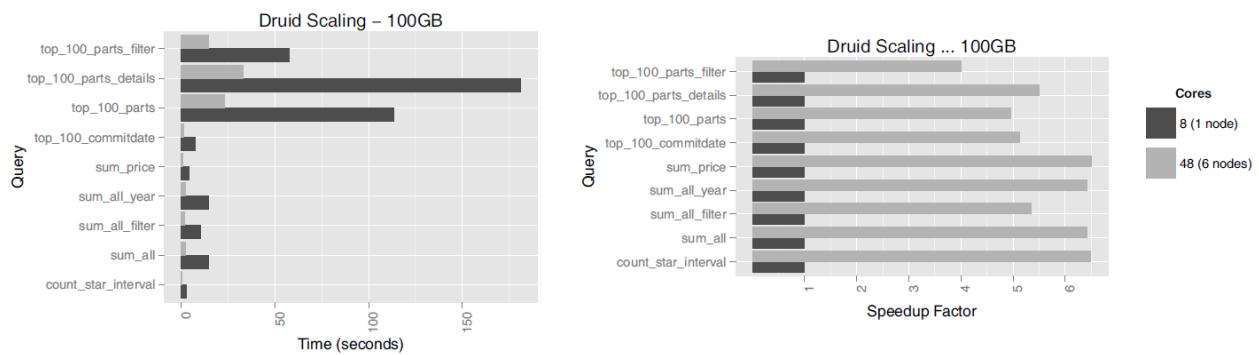


Fig. 9: Source: Druid: A Real-time Analytical Data Store

It was observed that not all types of queries achieve linear scaling, but the simpler aggregation queries do, ensuring a speed increment almost proportional to the number of the cores (SK Telecom's Metatron has made improvements to achieve much more obvious linear scalability).

Ingestion latency

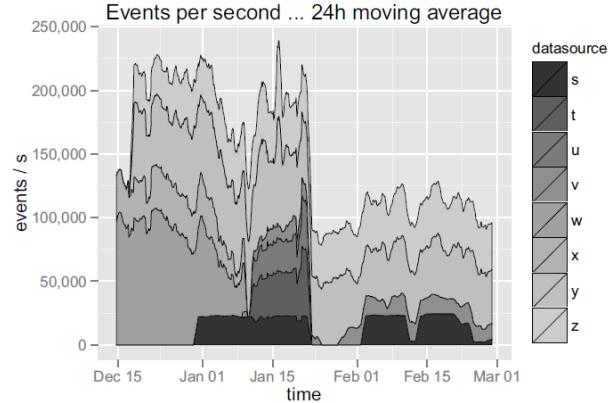
The paper also assessed Druid's data ingestion latency on a production ingestion setup consisting of:

- 6 nodes, totalling 360GB of RAM and 96 cores (12 x Intel®Xeon®E5-2670).

A total of eight production data sources were selected for this assessment. The characteristics of each data source and their ingestion results are shown below. Note that in this setup, several other data sources were being ingested and many other Druid related ingestion tasks were running concurrently on the machines.

Data Source	Dimensions	Metrics	Peak events/s
s	7	2	28334.60
t	10	7	68808.70
u	5	1	49933.93
v	30	10	22240.45
w	35	14	135763.17
x	28	6	46525.85
y	33	24	162462.41
z	33	24	95747.74

Ingestion characteristics of various data sources



Combined cluster ingestion rates

Fig. 10: Source: Druid: A Real-time Analytical Data Store

Druid's data ingestion latency is heavily dependent on the complexity of the dataset being ingested, but the latency measurements present here are sufficient to demonstrate that Druid well addresses the stated problems of interactivity.

Druid performance assessment by SK Telecom

SK Telecom also measured the query and ingestion latencies of Druid as detailed below:

Query latency test

The conditions of query latency measurement were as follows:

- Data: TPC-H 100G dataset (900 million rows)
- Pre-aggregation granularity: day
- Servers: r3.4xlarge nodes, (2.5GHz * 16, 122G, 320G SSD) * 6
- No. of historical nodes: 6
- No. of broker nodes: 1

The query times for five queries of the TPC-H 100G dataset were as follows (the query times in Hive were also measured as a reference):



Fig. 11: Source: SK Telecom T-DE WIKI Metatron Project

Note: The reasons why the Hive benchmark performed poorly include that some processes

were performed through Thrift and the dataset wasn't partitioned.

Ingestion latency test

The conditions of ingestion latency measurement were as follows:

- Ingestion data size: 30 million rows/day, 10 columns
- Memory: 512 GB
- CPU: Intel (R) Xeon (R) Gold 5120 CPU @ 2.20 GHz (56 cores)
- No. of historical nodes: 100
- No. of broker nodes: 2
- Jobs performed by three out of ten middle-manager nodes
- Ingestion tool: Apache Kafka

Data ingestion was performed 100 times under the conditions specified above, and the average ingestion latency was 1.623439 seconds. As illustrated below, ingestion latency was computed as the sum of Kafka ingestion latency, Druid ingestion latency, and Druid query latency.

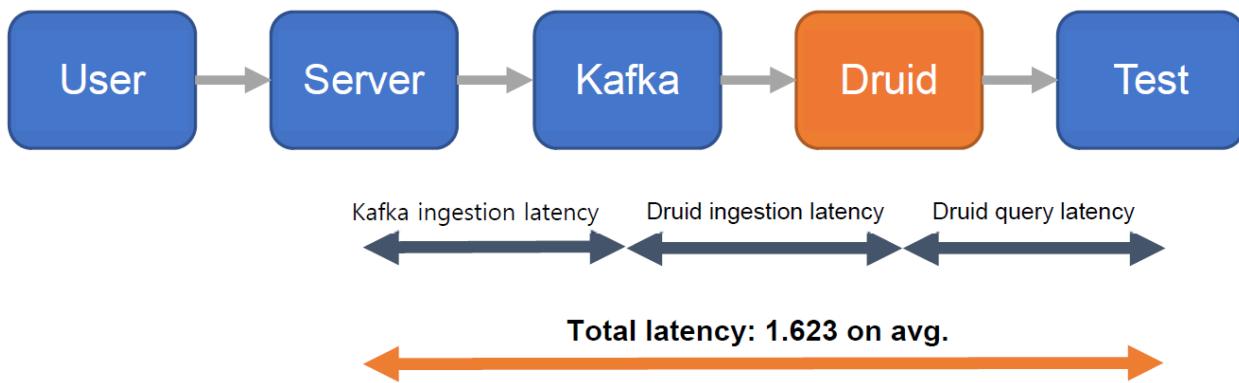


Fig. 12: Source: SK Telecom T-DE WIKI Metatron Project

Druid assessments by third parties

Druid assessment by Outlyer

In the Outlyer blog, twenty open source time-series database systems were assessed in a post² titled Top 10 Time Series Databases and published on August 26, 2016. The author Steven Acreman ranked Druid in the 8th place, and his set of criteria was as follows:

Table 1: A summary of Druid assessment by Outlyer

Items	Druid performance
Write performance - single node	25k metrics/sec Source: https://groups.google.com/forum/#!searchin/druid-user/benchmark%7Csort:relevance/druid-user/90BMCxz22Ko/73D8HidLCgAJ
Write performance - 5-node cluster	100k metrics / sec (calculated)
Query performance	Moderate
Maturity	Stable
Pro's	Good data model and cool set of analytics features. Mostly designed for fast queries over large batch loaded datasets which it's great at.
Con's	Painful to operate, not very fast write throughput. Real time ingestion is tricky to setup.

Druid assessment by DB-Engines

DB-Engines³, an online website, publishes a list of database management systems ranked by their current popularity every months. To measure the popularity of a system, it uses the following parameters:

- Number of mentions of the system on websites: It is measured as the number of results in queries of the search engines Google, Bing and Yandex.
- General interest in the system: For this measurement, the frequency of searches in Google Trends is used.
- Frequency of technical discussions about the system: The ranking list uses the number of related questions and the number of interested users on the well-known IT-related Q&A sites Stack Overflow and DBA Stack Exchange.

² Steven Acreman. (2016, Aug 26). Top 10 Time Series Databases. Retrieved from <https://blog.outlyer.com/top10-open-source-time-series-databases>.

³ DB-Engines website. <https://db-engines.com>, July 2018.

- Number of job offers, in which the system is mentioned: The ranking list uses the number of offers on the leading job search engines Indeed and Simply Hired.
- Number of profiles in professional networks, in which the system is mentioned: The ranking list uses the internationally most popular professional networks LinkedIn and Upwork.
- Relevance in social networks. The ranking list counts the number of Twitter tweets, in which the system is mentioned.

As of July 2018, Druid ranked 118th out of a total of 343 systems, and 7th out of 25 time-series database systems.

Comparison with Apache Spark

Comparing Druid with Apache Spark is meaningful because both technologies are emerging as next-generation solutions for large-scale analytics and their different advantages make them very complementary when combined together. Metatron also makes use of this combination: Druid as the data storage/processing engine and Spark as an advanced analytics module.

This section briefly introduces a report comparing the performance of Druid and Spark⁴⁵ published by Harish Butani, the founder of Sparkline Data Inc. Prior to the performance comparison, the report states that the two solutions are in complementary relations, rather than competitors.

Apache Spark characteristics

Apache Spark is an open-source cluster computing framework providing rich APIs in Java, Scala, Python, and R. Spark's programming model is used to build analytical solutions that combine SQL, machine learning, and graph processing. Spark supports powerful functions to process large-scale and/or complex data manipulation workflows, but it isn't necessarily optimized for interactive queries.

Dataset, queries, performance results

For the benchmark, the 10G TPC-H dataset was used. The 10G star schema was converted into a flattened (denormalized) transaction dataset and reorganized to be queryable in Druid and Spark. The sizes of the resulting datasets were:

⁴ Harish Butani. (2018, Sep 18). Combining Druid and Spark: Interactive and Flexible Analytics at Scale. Retrieved from <https://www.linkedin.com/pulse/combining-druid-spark-interactiveflexible-analytics-scale-butani>.

⁵ Harish Butani. (2015, Aug 28). TPCH Benchmark. Retrieved from <https://github.com/SparklineData/spark-druid-olap/blob/master/docs/benchmark/BenchMarkDetails.pdf>.

- TPCH Flat TSV: 46.80GB
- Druid Index in HDFS: 17.04GB
- TPCH Flat Parquet: 11.38GB
- TPCH Flat Parquet Partition by Month: 11.56GB

And then, a number of queries were chosen to test the performance differences in various aspects as shown below:

Table 2: Queries used for query latency comparison between
Druid and Apache Spark

Query	Interval	Filters	Group By	Aggregations
Basic Aggregation.	None	None	ReturnFlag LineStatus	Count(*) Sum(exdPrice) Avg(avlQty)
Ship Date Range	1995-12/1997-09	None	ReturnFlag LineStatus	Count(*)
SubQry Nation, pType ShpDt Range	1995-12/1997-09	P_Type S_Nation + C_Nation	S_Nation	Count(*) Sum(exdPrice) Max(sCost) Avg(avlQty) Count(Distinct oKey)
TPCH Q1	None	None	ReturnFlag LineStatus	Count(*) Sum(exdPrice) Max(sCost) Avg(avlQty) Count(Distinct oKey)
TPCH Q3	1995-03-15-	O_Date MktSegment	Okey Odate ShipPri	Sum(exdPrice)
TPCH Q5	None	O_Date Region	S_Nation	Sum(exdPrice)
TPCH Q7	None	S_Nation + C_Nation	S_Nation C_Nation ShipDate.Year	Sum(exdPrice)
TPCH Q8	None	Region Type O_Date	ODate.Year	Sum(exdPrice)

The test results are as follows:

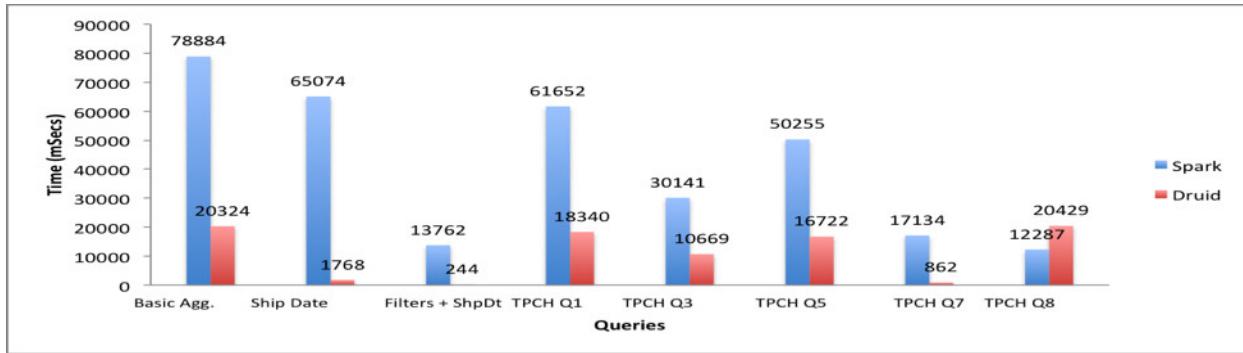


Fig. 13: Source: Combining Druid and Spark: Interactive and Flexible Analytics at Scale

- The Filters + Ship Date query provides the greatest performance gain (over 50 times over Spark) when Druid is used. This is not surprising as this query is a typical slice-and-dice query tailor-made for Druid. Along the same lines, TPCH Q7 shows a significant performance boost when running on Druid: milliseconds on Druid vs. 10s of seconds on Spark.
- For TPCH Q3, Q5, and Q8 there is an improvement, but not to the same level as Q7. This is because the OrderDate predicate is translated to a JavaScript filter in Druid, which is significantly slower than a native Java filter.
- The Basic Aggregation and TPCH Q1 queries definitely show improvement. The Count-Distinct operation is translated to a cardinality aggregator in Druid, which is an approximate count. This is definitely an advantage for Druid, especially for large cardinality dimensions.

These results can vary with testing conditions, but one thing is clear: Queries that have time partitioning or dimensional predicates (like those commonly found in OLAP workflows) are significantly faster in Druid.

Implications

The testing results showcase that combining the analytic capabilities with Spark and the OLAP and low latency capabilities of Druid can create great synergy. Druid ingests, explores, filters, and aggregates data efficiently and interactively, while the rich programming APIs of Spark enable in-depth analytics. By leveraging these different capabilities, we can build a more powerful, flexible, and extremely low latency analytics solution.

References

2.3.5 Metatron powered by Druid

As explained previously, Metatron employs Druid as its underlying engine and has made developments and improvements of Druid for its own uses. This section introduces the background, progress, and results of the adoption of Druid to Metatron.

Metatron development background and Druid integration

Metatron as a big data analytics solution

As a telecommunications service provider with the most number of subscribers in South Korea, SK Telecom has exerted significant efforts to establish a stable network environment through by using the mass amounts of network data logs generated by its users.

Due to the limitations of existing IT infrastructure in mass data processing, SK Telecom needed a big-data warehousing system (Apache Hadoop) and a big-data analytics solution compatible with the system. The company built its own Hadoop infrastructure to store mass amounts of data at low cost, but faced the following limitations:

- Network data generated by the countless users could not be analyzed in real time. Although it was possible to store and process big data, visualizations could be implemented only with a sampled subset of data in the same way as on legacy systems.
- Having different solutions and different managers support each stage of data analytics, such as ETL, DW, and BI, not only involved significant time and costs, but also resulted in poor data accessibility. An end-to-end solution was needed to analyze all stages at once in a simple and quick manner.

Why the Druid engine

Druid was the optimal engine for the Metatron solution because it fulfilled the aforementioned needs with the features below:

- Druid collects mass amounts of data in real time and indexes them into a queryable format, ensuring very fast data aggregations (a few seconds at the slowest) based on distributed processing.
- Druid's OLAP time-series data format enables analysts to perform data exploration, filtering, and visualization as desired. Such free and flexible data exploration is essential for users to intuitively select the required data and determine correlations between different dimensions on it.

- Druid's extensible architecture allows modules to be easily added.

Built on this architecture, Metatron is an end-to-end solution that embraces all layers of data collection, storage, processing, analysis, and visualization.

Druid engine integration

The Druid engine was integrated in Metatron as follows:

- With Druid as the basic engine for processing/analytics, the GUI was designed to support users in different professional domains and big-data analysts in data-related tasks such as data preparation, analytics, and visualization, as well as the sharing of results.
- IT administrators can manage/monitor data sources in Druid, and they can establish data preparation rules if data sources of higher quality are required.

Druid functions reinforced in Metatron

The open-source Druid, despite its strengths in data collection and processing, had to be improved for Metatron to properly function as an end-to-end solution. This section examines the limitations of the open-source Druid and the functions reinforced in Metatron.

Limitations of the open-source Druid

The open-source Druid has the following limitations:

- Since Druid does not yet have full support for joins, Metatron uses another SQL engine for data preparation.
- Druid supports only a subset of SQL queries.
- For a data lake, a traditional SQL engine is more appropriate.
- Druid cannot append to or update already indexed segments, except for in some unusual cases.
- Nulls are not allowed.
- Filtering is not supported for metric columns.
- Linear scalability is not ensured. Increasing the number of servers doesn't improve the performance as much.
- Only a few data types are supported and it is difficult to add a new one.

- The management and monitoring tools are not powerful enough.

Druid functions reinforced in Metatron

The following functions of Druid were strengthened in Metatron:

Query functionality improvements

- Improved the functionality of the GroupBy query type.
- Slightly improved the functionality of other types of queries.

Features added

- Virtual columns (map, expression. etc.)
- New metric types (double, string, array, etc.)
- New expression functions
- Druid query results can be stored on the HDFS or exported into a file.
- Queries for meta information and statistics
- New aggregate functions (variance, correlation, etc.)
- (Limited) Window functions (lead, lag, running aggregations, etc.)
- (Limited) Joins
- (Limited) Sub-queries
- Temporary data sources
- Complex queries (data source summarization, correlation between data sources, k-means, etc.)
- Custom columns grouping
- Geographic information system (GIS) supported
- Columnar histograms
- Bit-slice indexing

Index structure improvements

- Histograms for filtering on metrics
- Lucene format supported for text filtering

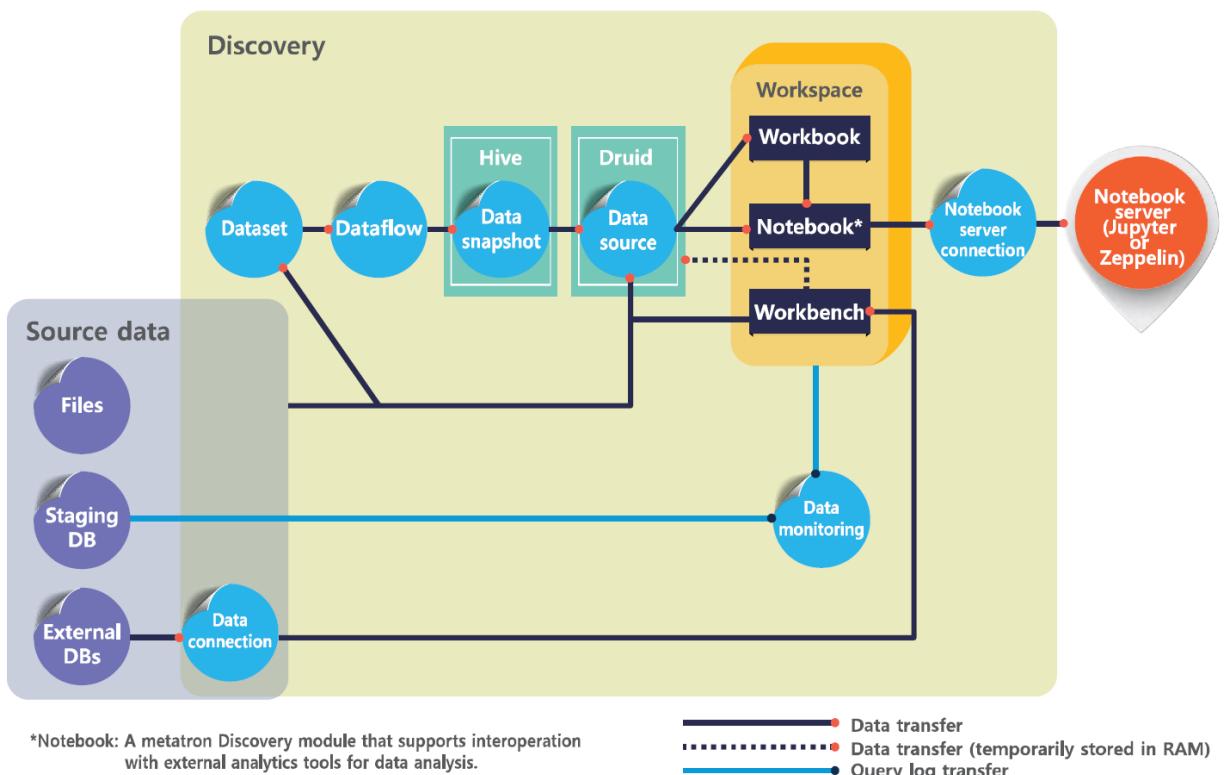
Connectability with other systems

- Hive storage handler
- Ingestion into Hive tables (based on connection with the Hive metastore)
- Ingestion into the ORC format
- RDBMS data ingestion via based on JDBC
- (Limited) SQL support backported

Miscellaneous improvements

- Bug fixes (+50) and minor improvements

DATA MANAGEMENT



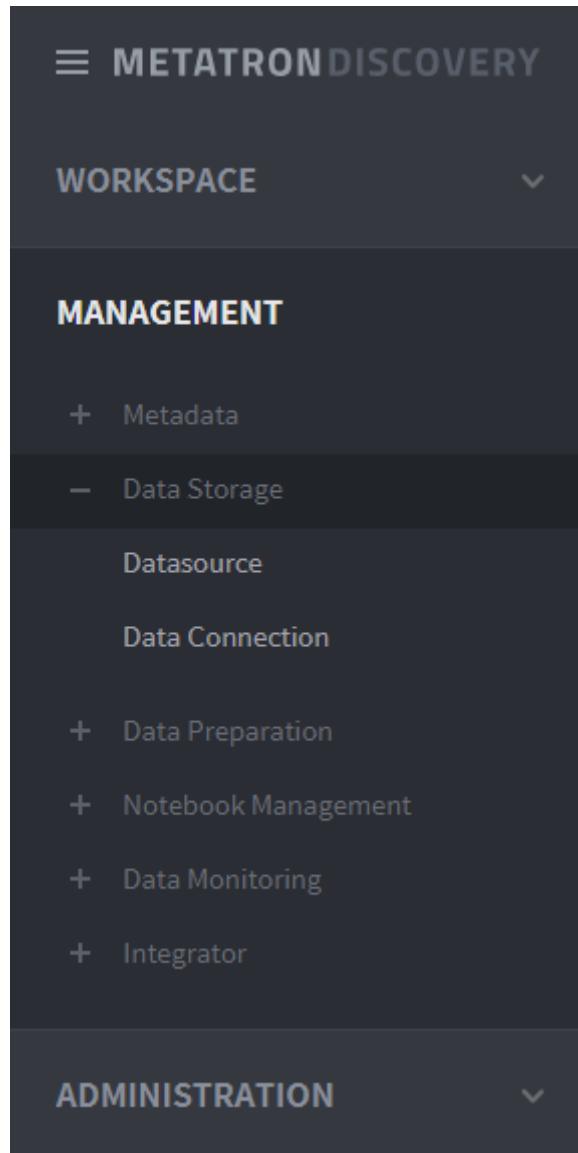
As shown above, data used by the three Discovery modules (workbook, notebook and workbench) is prepared from various types of source data, engines, and storages. For these operations, data flows need to be standardized and managed, and different types of source data need to be linked.

Source data required for analysis and visualization is either ingested into the Metatron engine as a **data source**, or linked directly from an external database with a **data connection**. Data usage can be monitored and tracked using **data monitoring**.

3.1 Data Source

In Metatron Discovery, a “data source” refers to a Druid database table into which data is ingested. Based on these data sources, workbooks and notebooks perform data analytics and visualization.

The Data Source menu can be accessed under **MANAGEMENT** > **Data Storage** > **Data Source** on the left-hand panel of the main screen.



3.1.1 “Dimensions” and “Measures”

The columns of a data source linked to the dashboard are categorized into **dimension** and **measure** columns as explained below. To make full use of Discovery’s data analysis and visualization features, you must understand the concepts of dimensions and measures clearly.

The screenshot shows the 'Datasource' configuration screen. At the top, there's a title bar with a file icon and the word 'Datasource'. Below it is a card for 'Sales Report' with an info icon and a dropdown arrow. A search bar follows. The main area is divided into two sections: 'Dimension' and 'Measure'. The 'Dimension' section is expanded, showing a list of categorical columns: GeoPoint, OrderDate, Category, City, Country, CustomerName, OrderID, PostalCode, and ProductName. Most of these have a small location pin icon next to them. The 'Measure' section is also expanded, showing numerical columns: Discount, Profit, Quantity, Sales, DaystoShipActual, and SalesForecast. Most of these have a small dollar sign icon next to them. Each section has a collapse arrow and a plus sign for adding more. Navigation buttons '< Previous' and 'Next >' are at the bottom of each section. There are also '< Previous' and 'Next >' buttons at the very bottom of the page.

Dimension column

A column containing categorical data with the following characteristics:

- The values in this type of column are not for aggregation but to be categorized (e.g.: Category, Region, Organization)
- By each of these categories, measure values are aggregated.

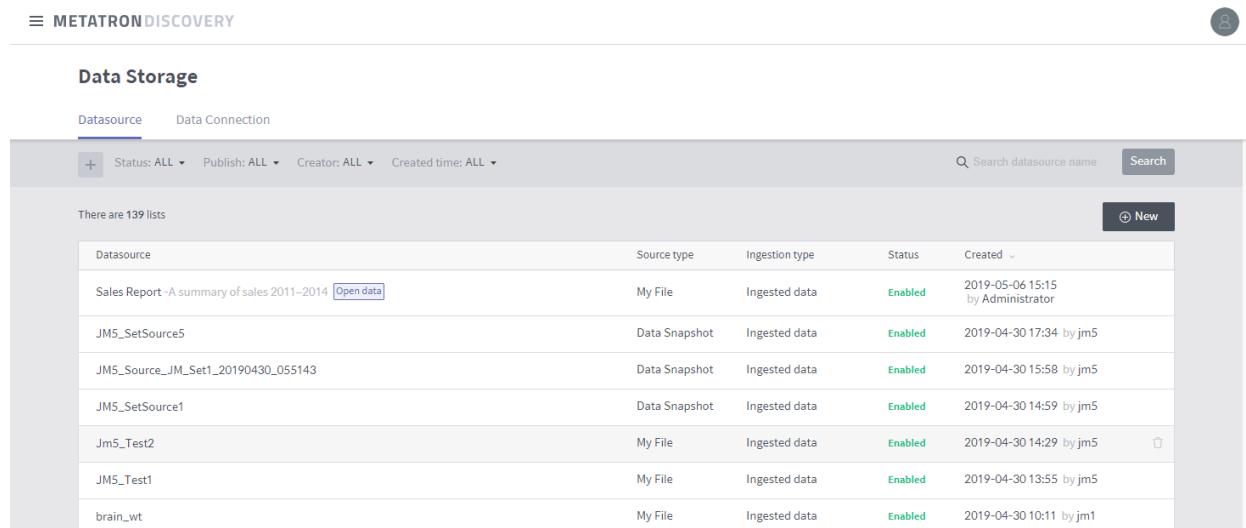
Measure columns

A column containing quantitative data with the following characteristics:

- The values in this type of column are subject to aggregation or contain quantitative information (e.g.: Sales)
- These values are aggregated based on dimensions.

3.1.2 Data source management home

On this home page, you can create, edit and view data sources.



The screenshot shows the 'Data Storage' section of the Metatron Discovery interface. At the top, there are tabs for 'Datasource' (which is selected) and 'Data Connection'. Below the tabs are filters for 'Status: ALL', 'Publish: ALL', 'Creator: ALL', and 'Created time: ALL'. A search bar with a placeholder 'Search datasource name' and a 'Search' button are also present. The main area displays a table with 139 lists. The columns are 'Datasource' (listing names like 'Sales Report - A summary of sales 2011–2014 [Open data]', 'JM5_SetSource5', etc.), 'Source type' (listing 'My File', 'Data Snapshot'), 'Ingestion type' (listing 'Ingested data'), 'Status' (listing 'Enabled' with a dropdown arrow), and 'Created' (listing dates and times like '2019-05-06 15:15 by Administrator'). A 'New' button is located in the top right corner of the table area.

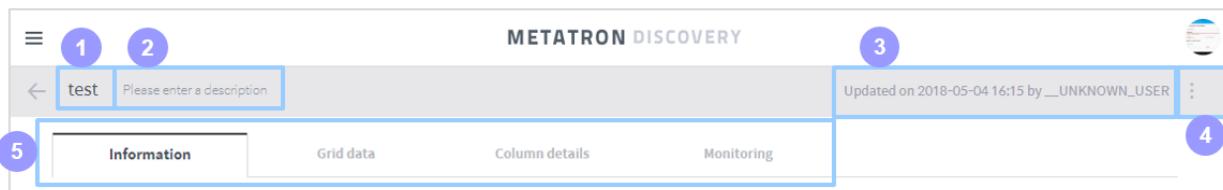
Datasource	Source type	Ingestion type	Status	Created
Sales Report - A summary of sales 2011–2014 [Open data]	My File	Ingested data	Enabled	2019-05-06 15:15 by Administrator
JM5_SetSource5	Data Snapshot	Ingested data	Enabled	2019-04-30 17:34 by jm5
JM5_Source_JM_Set1_20190430_055143	Data Snapshot	Ingested data	Enabled	2019-04-30 15:58 by jm5
JM5_SetSource1	Data Snapshot	Ingested data	Enabled	2019-04-30 14:59 by jm5
Jm5_Test2	My File	Ingested data	Enabled	2019-04-30 14:29 by jm5
JM5_Test1	My File	Ingested data	Enabled	2019-04-30 13:55 by jm5
brain_wt	My File	Ingested data	Enabled	2019-04-30 10:11 by jm1

1. **Status:** Filters the data source list by the availability of data sources stored in the data storage.
 - **Enable:** Displays data sources that have been ingested and are available in workbooks or workbenches.

- **Preparing:** Displays new data sources whose ingestion is in progress.
 - **Failed:** Displays data sources that have not been created properly.
 - **Disabled:** Displays data sources that have been ingested but are not available because of an error in a certain Druid process.
2. **Publish:** Filter the data source list by public workspace.
- **Open Data:** Displays only data sources publicly available in all workspaces.
 - **Admin Workspace:** Displays only data sources available in the administrator workspace.
 - **Shared workspaces:** Displays only data sources available in the selected shared workspaces.
3. **Creator:** Filters the data source list by user or group that created the source data.
4. **Created time:** Determines whether the data source list is filtered by created or updated time. You can choose from among All, Today, and Last 7 days or specify a time range to display only those entries that were created/updated within the range.
5. **Search by name of data source:** Searches the data source list for the name you type in.
6. **Data source list:** Lists data sources filtered by specified criteria. Click an entry in the list to view its details. (Refer to [Data source details](#))
7. **Delete:** Hover the mouse over a data source to display a trash icon. Click the icon to delete the data source.

3.1.3 Data source details

Click a data source listed in the data source management home to view various attributes of that data source. The following subsections describe each area of the data source details. Note that a data source represents a Druid database table stored in Metatron and necessarily includes a timestamp column as a time-series table.

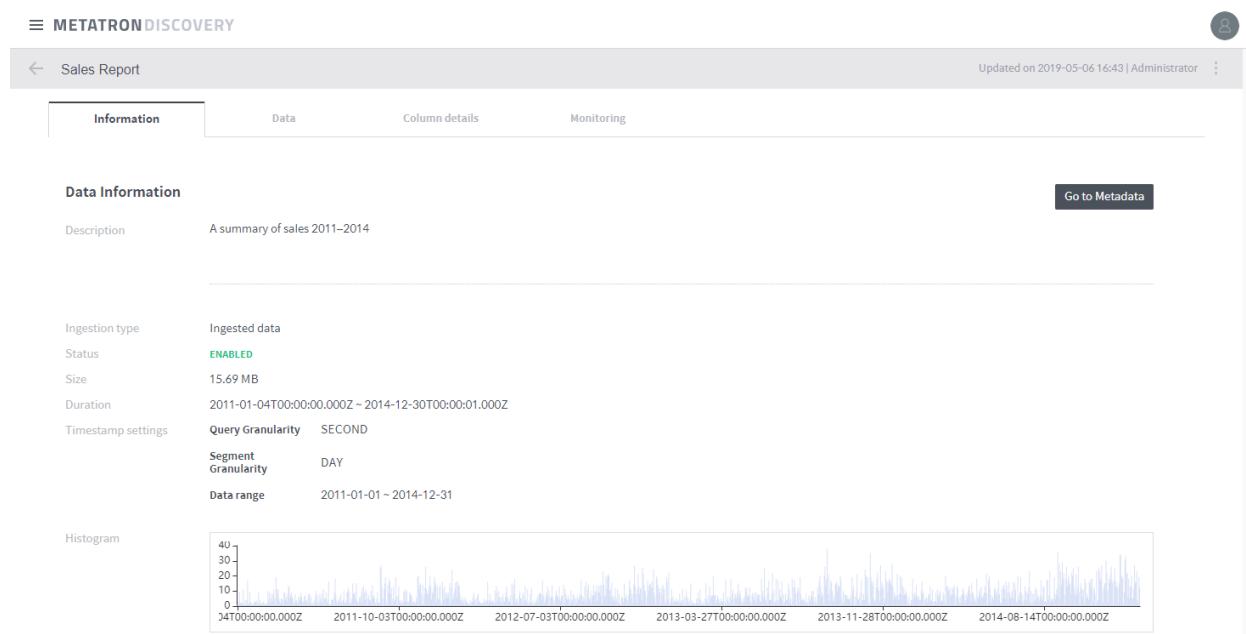


Common top area

1. **Name:** Name of the data source. Click on it if you want modify it.
2. **Description:** Description of the data source. Click on it if you want modify it.
3. **Last update:** Shows who and when last updated the data source.
4. **Delete:** Click this icon to display a menu that allows you to delete the data source.
5. **Tab selection:** Each tab displays a specific set of attributes of the data source. Depending upon the type of data source, not all of the three tabs may be displayed. For details on each tab, refer to the relevant subsection below.

Data information area

This area displays basic information of the data source.



The screenshot shows the Metatron Discovery interface with the following details:

- Header:** METATRON DISCOVERY, Sales Report, Updated on 2019-05-06 16:43 | Administrator, User icon.
- Tabs:** Information (selected), Date, Column details, Monitoring.
- Data Information:**
 - Description:** A summary of sales 2011–2014.
 - Ingestion type:** Ingested data.
 - Status:** ENABLED.
 - Size:** 15.69 MB.
 - Duration:** 2011-01-04T00:00:00.000Z ~ 2014-12-30T00:00:01.000Z.
 - Timestamp settings:**
 - Query Granularity:** SECOND.
 - Segment Granularity:** DAY.
 - Data range:** 2011-01-01 ~ 2014-12-31.
- Histogram:** A histogram showing data distribution over time from 2011-01-01 to 2014-12-31. The x-axis represents time in UTC, and the y-axis represents frequency or count, ranging from 0 to 40.

1. **Data type:** Type of the imported source data from which the data source has been created.
2. **Status:** Displays the availability of the data source.
3. **Size:** Displays the size of the data source.

4. **Duration:** Displays the time range of the timestamps included in the data source.
5. **Timestamp setting:** Displays the granularities defined when the data source was created.
 - **Query Granularity:** Defines the minimum time period by which data is queried. This ensures faster returns by aggregating data per granularity interval.
 - **Segment Granularity:** In Druid, a data source is stored into multiple segments to be processed over multiple nodes in the distributed cluster environment. This granularity setting defines the time intervals into which the data source is partitioned.
 - **Histogram:** A graph displaying the size of the data stored within each time interval in Kbytes. This histogram is can be rendered because the Druid engine timestamps every table record.

Publish area

In this area, you can check and set which workspaces have access to the data source.

The screenshot shows a user interface for managing workspace access. On the left, there is a sidebar with the title "Publish". To its right, there is a section titled "Allow all workspaces to use this datasource" with a checkbox labeled "Edit". Below this, it says "1 workspaces".

1. **Allow all workspaces to use this data source:** Select this check box to make the data source available in all workspaces.
2. **Edit:** Used to allow specific workspaces to access the data source. This button will disappear if the data source is set as open data.
3. **Number of shared workspaces:** Displays how many workspaces have access to the data source.

Change data schema

The top section of the column details tab provides a user interface to filter columns by the criteria you define. Columns that meet the criteria are displayed on the left. You can also edit column settings.

Column view/settings

The screenshot shows the Metatrondiscovery interface with the following details:

- Page Title:** mysql_preset_engine_dialog_single_all
- Header:** Updated on 2019-05-06 17:22 | Administrator
- Toolbar:** Information, Data, **Column details**, Monitoring
- Search Bar:** Search data, Role (radio buttons for All, Dimension, Measure), Type (radio buttons for All, Dimension, Measure), **All** dropdown, **Configure schema** button
- Table View:** Shows a list of columns with their logical names and descriptions. The selected column is **event_time**.
- Column Information:** Displays attributes for the selected column (**event_time**).
- Column Settings:** Displays metadata settings for the selected column.
- Metadata:** Displays logical column name, dictionary, code table, and description for the selected column.
- Statistic:** Displays row count (215), minimum value (2018-06-01T00:00:00.000Z), and maximum value (2018-10-01T00:00:00.000Z).
- Histogram:** A histogram visualization for the selected column.

1. **Search data:** Searches for columns by the column name you type in.
2. **Role:** Displays all, dimension, or measure columns.
3. **Type:** Displays the columns whose data type is selected.
4. **View all:** Clears all filter settings in the Search data, Role, and Type options and returns to view all columns.
5. **Configure schema:** Click this button to prompt a window to edit the current column settings.
6. **Column list:** Lists table columns.
7. **Column information:** Displays attributes of the selected column.
8. **Column settings:** Displays the metadata of the selected column.

9. **Statistics:** Displays the row count and other statistical values of the selected column.

Configure the schema

Provides a user interface for editing the name and type of columns.

Configure the schema

Cancel Save

ⓘ Metadata is also updated when modified.

Role	Name	Logical name	Type	Description
Dimension	GeoPoint	GeoPoint	📍 Point	
Dimension	OrderDate	OrderDate	📅 Timestamp	
Dimension	Category	Category	🔤 String	▼
Dimension	City	City	🔤 String	▼
Dimension	Country	Country	🔤 String	▼
Dimension	CustomerName	CustomerName	🔤 String	▼
Measure	Discount	Discount	₦ Decimal	▼
Dimension	OrderID	OrderID	🔤 String	▼
Dimension	PostalCode	PostalCode	🔤 String	▼
Dimension	ProductName	ProductName	🔤 String	▼
Measure	Profit	Profit	₦ Integer	▼
Measure	Quantity	Quantity	₦ Integer	▼
Dimension	Region	Region	🔤 String	▼
Measure	Sales	Sales	₦ Integer	▼
Dimension	Segment	Segment	🔤 String	▼
Dimension	ShipDate	ShipDate	📅 Date/Time	▼ ⓘ
Dimension	ShipMode	ShipMode	🔤 String	▼

1. **Role:** Displays whether the column is a dimension or measure.

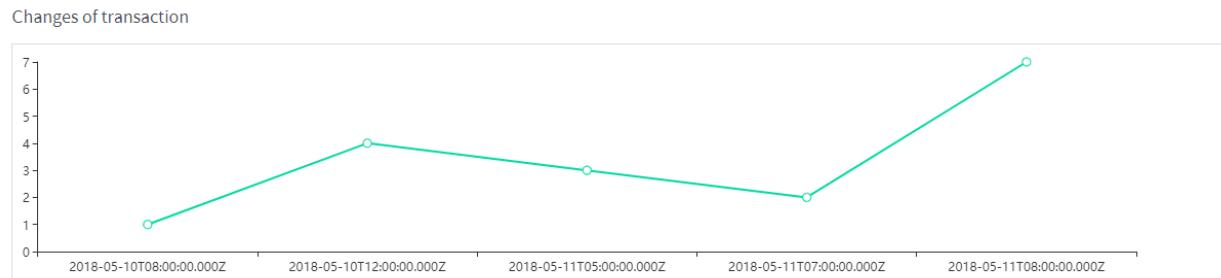
2. **Name:** Displays the actual name of the column.
3. **Logical name:** Allows you to edit the logical name of the column displayed in the system.
4. **Type:** Allows you to edit the logical type (character/integer/date, etc.) of the column.
5. **Format:** Allows you to edit the display format of the column in the case of the column being a timestamp type.
6. **Description:** Allows you to add a detailed description of the column.

Analyze data statistics

The Monitoring tab reports the usage of the data source.

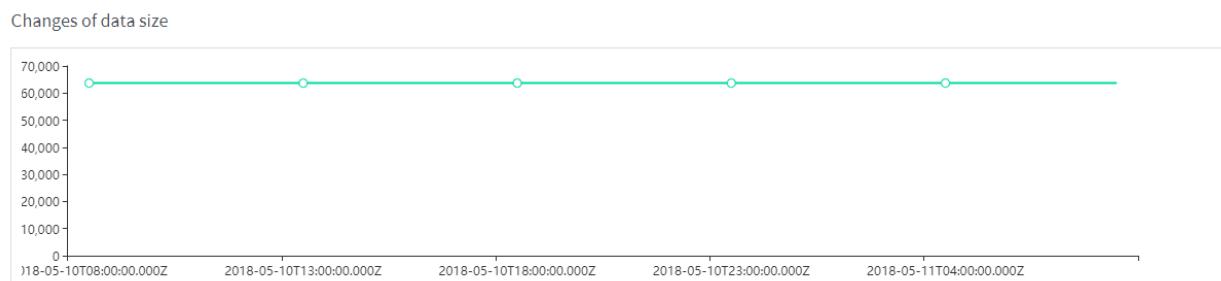
Change of transaction

Displays the trend of data source transactions over time.



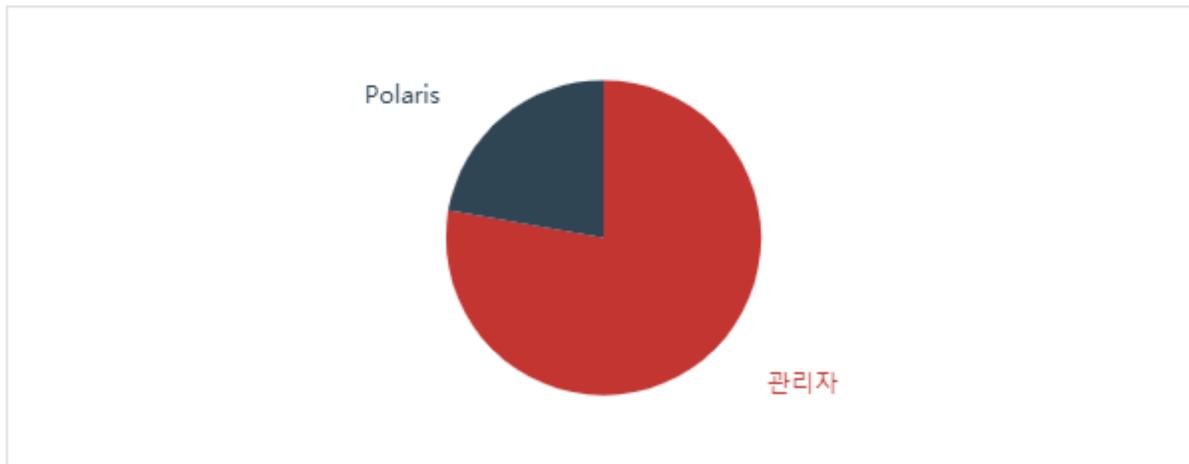
Changes of data size

Displays the trend of the data source size over time.

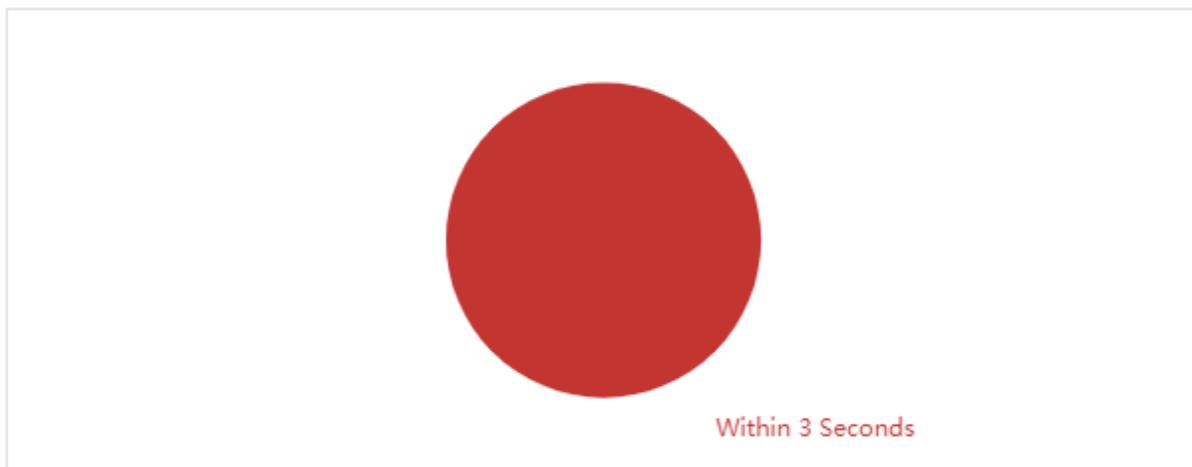


Query distribution (during last one week)

Query distribution by user (during last one week)



Query distribution by elapsed time (during last one week)



- **Query distribution by user (during last one week):** Displays a pie chart of query percentages by user for the past week.
- **Query distribution by elapsed time (during last one week):** Displays a pie chart of query percentages by execution time for the past week.

Query log

Used to view a detailed history of each performed query.

The screenshot shows the 'Query log' section of the Metatron interface. At the top, there are several filter options: 'Query date' (with 'All', 'Today', and 'Last 7 days' buttons), a date range input ('yyyy-MM-dd hh:mm ~ yyyy-MM-dd hh:mm'), an 'Apply' button, and dropdowns for 'Query type' (set to 'All') and 'Result' (set to 'All'). Below these are five numbered callouts:

- 1**: Points to the 'Query date' filters.
- 2**: Points to the 'Query type' dropdown.
- 3**: Points to the 'Result' dropdown.
- 4**: Points to the table header row, which includes columns for 'No.', 'Query date', 'Query type', 'User', 'Elapsed time', and 'Result'.
- 5**: Points to a series of 'Detail >' links next to each query entry in the table.

No.	Query date	Query type	User	Elapsed time	Result
1	2018-05-10 21:17	SUMMARY		85ms	Success
2	2018-05-11 16:41	SUMMARY		78ms	Success
3	2018-05-10 21:17	SEARCH		78ms	Success
4	2018-05-10 21:17	SUMMARY		76ms	Success
5	2018-05-11 17:30	SUMMARY		64ms	Success

- Date:** Set a time range to display only those queries that were last executed within this time range.
- Query type:** Filters the performed queries by type.
- Status:** Displays all, succeeded, or failed queries.
- Query list:** Lists queries filtered by specified criteria.
- Detail:** Click on it to view the query statement.

3.1.4 Create a data source

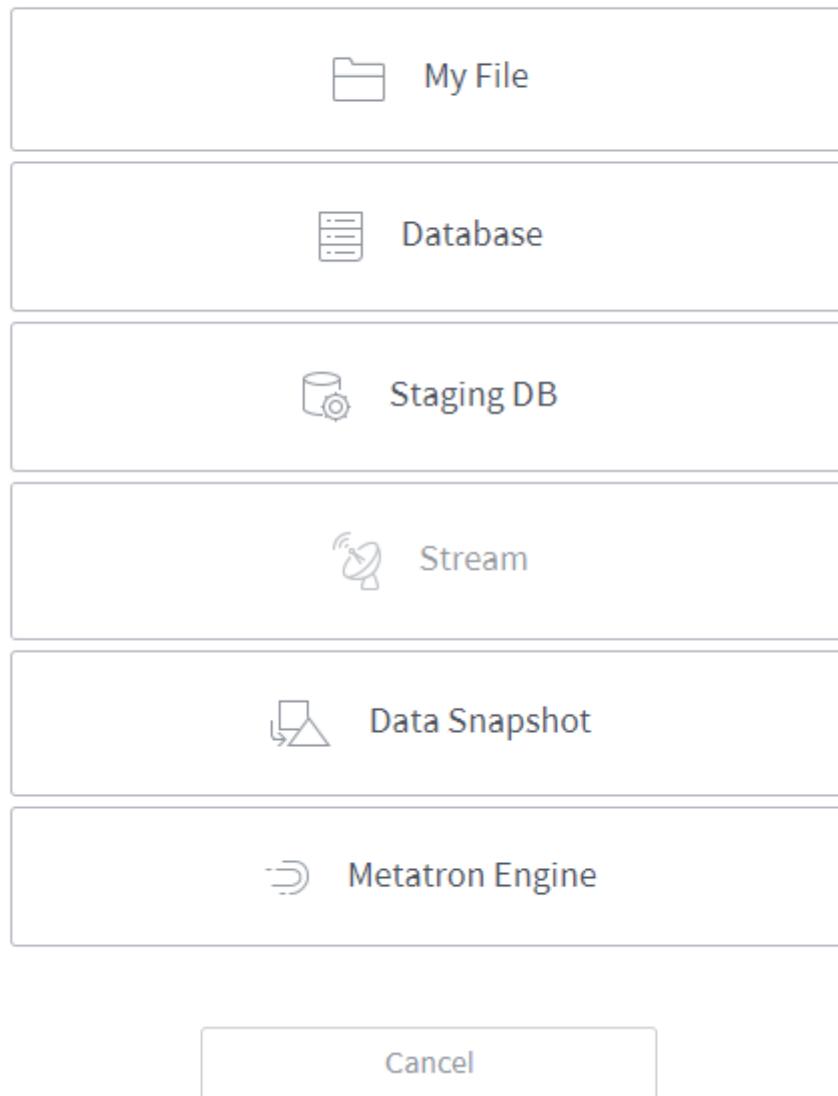
This section explains the process of ingesting various types of source data into the Metatron engine and converting them into data sources.

To create a data source, click the **+ New** button at the top right of the **Data Source** home screen.

The screenshot shows the 'Data Storage' section of the Metatron Discovery interface. At the top, there are tabs for 'Datasource' (which is selected) and 'Data Connection'. Below the tabs are filter buttons for 'Status: ALL', 'Publish: ALL', 'Creator: ALL', and 'Created time: ALL'. To the right is a search bar with a 'Search' button. The main area displays a message 'There are 139 lists' and a large 'New' button with a plus sign.

Then, select the type of source data.

Select source type



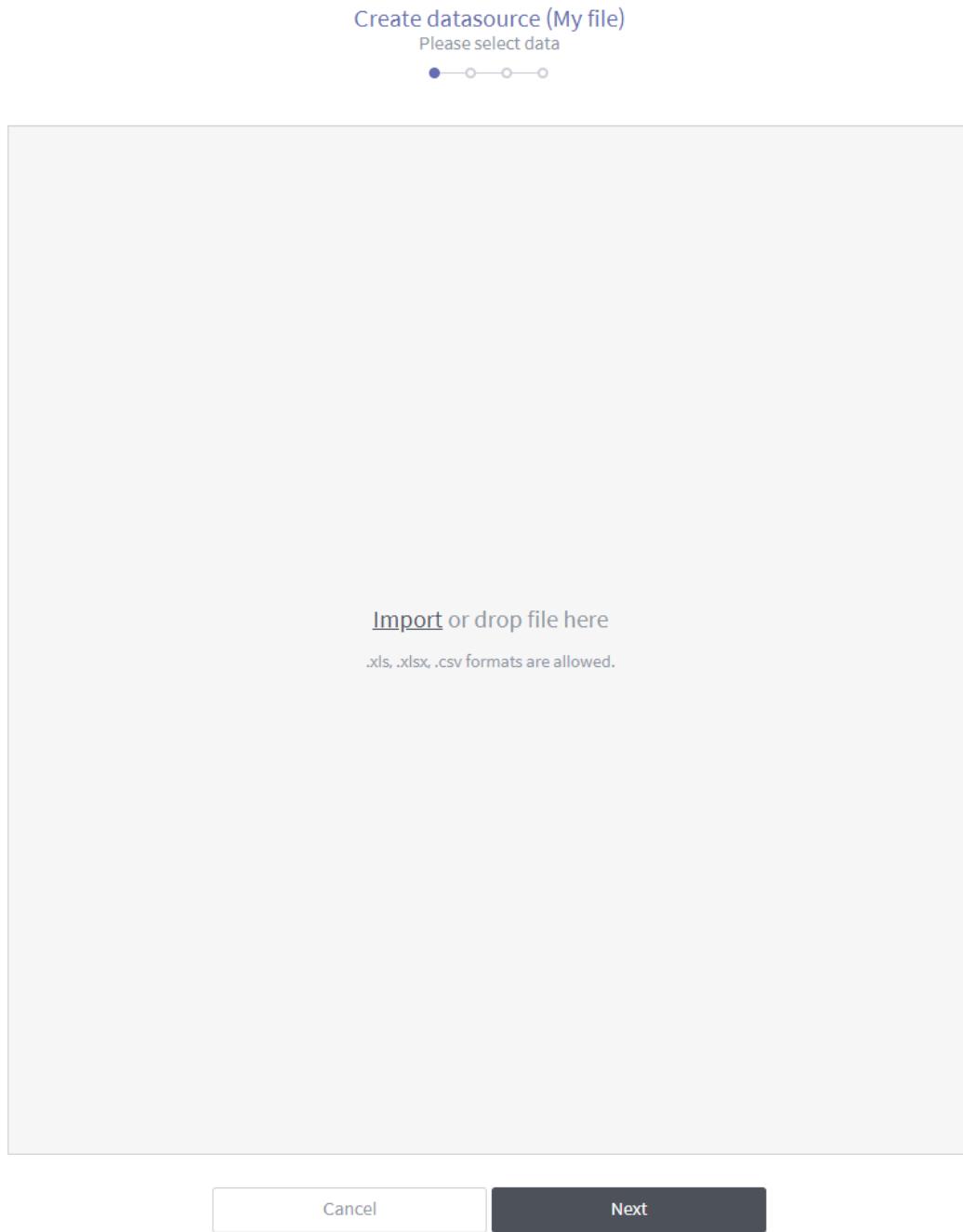
- **File:** Creates a data source from a file stored on your local PC (for details, refer to [Create a data source from a file](#)).
- **Database:** Creates a data source from an external database (for details, refer to [Create a data source from a database](#)).
- **Staging DB:** Creates a data source from Metatron's internal Hive database (for details, refer to [Create a data source from a staging database](#)).

- **Stream:** This function is not currently supported.
- **Data Snapshot:** This function is not currently supported.
- **Metatron Engine:** Migrates a data source stored in a previous Metatron version (for details, refer to [Add a data source with the Metatron engine](#)).

Create a data source from a file

Creates a data source from a file stored on your local PC.

1. On the source data type selection page, select **File**.
2. Select a file to be used as a data source from your local PC. You can either click the **Import** button and select the file, or drag and drop a file to the box. Once a file is selected, click Next.



3. From the file, select the sheet to be included in the data source.

Note: If the “No preview data” message is shown in spite of there being data, check whether the **Column delimiter** and **Line Separator** have been configured correctly. In this example, the **Line Sep-**

arator must be set to “r”? the carriage return for MS Windows.

Create datasource (My file)

Please select data

sales-data-sample.csv Import or drop file here

	OrderDate	Category	City	Country	CustomerName	Discount	OrderID	Pos
2011-01-04T00:00:00.000Z	Office Supplies	Houston	United States	Darren Powers	0.2	CA-2011-103...	770	
2011-01-05T00:00:00.000Z	Office Supplies	Naperville	United States	Phillina Ober	0.2	CA-2011-112...	605	
2011-01-05T00:00:00.000Z	Office Supplies	Naperville	United States	Phillina Ober	0.8	CA-2011-112...	605	
2011-01-05T00:00:00.000Z	Office Supplies	Naperville	United States	Phillina Ober	0.2	CA-2011-112...	605	
2011-01-06T00:00:00.000Z	Office Supplies	Philadelp...	United States	Mick Brown	0.2	CA-2011-141...	191	
2011-01-07T00:00:00.000Z	Furniture	Henderson	United States	Maria Etezadi	0.0	CA-2011-167...	424	
2011-01-07T00:00:00.000Z	Office Supplies	Athens	United States	Jack OBriant	0.0	CA-2011-106...	306	
2011-01-07T00:00:00.000Z	Office Supplies	Henderson	United States	Maria Etezadi	0.0	CA-2011-167...	424	
2011-01-07T00:00:00.000Z	Office Supplies	Henderson	United States	Maria Etezadi	0.0	CA-2011-167...	424	
2011-01-07T00:00:00.000Z	Office Supplies	Henderson	United States	Maria Etezadi	0.0	CA-2011-167...	424	
2011-01-07T00:00:00.000Z	Office Supplies	Los Angeles	United States	Lycoris Saunders	0.0	CA-2011-130...	900	
2011-01-07T00:00:00.000Z	Technology	Henderson	United States	Maria Etezadi	0.0	CA-2011-167...	424	
2011-01-07T00:00:00.000Z	Technology	Henderson	United States	Maria Etezadi	0.0	CA-2011-167...	424	
2011-01-08T00:00:00.000Z	Furniture	Huntsville	United States	Vivek Sundaresam	0.6	CA-2011-105...	773	
2011-01-08T00:00:00.000Z	Office Supplies	Huntsville	United States	Vivek Sundaresam	0.8	CA-2011-105...	773	

Column delimiter: ,

Line separator: \n

Use the first row as the head column. (If not checked, a new row is created and is used as the head column)

- **File name:** Name of the imported file. You can replace it with another file.
- **File sheet list:** Displays the sheets included in the imported file. Select the sheet from which you want to create a data source.

- **File sheet name:** Name of the currently selected sheet.
 - **Size:** Size of the imported file.
 - **Column:** Number of columns in the imported file.
 - **Row:** Displayed number of rows and total number of rows in the imported file. Enter the number of rows to be displayed on the page.
 - **Type:** Displays how many data types are recognized from the columns. The data type of each column can be modified later.
 - **Use the first row as the head column:** Select the check box to use the first row of the file as column headers. If you don't select it, a new row is inserted as a column header row.

4. Configure the schema of the data source.

Create datasource (My file)

Configure schema

○ ● ○ ○ ○

	Column	Role	Type	Add column
<input type="checkbox"/>	Dimension ab OrderDate			
<input type="checkbox"/>	Dimension ab Category			
<input type="checkbox"/>	Dimension ab City			
<input type="checkbox"/>	Dimension ab Country			
<input type="checkbox"/>	Dimension ab CustomerName			
<input type="checkbox"/>	Dimension ab Discount			
<input type="checkbox"/>	Dimension ab OrderID			
<input checked="" type="checkbox"/>	Dimension ab PostalCode			
<input checked="" type="checkbox"/>	Dimension ab ProductName			
<input type="checkbox"/>	Dimension ab Profit			
<input type="checkbox"/>	Dimension ab Quantity			
<input type="checkbox"/>	Dimension ab Region			
<input type="checkbox"/>	Dimension ab Sales			
<input type="checkbox"/>	Dimension ab Segment			
<input type="checkbox"/>	Dimension ab ShipDate			
<input type="checkbox"/>	Dimension ab ShipMode			
<input checked="" type="checkbox"/>	Dimension ab State			
<input type="checkbox"/>	Dimension ab Sub_Category			
<input type="checkbox"/>	Dimension ab DaystoShipActual			
<input type="checkbox"/>	Dimension ab SalesForecast			
<input type="checkbox"/>	Dimension ab ShipStatus			
<input type="checkbox"/>	Dimension ab DaystoShipScheduled			
<input type="checkbox"/>	Dimension ab OrderProfitable			
3 Selections		Change type	Delete	

One of the time-type columns or current time must be specified as a Timestamp

Current time Time-type column No selected time-type column

Previous Next

- **Search by column header:** Searches the imported file for columns by name.
-  **버튼 (우측 상단):** 선택한 컬럼을 삭제합니다.
- **Role:** Displays all, dimension, or measure columns from the imported file.
- **Recommended filters:** Displays columns to which a top-priority filter is applied.
- **Type:** Filters the columns in the imported file by field type.
- **Column list section:** Lists columns filtered by specified criteria. Once you have selected columns, a panel appears at the bottom of the screen. After selecting your desired batch action in the panel, click **Apply** to perform the batch action on the selected columns.
- **Individual column settings section:** This area is used to set the attributes of a column selected from the column list. **Missing** is used to set nulls in the column.
 - **Replace with:** Replaces the nulls with the value typed in.
 - **Discard:** Discards the nulls.
 - **Do not set:** Leaves the nulls as nulls. However, the nulls in the timestamp column are mandatorily discarded.
- **Timestamp setting:** Determines how to timestamp each row. You can either designate an existing time-type column as a timestamp column, or create a new time-type column whose values are all timestamped with the current time.

Note: Metatron Druid is a time-series engine that requires a timestamp for each row when a data source is created.

- **컬럼 추가:** 데이터에 위도, 경도 컬럼이 있는 경우 이를 결합하여 Point 타입의 신규 컬럼을 추가할 수 있습니다. 이 컬럼을 지우면 다른 컬럼들과 동일하게 동작합니다.

5. Configure data source ingestion and click Next.

Create datasource (My file)
Please complete ingestion settings

Timestamp settings

Query Granularity ⓘ

Second

Segment Granularity ⓘ

Hour

Data range

2010-12-31 05 ~ 2011-01-25 13 609 segment granularity units

ⓘ The interval should set equal to or greater than the range of data values in the timestamp column, and the number of segments units cannot exceed 10,000.

Rollup ⓘ

true false

[Advanced setting ▾](#)

[Previous](#) [Next](#)

- **Segment Granularity:** In Druid, a data source is stored into multiple segments to be processed over multiple nodes in the distributed cluster environment. This granularity setting defines the time intervals into which the data source is partitioned.
- **Query Granularity:** Defines the minimum time period by which data is queried. This ensures faster returns by aggregating data per granularity interval.
- **Rollup:** “Data rollup” summarizes data based on its dimension (for details on the concept of data rollup, refer to [Data roll-up](#)). A summarization rule might be summing up all values in each column or applying a set of expressions such as profit=sales=expenses.
- **Advanced settings:** Configures how to ingest data. Type in the text box in the JSON format. For example,

```
{maxRowsInMemory : 75000,
maxOccupationInMemory : -1,
maxShardLength : -2147483648,
```

(continues on next page)

(continued from previous page)

```
leaveIntermediate : false,
cleanupOnFailure : true,
overwriteFiles : false,
ignoreInvalidRows : false,
assumeTimeSorted : false}
```

6. Confirm the information about the data set from the imported file, enter the **Name** and **Description**, and click **Done** to create a data source. It may take a few seconds or minutes depending on the amount of data as the source data is ingested into the internal Metatron engine (Druid).

The screenshot shows the Metatron user interface for managing data sources. At the top, there's a header bar with a back arrow and the title "Sales Report". Below the header, there are four tabs: "Information" (which is selected), "Data", "Column details", and "Monitoring".

Data Information

Description	A summary of sales 2011–2014
Ingestion type	Ingested data
Status	ENABLED
Timestamp settings	Query Granularity : SECOND Segment Granularity : DAY Data range : 2011-01-01 ~ 2014-12-31

7. After data ingestion is complete, you can check the status. In the example below, the status is set to **ENABLED** and a histogram is displayed.

≡ METATRON DISCOVERY 

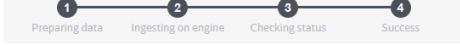
← Sales Report Updated on 2019-05-06 15:15 | Administrator ⋮

Information Data Column details Monitoring

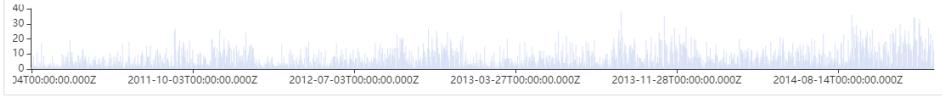
Data Information [Go to Metadata](#)

Description A summary of sales 2011–2014

Ingestion type Ingested data
Status **ENABLED**



Timestamp settings Query Granularity SECOND
Segment Granularity DAY
Data range 2011-01-01 ~ 2014-12-31

Histogram 

Publish Allow all workspaces to use this datasource [Edit](#)
 1 workspaces

Ingestion information

Master data	Type	My File
...

8. In the **Data** tab, you can check the ingested data in the form of a table.

The screenshot shows the METATRON DISCOVERY interface with a "Sales Report" selected. The top navigation bar includes "METATRON DISCOVERY", a user icon, and a timestamp "Updated on 2019-05-06 16:25 | Administrator". Below the header are tabs for "Information", "Data" (which is selected), "Column details", and "Monitoring". A search bar "Search data" is followed by filters for "Role" (set to "All"), "Dimension", "Measure", "Type" (set to "All"), and a row limit of "100 Row". A "Download CSV" button is also present. The main area displays a table with columns: GeoPoint, OrderDate, UTC+9, Category, City, Country, CustomerName, Discount, OrderID, PostalCode, ProductName, Profit, Quantity, Region. The table contains 32 rows of sales data from 2011.

GeoPoint	OrderDate	UTC+9	Category	City	Country	CustomerName	Discount	OrderID	PostalCode	ProductName	Profit	Quantity	Region
29.8941-9...	2011-01-04T...	Office Supp...	Houston	United States	Darren Powers	0.2	CA-2011-1...	77095	Message Book...	6	2	C	
41.7662-8...	2011-01-05T...	Office Supp...	Naperville	United States	Phillina Ober	0.2	CA-2011-1...	60540	Avery 508	4	3	C	
41.7662-8...	2011-01-05T...	Office Supp...	Naperville	United States	Phillina Ober	0.8	CA-2011-1...	60540	GBC Standard Pi...	-5	2	C	
41.7662-8...	2011-01-05T...	Office Supp...	Naperville	United States	Phillina Ober	0.2	CA-2011-1...	60540	SAFCO Boltless ...	-65	3	C	
39.9448-7...	2011-01-06T...	Office Supp...	Philadelphia	United States	Mick Brown	0.2	CA-2011-1...	19143	Avery Hi-Liter Ev...	5	3	E	
37.8274-8...	2011-01-07T...	Furniture	Henderson	United States	Maria Etezadi	0	CA-2011-1...	42420	Global Deluxe Hi...	746	9	S	
33.9321-8...	2011-01-07T...	Office Supp...	Athens	United States	Jack OBriant	0	CA-2011-1...	30605	Dixon Prang Wat...	5	3	S	
37.8274-8...	2011-01-07T...	Office Supp...	Henderson	United States	Maria Etezadi	0	CA-2011-1...	42420	Alliance Super-S...	0	4	S	
37.8274-8...	2011-01-07T...	Office Supp...	Henderson	United States	Maria Etezadi	0	CA-2011-1...	42420	Ibico Hi-Tech Ma...	274	2	S	
37.8274-8...	2011-01-07T...	Office Supp...	Henderson	United States	Maria Etezadi	0	CA-2011-1...	42420	Rogers Handhel...	1	2	S	
37.8274-8...	2011-01-07T...	Office Supp...	Henderson	United States	Maria Etezadi	0	CA-2011-1...	42420	Southworth 25%...	3	1	S	
34.066-11...	2011-01-07T...	Office Supp...	Los Angeles	United States	Lycoris Saunders	0	CA-2011-1...	90049	Xerox 225	9	3	W	
37.8274-8...	2011-01-07T...	Technology	Henderson	United States	Maria Etezadi	0	CA-2011-1...	42420	GE 30524EE4	114	2	S	
37.8274-8...	2011-01-07T...	Technology	Henderson	United States	Maria Etezadi	0	CA-2011-1...	42420	Wireless Extende...	204	4	S	
30.6448-9...	2011-01-08T...	Furniture	Huntsville	United States	Vivek Sundaresam	0.6	CA-2011-1...	77340	Howard Miller 14...	-54	3	C	
30.6448-9...	2011-01-08T...	Office Supp...	Huntsville	United States	Vivek Sundaresam	0.8	CA-2011-1...	77340	Acco Four Pocke...	-18	7	C	
27.5569-9...	2011-01-10T...	Office Supp...	Laredo	United States	Melanie Seite	0.2	CA-2011-1...	78041	Newell 312	1	2	C	
27.5569-9...	2011-01-10T...	Technology	Laredo	United States	Melanie Seite	0.2	CA-2011-1...	78041	Memorex Micro ...	10	3	C	
38.7449-7...	2011-01-11T...	Furniture	Springfield	United States	Anthony Jacobs	0	CA-2011-1...	22153	Howard Miller 11...	21	1	S	
38.7449-7...	2011-01-11T...	Office Supp...	Springfield	United States	Anthony Jacobs	0	CA-2011-1...	22153	Avery 482	1	1	S	
39.1564-7...	2011-01-12T...	Furniture	Dover	United States	Seth Vernon	0	CA-2011-1...	19901	DAX Value U-Ch...	3	2	E	
32.8473-7...	2011-01-14T...	Furniture	Mount Plea...	United States	Natalie DeCherney	0	CA-2011-1...	29464	Global Highback ...	87	6	S	

- On the Data Source management home screen, you will find a newly-created data source. While data is being ingested, the status is displayed as **Disabled** as shown below; the status changes to **Enabled** once ingestion is complete. After that, you can use the data source.

Data Storage

The screenshot shows the Data Source management interface. At the top, there are tabs for "Datasource" (which is selected) and "Data Connection". Below the tabs are filters for "Status: ALL", "Publish: ALL", "Creator: ALL", and "Created time: ALL". A search bar "Search datasource name" and a "Search" button are also present. The main area displays a table with a single row for "Sales Report -A summary of sales 2011–2014". The table columns are: Datasource, Source type, Ingestion type, Status, and Created. The status is currently "Disabled" in green, but it is noted as "2019-05-06 15:15 by Administrator".

Datasource	Source type	Ingestion type	Status	Created
Sales Report -A summary of sales 2011–2014 [Open data]	My File	Ingested data	Disabled	2019-05-06 15:15 by Administrator

Create a data source from a database

Creates a data source from an external database.

1. On the source data type selection page, select **Database**.
2. Enter the information to connect the database.

Create datasource (DB)
Please set data connection

● — ○ — ○ — ○

Ingestion type Ingested data Linked data

DB connection

Host	Port
metatron-hadoop-04	10000
<input type="checkbox"/> URL only	
User name	Password
hive	****
Security	
<input checked="" type="radio"/> Always connect	
<input type="radio"/> Connect by user's account	
<input type="radio"/> Connect with ID and password <i>Can not ingest by batch method.</i>	

- **Ingestion type:** Select how to ingest data into the data source.
 - **Ingested data:** Displays data sources that contain data ingested into the Metatron storage.
 - **Linked data:** Displays data sources that load data from linked databases whenever necessary.
 - **Load a data connection:** Automatically loads access information for a database that is already registered as a data connection. However, you must verify the connection by clicking the **Validation check** button.
 - **DB type:** Select the type of the database to be connected.
 - **Host:** Enter the hostname to connect to the database.
 - **Port:** Enter the port to connect to the database.
 - **User name:** Enter the username of the database.
 - **Password:** Enter the password of the database.
 - **Validation check:** Once you fill out all fields, the Test button becomes active. Click on it to verify if the connection is valid: The validity of the connection appears below the button.
3. Select data. You can either select a table from the connected database, or write a query yourself.

Create datasource (DB)
Please select data
○ ● ○ ○ ○

✓ Table Query

ab_id	ab_created_by	ab_created_time	ab_modified_by	ab_modified_time	# version	ab_dc_connect_url	ab_dc_
01007...	admin	2018-09-26 14:3...	admin	2018-09-26 14:34...	3	jdbc:hive2://metat...	met
01b73...	admin	2018-10-23 02:1...	anonymousUser	2018-10-23 04:11...	15	jdbc:hive2://metat...	met
01ced...	polaris	2018-10-18 06:4...	polaris	2018-10-18 06:48...	3	jdbc:hive2://metat...	met
023ee...	admin	2018-09-07 12:4...	admin	2018-09-08 12:05...	3	jdbc:hive2://metat...	met
0259c...	admin	2018-10-17 08:1...	admin	2018-10-17 08:13...	3	jdbc:hive2://metat...	met
03464...	admin	2018-10-17 08:5...	admin	2018-10-17 08:51...	3	jdbc:hive2://metat...	met
04b7f...	admin	2018-08-10 02:1...	admin	2018-08-10 02:15...	3	jdbc:hive2://metat...	met
05237...	admin	2018-09-07 12:4...	admin	2018-09-08 12:05...	3	jdbc:hive2://metat...	met
05692...	admin	2018-09-07 12:4...	admin	2018-09-08 12:05...	3	jdbc:hive2://metat...	met
06af8...	admin	2018-10-22 07:3...	admin	2018-10-22 07:35...	3	jdbc:hive2://metat...	met
0727b...	admin	2018-09-07 12:4...	admin	2018-09-08 12:05...	3	jdbc:hive2://metat...	met
0851d...	admin	2018-10-29 00:4...	admin	2018-10-29 00:48...	3	jdbc:hive2://metat...	met
0902d...	polaris	2018-10-17 07:3...	polaris	2018-10-17 07:32...	3	jdbc:hive2://metat...	met
096cf...	admin	2018-10-17 08:3...	admin	2018-10-17 08:37...	3	jdbc:hive2://metat...	met
09e00...	admin	2018-09-07 12:4...	admin	2018-09-08 12:05...	3	jdbc:hive2://metat...	met
0a52c...	admin	2018-10-15 01:0...	admin	2018-10-15 01:04...	3	jdbc:hive2://metat...	met
0ae83...	admin	2018-10-17 08:1...	admin	2018-10-17 08:12...	3	jdbc:hive2://metat...	met
0b263...	admin	2018-09-24 18:2...	admin	2018-09-24 18:21...	3	jdbc:hive2://metat...	met
0b69f...	admin	2018-10-23 08:2...	anonymousUser	2018-10-23 08:32...	19	jdbc:hive2://metat...	met
0b6f8...	admin	2018-09-07 12:4...	admin	2018-09-08 12:05...	3	jdbc:hive2://metat...	met
0ba77...	admin	2018-09-07 12:4...	admin	2018-09-08 12:05...	3	jdbc:hive2://metat...	met
0bccd...	admin	2018-10-29 00:4...	admin	2018-10-29 00:48...	3	jdbc:hive2://metat...	met

Previous Next

- **Table:** Select a database and a table to display the table's data. Once the data being ingested has been displayed, confirm the data and click **Next**.
- **Query:** Write a query to import the data you want, and click **Run** to display the data in the lower section. Confirm the data and click **Next**.

4. The rest of the process is identical to [Create a data source from a file](#). However, when creating a data source from a database, you must configure additional **ingestion settings** as follows.

Create datasource (DB)
Please complete ingestion settings

Ingestion settings

Ingest Once Ingest periodically

Scope of Ingesting data

All Limited record count 10000 rows

Timestamp settings

Query Granularity

Second

Segment Granularity

Hour

Data range

2018-08-05 22 ~ 2018-11-04 00 2,163 segment granularity units

ⓘ The interval should set equal to or greater than the range of data values in the timestamp column, and the number of segments units cannot exceed 10,000.

Rollup

true false

[Advanced setting](#) ▾

Previous Next

- **Ingest once:** Ingest the data currently stored in the database only this once. When selecting the **Limited record count**, you can specify how many rows are to be ingested from the first row.

Ingestion settings

Ingest Once Ingest periodically

Scope of Ingesting data

All Limited record count 10000 rows

- **Ingest periodically:** Saves data on a regular basis.

Ingestion settings

Ingest Once **Ingest periodically**

Scope of Ingesting data
 Overwrite only incremental All

Batch cycle
Hourly 1

Max. query row
10000

Create a data source from a staging database

Creates a data source from Metatron's internal Hive database.

1. On the source data type selection page, select **Staging DB**.
2. Once you select the database and its table to connect, the data is displayed.

Create datasource (Staging DB)
Please select data

● — ○ — ○ — ○

tpch_10		lineitem												
#	I_orderkey	#	I_partkey	#	I_suppkey	#	I_linenumber	##	I_quantity	##	I_extendedprice	##	I_discount	##
1	1551894	76910	1		17			33078.94		0.04				
1	673091	73092	2		36			38306.16		0.09				
1	636998	36999	3		8			15479.68		0.1				
1	21315	46316	4		28			34616.68		0.09				
1	240267	15274	5		24			28974		0.1				
1	156345	6348	6		32			44842.88		0.07				
2	1061698	11719	1		38			63066.32		0				
3	42970	17971	1		45			86083.65		0.06				
3	190355	65359	2		49			70822.15		0.1				
3	1284483	34508	3		27			39620.34		0.06				
3	293797	18800	4		2			3581.56		0.01				
3	1830941	5996	5		28			52411.8		0.04				
3	621426	96445	6		26			35032.14		0.1				
4	880347	55372	1		30			39819		0.03				
5	1085693	85694	1		15			25179.6		0.02				
5	1239268	39269	2		26			31387.2		0.07				
5	375302	306	3		50			68864.5		0.08				
6	1396355	21369	1		37			53697.73		0.08				
7	1820519	95574	1		12			17273.04		0.07				
7	1452428	77443	2		9			12423.15		0.08				
7	947798	97817	3		46			84904.5		0.1				
7	1630721	30722	4		28			46245.92		0.03				

[Cancel](#)
[Next](#)

3. The rest of the process is identical to [Create a data source from a database](#).

Create datasource (Staging DB)

Configure schema

Search by column name

Role: All Dimension Measure Type: All Add column

Column
Measure # I_orderkey
Measure # I_partkey
Measure # I_suppkey
Measure # I_linenumber
Measure ## I_quantity
Measure ## I_extendedprice
Measure ## I_discount
Measure ## I_tax
Dimension ab I_returnflag
Dimension ab I_linenstatus
Dimension ab I_shipdate
Dimension ab I_commitdate
Dimension ab I_receiptdate
Dimension ab I_shipinstruct
Dimension ab I_shipmode
Dimension ab I_comment

I_orderkey

Data 50 Row Setting

Role: Dimension Measure

Type: # Integer

Missing: Replace with 0

Discard Do not apply

Previous Next

One of the time-type columns or current time must be specified as a Timestamp

Current time Time-type column No selected time-type column

Add a data source with the Metatron engine

Migrates a data source stored in a previous Metatron version.

1. On the source data type selection page, select **Metatron Engine**.
2. When data sources created in a previous version of Metatron are listed on the left as shown below, select the check boxes of the data sources you want to migrate to the current version.

Create datasource (Metatron Engine)
Please select data table

Selections	mysql_preset_engine_dialog_single_all				
	event_time	activity_action	activity_actor	activity_actor_type	activity_generator
<input type="checkbox"/> monthday	2018-06-01 00:00:00	VIEW	admin	PERSON	Mozilla/5.0 (Macintosh; Intel Mac OS X 10_13_4) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/67.0.3396.87 Safari/537.36
<input type="checkbox"/> monthmonth	2018-06-01 00:00:00	VIEW	admin	PERSON	Mozilla/5.0 (Macintosh; Intel Mac OS X 10_13_4) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/67.0.3396.87 Safari/537.36
<input type="checkbox"/> monthyear	2018-06-01 00:00:00	VIEW	admin	PERSON	Mozilla/5.0 (Macintosh; Intel Mac OS X 10_13_4) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/67.0.3396.87 Safari/537.36
<input type="checkbox"/> mv_current	2018-06-01 00:00:00	VIEW	admin	PERSON	Mozilla/5.0 (Macintosh; Intel Mac OS X 10_13_4) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/67.0.3396.87 Safari/537.36
<input type="checkbox"/> mv_twmuq	2018-06-01 00:00:00	VIEW	admin	PERSON	Mozilla/5.0 (Macintosh; Intel Mac OS X 10_13_4) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/67.0.3396.87 Safari/537.36
<input type="checkbox"/> mysql_1	2018-06-01 00:00:00	VIEW	admin	PERSON	Mozilla/5.0 (Macintosh; Intel Mac OS X 10_13_4) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/67.0.3396.87 Safari/537.36
<input type="checkbox"/> mysql_10	2018-06-01 00:00:00	VIEW	admin	PERSON	Mozilla/5.0 (Macintosh; Intel Mac OS X 10_13_4) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/67.0.3396.87 Safari/537.36
<input type="checkbox"/> mysql_8	2018-06-01 00:00:00	VIEW	admin	PERSON	Mozilla/5.0 (Macintosh; Intel Mac OS X 10_13_4) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/67.0.3396.87 Safari/537.36
<input type="checkbox"/> mysql_9	2018-06-01 00:00:00	VIEW	admin	PERSON	Mozilla/5.0 (Macintosh; Intel Mac OS X 10_13_4) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/67.0.3396.87 Safari/537.36

mysql_preset_engine_dialog_single_all

mysql_preset_engine_dialog_single_row

mysql_preset_engine_manual_batch_all

mysql_preset_engine_manual_batch_inc

mysql_preset_engine_manual_single_all

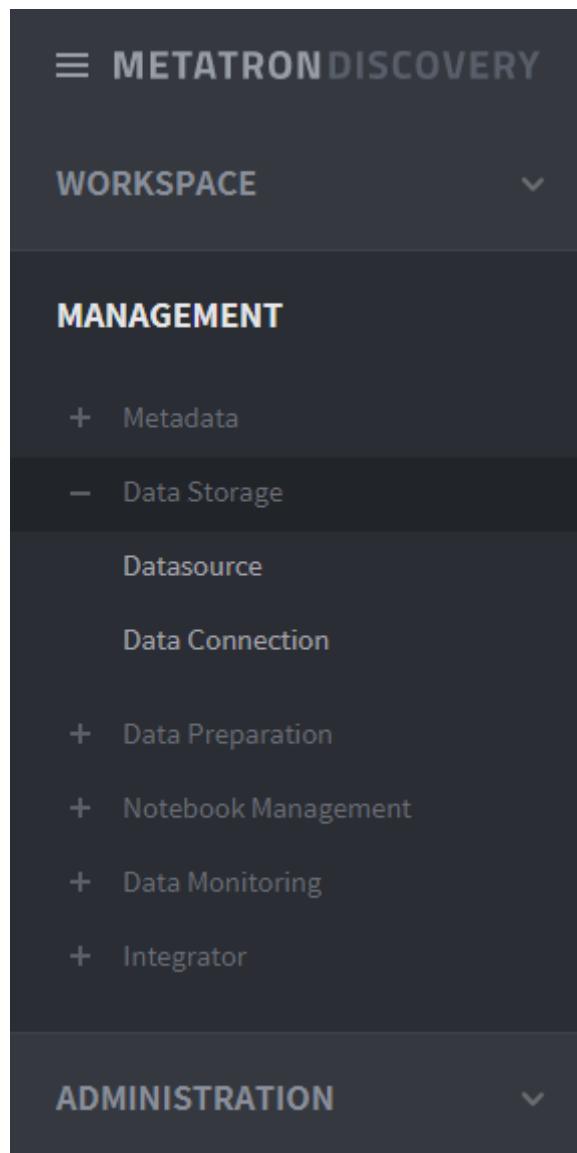
3. Click **Done** to migrate the selected data sources.

Datasource	Source type	Ingestion type	Status	Created
mysql_preset_engine_dialog_single_all	Metatron Engine	Ingested data	Enabled	2019-05-06 17:22 by Administrator

3.2 Data Connection

Metatron Discovery can connect to an external database directly. To connect to an external database, you must create and manage a data connection containing the access information to that database. By registering such a data connection, you don't need to enter the access information each time you connect to the same database.

The Data Connection menu can be accessed under MANAGEMENT > Data Storage > Data Connection on the left-hand panel of the main screen.



3.2.1 Data connection management home

On the **Data Connection** home page, you can create, edit and view database connections.

Data connection	DB Type	Host/Port(URL)	Created
Hive-metatron-hadoop-01-10000	Hive	metatron-hadoop-04 / 10000	2019-03-13 15:18 by Administrator
Presto-metatron-hadoop-01-8089	Presto	metatron-hadoop-01 / 8089	2019-03-02 16:10 by Administrator
druid connection	Druid	metatron-hadoop-02 / 8082	2019-02-25 13:43 by Administrator
MySQL-metatron-web-03-3306	MySQL	metatron-web-03 / 3306	2019-02-21 10:44 by Administrator

- **Publish:** Filter the data connection list by public workspace.
- **Creator:** Filter the data connection list by creator.
- **DB type:** Filter the data connection list by database type (MySQL, PostgreSQL, Hive, or Presto).
- **Security:** Filter the data connection list by security type (Always connect, connect by user's account, or connect with ID and password).
- **Created time:** Filter the data connection list by time of creation (Today, Last 7 days, or Between).
- **Search:** Search the data connection list by data connection name.
- **Number of data connections:** Displays how many data connections are returned in the list.
- **New:** Click on it to create a new data connection.
- **Delete:** Hover the mouse over a data connection to display a recycle bin icon. Click the icon to delete the data connection.

3.2.2 Create a data connection

On the **Create data connection** screen, enter the required information to create a connection.

Create data connection
Please set required items and complete data connection creation

DB connection

MySQL PostgreSQL Hive Presto Druid MSSQL

Host	Port
Host	Port
<input type="checkbox"/> URL only	
User name	Password
admin
Security	
<input checked="" type="radio"/> Always connect	
<input type="radio"/> Connect by user's account	
<input type="radio"/> Connect with ID and password	
Validation check	
Advanced settings ▾	

Publish

1 workspaces [Edit](#)
 Allow all workspaces to use this dataconnection

Connection name

Enter name of new data connection

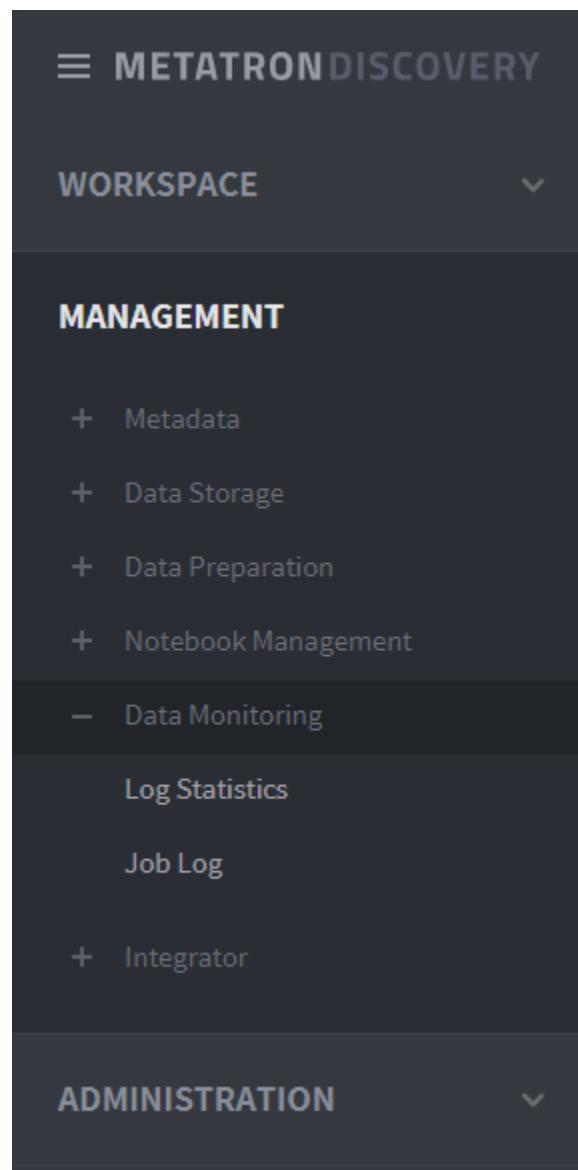
- **DB type:** Four database types are currently supported. (MySQL, PostgreSQL, Hive, Presto)

- **Host:** Enter the hostname to connect to the database.
- **Port:** Enter the port to connect to the database.
- **URL only:** Enter a database URL instead of a host and port.
- **User name:** Enter the username of the database.
- **Password:** Enter the password of the database.
- **Security:** Set the type of security to be applied while using the data connection.
 - **Always connect:** Logs in using the account information the user has entered to create a new data connection.
 - **Connect by user's account:** Logs in using the account information registered in Metatron Discovery.
 - **Connect with ID and password:** Requires to enter the account information every time the data connection is used.
- **Validation check:** Checks whether the connection information entered is valid; the result is shown next to the button. The validity of the connection appears below the button.
- **Advanced settings:** You can add a custom property key and value as options.
- **Publish:** Set which workspaces have access to the data connection.
 - **Allow all workspaces to use this data connection:** Select this check box to make the data connection available in all workspaces.
 - **Edit:** Used to allow specific workspaces to access the data connection. This button will disappear if the data connection is set as open data.
 - **Number of shared workspaces:** Displays how many workspaces have access to the data connection.

3.3 Data Monitoring

Data monitoring supports monitoring the logs of all queries submitted by users in Metatron Workbench to the staging database (internal Hive database) and external databases connected to Metatron.

The Data Monitoring menu can be accessed under **MANAGEMENT** > **Data Storage** > **Data Monitoring** on the left-hand panel of the main screen.



3.3.1 Log Statistics

This page collects and reports various statistics related to the performance of queries in Metatron Discovery. You can view the following nine types of basic statistics.

≡ METATRON DISCOVERY 

Data Monitoring

Log Statistics Job Log

Log type: All | Performed Start Time: Today | Last 7 days | 2019-05-06 00:00 | 2019-05-06 23:59 | Apply

Search by Username:

Daily query success / failure rate



Daily query frequency by user



More	Query	Query Time	User	Result	Elapsed time
	SELECT `jicode` ,`price` ,`build_year` ,`trade_year` ...	2019-05-06 09:30	hive	SUCCESS	19 sec
	SELECT `jicode` ,`price` ,`build_year` ,`trade_year` ...	2019-05-06 08:40	hive	SUCCESS	18 sec
	SELECT `jicode` ,`price` ,`build_year` ,`trade_year` ...	2019-05-06 05:40	hive	SUCCESS	18 sec
	SELECT `jicode` ,`price` ,`build_year` ,`trade_year` ...	2019-05-06 09:40	hive	SUCCESS	18 sec
	SELECT `jicode` ,`price` ,`build_year` ,`trade_year` ...	2019-05-06 02:20	hive	SUCCESS	17 sec

More	Query	Count
	SELECT apartment_trade.* FROM realty.apartm... 105	
	SELECT `created` ,`modified` ,`c1` ,`m1` F... 105	
	SELECT `created` ,`modified` ,`c1` ,`m1` F... 105	
	SELECT addrlist.* FROM default.addrlist ad... 105	
	SELECT datflowtest_snapshot1.* FROM def... 90	

Amount of scan data

More	Query	Query Time	User	Result	Row Count
	SELECT apartment_trade.* FROM realty.apartm... 2019-05-06 15:40	hive	SUCCESS	0	
	SELECT `created` ,`modified` ,`c1` ,`m1` F... 2019-05-06 12:40	hive	SUCCESS	0	
	SELECT `created` ,`modified` ,`c1` ,`m1` F... 2019-05-06 02:51	hive	SUCCESS	0	
	SELECT `created` ,`modified` ,`c1` ,`m1` F... 2019-05-06 11:11	hive	SUCCESS	0	
	SELECT `jicode` ,`price` ,`build_year` ,`trade_year` ... 2019-05-06 16:20	hive	SUCCESS	0	

Frequency of failed queries

No data

Total memory usage

More	Query	Application ID	Queue	Memory
	SELECT `jicode` ,`price` ,`build_y... application_1540788884...	default	783,968	
	SELECT `jicode` ,`price` ,`build_y... application_1540788884...	default	756,238	
	SELECT `jicode` ,`price` ,`build_y... application_1540788884...	default	754,223	
	SELECT `jicode` ,`price` ,`build_y... application_1540788884...	default	739,128	
	SELECT `jicode` ,`price` ,`build_y... application_1540788884...	default	728,767	

Total CPU usage

More	Query	Application ID	Queue	CPU
	SELECT `jicode` ,`price` ,`build_y... application_1540788884...	default	123	
	SELECT `jicode` ,`price` ,`build_y... application_1540788884...	default	115	
	SELECT `jicode` ,`price` ,`build_y... application_1540788884...	default	114	
	SELECT `jicode` ,`price` ,`build_y... application_1540788884...	default	114	
	SELECT `jicode` ,`price` ,`build_y... application_1540788884...	default	114	

Total resource usage by Queue

More	Queue	Memory usage	CPU usage
	default	87,594,128	13,400

- Query success/failure rate:** Displays the daily success/failure rates of queries performed in Metatron.
- Query frequency by user:** Graph indicating how many queries were performed by each user. Click a bar to view the job log for the user.
- In order of longest:** Displays the performed queries in the order of the longest running time.

4. **Amount of scan data:** Displays the performed queries in the order of the highest amount of scanned data.
5. **Frequency of successful queries:** Displays the performed queries in the order of the highest frequency of success.
6. **Frequency of failed queries:** Displays the performed queries in the order of the highest frequency of failure.
7. **Total memory usage:** Displays the performed queries in the order of the largest memory usage in total.
8. **Total CPU usage:** Displays the performed queries in the order of the largest CPU usage in total.
9. **Resource usage by queue:** Displays the resource usage in each YARN queue in the Hadoop environment.

3.3.2 Job Log

This page reports the history of all queries performed in Metatron. You can easily view previous jobs by searching the history of queries with your customized filters. The following are the filters applicable to job searching.

The screenshot shows the Metatron Discovery interface for Data Monitoring. The Job Log tab is selected. The table displays the following data:

Status	Job name	Application ID	Queue	Username	Started time	Elapsed time
SUCCESS	SELECT `created`, `modified`, `c1`, `m1` FROM (select * from default.hive_batch_...)	application_1540788884137_63461	default	hive	2019-05-06 17:21	12 sec
SUCCESS	SELECT lineitem.* FROM tpch_10.lineitem lineitem	-	-	hive	2019-05-06 17:20	1 sec
SUCCESS	DESCRIBE FORMATTED tpch_10.lineitem	-	-	hive	2019-05-06 17:20	735ms
SUCCESS	SHOW TABLES IN tpch_10	-	-	hive	2019-05-06 17:20	256ms
SUCCESS	SELECT `jicode`, `price`, `build_year`, `trade_year`, `trade_month`, `trade_day`, `...`	application_1540788884137_63460	default	hive	2019-05-06 17:20	15 sec
SUCCESS	SELECT `created`, `modified`, `c1`, `m1` FROM (SELECT * FROM hive_batch_test_...)	application_1540788884137_63459	default	hive	2019-05-06 17:20	12 sec
SUCCESS	SELECT datflowtest_snapshot1.* FROM default.datflowtest_snapshot1 datflowtest_...	-	-	hive	2019-05-06 17:20	715ms
SUCCESS	SELECT `jicode`, `price`, `build_year`, `trade_year`, `trade_month`, `trade_day`, `...`	-	-	hive	2019-05-06 17:20	1 sec
SUCCESS	SELECT apartment_trade.* FROM realty.apartment_trade apartment_trade	-	-	hive	2019-05-06 17:20	541ms
SUCCESS	SELECT addrlist.* FROM default.addrlist addrlist	-	-	hive	2019-05-06 17:20	385ms
SUCCESS	SELECT jhkim_audit_final.orc.* FROM cazen_lee.jhkim_audit_final.orc jhkim_audi...	-	-	hive	2019-05-06 17:18	715ms
SUCCESS	SELECT excelsales_snapshot_99.* FROM cazen_lee.excelsales_snapshot_99 excelsa...	-	-	hive	2019-05-06 17:18	951ms
SUCCESS	SELECT cazen_log_click.* FROM cazen_lee.cazen_log_click cazen_log_click	-	-	hive	2019-05-06 17:16	7 sec
SUCCESS	SHOW TABLES IN cazen_lee	-	-	hive	2019-05-06 17:16	443ms
SUCCESS	SELECT 1	-	-	hive	2019-05-06 17:16	651ms

- Status:** Filters queries by whether they were successful or failed.
- Limited elapsed time:** Filters queries by long running time. You can set a reference time for this filtering.
- Performed start time:** Determines a time range by which to filter queries. This time range is based on when each query started running.
- Search by job or application:** Searches the query history by query statement or application ID.
- Number of entries:** Displays how many queries are returned in the list.
- Job list:** Lists queries filtered by specified criteria. Click an entry in the list to view its details.

Query details

Click a query listed in the job log home to view details on that query. The following information can be viewed in the details page.

The screenshot shows the Metatron Discovery interface with the following details:

Log Information

Status	SUCCESS
Log	No log
Job name	SELECT * FROM druid.\"from_csv\"
Started time	2019-05-05 20:04
Elapsed time	39ms
User	metatron

Query Information

Connection	Type	DRUID
	Host	metatron-hadoop-02
	Port	8082
	JDBC URL	jdbc:avatica:remote:url=http://metatron-hadoop-02:8082/druid/v2/sql/avatica/

Recent history of the same connection

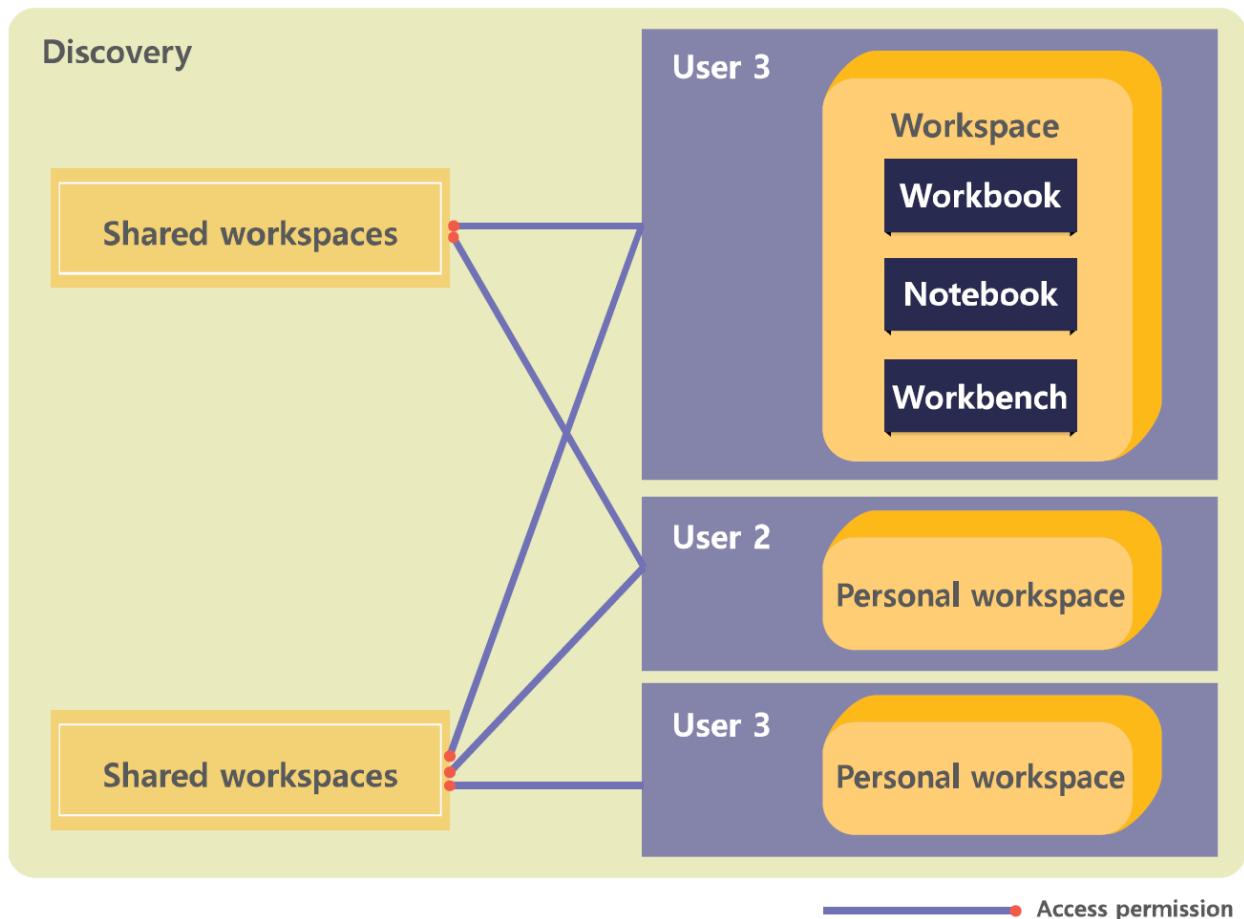
Query date	User	Elapsed time	Result	
2019-05-05 20:04	Metatron	39 ms	SUCCESS	Detail >
2019-05-03 14:26	Metatron	24 ms	SUCCESS	Detail >
2019-05-01 04:02	Metatron	40 ms	SUCCESS	Detail >
2019-05-01 03:59	Metatron	29 ms	SUCCESS	Detail >
2019-05-01 03:59	Metatron	29 ms	SUCCESS	Detail >

Plan [See query plan](#)

1. **Status:** Displays whether the query was successful or failed.
2. **Job name:** Statement used to perform the query.

3. **Start time:** Time when the query started running.
4. **Elapsed time:** Time taken to perform the query.
5. **User:** User ID who performed the query.
6. **Connection:** For a query performed in a workbench, the connection information of the database is displayed.
7. **Recent history of the same connection:** For a query performed in a workbench, the latest five queries performed in the database and their results are displayed. Click Detail to pop up a window showing the query statement.
8. **Plan:** Implements the query plan.

WORKSPACE



A workspace stores Metatron Discovery's analytics entities such as workbooks, notebooks, and workbenches. There are two types of workspaces: personal and shared workspaces.

- **Personal workspace:** A private workspace assigned to each Discovery member. It is accessible only to the owner.

- **Shared workspace:** A public workspace shared by multiple users. It is used for users to share analytics processes and results with each other. The owner or administrator of a shared workspace can grant various levels of access to Discovery members.

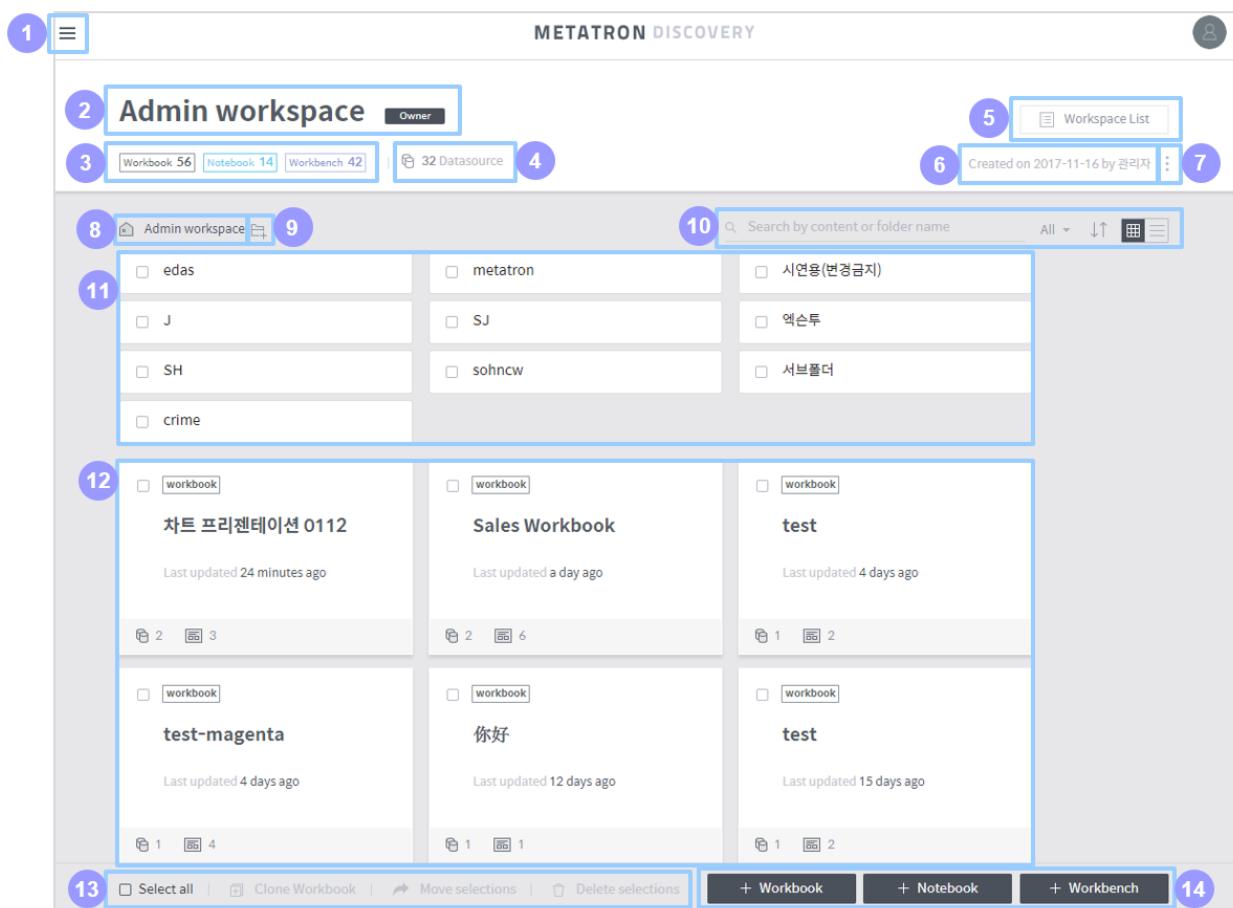
This chapter introduces **workspace home page and UI**, and then how to use **shared workspaces**.

4.1 Workspace home

On the workspace home page, you can perform manage the Metatron Discovery entities (workbooks, notebooks and workbenches) contained in the workspace.

4.1.1 Composition of the workspace home

The overall composition of the workspace home is as follows:



1. **Main menu button:** Click this button to open a panel to access another workspace.

2. **Workspace information:** Displays the name and description of the workspace. If the logged-in user owns the workspace, an Owner icon will be displayed next to the name of the workspace.
3. **Registered entities:** Displays the number of entities registered in the workspace by entity type.
4. **Data source:** Displays the number of data sources used in the workspace. Click this area to show a list of these data sources.
5. **Workspace list:** Click this button to show a list of shared workspaces. (See [Shared workspace list](#) for how to handle it.)
6. **Creation information:** Displays who and when created the workspace.
7. **More:** Edit the settings of the workspace.
 - **Edit the name and description:** Edits the name and description of the workspace.
 - **Set shared member & group:** Sets the users and groups who can access the workspace. (See [Set access permissions for a shared workspace](#) for details.)
 - **Set notebook server:** Sets access information for external analytics tool servers used by the Notebook module.
 - **Set permission schema:** Sets the access permission of each user role for the workspace. (See [Set access permissions for a shared workspace](#) for details.)
 - **Change owner:** Changes the owner of the workspace.
 - **Delete workspace:** Deletes the workspace.
8. **Path in the workspace:** Displays the current location in the workspace. Click on a parent folder listed in the path to move to that folder.
9. **Create a folder:** Click on it to create a new folder in the current location.
10. **Filter/sort the entity list:**
 - **Search:** Searches for an entity or folder in the workspace by name.
 - **Entity type:** Displays only your selected type of entities among workbooks, notebooks, and workbenches.
 - **Sort:** Sorts folders and entities by their name or when they were last updated.
 - **View type:** Select either the grid view or list view as the format of how the entities are listed in the workspace.

11. **Folder list:** Displays folders that meet search criteria in the current location. Click one to enter that folder. (For details on individual folders, see [Folder items](#))
12. **Entity list:** Displays entities that meet search or sorting criteria in the current location. Click an entity to enter its home. (For details on individual entities, see [Entity items](#))
13. **Select/clone/move/delete entity:** Select all entities, or clone, move or delete an entity. (See [Select/clone/move/delete folder and entity](#) for details.)
14. **Create an entity:** Buttons used to create a specific type of entity in the workspace. (For details, see [Create a workbook](#), [Create a notebook](#), and [Create a workbench](#), respectively.)

4.1.2 Folder items

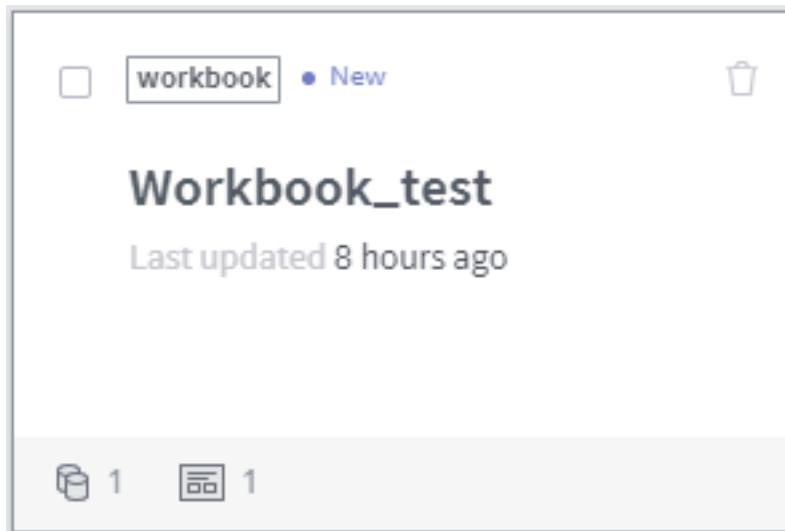
When the mouse cursor is over a folder, it is shown as follows:



- **Check box:** Used to select the folder. You can clone, move or delete the selected folder.
- **Name:** Name of the folder.
- **Edit:** Click on it to modify the name of the folder. This button is displayed only when you hover the mouse over the folder item.
- **Delete:** Click on it to delete the folder. This button is displayed only when you hover the mouse over the folder item.

4.1.3 Entity items

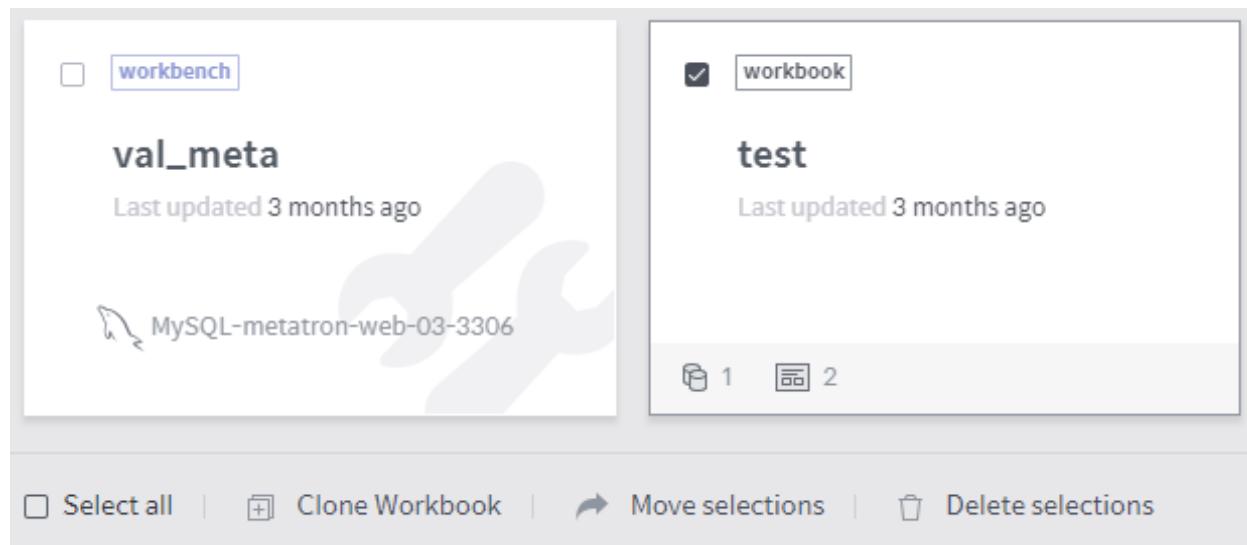
When the mouse cursor is over an entity, it is shown as follows:



- **Check box:** Used to select the entity. You can clone, move or delete the selected entity.
- **Entity type:** Displays the type of the entity (workbook/notebook/workbench).
- **Delete:** Click on it to delete the entity. This button is displayed only when you hover the mouse over the entity item.
- **Name:** Name of the entity.
- **Last updated:** Displays when the entity was last updated.
- **Number of data sources/dashboards:** This is an exclusive area for the workbook type.
 - The number next to the icon refers to how many data sources are connected to the workbook.
 - The number next to the icon refers to how many dashboards are registered in the workbook.

4.1.4 Select/clone/move/delete folder and entity

You can clone, move or delete folders and entities in the workspace. Once you select a folder or entity, the clone, move, and delete buttons in the lower-left corner of the workspace home become active.



- **Select all:** Selects all items in the current folder and entity list.
- **Clone workbook:** This is exclusive for the workbook type. Click this button to clone the selected workbooks.
- **Move selections:** Moves the selected folders and entities. Workbooks can be moved to another workspace, and other types of items can be moved to another folder in the same workspace. However, it is impossible to move selections when workbooks and other types of entities are selected together.
- **Delete:** Deletes the selected folders and entities.

4.2 Shared workspace

A shared workspace is designed for access and use by multiple users. The following subsections describe how to view and create shared workspaces, and explain “permission schema,” which sets which users or groups are allowed to access shared workspaces.

4.2.1 Shared workspace list

The shared workspace list page is used to view a list of all shared workspaces accessible to the logged-in user and to move to a specific workspace. This page can be accessed via two methods:

- Click the button at the top-left of the Discovery screen to open the main panel, and click **Workspace list >>**.

- Click **Workspace list** at the top-right of the workspace home.

The shared workspace list page is composed as follows:

The screenshot shows a list of shared workspaces. At the top, there's a header with a back arrow, a search bar, and several filter buttons. Below the header is a table listing workspaces with columns for name, owner, and various statistics. A blue box highlights the top section of the table, and a blue circle with the number 9 points to the bottom right corner of the table area.

Name	Owner	Workbook	Notebook	Workbench	Members	Groups
테스트 스키마11	Owner	Workbook 0	Notebook 0	Workbench 0	0 Member	0 Group
룰렛 테스트 워크스페이스 (조민정)	Owner	Workbook 0	Notebook 0	Workbench 0	4 Member	0 Group
★ 공유 워크스페이스	Owner	Workbook 2	Notebook 0	Workbench 0	1 Member	0 Group
★ X-test - X-test	Owner	Workbook 2	Notebook 0	Workbench 0	0 Member	0 Group
test-magenta-dictionary	Owner	Workbook 0	Notebook 0	Workbench 1	0 Member	0 Group
★ test-magenta	Owner	Workbook 7	Notebook 0	Workbench 1	4 Member	0 Group
Shared Workspace		Workbook 1	Notebook 5	Workbench 0	3 Member	0 Group
★ samples - sample들을 모아 보자	Owner	Workbook 1	Notebook 0	Workbench 1	1 Member	0 Group

- Number of shared workspaces:** Displays how many shared workspaces are listed.
- Add a shared workspace:** Click this button to move to the page to add a shared workspace. (See [Create a shared workspace](#) for a detailed procedure)
- Personal workspace:** Click this button to move to the personal workspace owned by the logged-in user.
- Search:** Searches the shared workspace list by the name you typed in.
- Favorites:** Displays only those workspaces designated as favorites.
- Public only:** Displays only those workspaces set as public.
- I'm the owner:** Displays only those workspaces for which the logged-in user is the administrator.
- Name ascending/descending:** Sorts the shared workspace list by name ascending/descending.

9. **Workspace list:** Lists workspaces filtered by specified criteria. Click one to move to enter that workspace.

4.2.2 Create a shared workspace

A new shared workspace is created as follows:

1. Click the  button on the shared workspace list page to move the page to create a new shared workspace.
2. Enter a **Name** and **Description**, and then set up the **Permission schema** by referring to the descriptions below:

[Create shared workspace](#)

Name

Please enter a name

Description

Please enter a description

Permission schema

Use a preset schema Default Schema ▾ Use a custom schema

User roles

User role	Default role	Workbook			Notebook			Workbench			Workspace	
		View	Create	Edit any	View	Create	Edit any	View	Create	Edit any	Create folders	Set config.
Manager		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Editor		✓	✓	-	✓	✓	-	✓	✓	-	-	
Watcher	●	✓	-	-	✓	-	-	✓	-	-	-	

Explanation

- Default role : Role to be granted when adding new members and groups
- View of (item) : Enable to access to item and to read contents
- Create of (item) : Enable to create, modify and delete items
- Edit any of (item) : Enable to create, modify and delete items which is created by other users
- Create folders : Enable to create, modify and delete folders
- Set config. : Enable to edit information and to set configuration of workspace

- **Use a preset schema:** Load the permission schema defined by the administrator.
 - **Use a custom schema:** Define a new permission schema. (See [Set access permissions for a shared workspace](#) for how to define a new permission schema.)
3. Click Done to finish creating a workspace.

4.2.3 Set access permissions for a shared workspace

Setting the access permission for a shared workspace is conducted in the following two steps:

- Set an access permission for each user role (See [Set permission schema](#))
- Grant a role to each user or user group (See [Set shared members & groups](#))

Set permission schema

View permission schema

Click the  icon at the top-right of the shared workspace home and click **Set permission schema** to view the defined permission schema as follows:

Set permission schema

Cancel Done

		User roles of asd						Change schema				
User role	Default role	Workbook			Notebook			Workbench			Workspace	
		View	Create	Edit any	View	Create	Edit any	View	Create	Edit any	Create folders	Set config.
Manager		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Editor		✓	✓	-	✓	✓	-	✓	✓	-	-	
Watcher	●	✓	-	-	✓	-	-	✓	-	-	-	
Guest		✓	-	-	-	-	-	-	-	-	-	

Explanation

- Default role : Role to be granted when adding new members and groups
- View of (item) : Enable to access to item and to read contents
- Create of (item) : Enable to create, modify and delete items
- Edit any of (item) : Enable to create, modify and delete items which is created by other users
- Create folders : Enable to create, modify and delete folders
- Set config. : Enable to edit information and to set configuration of workspace

In the above example, Manager, Editor, Watcher, and Guest are defined as user roles. As shown in this example, a permission schema is a set of user roles defining different access permissions.

What each column determines is as follows:

Default role

When a new user or user group is added, it is assigned the default role.

Permission for each entity type (workbook/notebook/workbench)

- **View:** Allows to access and view data in entities of the type.
- **Create:** Allows to create, edit, and delete entities of the type.
- **Edit any:** Allows to edit or delete entities of the type created by another user.

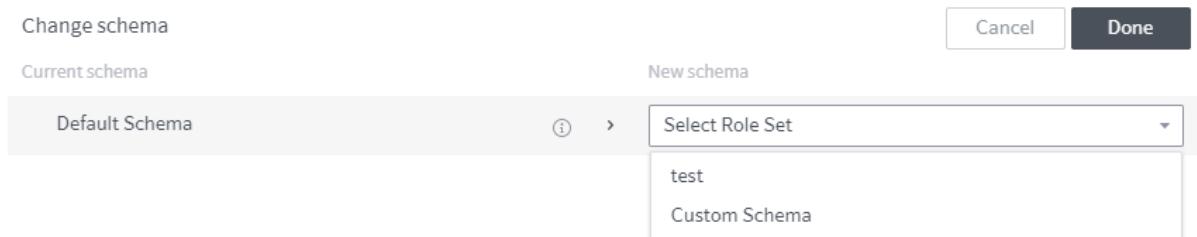
Workspace permission

- **Create folders:** Allows to create, edit, and delete folders in the workspace.
- **Set config.:** Allows to modify the name and description of the workspace and to change the workspace permission schema.

Change permission schema

Click the **Change schema** button on the permission schema view page to move to a page to change the defined permission schema as follows:

Change permission schema



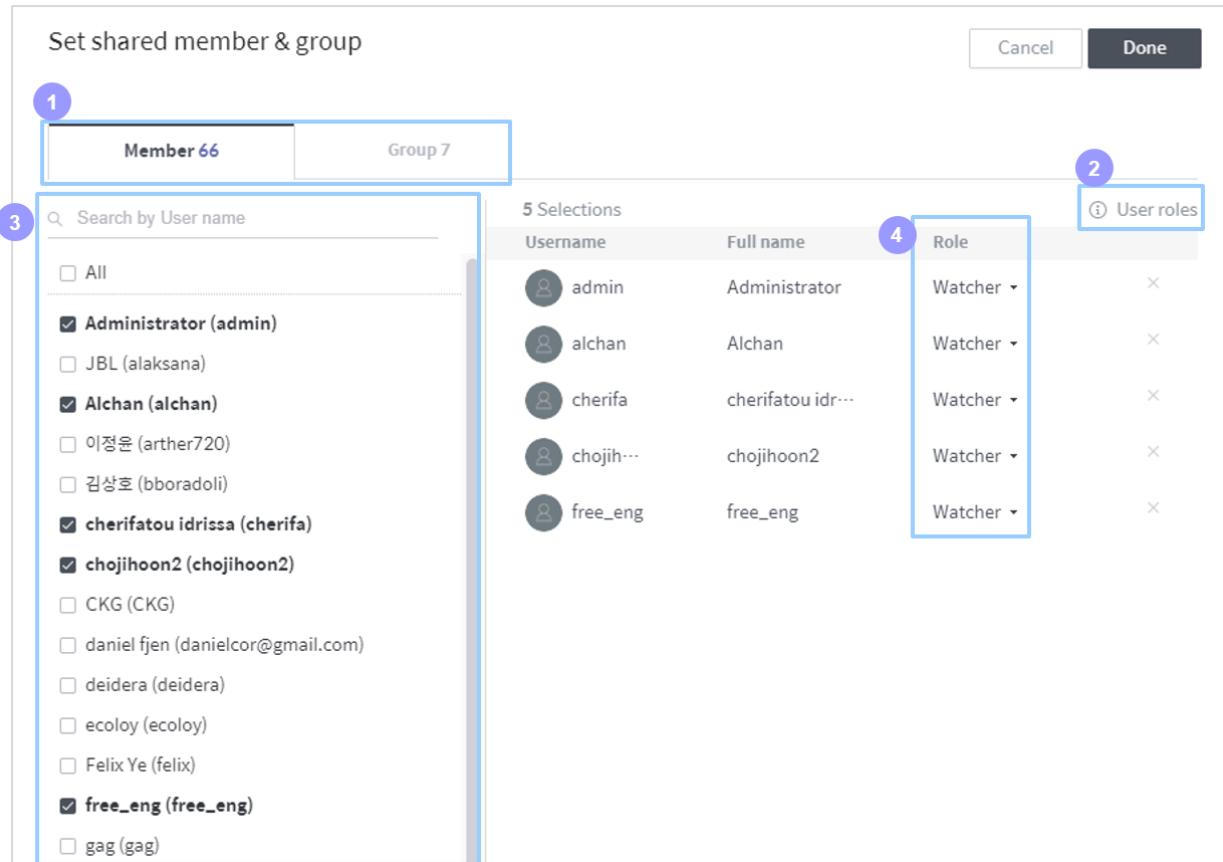
Click **Select Role Set** combo box on the right to display the permission schema defined by the administrator. **Custom schema** at the bottom of the list allows you to set new user roles. Select one to display the following section. (If you select **Custom schema**, you must first define a permission for each user role. Click the button at the right of New schema to move to the permission setting page, and set a permission for each user role by referring to [View permission schema](#))

Current role		New role
Manager	(i) >	Manager (i) ▾
Editor	(i) >	Editor (i) ▾
Watcher	(i) >	Watcher (i) ▾
Guest	(i) >	Watcher (i) ▾

Here, each user role of the current permission schema is substituted with the user role defined in the new permission schema. Hover the mouse over the (i) icon next to the name of a user role to display the permission assigned to the user role. Click **Done** to finish setting the permission schema.

Set shared members & groups

Click the icon at the top-right of the shared workspace home, and click **Set shared member & group** to move to a page to set members and groups for the shared workspace as follows: On this page, each user or user group is assigned a user role defined in the permission schema. Assign user roles by referring to the following explanation, and click **Done** to finish setting workspace access permissions.



1. Select whether to assign user roles individually or in groups

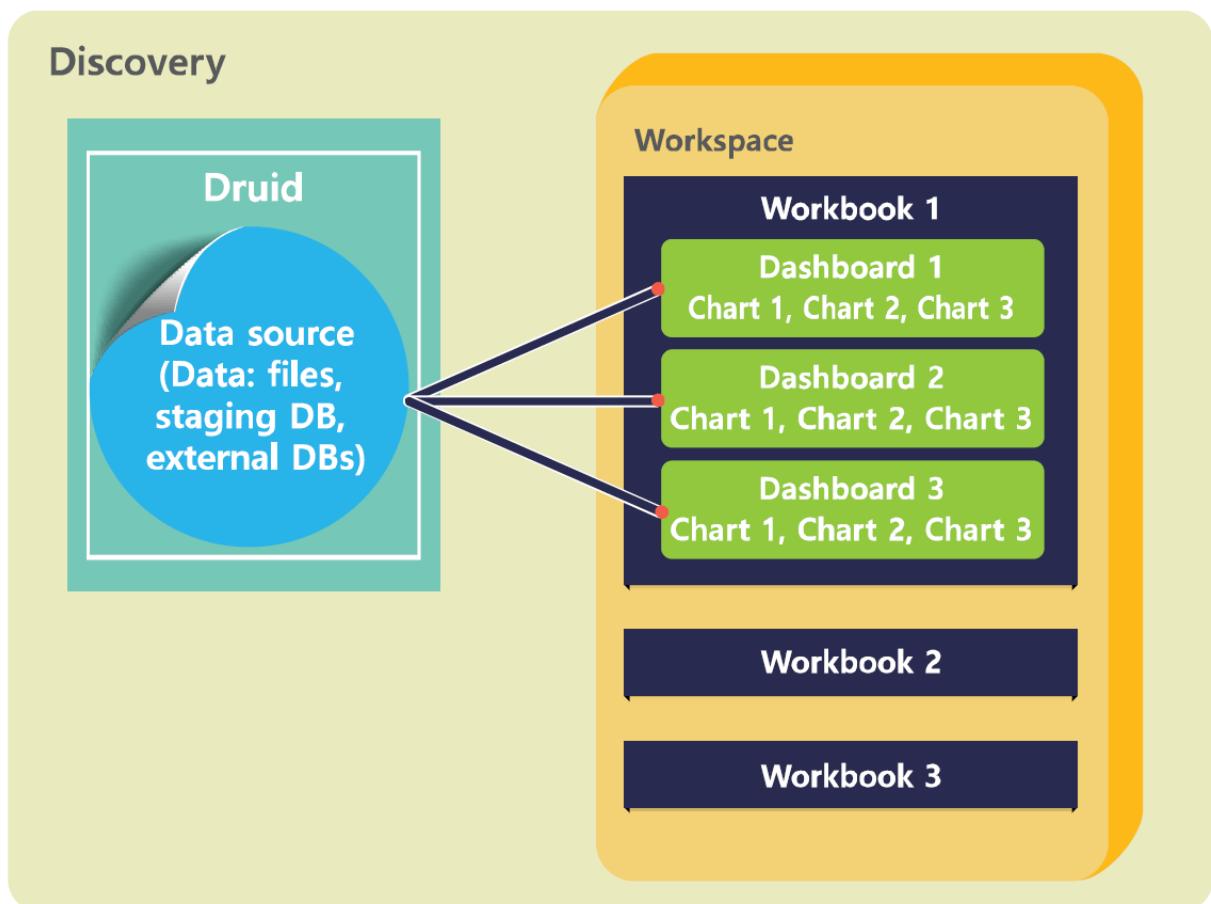
- **Member tab:** Assign user roles to individual users.
- **Group tab:** Assign user roles in groups. (A user group can be established by administrator permission.)

2. **User roles:** Click on it to pop up a dialog box showing the permission schema, which defines a permission for each user role.

3. **Member/group list:** Lists the users (groups in the case of the group tab) registered in Discovery. Click a user (group) in the list to add it to the role assignment section on the right. Click an added user (group) to remove it from the section on the right.

4. **Assign a user role:** Click this combo box to display user roles defined in the active permission schema. Select the role you want to assign to the user (group).

WORKBOOK



Workbook is a data visualization module powered by the Metatron Druid engine. As shown in the diagram above, each **workbook**? a standalone report? consists of multiple **dashboards**, while each dashboard consists of various **charts** showing a visualization of source data analysis.

The main features of Workbook are as follows:

- Fast and flexible data analytics over time-series multidimensional data sources.
- Dashboards contain a variety of visualized charts and texts to be compiled into a report for presentations.
- Frequently used algorithms such as clustering, prediction lines, and trend lines can be implemented through a GUI (graphical user interface).

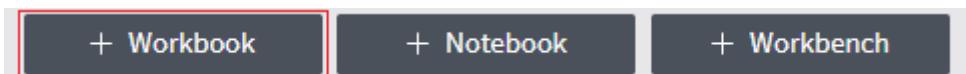
This chapter consists of:

5.1 Create a workbook

In Metatron Discovery, a **workbook** functions as a standalone data analytics report. Once a workbook is created, you can store a number of **dashboard** slides in the workbook and present them in the proper order.

A workbook is created as follows:

1. Click the **+ Workbook** button at the bottom of the workspace to move to the workbook creation page.



2. Enter a name (required) and description for the workbook to be created and click **Done**. If you select **Continue to create a dashboard of a new workbook**, you'll proceed directly to the **Create Dashboard** page. This option is provided because a workbook cannot work without dashboards in it.



Create Workbook

Name

Please enter a name

Description

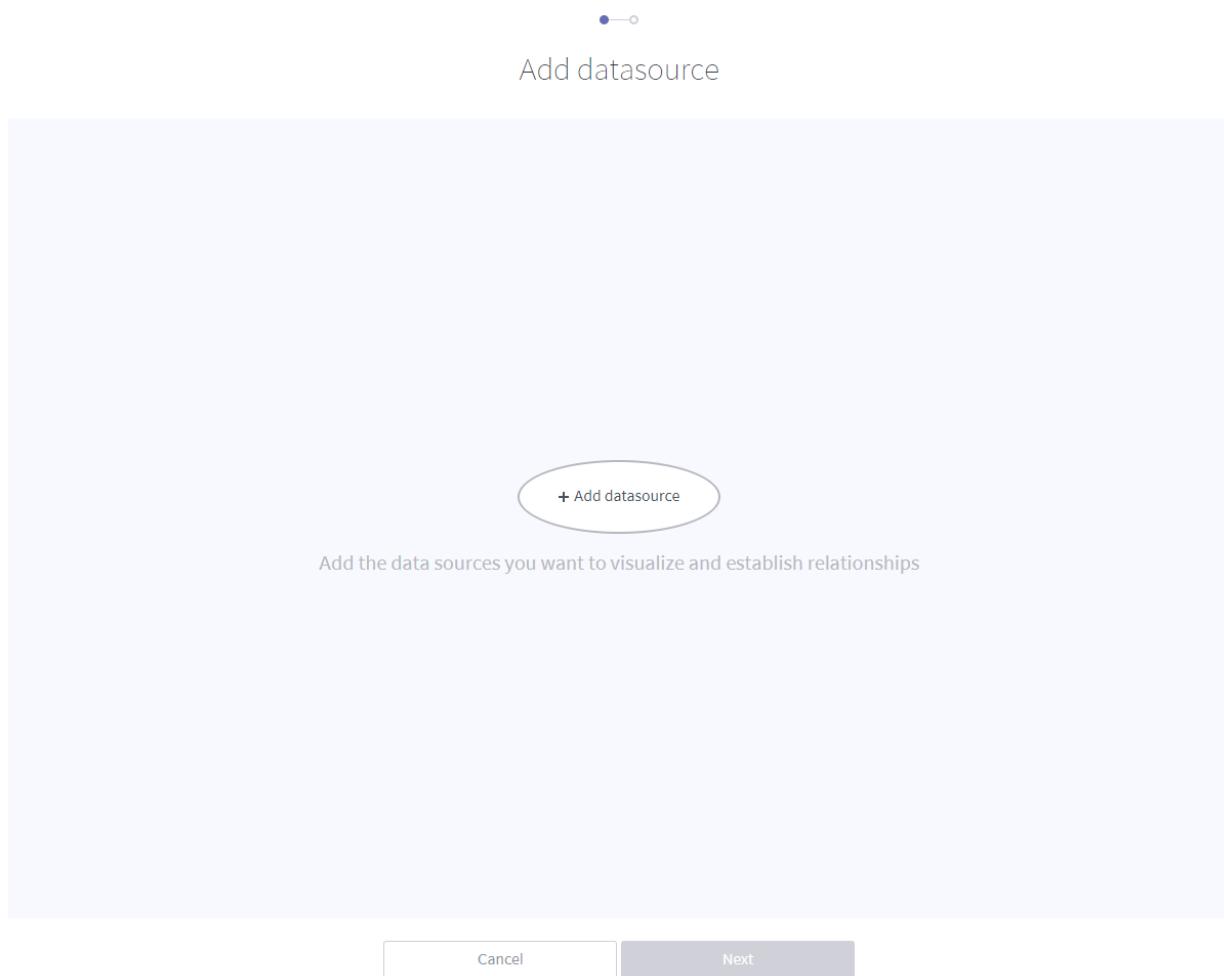
Please enter a description

Continue to create dashboard of a new workbook

Cancel

Done

3. After clicking the “+ Add Data Source” button in the middle of the screen, select a data source to create a dashboard. For details on how to create a dashboard, refer to [Create a dashboard](#).



Please select a datasource

[Cancel](#)

[Done](#)

Search by datasource name
 Show open data only
Type [All](#)

No.	Datasource	Type
<input type="checkbox"/> 44	mysql_preset_engine_dialog_single_all	Ingested type
<input type="checkbox"/> 43	Sales Report - A summary of sal...	Open data Ingested type
<input type="checkbox"/> 42	3.2 집중테스트 통계 - Feat. Trello	Ingested type
<input type="checkbox"/> 41	geo Open data	Ingested type
<input type="checkbox"/> 40	uk_cust_basic - Basic Informati...	Open data Ingested type
<input type="checkbox"/> 39	hive_date - asdfasdfasdfsdfasdf	Ingested type
<input type="checkbox"/> 38	판매현황 데이터 - 2010-2011 판매...	Open data Ingested type
<input type="checkbox"/> 37	saleswithcity - 도시가 추가된 매출 ...	Open data Ingested type
<input type="checkbox"/> 36	범죄발생지 2016	Ingested type
<input type="checkbox"/> 35	Test	Ingested type
<input type="checkbox"/> 34	druid_linked_query	Linked type
<input type="checkbox"/> 33	druid_linked	Linked type
<input type="checkbox"/> 32	access_log_table-link	Linked type
<input type="checkbox"/> 31	3	Ingested type
<input type="checkbox"/> 30	0002	Ingested type
<input type="checkbox"/> 29	audit_test	Ingested type
<input type="checkbox"/> 28	0	Ingested type
More ▾		

mysql_preset_engine_d... [X](#)

Metadata name: mysql_preset_engine_dialog_single_all

Description:

Type: Ingested type

Visibility: Private

Created: 2019-05-06

Dimensions:

- [Dimension](#) [event_time](#)
- [Dimension](#) [activity_action](#)
- [Dimension](#) [activity_actor](#)
- [Dimension](#) [activity_actor_type](#)
- [Dimension](#) [activity_generator_name](#)
- [Dimension](#) [activity_generator_type](#)
- [Dimension](#) [activity_object_id](#)
- [Dimension](#) [activity_object_type](#)
- [Measure](#) [## id](#)

4. You can check the new workbook in the workspace home as shown below. Click the workbook to enter it.

Admin Workspace

Owner

Workbook 66 Workbench 33 | 78 Datasource

The screenshot shows the Admin Workspace interface. At the top, there are navigation links for 'Workbook 66', 'Workbench 33', and '78 Datasource'. A 'Owner' badge is visible. Below this is a grid of items:

Icon	Name	Icon	Description
<input type="checkbox"/>	new folder	<input type="checkbox"/>	taehui
<input type="checkbox"/>	esezin	<input type="checkbox"/>	325
<input type="checkbox"/>	new folder	<input type="checkbox"/>	comefeel
<input type="checkbox"/>	eltriny	<input type="checkbox"/>	sting
<input type="checkbox"/>	heesoo	<input type="checkbox"/>	sohncw

Below the grid are two detailed view cards:

workbook • New

test

Last updated a minute ago

0 0

workbook • New

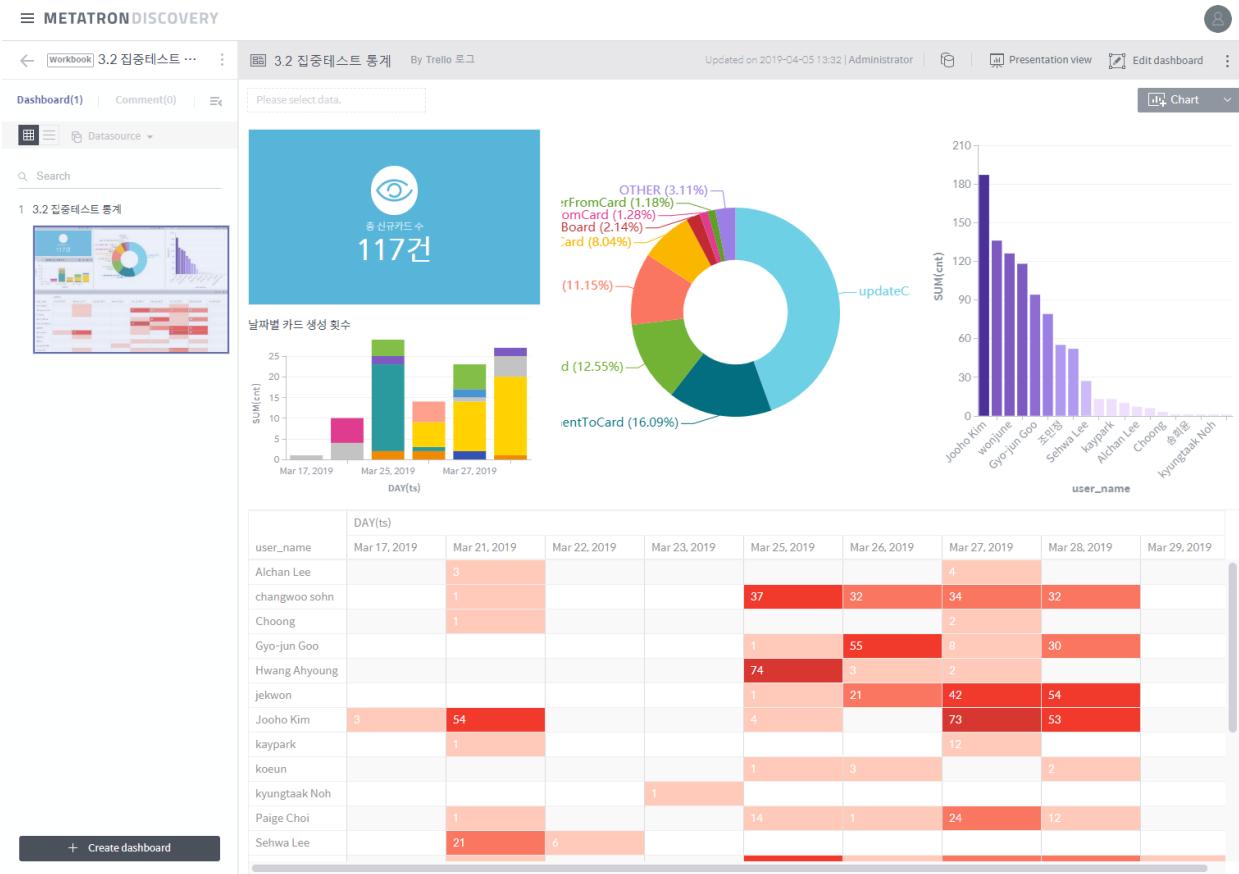
Workbook_test

Last updated an hour ago

1 1

5.2 Dashboard

Stored in a workbook, a **dashboard** provides functions to analyze and visualize its connected data source as needed. Therefore, an important step to create a dashboard is connecting to a data source.



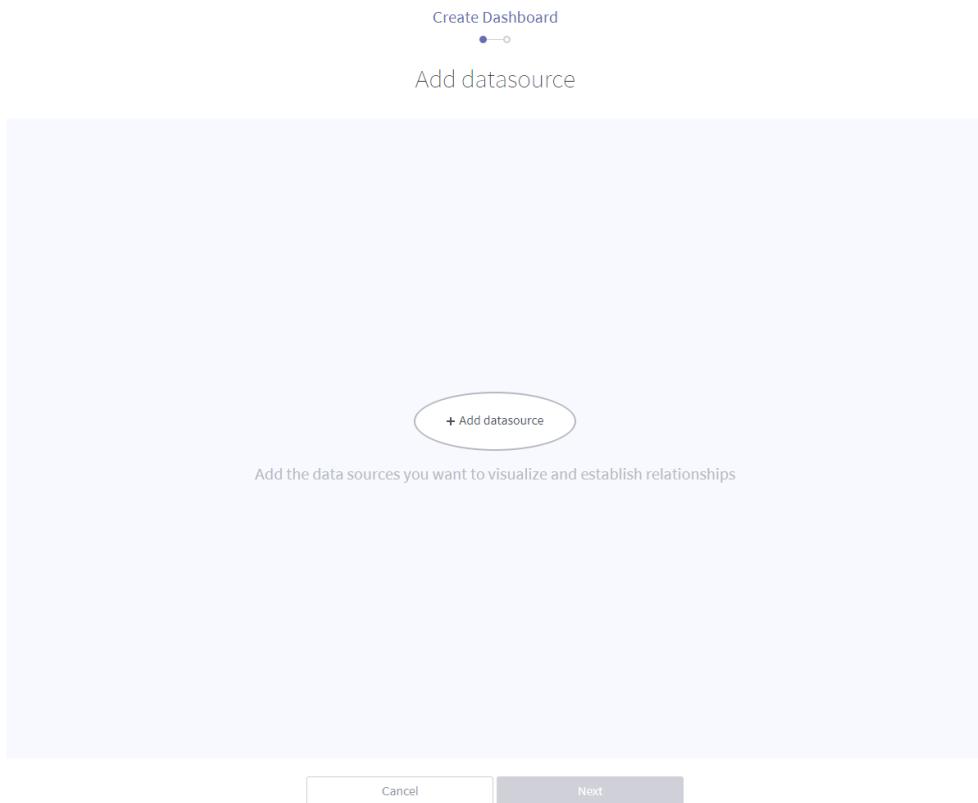
You can visualize analyses of various data sources into charts and texts; those visualizations are customizable using pivoting, chart mapping, and filtering.

5.2.1 Create a dashboard

A dashboard is created as follows:

1. Click **+ Add data source** on the workbook screen.

×



2. From the list of data sources accessible to the workspace, select the master data sources to which you want to connect the dashboard. In a subsequent step, you can select additional data sources to be joined to these master data sources selected here.

Please select a datasource

[Cancel](#)

[Done](#)

No.	Datasource	Type
<input type="checkbox"/> 44	mysql_preset_engine_dialog_single_all	Ingested type
<input checked="" type="checkbox"/> 43	Sales Report - A summary of sal... Open data	Ingested type
<input type="checkbox"/> 42	3.2 집중테스트 통계 - Feat. Trello	Ingested type
<input type="checkbox"/> 41	geo Open data	Ingested type
<input type="checkbox"/> 40	uk_cust_basic - Basic Informati... Open data	Ingested type
<input type="checkbox"/> 39	hive_date - asdfasdfasdfsadf	Ingested type
<input checked="" type="checkbox"/> 38	판매현황 데이터 - 2010-2011 판매현황 데이터	Open data ✓
<input type="checkbox"/> 37	saleswithcity - 도시가 추가된 매출 ... Open data	Ingested type
<input type="checkbox"/> 36	범죄발생지 2016	Ingested type
<input type="checkbox"/> 35	Test	Ingested type
<input type="checkbox"/> 34	druid_linked_query	Linked type
<input type="checkbox"/> 33	druid_linked	Linked type
<input type="checkbox"/> 32	access_log_table-link	Linked type
<input type="checkbox"/> 31	3	Ingested type
<input type="checkbox"/> 30	0002	Ingested type
<input type="checkbox"/> 29	audit_test	Ingested type
<input type="checkbox"/> 28	0	Ingested type
More ▾		

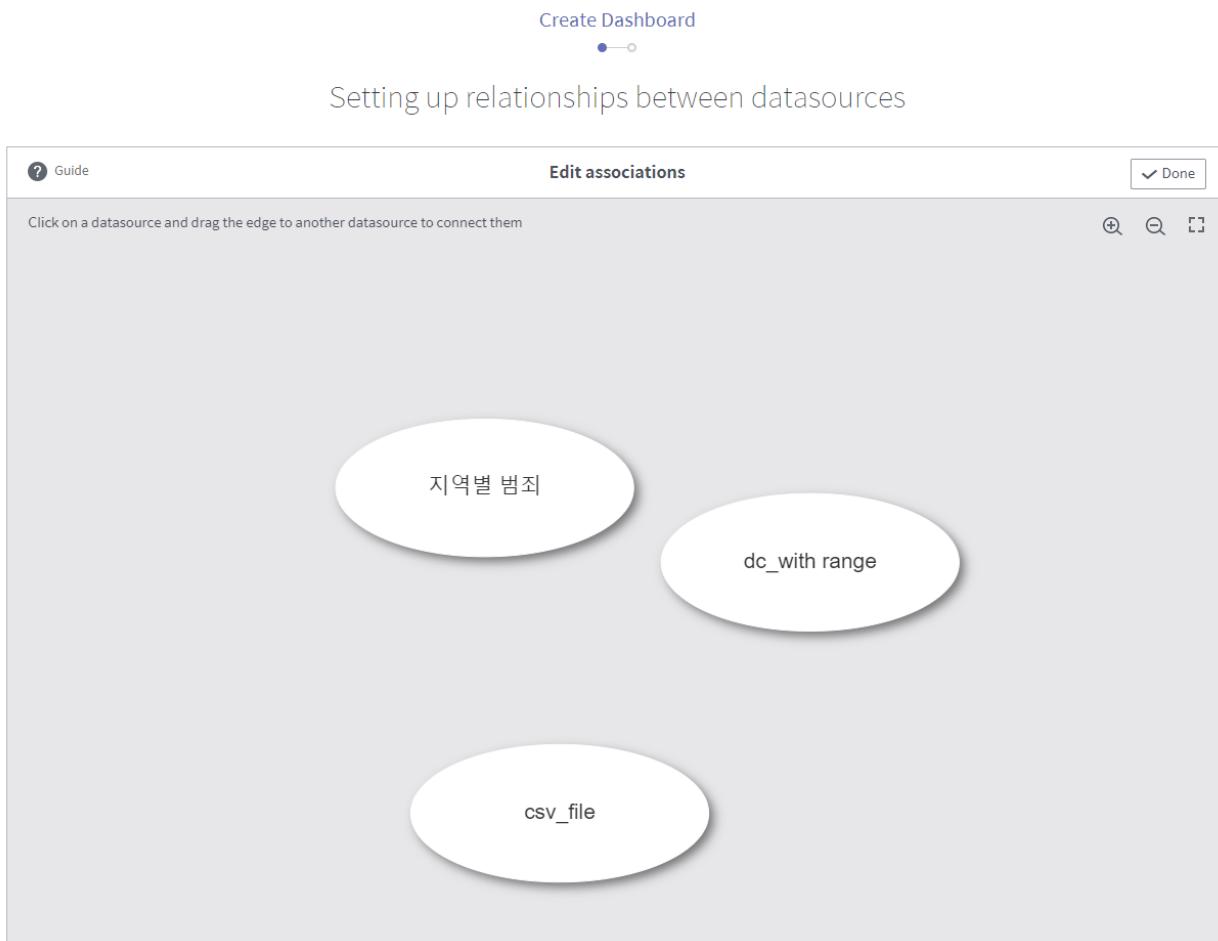
판매현황 데이터 [☰](#) [×](#)

Metadata name	판매현황 데이터
Description	2010-2011 판매현황 데이터입니다.
Type	Ingested type
Visibility	Public
Created	2019-04-15
Size	189.58 KB
Rows	63

Dimension	📍 GeoPoint
Dimension	📅 OrderDate
Dimension	ab Category
Dimension	ab City
Dimension	ab Country
Dimension	ab CustomerName
Measure	## Discount
Dimension	ab OrderID
Dimension	ab PostalCode
Dimension	ab ProductName
Measure	# Profit
Measure	# Quantity
Dimension	ab Region
Measure	# Sales
Dimension	ab Segment
Dimension	📅 ShipDate
Dimension	ab ShipMode
Dimension	ab State
Dimension	ab Sub-Category
Measure	# DaystoShipActual
Measure	# SalesForecast
Dimension	ab ShipStatus

- **Search by data source name:** Search for a data source accessible to the workspace by name.
- **Show open data only:** Displays only those designated as “open data sources.”
- **Type:** Displays only those data sources that are the connection or collection type.

- **Data source list:** Lists data sources filtered by specified criteria.
 - **Data source information:** Displays brief information of the data source selected in the list.
3. If you have selected more than one data source, you can associate them by dragging one data source to another. Associated data sources can be filtered by each other. If you do not want data source association, simply click **Done**.



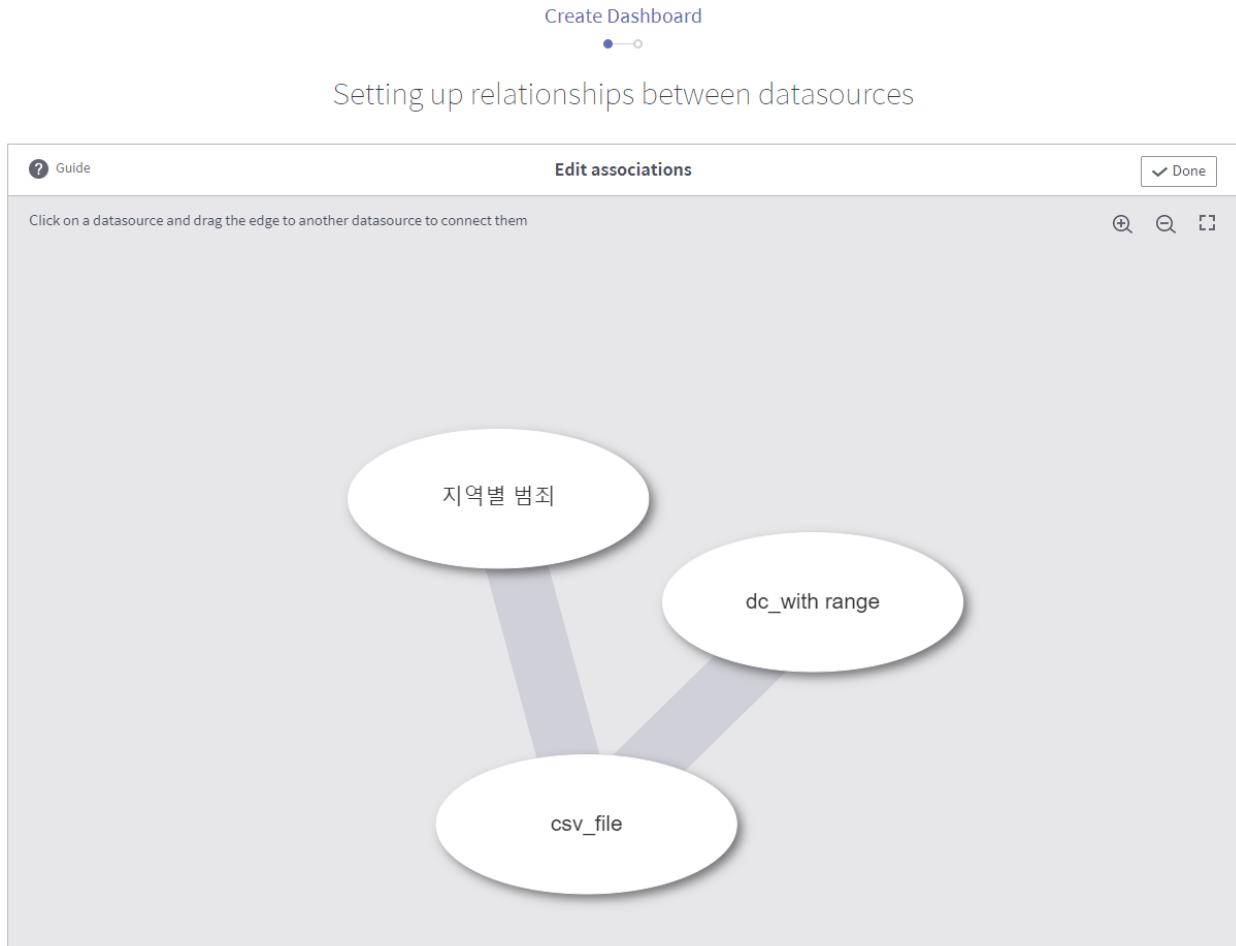
4. Once you drag a data source to another one, a new window will pop up to prompt you to configure the data source association. Select a column on each table as an association key by which to filter the other data source. And click **Done**.

Set Association

[Cancel](#)[Done](#)

csv_file				dc_with range			
Category		City	Country	Category		City	Country
OrderDate_str	Category	City	Country	OrderDate	Category	City	Country
2011-04-01 00:00:00	Office Supplies	Houston	United States	2011-01-12 00:00:00	Furniture	Dover	United States
2011-06-01 00:00:00	Office Supplies	Philadelphia	United States	2011-01-14 00:00:00	Furniture	Mount Pleasant	United States
2011-08-01 00:00:00	Furniture	Huntsville	United States	2011-01-14 00:00:00	Furniture	San Francisco	United States
2011-08-01 00:00:00	Office Supplies	Huntsville	United States	2011-01-14 00:00:00	Office Supplies	Bossier City	United States
2011-11-01 00:00:00	Furniture	Springfield	United States	2011-01-14 00:00:00	Office Supplies	Bossier City	United States
2011-11-01 00:00:00	Office Supplies	Springfield	United States	2011-01-14 00:00:00	Office Supplies	Bossier City	United States
				2011-01-14 00:00:00	Office Supplies	Bossier City	United States
				2011-01-14 00:00:00	Office Supplies	Newark	United States
				2011-01-14 00:00:00	Office Supplies	Newark	United States
				2011-01-14 00:00:00	Office Supplies	San Francisco	United States
				2011-01-14 00:00:00	Office Supplies	San Francisco	United States
				2011-01-14 00:00:00	Technology	Bossier City	United States
				2011-01-15 00:00:00	Furniture	Philadelphia	United States
				2011-01-16 00:00:00	Technology	Roswell	United States
				2011-01-17 00:00:00	Furniture	Philadelphia	United States
				2011-01-17 00:00:00	Office Supplies	Philadelphia	United States
				2011-01-17 00:00:00	Technology	Philadelphia	United States
				2011-01-19 00:00:00	Office Supplies	Springfield	United States
				2011-01-20 00:00:00	Furniture	Scottsdale	United States
				2011-01-20 00:00:00	Office Supplies	Scottsdale	United States
				2011-01-20 00:00:00	Office Supplies	Scottsdale	United States
				2011-01-21 00:00:00	Furniture	Jonesborough	United States
				2011-01-21 00:00:00	Furniture	Jonesborough	United States

5. Once you have finished setting up associations between the master data sources, click **Done**.



6. Re-configure master data source associations or add other data sources to be joined to the top data source selected above as described below:

Create Dashboard

Setting up relationships between datasources

Data preview

dc_with range

OrderDate	Category	City	Country	CustomerName	OrderId	PostalCode	ProductName	Quantity	Region	Segment
2011-01-12 00...	Furniture	Dover	United States	Seth Vernon	CA-2011-1...	19901	DAXValue U-Cha...	2	East	Consl
2011-01-14 00...	Furniture	Mount P...	United States	Natalie DeCherney	CA-2011-1...	29464	Global Highback...	6	South	Consl
2011-01-14 00...	Furniture	San Fra...	United States	Brian Dahlen	CA-2011-1...	94109	OSullivan Elevati...	3	West	Consl
2011-01-14 00...	Office Supplies	Bossier ...	United States	Chris Selesnick	CA-2011-1...	71111	Brown Kraft Recy...	3	South	Corpo
2011-01-14 00...	Office Supplies	Bossier ...	United States	Chris Selesnick	CA-2011-1...	71111	Fellowes Stor/Dr...	6	South	Corpo
2011-01-14 00...	Office Supplies	Bossier ...	United States	Chris Selesnick	CA-2011-1...	71111	Staples	2	South	Corpo
2011-01-14 00...	Office Supplies	Bossier ...	United States	Chris Selesnick	CA-2011-1...	71111	Staples	3	South	Corpo
2011-01-14 00...	Office Supplies	Newark	United States	Michael Moore	CA-2011-11...	43055	Avery Metallic Pol...	2	East	Consl

Manage Scheme

Unlink

Cancel **Next**

Master data source association view



- : Click on it to add a new master data source.

- Edit association:** Click on it to edit an established data source association.

Settings panel for individual master data sources (click one of the ovals corresponding to a master data source on the diagram to open it)

- Data preview:** Displays the data table resulting from data source joins.

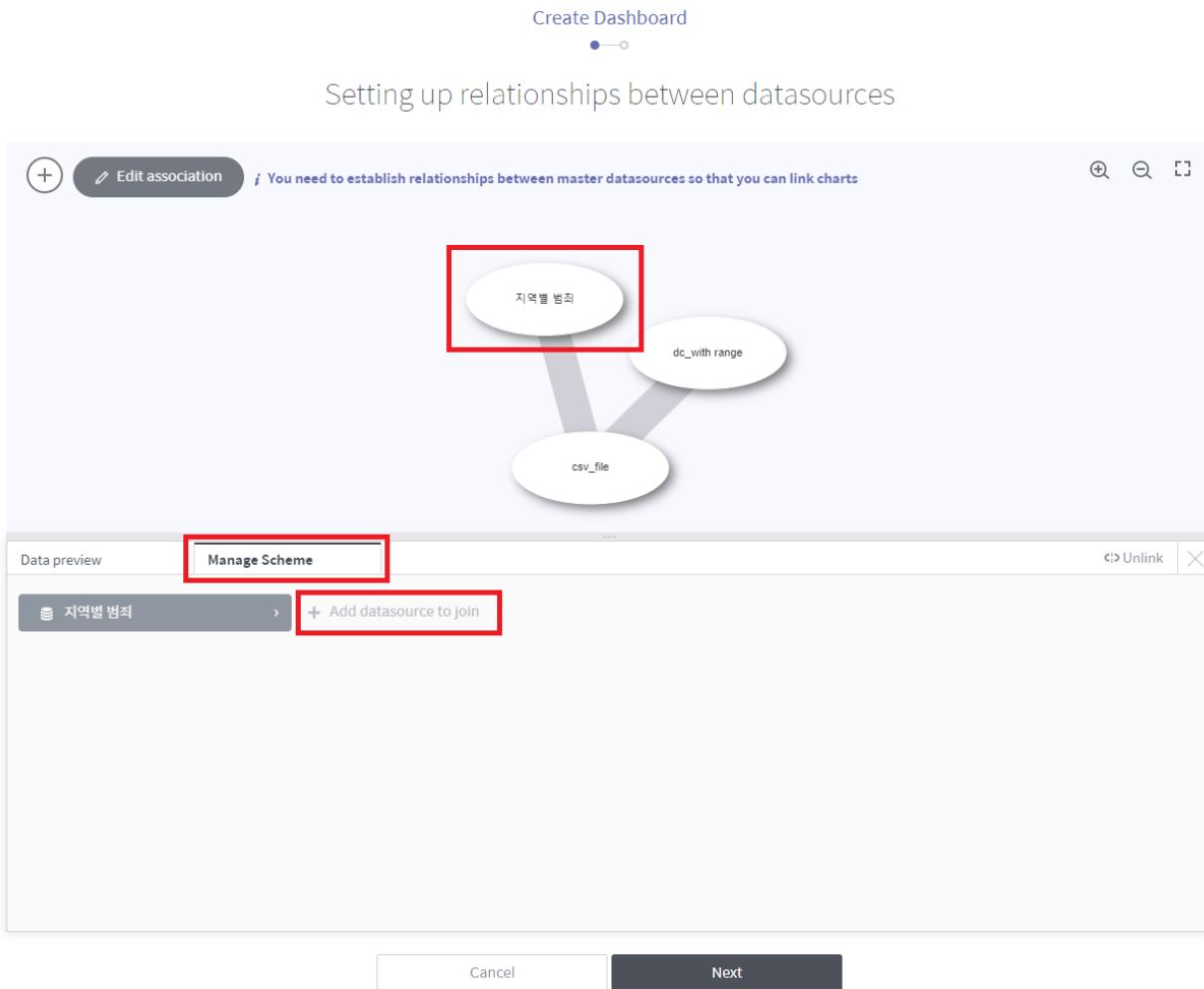
- Manage schema:** Allows you to manage joins to the selected data source (for a detailed procedure, refer to the next step).

- Unlink:** Click on it to remove the selected data source.



- : Click on it to close the panel.

7. To join one of the master data sources to other data sources, click the corresponding oval on the diagram → click the **Manage Schema** tab on the panel at the bottom → click **+ Add a data source to join**.



8. Refer to the description below to set up data joins.

Join

Cancel

Join

Master datasource

지역별 범죄

대분류	서울	부산	광주	세종	cu
교통범죄	74270	32944	22137	1234	
기타범죄	44407	22296	4809	495	
노동범죄	509	209	29	6	
마약범죄	1449	963	75	8	
병역범죄	4120	662	330	131	
보건범죄	3875	2365	249	22	
선거범죄	180	60	7	7	
안보범죄	19	6	8	1	
절도범죄	46861	16777	6050	638	
지능범죄	72137	25052	8896	821	
특별경제…	17109	8134	1616	357	

Datasource to join

Sales Report

GeoPoint	OrderDate	Category	City
29.8941,-95.99	2011-01-04T00:00:00	Office Supplies	Hous
41.7662,-88.11	2011-01-05T00:00:00	Office Supplies	Nape
41.7662,-88.11	2011-01-05T00:00:00	Office Supplies	Nape
41.7662,-88.11	2011-01-05T00:00:00	Office Supplies	Nape
39.9448,-75.12	2011-01-06T00:00:00	Office Supplies	Phila
37.8274,-87.00	2011-01-07T00:00:00	Furniture	Hend
33.9321,-83.00	2011-01-07T00:00:00	Office Supplies	Athei
37.8274,-87.00	2011-01-07T00:00:00	Office Supplies	Hend
37.8274,-87.00	2011-01-07T00:00:00	Office Supplies	Hend
37.8274,-87.00	2011-01-07T00:00:00	Office Supplies	Hend
37.8274,-87.00	2011-01-07T00:00:00	Office Supplies	Hend

Column = Column **Add to join keys**

Join type

Inner Left Right Full outer

1 join keys

대분류 = Category

Preview results

34 Columns 14 Rows

sales_report.ShipMode	sales_report.PostalCode	sales_report.DaysToShipActual	__wmnxd.대분류	sales_report.ShipSt
			교통범죄	
			기타범죄	
			노동범죄	
			마약범죄	

- **Master data source:** Displays information on the master data source to which you want to join another data source.
- **Datasource to join:** Select a data source to be joined to the master data source.
- **Add to join keys:** A join key defines the join relationship between the master and slave

data sources in each column. Select a column to be joined from each data source, and click this button to add a new join key. For this, the two columns must be of the same data type.

- **Join type:** Select how to join and transform a data source. To help you understand, each join type is explained below using the following tables as an example.

Table 1: Master data source

Product name (join key)	Price
A	\$22.11
B	\$9.23
C	\$8.99
D	\$10.10

Table 2: Data source to be joined

Product name (join key)	Sales
B	100
D	200
E	50

- **Inner:** Imports those records of each data source whose join key column values are present also in the other data source's join key column, joins them, and stores the joined records in the resulting table. (Intersection between two data sources)

Product name (join key)	Price	Sales
B	\$9.23	100
D	\$10.10	200

- **Left:** Imports those records of the right data source (data source to be joined) whose join key column values are present also in the join key column of the left data source (master data source to join), joins them to the left data source records, and stores the joined records in the resulting table. Those records from the right data source whose join key column values are not present in the left data source are discarded.

Product name (join key)	Price	Sales
A	\$22.11	null
B	\$9.23	100
C	\$8.99	null
D	\$10.10	200

- **Right:** Imports those records of the left data source (master data source to join) whose join key column values are present also in the join key column of the right data source (data source to be joined), joins them to the right data source records, and stores the joined records in the resulting table. Those records from the left data source whose join key column values are not present in the right data source are discarded.

Product name (join key)	Price	Sales
B	\$9.23	100
D	\$10.10	200
E	\$null	50

- **Full Outer:** Imports all records from both data sources, join them, and stores the joined records in the resulting table. (Union between two data sources)

Product name (join key)	Price	Sales
A	\$22.11	null
B	\$9.23	100
C	\$8.99	null
D	\$10.10	200
E	\$null	50

- **Preview results:** Displays the data table resulting from data source joins.
9. Confirm the information on the imported data source, enter the **Name** and **Description**, and click **Done** to create a new dashboard.

Create Dashboard
Please complete dashboard creation

○ — ●

Workbook 3.2 집중테스트 통계

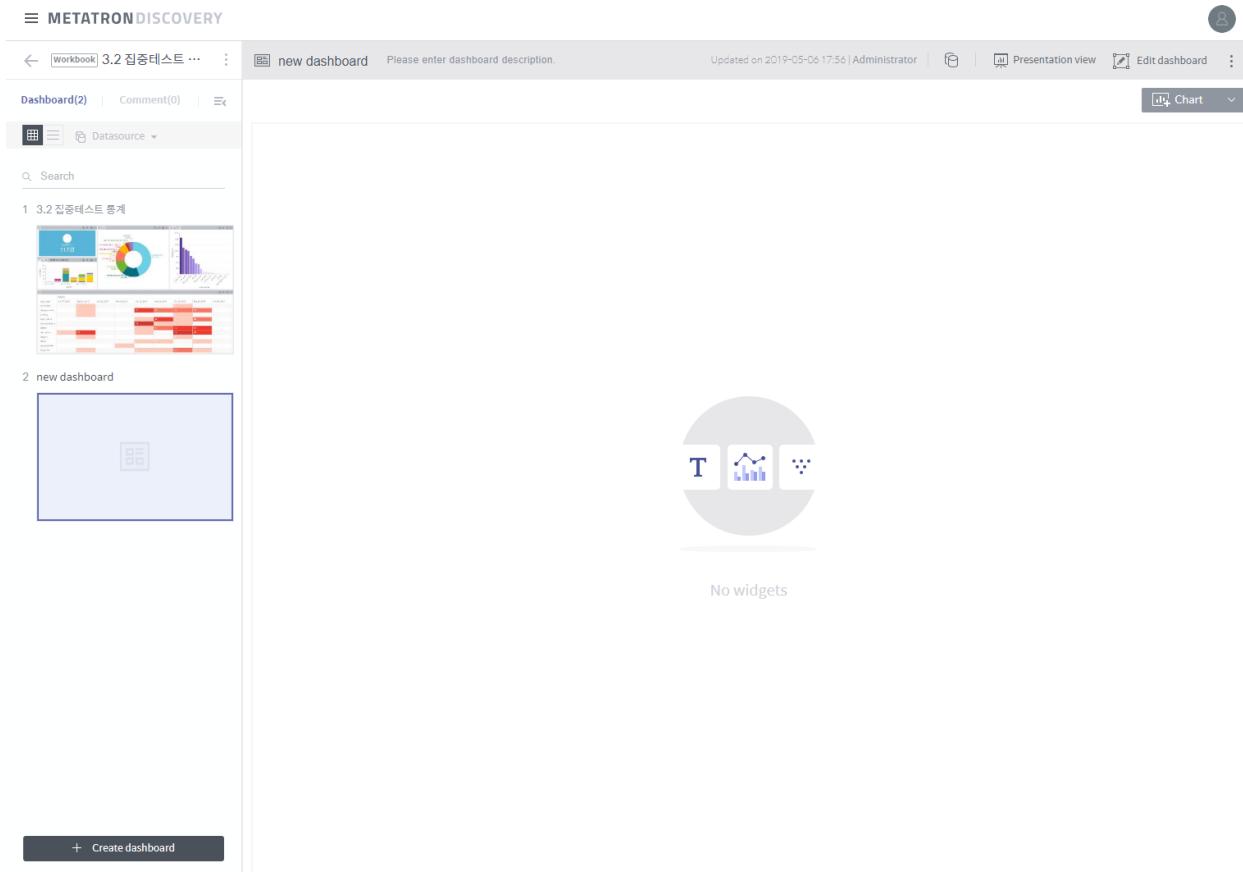
Datasource 지역별 범죄 / sales_report
 csv_file
 dc_with range

Name
Please enter a name

Description
Please enter a description

Previous Done

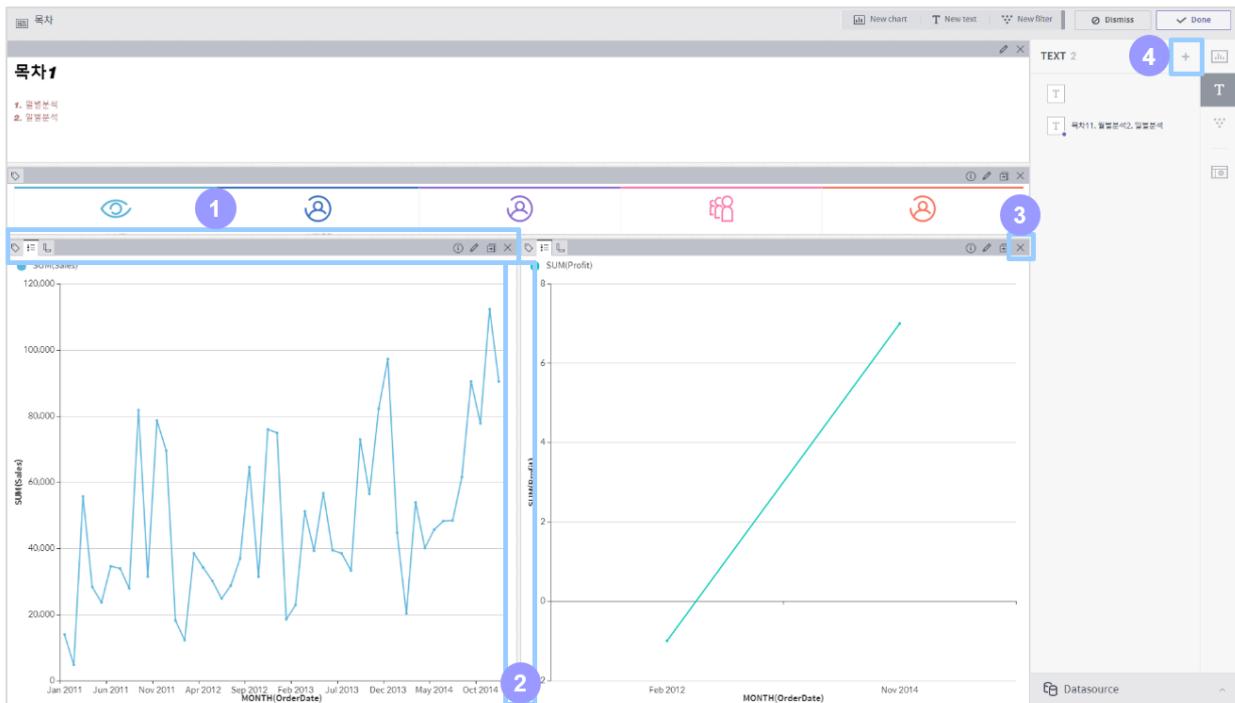
10. The new dashboard will be added to the workbook home. Click the dashboard to display its contents.



5.2.2 Change dashboard size and layout

Click **Edit Dashboard** on the basic dashboard page to go to a page for editing the configuration of the dashboard. In this page, you can add a widget, edit the dashboard, set the hierarchy and change the layout.

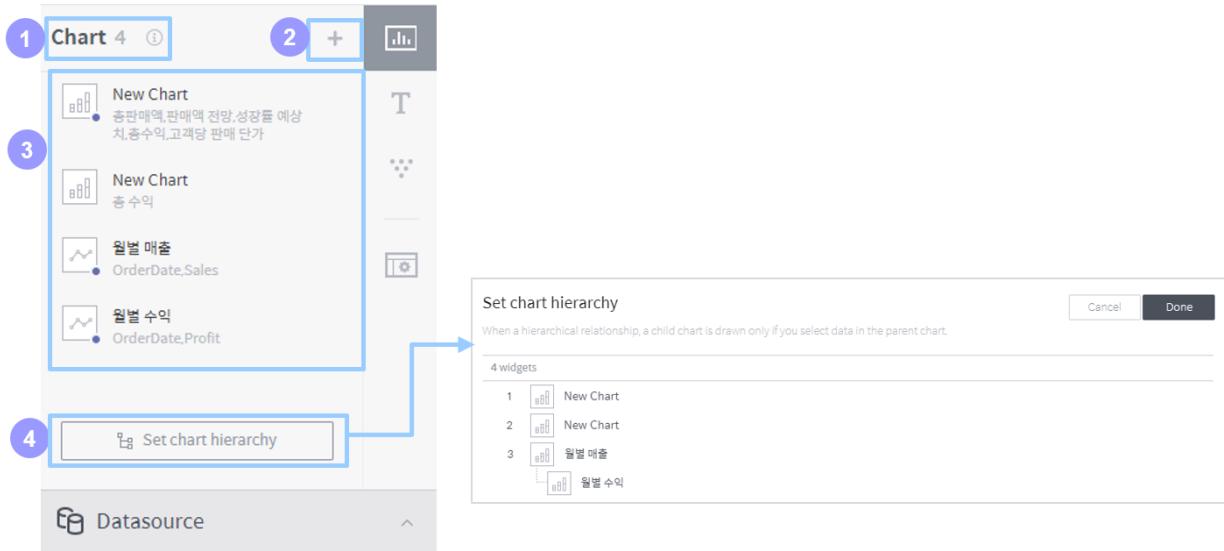
Dashboard widget arrangement settings



- 1. Change widget location:** Drag the title of a widget to move the widget.
- 2. Adjust widget width:** Move the distance between widgets to adjust their widths.
- 3. Add a widget to the display area:** Drag a widget from the widget list on the right panel to the left widget display area to add the widget to the display area.
- 4. Delete a widget from the display area:** Click the X button on a widget shown in the widget display area to delete the widget from the display area.

Chart widget panel

On the chart widget panel, you can add/edit/delete a chart in the dashboard.



1. **Number of chart widgets:** Displays how many chart widgets are registered in the dashboard.
2. **Add a chart widget:** Click on it to create a new chart widget in the dashboard.
3. **Chart widget list:** Lists chart widgets registered in the dashboard. Hover the mouse over a widget to display the edit and delete icons. Drag a widget to the widget display area to display the widget in the display area.
4. **Set chart hierarchy:** Click on it to set parent/child relationships between charts in the dashboard. Selecting a data item from the parent chart filters the child chart by the selection. To set a hierarchy, drag the chart to be set as a child under the chart to be set as a parent. Once you finish setting the chart hierarchy, the chart menu is restructured accordingly.

Text widget panel

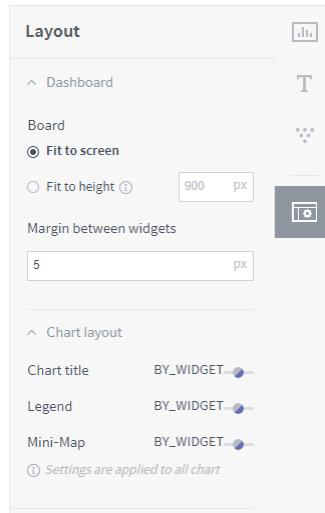
On the text widget panel, you can add/edit/delete a text widget in the dashboard.



1. **Number of text widgets:** Displays how many text widgets are registered in the dashboard.
2. **Add a text widget:** Click on it to create a new text widget in the dashboard.
3. **Text widget list:** Lists text widgets registered in the dashboard. Hover the mouse over a widget to display the edit and delete icons. Drag a widget to the widget display area to display the widget in the display area.

Layout panel

On the layout panel, you can adjust some settings on how to arrange widgets and display each widget in the widget display area.



- **Set board height**
 - **Fix to screen:** Maximizes the height of the dashboard to fill the screen.
 - **Fix to height:** Set the height of the dashboard to a specific pixel value.
 - **Margin between widgets:** Sets the margin between widgets in the widget display area.
- **Chart title:** Sets whether to display the title of each chart and filter widget in the widget display area.
- **Legend:** Sets whether to display a legend for each chart widget in the widget display area.
- **Mini-map:** Sets whether to display a mini-map for each chart widget in the widget display area.

Data source panel

In the data source panel, you can view and edit information on connected data sources, as well as add column filters easily. Click on a filter icon on a dimension or measure on the right-hand side to add a filter.

The screenshot shows the 'Datasource' panel with the title 'Sales Report'. At the top, there is a search bar labeled 'Search'. Below it, the 'Dimension' section is expanded, listing various dimensions: 'GeoPoint', 'OrderDate' (selected), 'Category', 'City', 'Country', 'CustomerName', 'OrderID', 'PostalCode', and 'ProductName'. Each dimension has a small icon to its left and a plus sign (+) to its right. At the bottom of the dimension list are navigation buttons '< Previous' and 'Next >'. Below the dimension section, the 'Measure' section is expanded, listing measures: 'Discount', 'Profit' (selected), 'Quantity', 'Sales', 'DaystoShipActual', and 'SalesForecast'. Each measure has a small icon to its left and a plus sign (+) to its right. At the bottom of the measure list are navigation buttons '< Previous' and 'Next >'.

Please note that the filters you can apply or clear here are global filters applied to the entire dashboard, and those applied or cleared in the chart editor are all chart filters.

5.2.3 Check data sources in a dashboard

Click the  button on the basic dashboard page to display a dialog box displaying information about the data source used in the dashboard. At the top-left corner, you can choose the data source that you want to view. This dialog box consists of three tabs (Data grid, Column detail, Dashboard data information).

Data grid tab

Displays all values in the data source.

Sales Report														Data details - used in sales performance		X													
Data grid		Column detail		①															 Download										
OrderDate		All		Today		Last 7 days		2011-01-04 09:00		~		2014-12-30 09:00		Apply															
GeoPoint	OrderDate	Category	City	Country	CustomerName	Discount	OrderID	PostalCode	ProductName	Profit	Quantity	Region	Role	All	Dimension	Measure	Type	All	②	100	/ 9,987 Row	③	④	⑤	⑥	⑦	⑧		
34.066,-11...	2014-12-30T...	Technology	Los Angeles	United States	James Galang	0.2	CA-2014-1...	90049	Adtran 1202752G1	23	3	W																	
40.8011,-7...	2014-12-30T...	Office Supp...	New York C...	United States	Michael Chen	0	US-2014-1...	10035	Ideal Clamps	3	3	E																	
38.1593,-8...	2014-12-30T...	Office Supp...	Louisville	United States	Katherine Hughes	0	US-2014-1...	40214	Panasonic KP-3...	10	1	S																	
38.1593,-8...	2014-12-30T...	Office Supp...	Louisville	United States	Katherine Hughes	0	US-2014-1...	40214	GBC ProClick Sp...	6	1	S																	
43.012,-85...	2014-12-30T...	Office Supp...	Grand Rapids	United States	Ken Brennan	0	CA-2014-1...	49505	Xerox 1915	101	2	C																	
47.8353,-1...	2014-12-30T...	Office Supp...	Edmonds	United States	Bruce Stewart	0	CA-2014-1...	98026	Acco Glide Clips	10	5	W																	
38.1593,-8...	2014-12-30T...	Furniture	Louisville	United States	Katherine Hughes	0	US-2014-1...	40214	Harbour Creatio...	78	3	S																	
38.1593,-8...	2014-12-30T...	Furniture	Louisville	United States	Katherine Hughes	0	US-2014-1...	40214	Global Leather a...	87	1	S																	
38.1593,-8...	2014-12-30T...	Furniture	Louisville	United States	Katherine Hughes	0	US-2014-1...	40214	DMI Arturo Colle...	314	8	S																	
34.066,-11...	2014-12-30T...	Furniture	Los Angeles	United States	James Galang	0.2	CA-2014-1...	90049	Global High-Bac...	-44	4	W																	
47.8353,-1...	2014-12-30T...	Furniture	Edmonds	United States	Bruce Stewart	0	CA-2014-1...	98026	Hand-Finished S...	21	2	W																	
33.8186,-1...	2014-12-30T...	Furniture	Anaheim	United States	Ben Peterman	0	CA-2014-1...	92804	Nu-Dell Executiv...	37	8	W																	
40.7864,-7...	2014-12-29T...	Technology	New York C...	United States	Jennifer Ferguson	0	CA-2014-1...	10024	Cush Cases Hea...	4	3	E																	
37.7509,-1...	2014-12-29T...	Office Supp...	San Francis...	United States	Kristen Hastings	0	CA-2014-1...	94110	Adjustable Dept...	210	4	W																	
30.5145,-9...	2014-12-29T...	Office Supp...	Round Rock	United States	Greg Hansen	0.2	CA-2014-1...	78664	Stanley Bostitch ...	3	2	C																	
40.7111,-8...	2014-12-29T...	Office Supp...	Peoria	United States	Lori Olson	0.8	CA-2014-1...	61604	Computer Printo...	-3	5	C																	
40.7864,-7...	2014-12-29T...	Office Supp...	New York C...	United States	Jennifer Ferguson	0.2	CA-2014-1...	10024	Storex Dura Pro ...	11	7	E																	
40.7864,-7...	2014-12-29T...	Office Supp...	New York C...	United States	Jennifer Ferguson	0	CA-2014-1...	10024	OIC Bulk Pack M...	6	4	E																	
40.7864,-7...	2014-12-29T...	Office Supp...	New York C...	United States	Jennifer Ferguson	0	CA-2014-1...	10024	Avery 473	35	7	E																	
36.0725,-8...	2014-12-29T...	Office Supp...	Nashville	United States	Erica Hernandez	0.2	CA-2014-1...	37211	Carina Double W...	-13	1	S																	
40.4262,-1...	2014-12-29T...	Office Supp...	Loveland	United States	Pamela Coakley	0.7	US-2014-1...	80538	Avery Reinforce...	-1	2	W																	
46.8564,-9...	2014-12-29T...	Office Supp...	Fargo	United States	Christopher Schild	0	CA-2014-1...	58103	Wilson Jones Im...	13	5	C																	
44.0521,-0...	2014-12-29T...	Office Supp...	Edmon...	United States	Christopher Schild	0	CA-2014-1...	50102	Stanley	1	1	C																	

Column details tab

Displays details about each column of the data source.

Column name	Logical column name
GeoPoint	GeoPoint
OrderDate	OrderDate
Category	Category
City	City
Country	Country
CustomerName	CustomerName
Discount	Discount
OrderID	OrderID
PostalCode	PostalCode
ProductName	ProductName
Profit	Profit
Quantity	Quantity
Region	Region
Sales	Sales
Segment	Segment
ShipDate	ShipDate
ShipMode	ShipMode
State	State
Sub_Category	Sub_Category
DaystoShipActual	DaystoShipActual
SalesForecast	SalesForecast
ShipStatus	ShipStatus
DaystoShipScheduled	DaystoShipScheduled
OrderProfitable	OrderProfitable
SalesperCustomer	SalesperCustomer
ProfitRatio	ProfitRatio
SalesaboveTarget	SalesaboveTarget

Column information

Column name	GeoPoint
Role	Dimension
Type	Point

Column Settings

Missing	Do not apply
---------	--------------

Metadata

Logical Column Name	GeoPoint
Dictionary	
Code table	
Description	

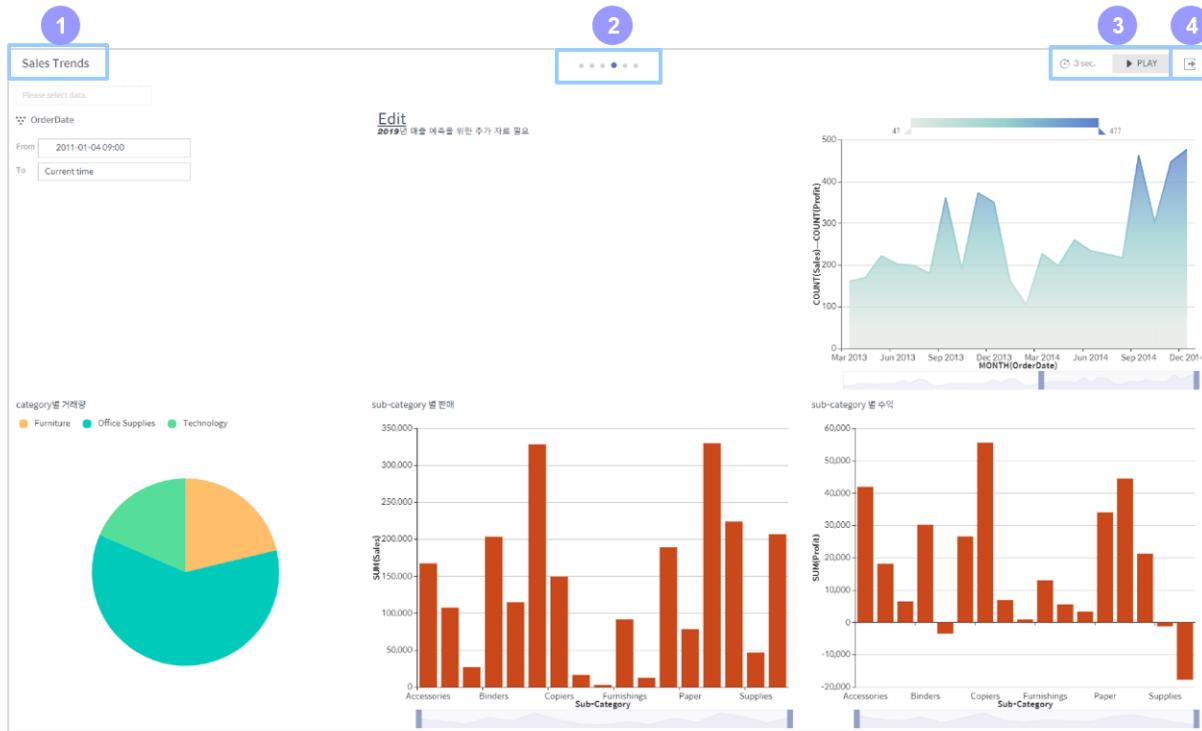
Dashboard data information tab

Displays an overview of the data source.



5.2.4 Presentation with a dashboard

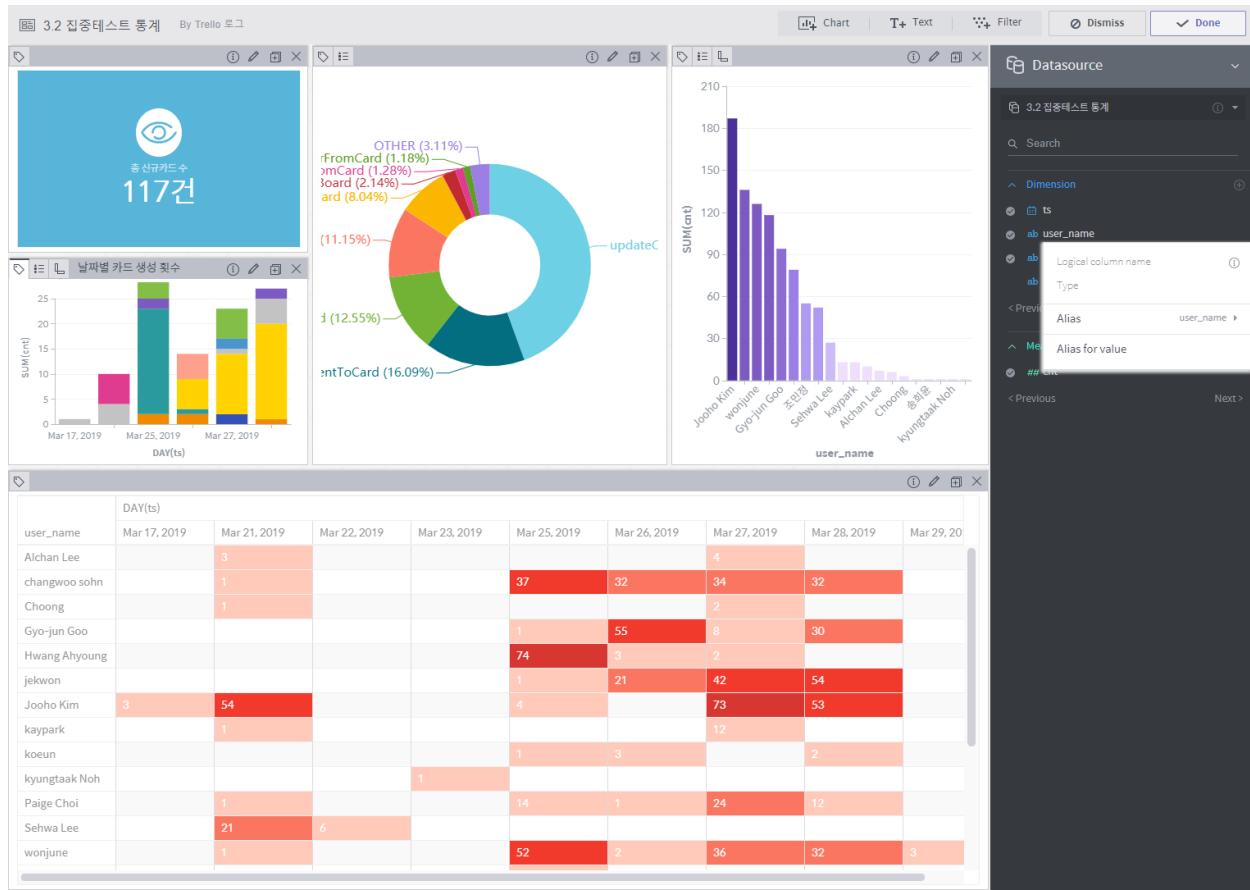
Click **Presentation view** on the basic dashboard page to view workbook dashboards with a presentation UI. In this mode, you can easily report and share data analytics results.



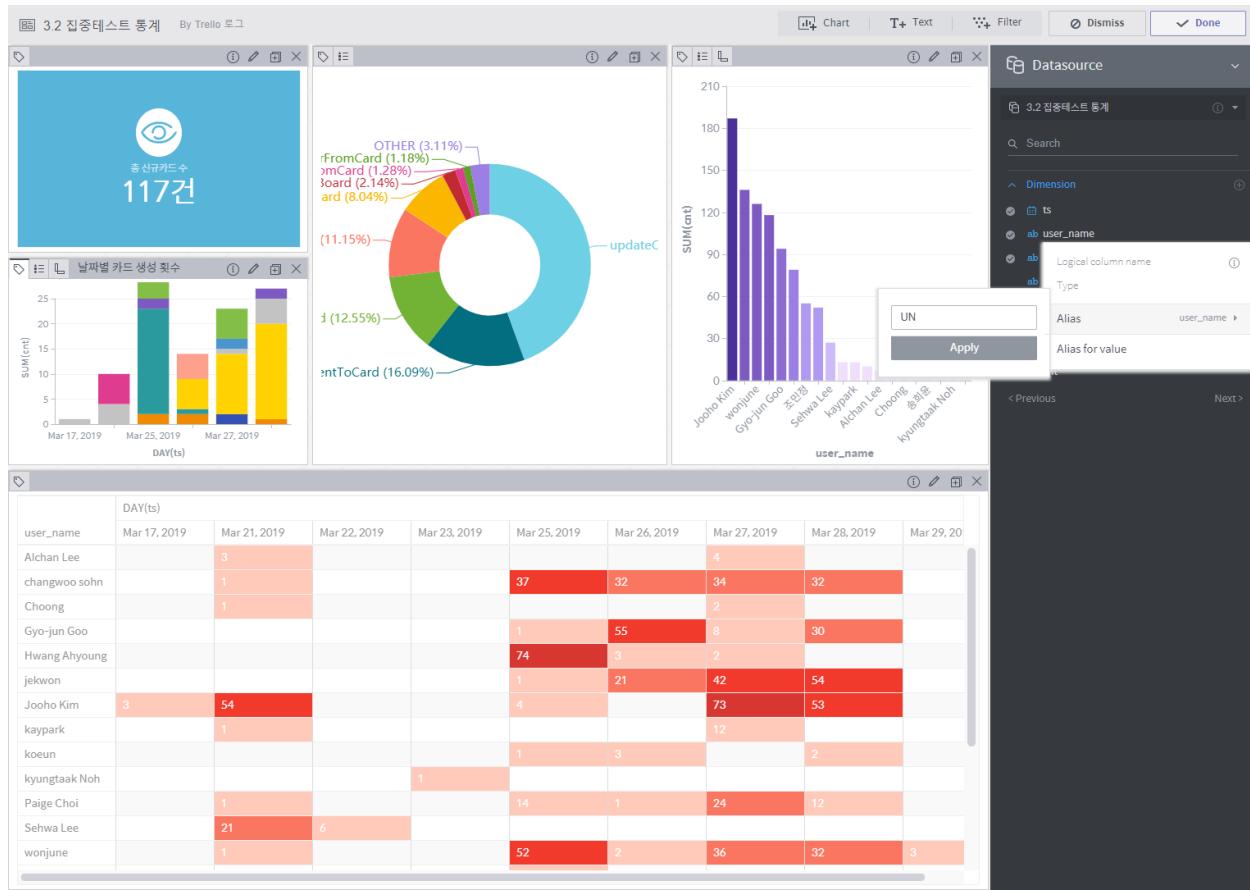
1. **Name:** Name of the current dashboard.
2. **Slide navigation:** Each circle represents a different dashboard in the workbook. For example, if you click the 4th circle, the 4th dashboard slide will be displayed with that circle highlighted.
3. **Auto slide show settings:** Select a duration for each slide and click PLAY to start an auto slide show.
4. **Exit:** Closes the presentation view and returns to the workbook/dashboard basic page.

5.2.5 Renaming columns

Hover the mouse over a column name on the data source panel in dashboard editing mode, and click the icon on the right to check the alias of the column.



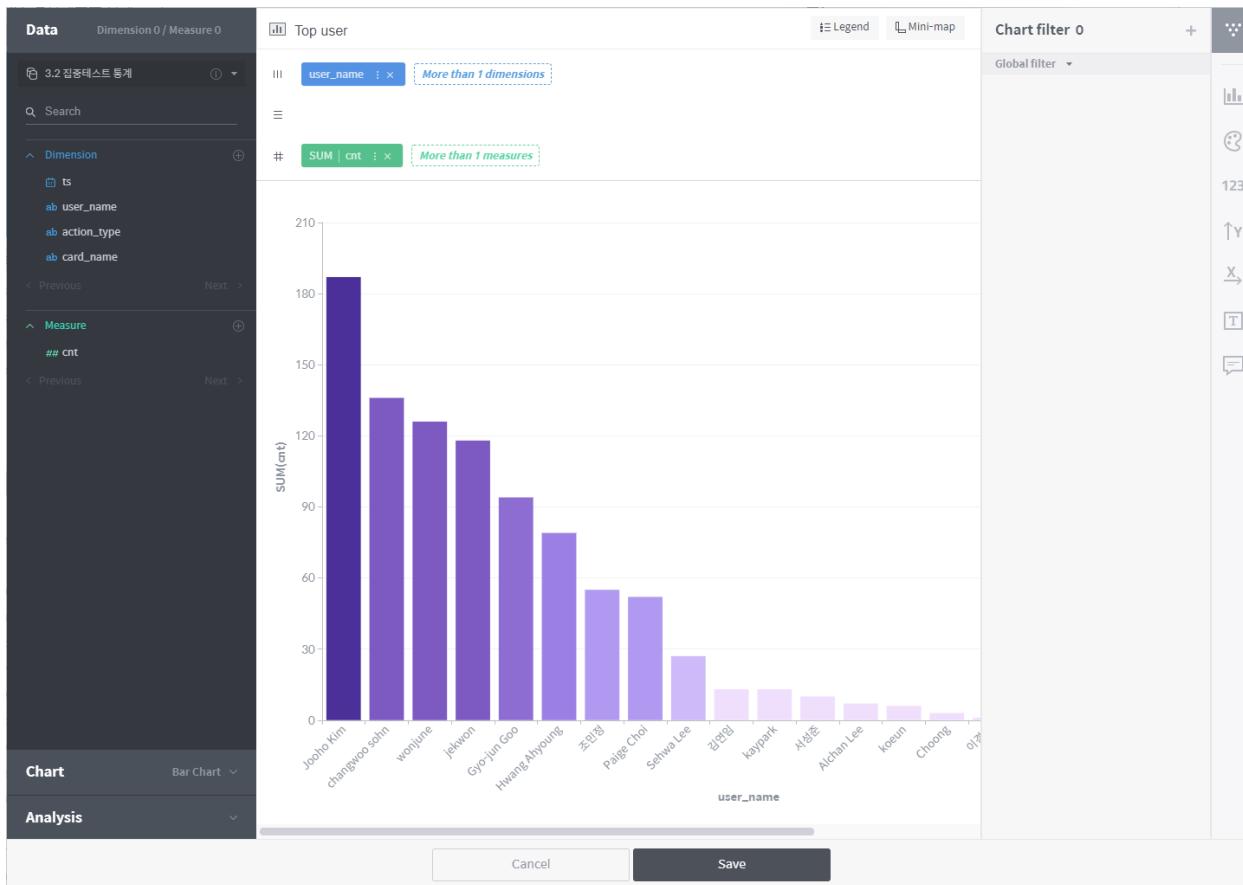
Hover the mouse over the alias to open a window where you can enter a new column name. After entering the name, click **Apply** to see the change applied.



5.3 Chart

Charts that analyze and visualize data are the main components of a dashboard. This section describes some concepts that you need to understand to create a chart for data analytics, as well as the elements that make up the chart configuration UI.

The chart home is divided into the following three sections:



- Column/chart selection section:** This section is so organized that you can create a chart step by step. You can either choose columns under the Data menu to have appropriate chart types suggested, or select a chart type under the Chart menu before choosing data columns. In addition, you can configure some analytics settings under the Analytics menu.
- Visualization section:** This section is composed of the shelves onto which columns are put and the visualization area where the chart is displayed. Once data and a chart type are selected in the column/chart selection section, the chart is drawn in this area.
- Option section:** Used to customize the appearance and display of the chart. Depending on the chart type, the option section may include the filter, palette, axis, numeric format, and chart format areas.

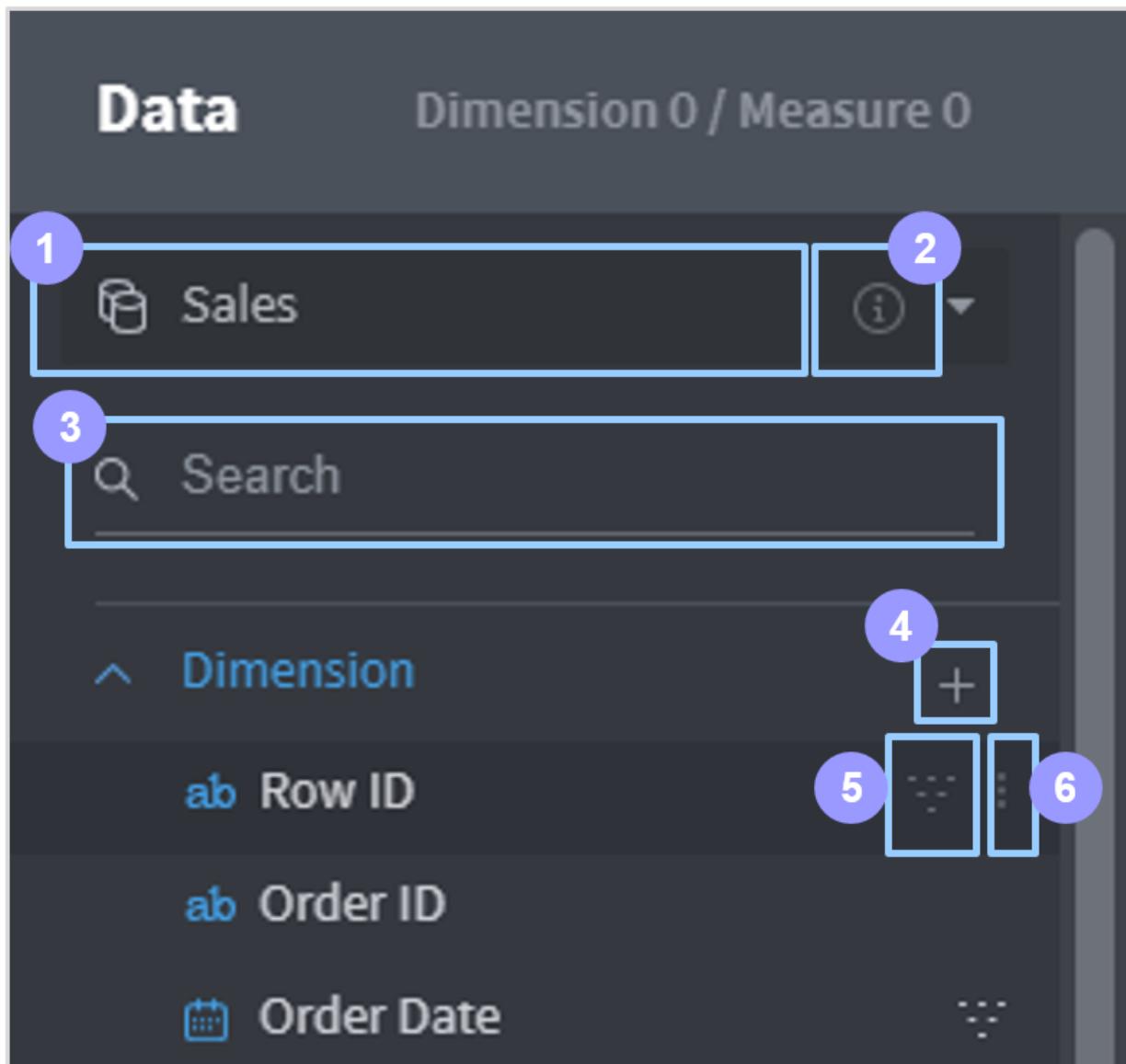
In the subsequent subsections, we will explain how to use this user interface to create and manage various types of charts.

5.3.1 Data column list

The columns listed in the data column list are categorized into “dimensions” and “measures.” For the concept of dimensions and measures, refer to “Dimensions” and “Measures”.

Structure of the data column list

In the data column list, you can view and edit information on connected data sources, as well as add or remove column filters easily.



1. Select/set data source: Allows you to select a data source or configure its associations

and joins.

2. **Data details:** Click on it to pop up a dialog box displaying information about the selected data source.
3. **Search by column name:** Searches the column list by name.
4. **Add custom column:** Click on it to open the dialog box to create a new column by combining/processing data source columns. Custom columns are commonly used throughout the dashboard.
5. **Apply/clear filter:** Hover the mouse over a column to display this button. Click on it to apply a chart filter to the column, and click again to clear the chart filter. For columns to which a filter is applied, the  icon is displayed regardless of the mouse position.
6. **More:** Hover the mouse over a column to display this button. It is used to check additional information on the column and set an alias.
 -  : Click on it to pop up a dialog box displaying a summary of the column and its data values.
 - **Logic column name:** Shows the logical name of the column.
 - **Type:** Shows the logical type of the column.
 - **Alias:** Sets a column alias. A regular column name can contain only alphanumeric characters and a limited number of special characters with no spaces allowed. Therefore, setting an alias may help to identify the column for convenient analytics work. Aliases are commonly used throughout the dashboard.
 - **Value alias:** You can also set an alias for each data value in the column. Aliases are commonly used throughout the dashboard.

Add a custom column

Click the + button on the data source column list to open a dialog box for adding a custom column. By applying various formulas to existing columns of the data source, you can create a new column that helps create your desired chart.

Custom column

Column name: DIMENSION_1

Coding box: `CAST([OrderDate], 'text')`

Validation check: ✓ There is no abnormality in the formula

Recommendation

Add column:

- OrderDate
- Category
- City
- Country
- CustomerName
- Discount
- OrderId
- PostalCode
- ProductName
- Profit
- Quantity
- Region
- Sales

Add formula:

- ALL
- CASE
- IN
- TYPE_CONVERT FUNCTION
- CAST**
- TIMESTAMP
- UNIX_TIMESTAMP
- TIME FUNCTION
- DATEDIFF
- NOW
- ETC FUNCTION
- IPV4_IN

CAST (TYPE_CONVERT FIELD)

지정한 타입으로 값을 변환하여 반환합니다.

CAST(parameta.type)

- parameta: 은(는) 변환할 대상이 되는 문자열 혹은 숫자입니다.
- type: 은(는) 'DOUBLE', 'LONG', 'STRING', 'DATETIME' 중 하나로 변환할 타입입니다.

CAST('100.123', 'DOUBLE') => 100.123

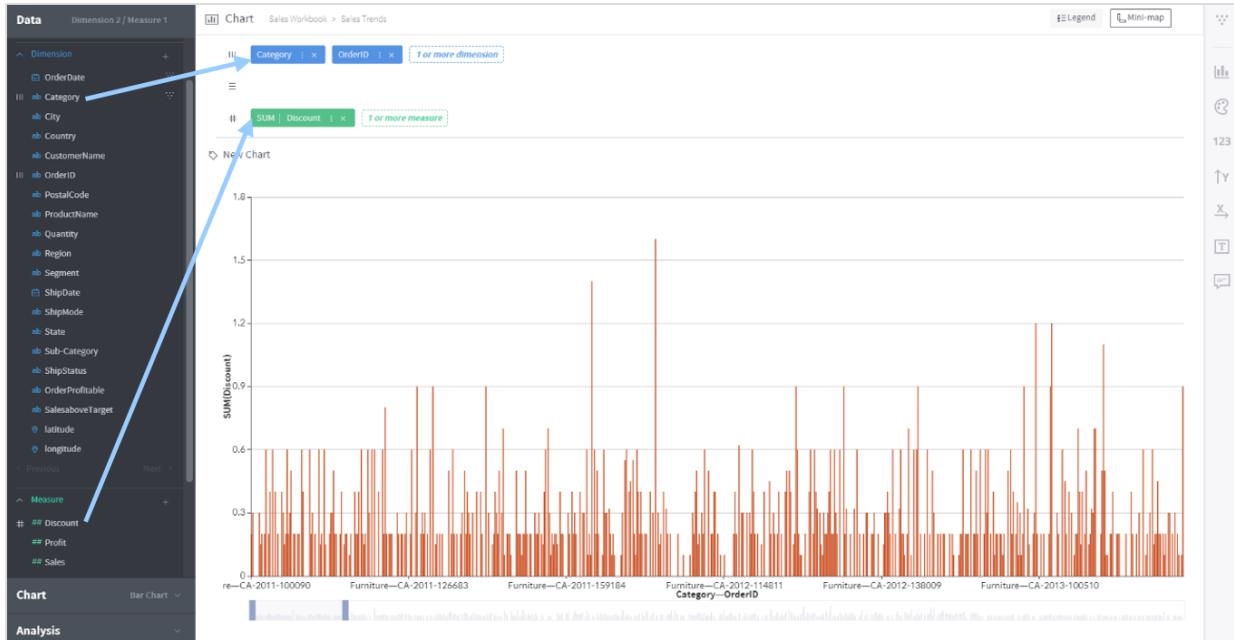
CAST(TIMESTAMP('2016-01-01T12:00:00')) => 1452240000000

- 1. Column name:** Fill in a name for the custom column.
- 2. Coding box:** Write a code for the custom column. Click a list from the column or formula list below to type your selection in this box automatically.
- 3. Add column:** Lists the columns of the data source. Click a column in the list to automatically type your selection in the coding box.
- 4. Add formula:** Lists the formulas supported by Metatron. Click a formula in the list to type your selection in the coding box automatically, with the text cursor relocated to where a parameter needs to be inserted. For details on each formula's purpose, use, and examples, see the help box on the right.

5.3.2 Draw a chart (pivoting)

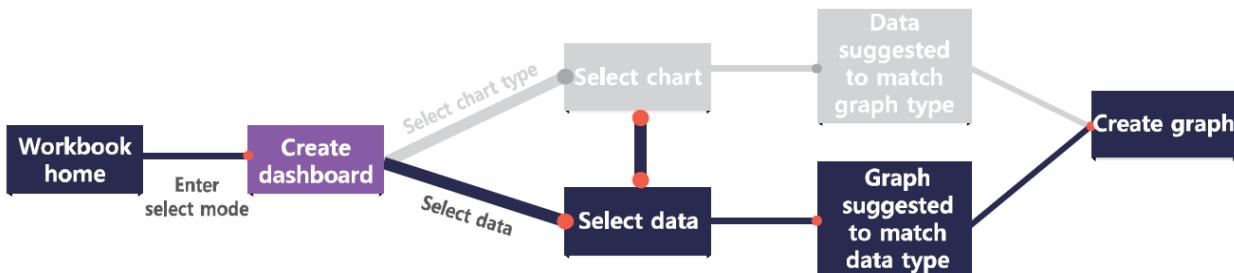
What is pivoting

Pivoting is a process of grouping the given table by specific columns, thereby helping the analyst view particular aspects of the source data in a graphic or tabular chart. This process includes selecting columns that contain meaningful data and placing them on the column/row/cross shelves.



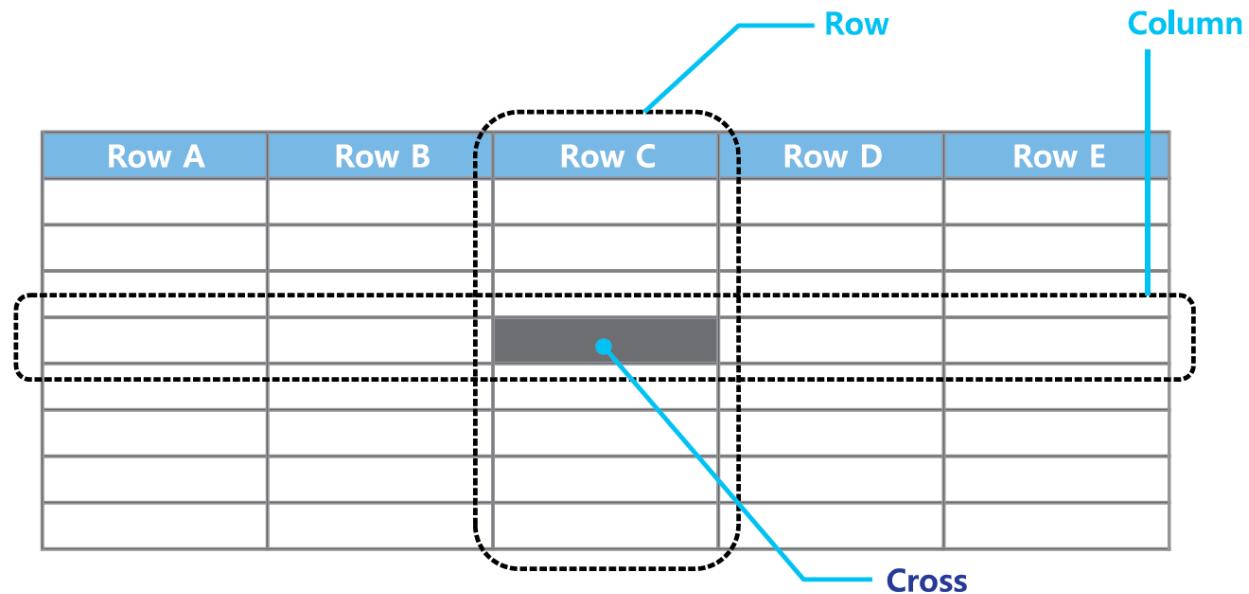
In the example shown above, two dimension columns are placed on the column shelf and one measure column is placed on the cross shelf. The chart displays data resulting from the columns placed on the shelves in this way.

Mandatory/recommended column types for each shelf vary depending on the chart type. Selecting a chart type before placing columns on a shelf shows the necessary column types for each shelf.

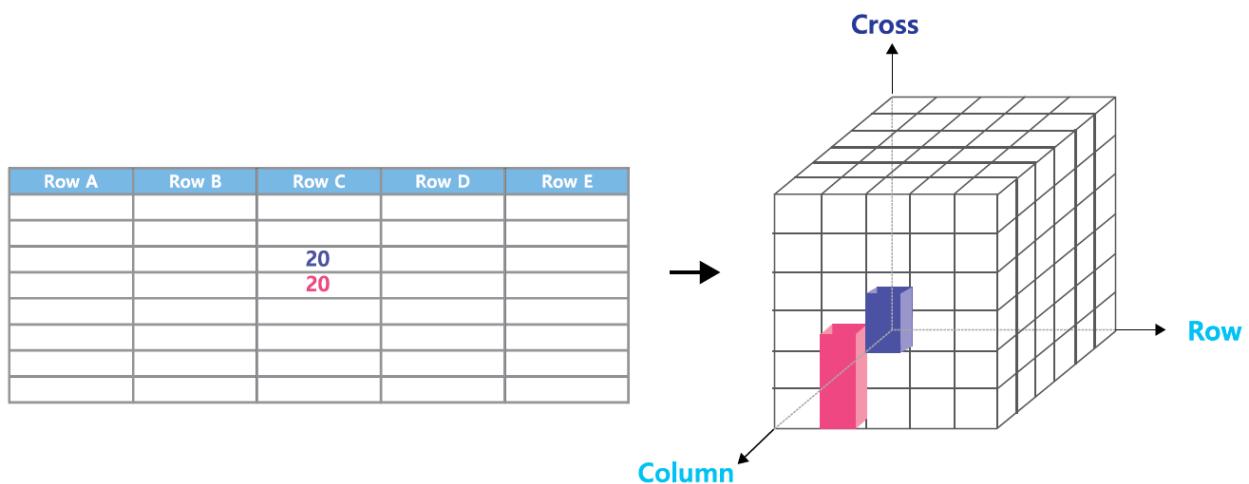


Column/row/cross shelves

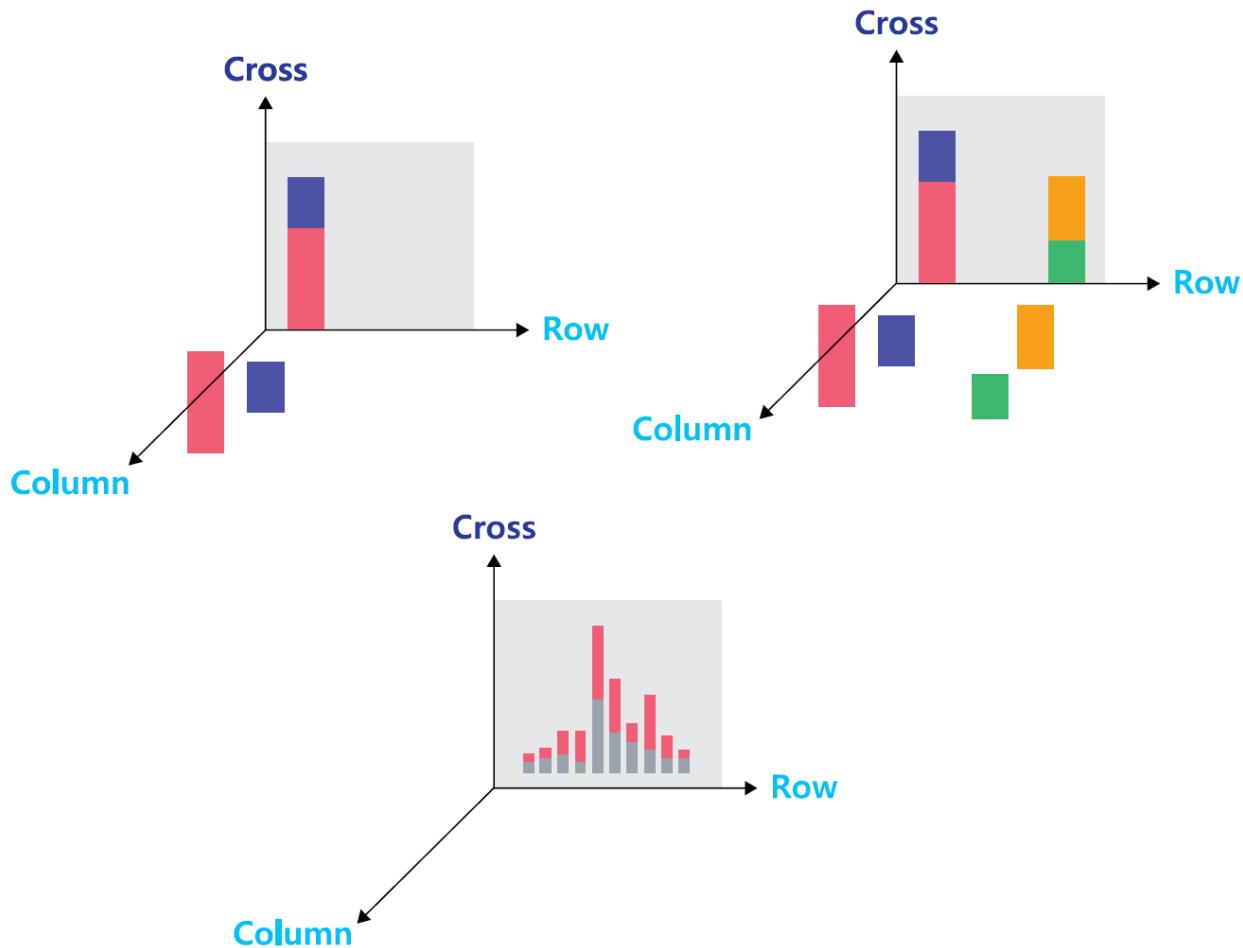
Think of the structure of Excel to understand what column/row/cross shelves work for. As shown below, the crossing of each column and row cross contains a value.



Whereas Excel shows data in a two-dimensional grid composed of columns, rows and crosses, Metatron is an OLAP data discovery tool capable of multidimensional data representation. In the following Metatron chart, the column, row, and crossing axes form a three-dimensional cube.

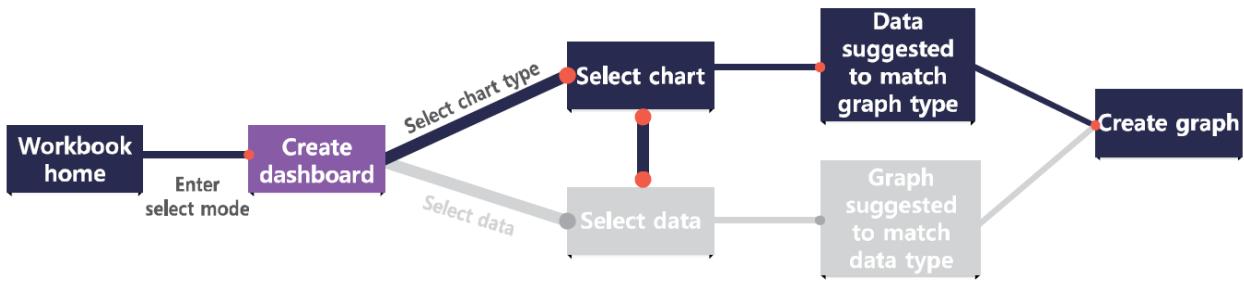


If the values of an Excel grid are displayed in a three-dimensional chart, each crossing value will be represented by a bar. However, Metatron needs to display such a chart two-dimensionally; for this, bars either in the same column or in the same row get stacked at one point while remaining distinctive from one another. The resulting two-dimensional chart is shown in the gray area of the chart below.



5.3.3 Select a chart type

Metatron Discovery provides about 20 types of charts. If you place columns on shelves before selecting a chart, suitable charts are highlighted in purple.



The table below summarizes conditions to create, uses, and examples for each chart.

Chart name/icon	Conditions to create	Characteristics	Uses	Examples
	Column: 1 or more dimensions / Cross: 1 or more measures	Compares the value of each item.	Used to compare groups or view trends over time. Very effective when the trend is significantly fluctuating.	Comparison between products regarding their sales and profits
	Column or row: 1 or more dimensions / Cross: 1 or more measures	Displays the values of crossings between two dimensions as text.	Used to view measure values aggregated by certain criteria. Useful to check exact values rather than a visualization of them.	Sales details by year
	Column: 1 or more dimensions / Cross: 1 or more measures	Displays data changes over time.	Used to view trends over time. If changes are moderate, a line chart is more effective than a bar chart.	Monthly sales trend
	Column: 1 measure / Row: 1 measure / Cross: 1 or more dimensions	Displays relations between items.	Used to define relations between two parameters.	Relations between product sales and profits
	Column or row: 1 or more dimensions / Cross: 1 or more dimensions	Displays the values of crossings between two dimensions represented by colors and sizes.	Used to provide an intuitive view of relations between two dimensions represented by colors and sizes. Similar to a table chart, but more of a visual type.	Sales of each product by region
168	1 or more measures	dimensions in colors and sizes at different points	colors and sizes. Similar to a table chart, but more of a visual type.	Chapter 5. Workbook

5.3.4 Chart style attributes

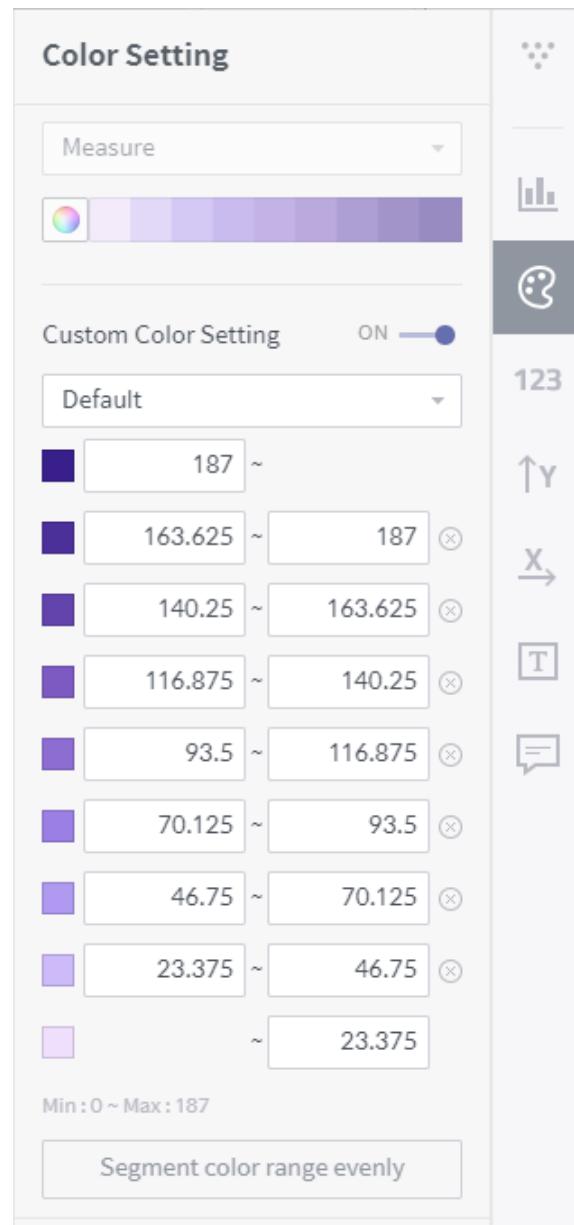
Once data is pivoted, an options menu is shown on the right of the screen to allow you to set the chart style. The composition of the menu varies with chart type. This section describes the settings used universally by all chart types and the “Common Setting” items for each chart type.

Chart style settings menu

This section describes how to configure the settings of the chart style settings menu. Note that not all the settings are shown for every chart type.

Color setting

Defines various colors used in the chart.

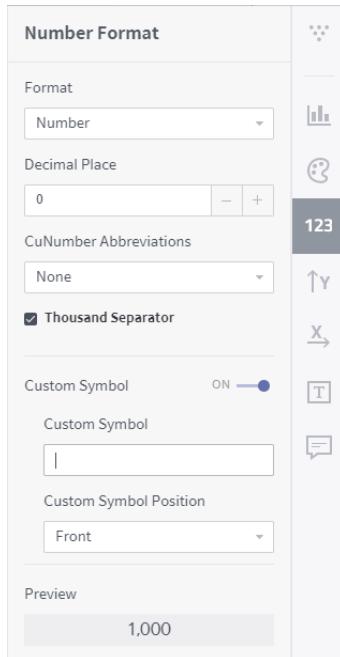


1. **Graph color setting:** Set criteria to classify data on the chart by color, and select a coloring theme.
 - **Series:** Colors data elements differently with measures.
 - **Dimension:** Colors data elements differently with dimensions.
 - **Measure:** Colors elements differently with the size of each aggregate of measure values.
2. **Setting color range:** This setting is displayed when **Measure** is selected as the criterion to classify data by color. Set “ON” to set colors differently with each range of measure

values. The measure data to be colored can be subdivided into as many ranges as you want, starting with the lowest one. To add a new range, adjust the upper limit of the highest range and click **Add new range**.

Number format

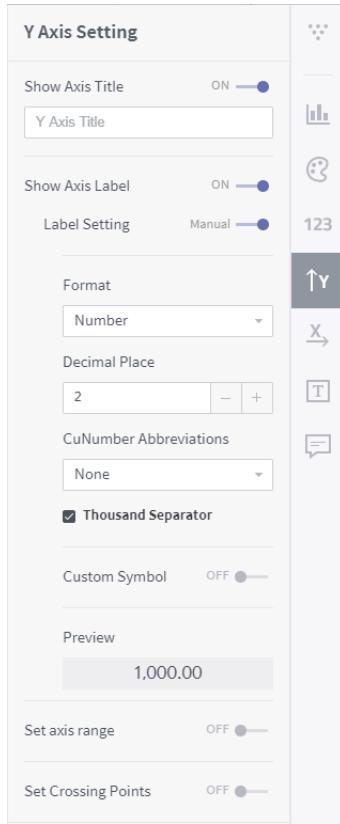
Defines how to display numerical text data on the chart graph. To use this function, turn on Show Axis Label in the Data Label Settings Menu.



1. **Format:** Select a display format for numeric values from among number, currency, percent, and exponent.
2. **Decimal place:** Set how many digits to display after the decimal point.
3. **Number abbreviations:** You can use K (thousands), M (millions), or B (billions) as an abbreviation for a large numeric value. Select **Automation** to automatically set the most proper symbol in accordance with the number of digits.
4. **Thousands separator:** Select whether to add thousands separators when displaying numeric data values.
5. **Customer symbol:** Insert a custom text before/after numeric data values.
6. **Preview:** Displays the result of the defined number format.

Y-axis setting (when chart type is vertical)

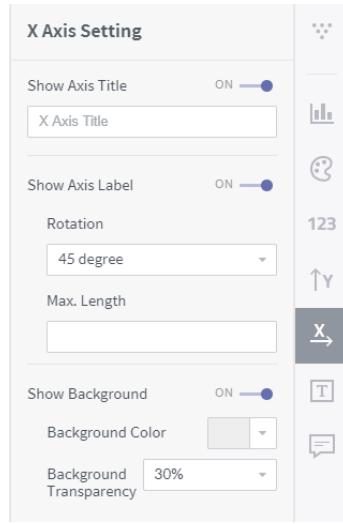
If you set the chart direction **Horizontal** in the Common Setting area, the settings are exchanged between X-axis and Y-axis.



1. **Show axis title:** Used to set a title for the Y-axis of the chart. Disabling this function hides the title of the Y-axis.
2. **Show axis label:** Select whether or not to show the data labels on the Y-axis of the chart. Disabling this function hides the data labels on the Y-axis.
 - **Label setting:** Set the numeric format of the data labels on the Y-axis. Set automatic to import the settings of **Format** or manual to set specific format for the data labels on the Y-axis.

X-axis setting (when chart type is vertical)

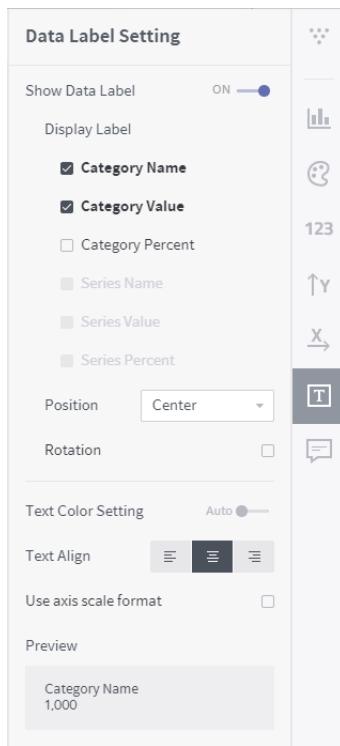
Defines how to display the X-axis of the chart. If you set the chart direction **Horizontal** in the Common Setting area, the settings are exchanged between X-axis and Y-axis.



1. **Show axis title:** Used to set a title for the X-axis of the chart. Disabling this function hides the title of the X-axis.
2. **Show axis label:** Select whether or not to show the data labels on the X-axis of the chart. Disabling this function hides the data labels on the X-axis.
 - **Rotation:** Select an angle for the data labels on the X-axis from among 0, 45, and 90 degrees.

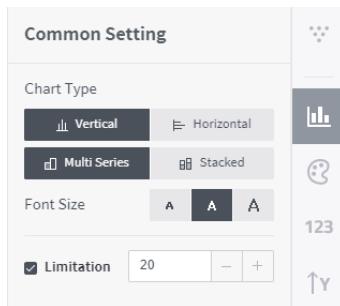
Data label setting

Selects whether to display the data values on the chart graph.



Common settings for each chart type

This section describes how to style the six most popular chart types (bar chart, table, line chart, scatter chart, heatmap, and pie chart).



Bar chart

This type of chart presents data values in each category of a dimension column with rectangular bars.



1. Chart type

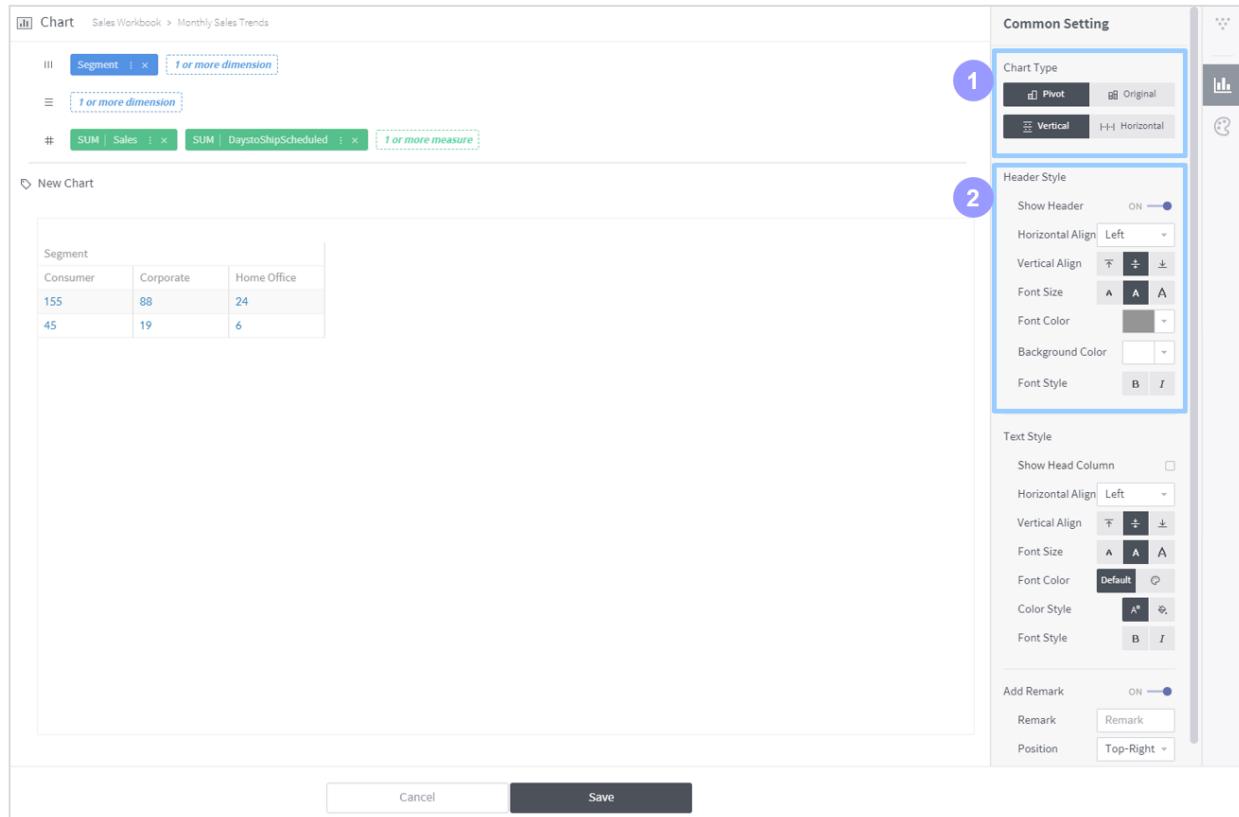
- **Vertical:** Displays data values as vertical bars with the dimension axis set vertical.
- **Horizontal:** Displays data values as horizontal bars with the dimension axis set horizontal.
- **Parallel:** If more than one measure are selected, different bars representing those measures are displayed in parallel.
- **Stacked:** If more than one measure are selected, different bars representing those measures are stacked at one position.

2. Limitation:

Set how many columns to display on the chart.

Table

A table block is formed based on the categories into which the dimension columns on the column/row shelves are grouped; accordingly, the values of the measure columns on the cross shelf are displayed as text in the crossings.



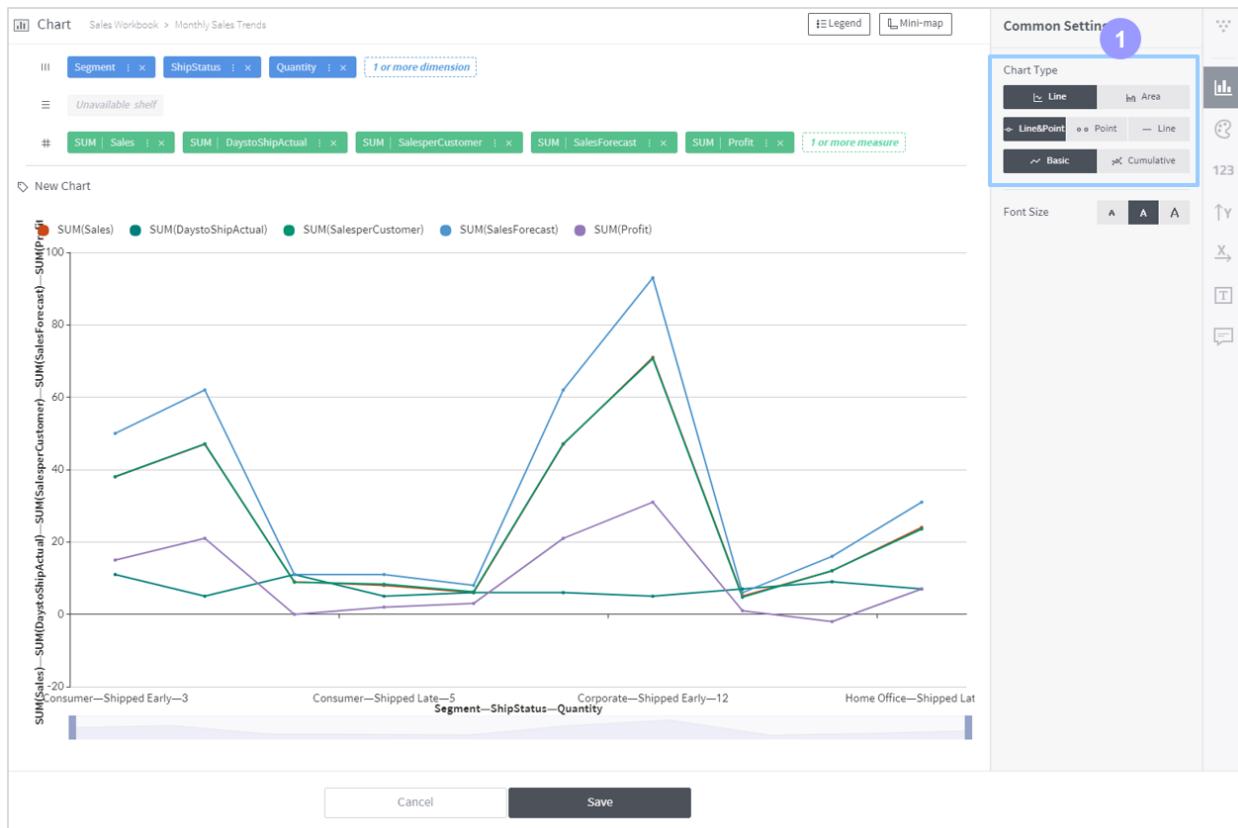
1. Chart type

- Pivot:** Aggregates (SUM, MIN, MAX, etc) measure values for each pair of column and row dimensions into a different cell.
- Original:** Displays all original measure values as unaggregated together with the selected dimensions.
- Vertical:** Displays measure values vertically in the table. This cannot be used when “Original” is selected for displaying the table.
- Horizontal:** Displays the table horizontally when “Pivot” is selected for displaying the table. Displays measure values horizontally in the table.

2. **Show head column:** Set horizontal and vertical text alignment in the column headers. When “Original” is selected, the column headers are necessarily shown. When “Pivot” is selected, you may optionally hide the column headers.

Line chart

This type of chart presents data values in each category of a dimension column with points. Adjacent data points are connected with each other. This type of chart is used to view trends.

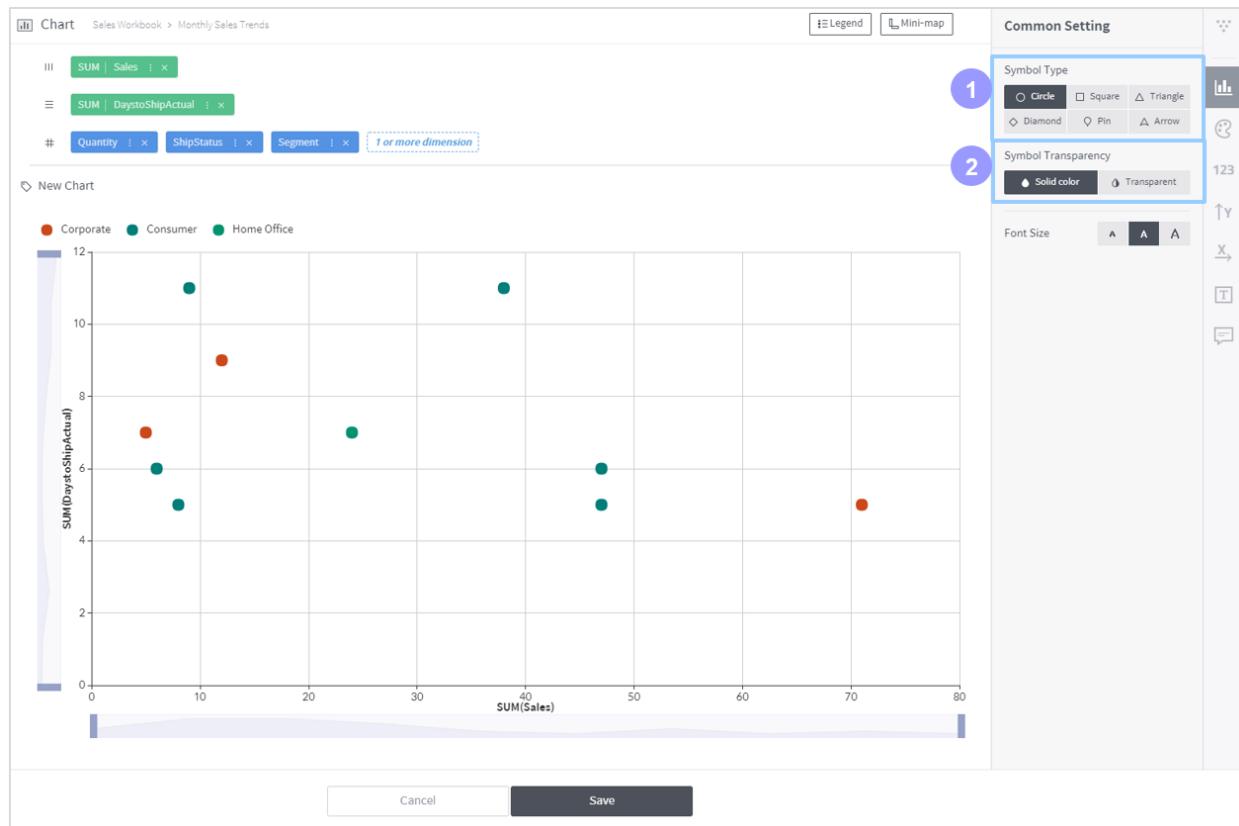


1. Chart type

- **Line type:** Displays the chart graph by drawing lines between points that represent measure value aggregates.
- **Area type:** Colors the area formed by the connecting lines.
- **Line & point:** Shows both the data points and connecting lines.
- **Point:** Shows the data points only.
- **Line:** Shows the connecting lines only.
- **Basic:** Displays each aggregate as it is on the chart.
- **Cumulative:** Displays cumulative aggregates on the chart.

Scatter chart

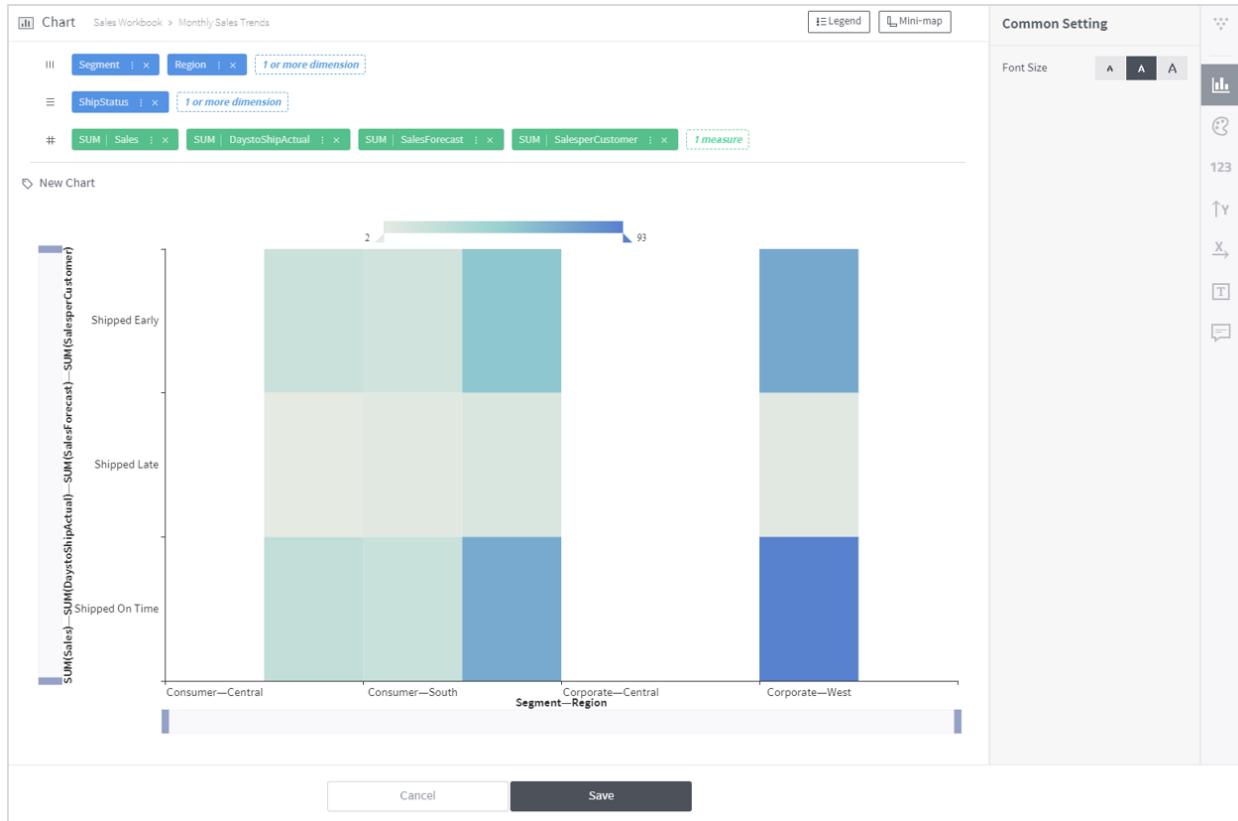
This type of chart presents data values in each category of a dimension column with defined symbols.



- 1. Symbol type:** Set the shape of the symbol to be shown on the chart.
- 2. Symbol transparency:** Set the transparency of the symbol to be shown on the chart. You can set colors either solid or transparent.

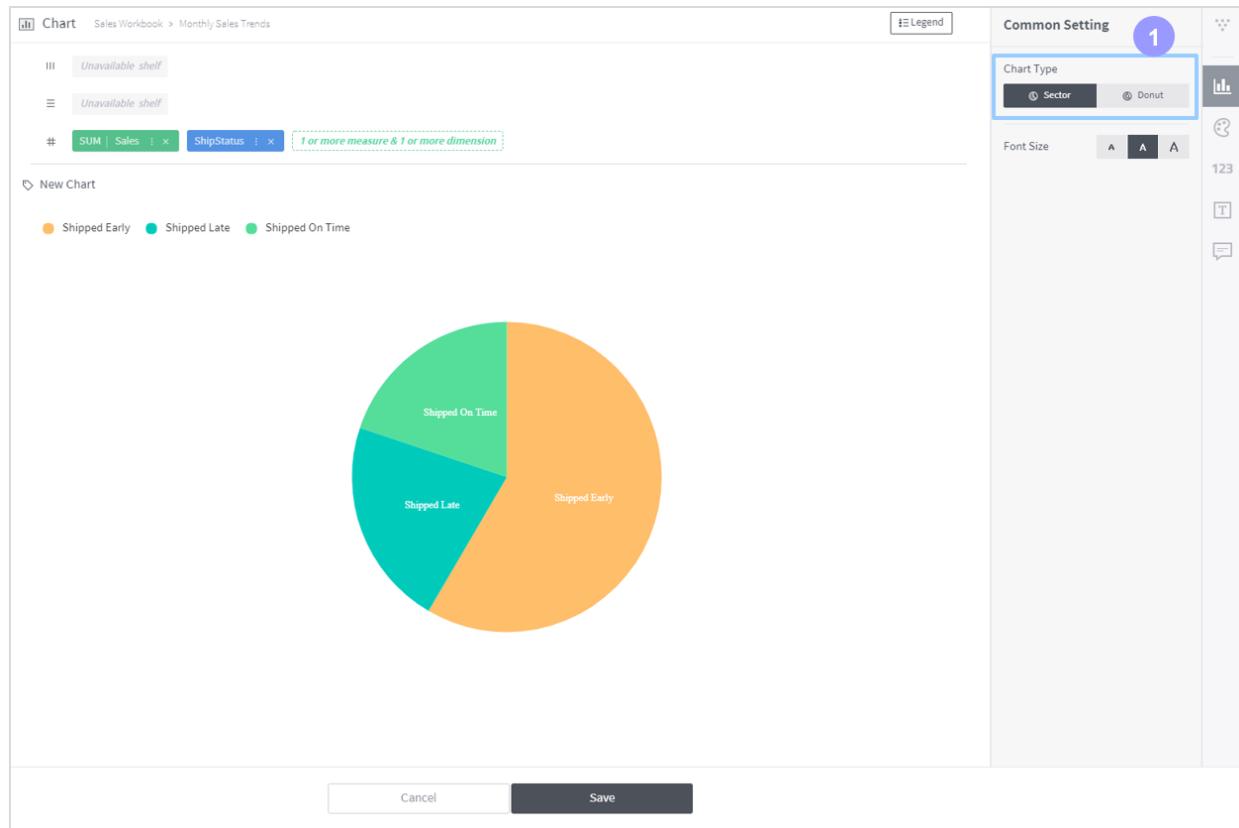
Heatmap

This type of chart displays values aggregated from the measure column placed on the cross shelf by using colors. For a larger aggregated value, a darker color is applied. The heatmap type does not provide any common settings.



Pie chart

This type of chart visualizes the proportion of each category of the dimension column.

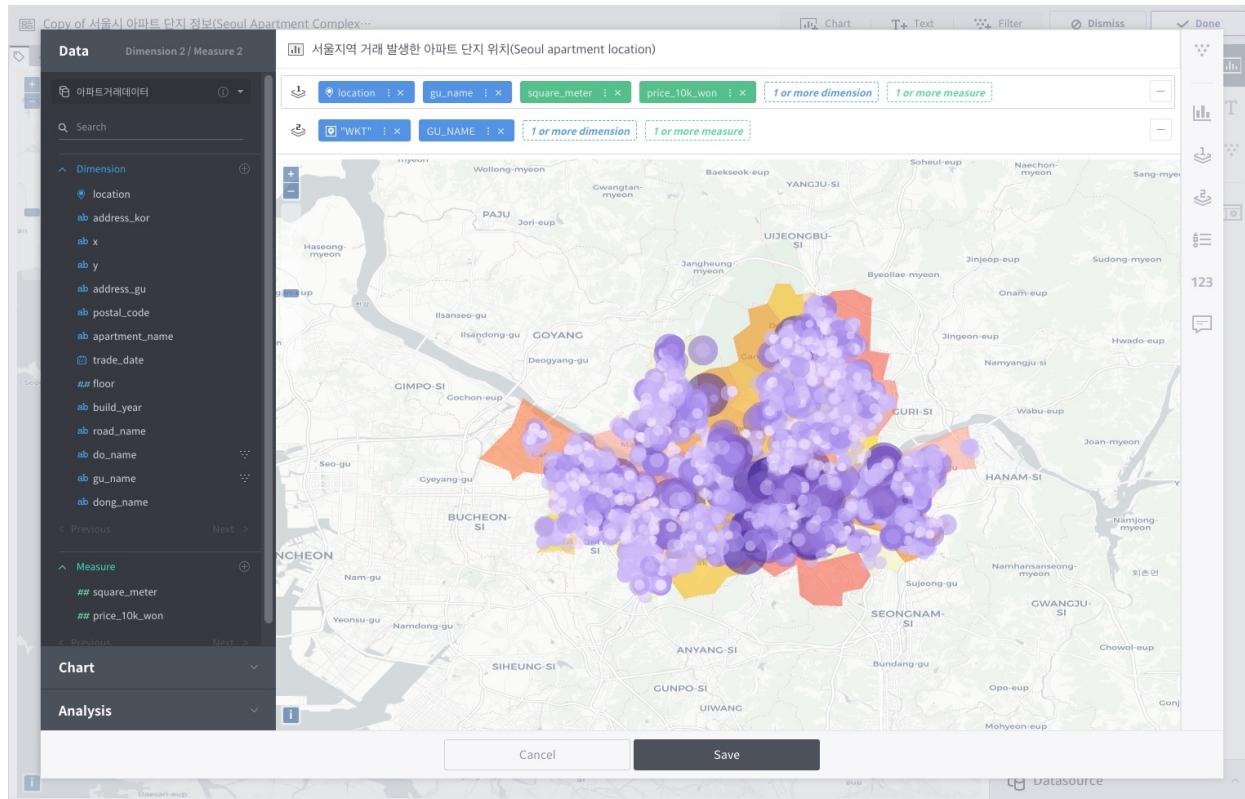


1. Chart type

- **Sector:** Displays a pie-shaped chart.
- **Donut:** Displays a donut-shaped chart.

5.3.5 Map view and spatial operations

Metatron Discovery, from version 3.1.0 and up, offers a **map view** function for visualizations of location data. Creating a chart in map view involves different conditions compared to other chart types.



- At least one **location** dimension is required.
- Data is placed on **map layer shelves** instead of the row/column/intersection shelves.
- **Style properties** are set for each layer.
- **Spatial operations** are provided.

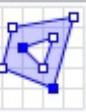
Location dimensions

To use map view, dimension columns of WKT geometry types such as Point, LineString, and Polygon must be placed on the layer shelf. There are largely three types of location data.

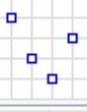
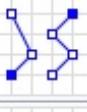
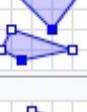
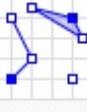
- **Point:** This is a 2D coordinate geometry type comprised of x and y values. Similar to GPS data, a point has a latitude and longitude.
- **Line:** This is a geometry type with line coordinates. WKT representations of LineString and Multi-LineString are supported.

- **Polygon:** This is a geometry type with shape coordinates. WKT representations of Polygon and MultiPolygon are supported.

Geometry primitives (2D)

Type	Examples
Point	 <code>POINT (30 10)</code>
LineString	 <code>LINESTRING (30 10, 10 30, 40 40)</code>
Polygon	 <code>POLYGON ((30 10, 40 40, 20 40, 10 20, 30 10))</code>
	 <code>POLYGON ((35 10, 45 45, 15 40, 10 20, 35 10), (20 30, 35 35, 30 20, 20 30))</code>

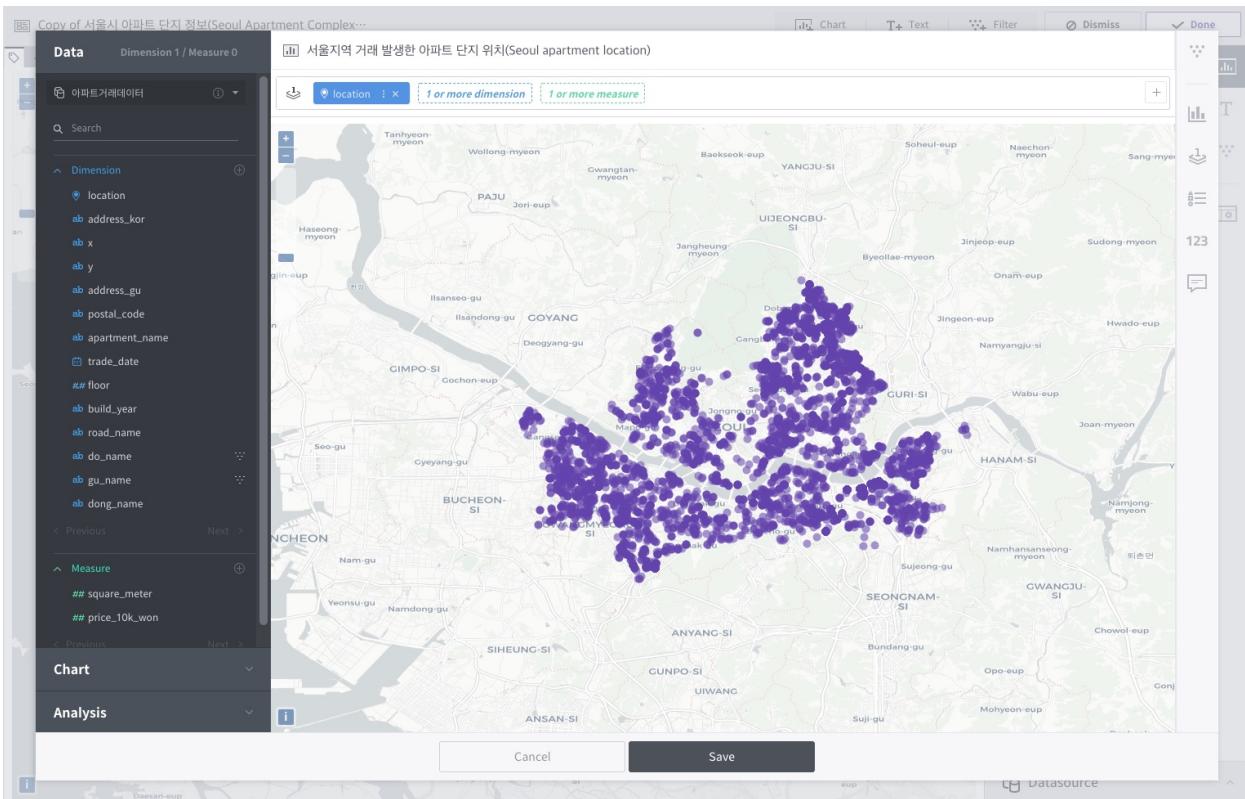
Multipart geometries (2D)

Type	Examples
MultiPoint	 <code>MULTIPOINT ((10 40), (40 30), (20 20), (30 10))</code>
	<code>MULTIPOINT (10 40, 40 30, 20 20, 30 10)</code>
MultiLineString	 <code>MULTILINESTRING ((10 10, 20 20, 10 40), (40 40, 30 30, 40 20, 30 10))</code>
MultiPolygon	 <code>MULTIPOLYGON (((30 20, 45 40, 10 40, 30 20), ((15 5, 40 10, 10 20, 5 10, 15 5))), ((40 40, 20 45, 45 30, 40 40), (20 35, 10 30, 10 10, 30 5, 45 20, 20 35), (30 20, 20 15, 20 25, 30 20)))</code>
GeometryCollection	 <code>GEOMETRYCOLLECTION (POINT (40 10), LINESTRING (10 10, 20 20, 10 40), POLYGON ((40 40, 20 45, 45 30, 40 40)))</code>

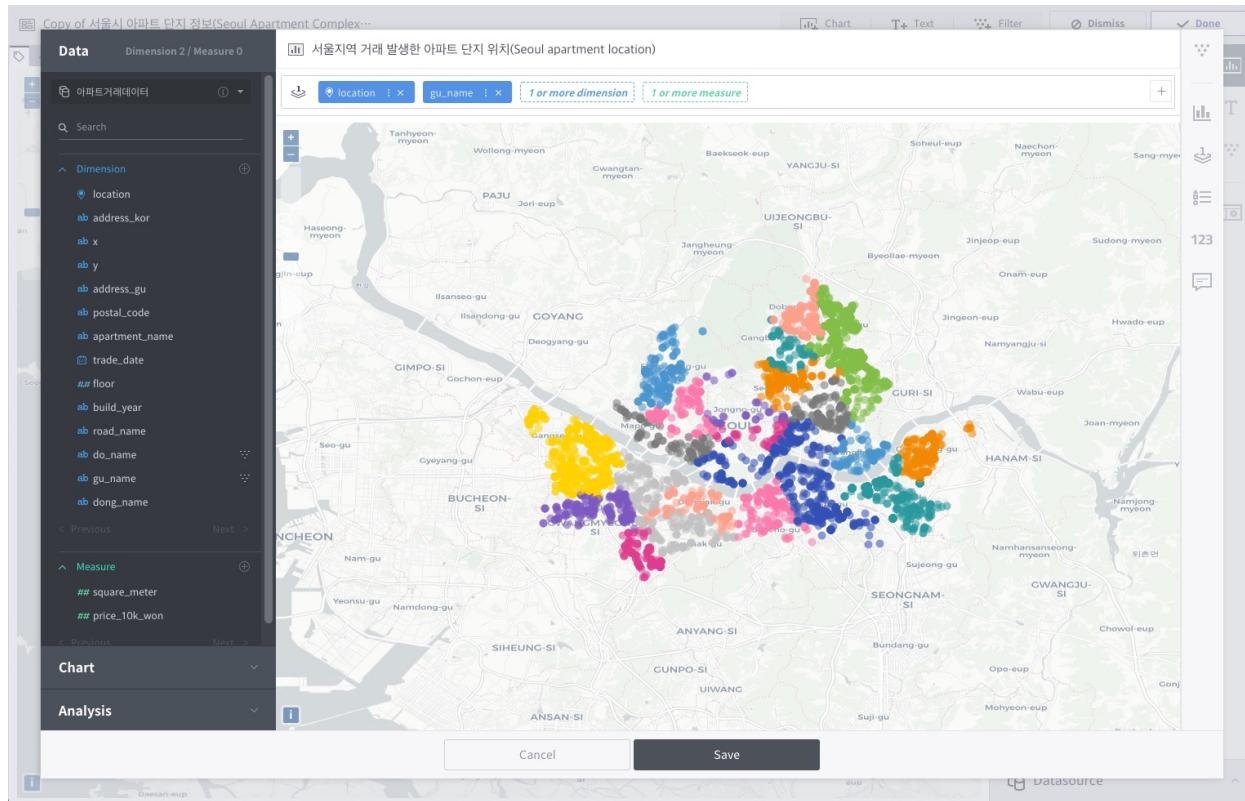
Map layer shelves



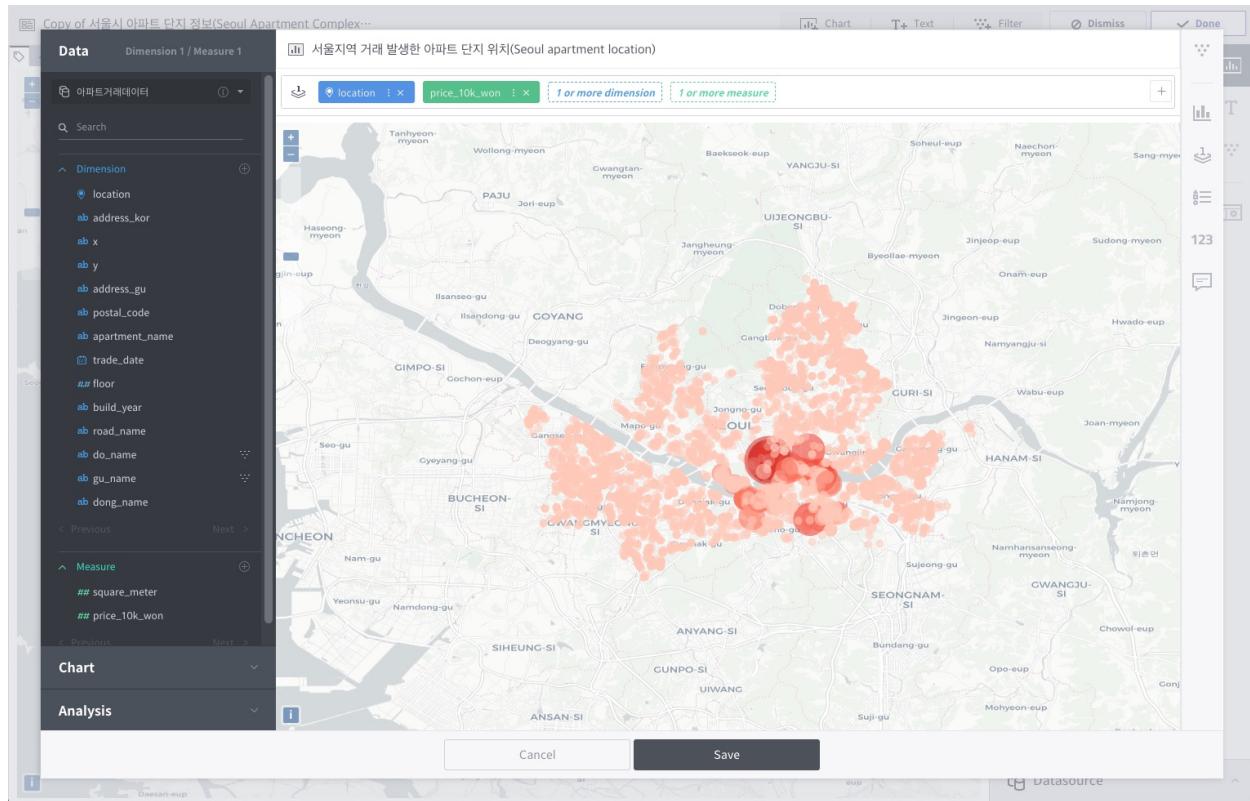
Map view uses map layer shelves instead of the row/column/intersection shelves that are used by other chart types. A map layer shelf requires at least one location dimension.



When a string dimension is placed on a map layer shelf, data points are colored based on its elements; when the mouse is over a data point, the corresponding string is displayed in the data tooltip.

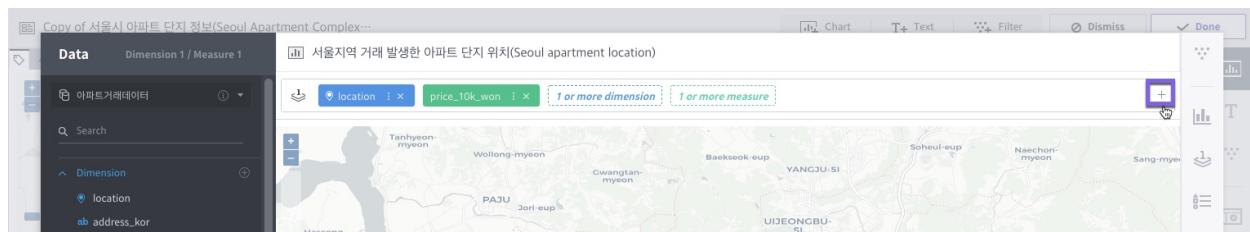


또한 측정값을 레이어 선반에 배치하면 측정값으로 색상을 분류하고 동시에 해당 측정값을 기준으로 포인트 크기를 다르게 표현합니다. 차원값과 마찬가지로 툴팁에 해당 측정값이 표기됩니다.



Add layer shelf

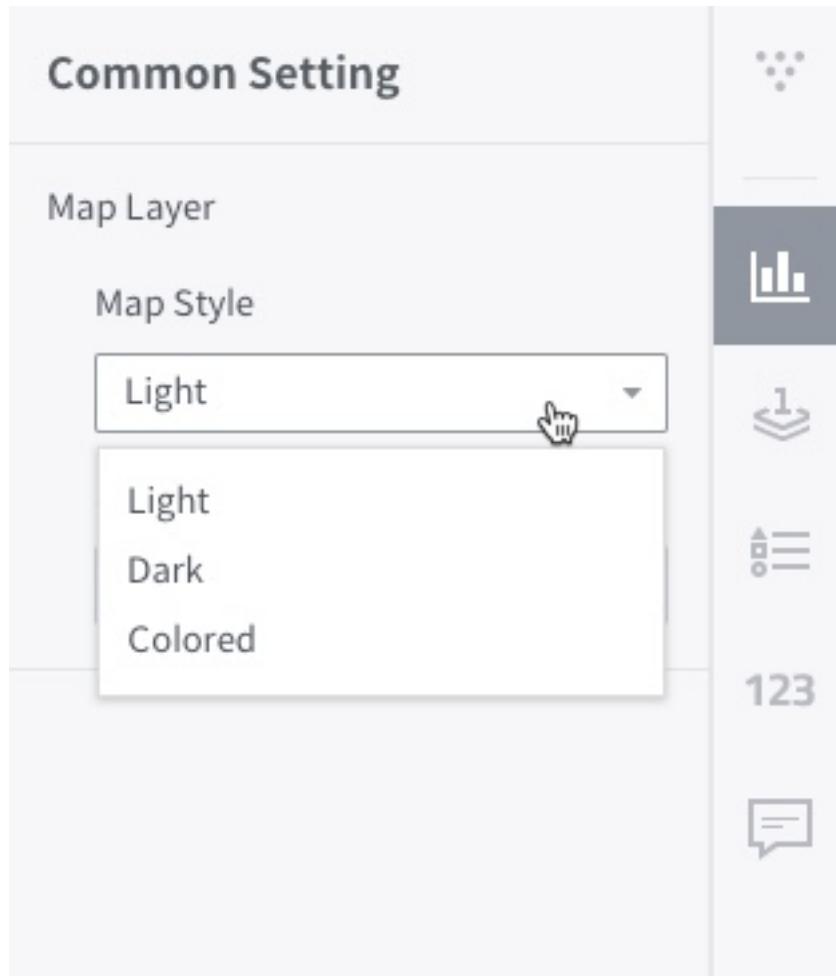
Click the + button on the right of a layer shelf to add another layer on top of the first layer. Each layer must use a different data source, and columns of only one data source are allowed to be placed per layer. Currently, up to two layer shelves are supported.



Style properties of map view layer

Common setting

지도 레이어에서 기본 지도를 표현하는 맵 스타일의 유형을 선택할 수 있습니다. OpenStreetMap을 활용하여 세 가지의 맵 스타일을 기본적으로 제공하고 있습니다.

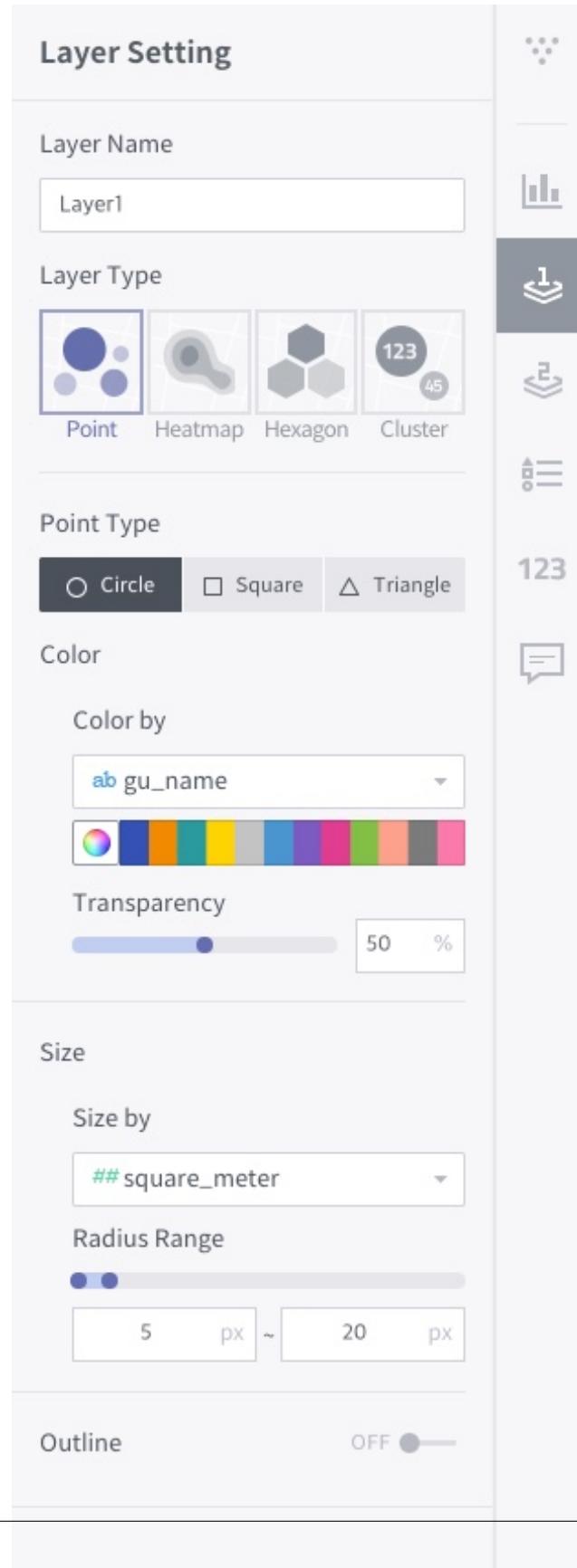


- Open Street Map Light (Default)
- Open Street Map Dark
- Open Street Map Colored

Layer settings

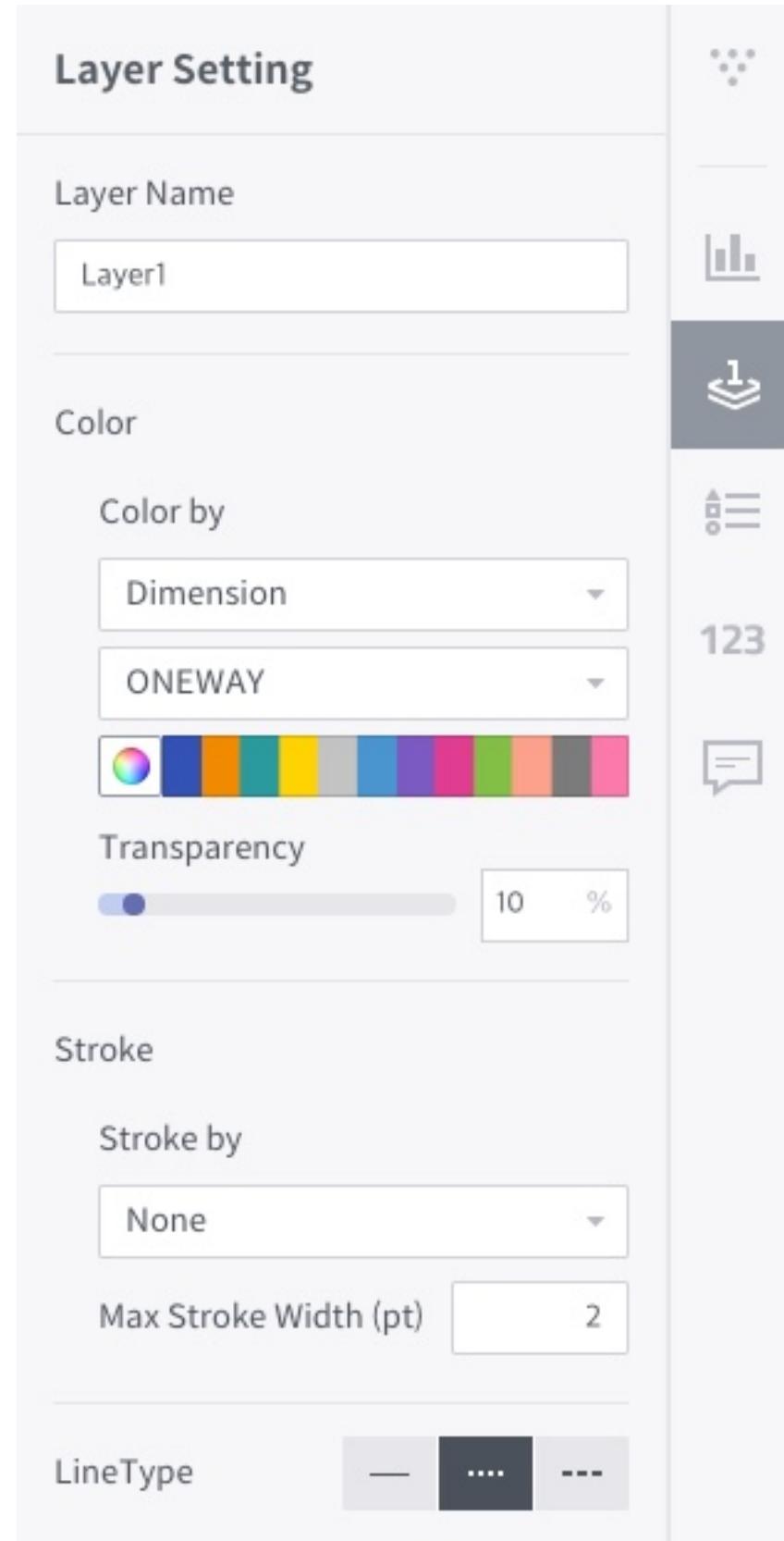
Sets how to express layers. When a layer shelf is added, separate setting menus are created for the first and second layers.

Layer properties of point type



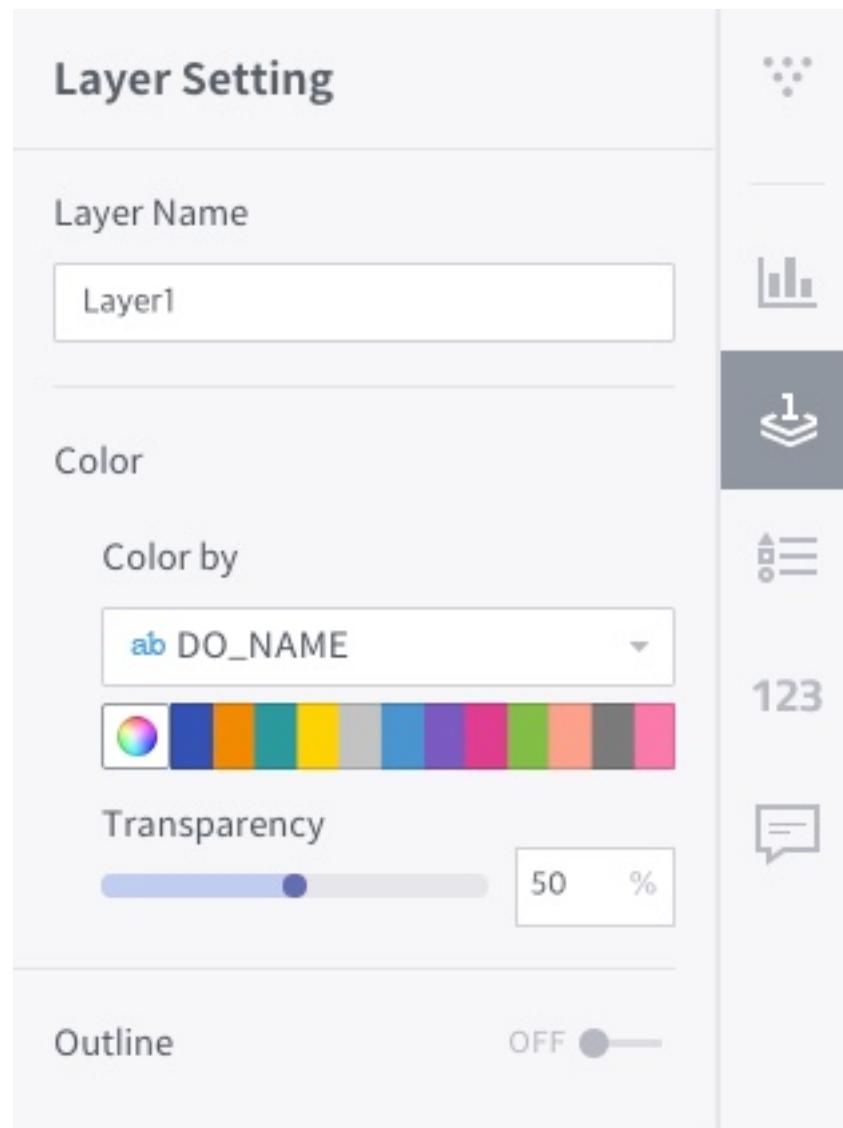
1. **Layer Name:** Set a name of the layer for legend and tooltip settings in the map view.
2. **Layer Type:** Data points can be displayed on the map as Point, Heatmap, Hexagon, or Cluster. The point type is selected by default.
3. **Point Type:** With Point selected as the layer type, you can choose the shape of data points from among Circle, Square, and Triangle. Circle is selected by default. The shapes are displayed on the map when cluster use is set to Off.
4. **Color:** Data points can be distinguished by color based on a string dimension or a measure on the layer shelf. A color can be picked from the palette if color standards are not available. The transparency can be set as a % value.
5. **Size:** If the layer type is Point, data points can be distinguished by size based on a measure on the layer shelf.
6. **Outline:** When set to On, an outline is drawn for each data point. The default is Off, and the color and thickness are customizable.
7. **Cluster Distance:** With Cluster selected as the layer type, you can set the cluster distance as a % value. The use of clusters is recommended to optimize browser performance when working with a large number of data points.
8. **Blur:** With Heatmap selected as the layer type, you can adjust the blur effect on the heat map. The default is 20%.
9. **Radius:** If the layer type is Heatmap or Hexagon, the display radius can be adjusted in the range of 1 to 100.

Layer properties of line type



1. **Layer Name:** Set a name of the layer for legend and tooltip settings in the map view.
2. **Color:** Data points can be distinguished by color based on a string dimension or a measure on the layer shelf. A color can be picked from the palette if color standards are not available. The transparency can be set as a % value.
3. **Thickness:** Set the line thickness.
4. **Line type:** Choose among a solid line, dotted line, and dashed line. The default is a solid line.

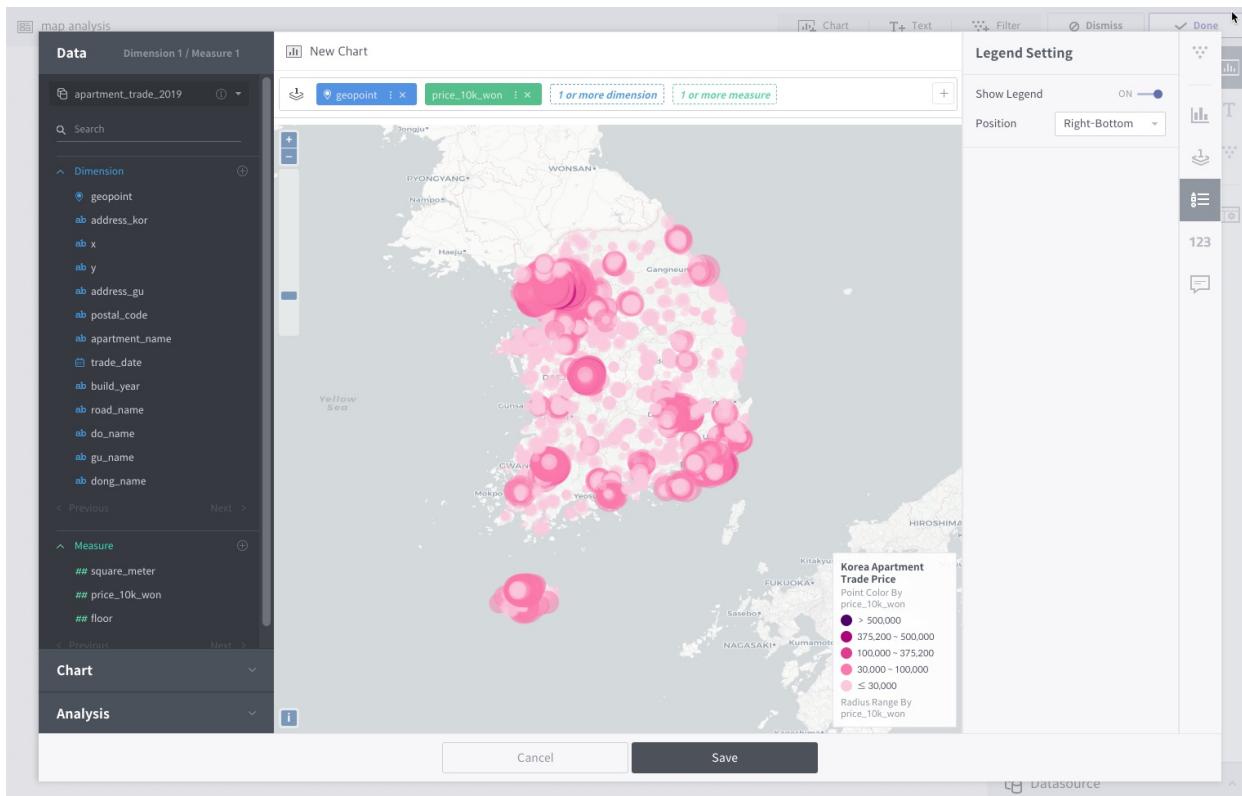
Layer properties of polygon type



1. **Layer Name:** Set a name of the layer for legend and tooltip settings in the map view.
2. **Color:** Data points can be distinguished by color based on a string dimension or a measure on the layer shelf. A color can be picked from the palette if color standards are not available. The transparency can be set as a % value.
3. **Outline:** When set to On, an outline is drawn for each polygon. The default is Off, and the color and thickness are customizable.

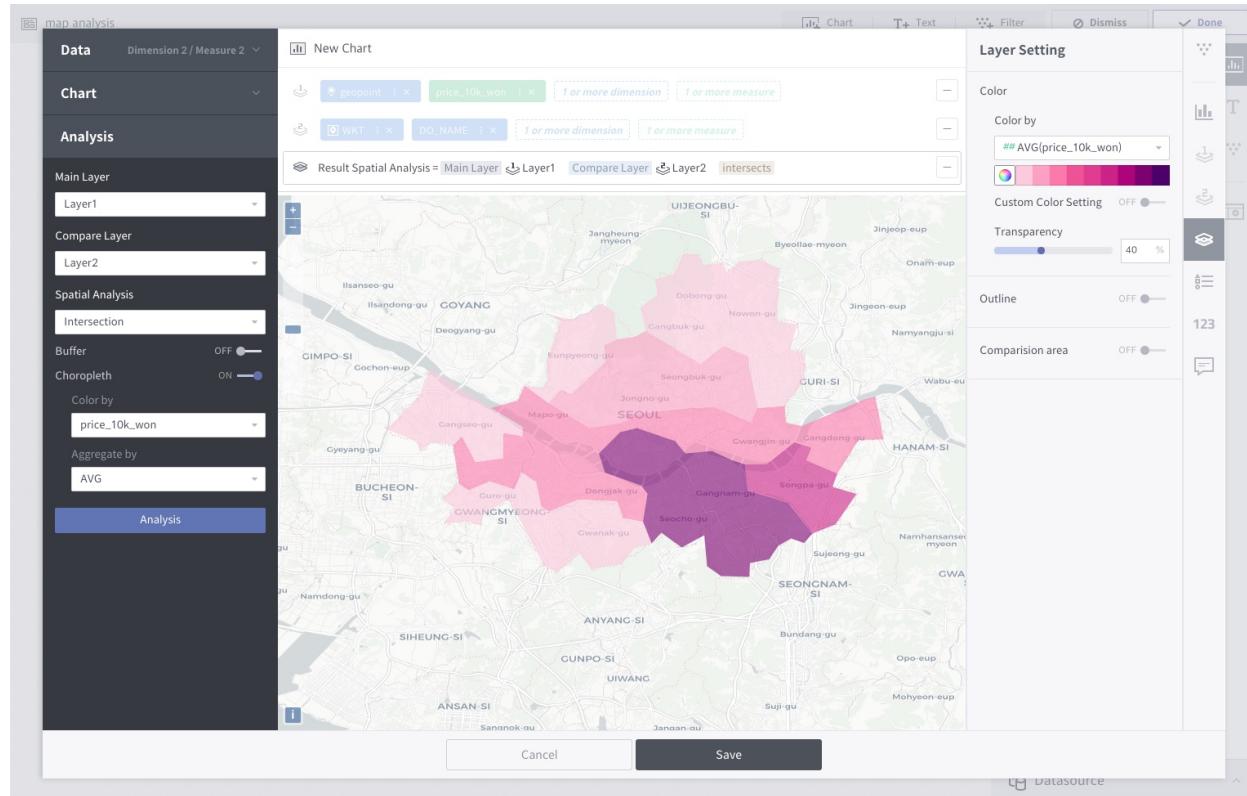
Legend settings

Choose whether or not to display a legend. The default is Off. The position of the legend can be set when turned on.



Spatial analysis

The map view of Metatron Discovery supports simple spatial analysis between two layers. Spatial operations can be set in the analysis tab on the left, and the current version supports two types of spatial operations.



- **Within:** This returns values within a distance designated between elements of the Main and Compare Layers.
- **Intersection:** This method returns overlapping areas between the Main and Compare Layers. Return values may vary with the scale of the geometry selected (Polygon > Line > Point).

Additional settings that can be customized for each operation are as follows:

- **Buffer:** Set a tolerant distance within which the Main and Compare Layers could be compared. The distance can be set either in meters or in kilometers.
- **Choropleth map:** The resulting layer can be displayed in the form of a choropleth map. The color scheme of the choropleth map can be selected; by default, colors are divided according to the data count. If the Main Layer includes a measure, colors can be changed based on its elements.

5.4 Filter

Filters are to display only data matching their preset conditions when forming dashboards and charts. Charts use two types of filters: chart filters and global filters. Chart filters are applied to individual charts, whereas global filters are applied to an entire dashboard.

5.4.1 Chart filters

A chart filter defines what range of data is to be shown on the chart. This chapter describes how to set up and make use of chart filters.

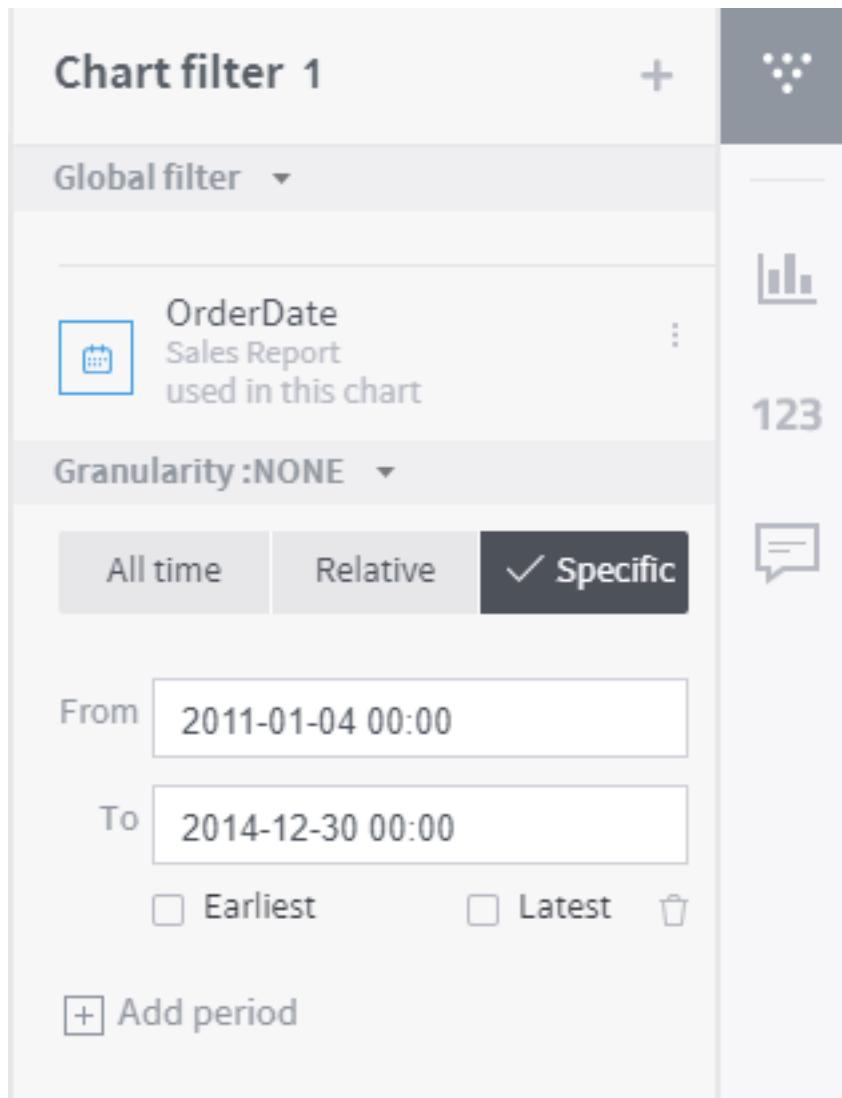
Automatically included filters

The following column filters are included automatically when a chart is created:

- **Timestamp column filter:** As a time-series data store, the Metatron engine necessarily uses a time filter.
- **Recommended filters:** Column filters designated as “recommended filters” during the registration of the data source.
- **Dashboard filters set global:** Filters applied to all charts registered in the dashboard.

Chart filter panel

The chart filter panel is located on the right-hand side of the chart home screen. On this panel, you can easily view and configure registered filters.



1. **Filter number:** Displays how many filters are registered for the chart.
2. **Add/edit filter:** Click on “+” at the top right to either add a new filter or open a popup for configuring an existing filter.
3. **Columns applied with the filter:** The top part of each individual filter displays which columns are applied with the filter.
4. **Filter settings:** Click the hamburger menu at the top right of an individual filter either to reset the filter or configure the details of the filter.

Chart filter dialog box

Click the button at the top of the chart filter panel or click the button in each filter area to open the chart filter dialog box. With this dialog box, you can add a new filter or configure an existing filter.

The chart filter dialog box is divided into the Dimension and Measure tabs as shown below:

⋮ Add chart filter

Sales Report

Dimension	Measure
Search by field name	
GeoPoint	+
OrderDate	🕒 ✅
Category	+
City	+
Country	+
CustomerName	+
OrderID	+
PostalCode	+
ProductName	+
Region	✅
Segment	+
ShipDate	+
ShipMode	+
State	+
Sub_Category	+
ShipStatus	+
OrderProfitable	+
SalesaboveTarget	+
latitude	+
longitude	+

Cancel

Dimension filtering

From the connected data source, select a dimension on which to create a filter.

 **Region**
Sales Report  New Chart

Single Multiple

Search by item name ▽ ▲ ⚡

(All) Turn all on | off

Central 2322 👁
 East 2845 👁
 South 1620 👁
 West 3200 👁

All

Defined value Add

Cancel Done

- **Value range:** Select whether to filter the chart by a single or multiple data categories.
 - **Single:** Select one data category by which to filter the chart.
 - **Multiple:** Select multiple data categories by which to filter the chart.
- **Search:** If there are too many elements in the column, this function allows you to limit the results only to those you wish to see.
 - **Search by name:** Search the column element list by name.
 - **Element filtering:** Filters elements either by matching element names with regular expressions or wildcards, or by applying a range condition to a measure.

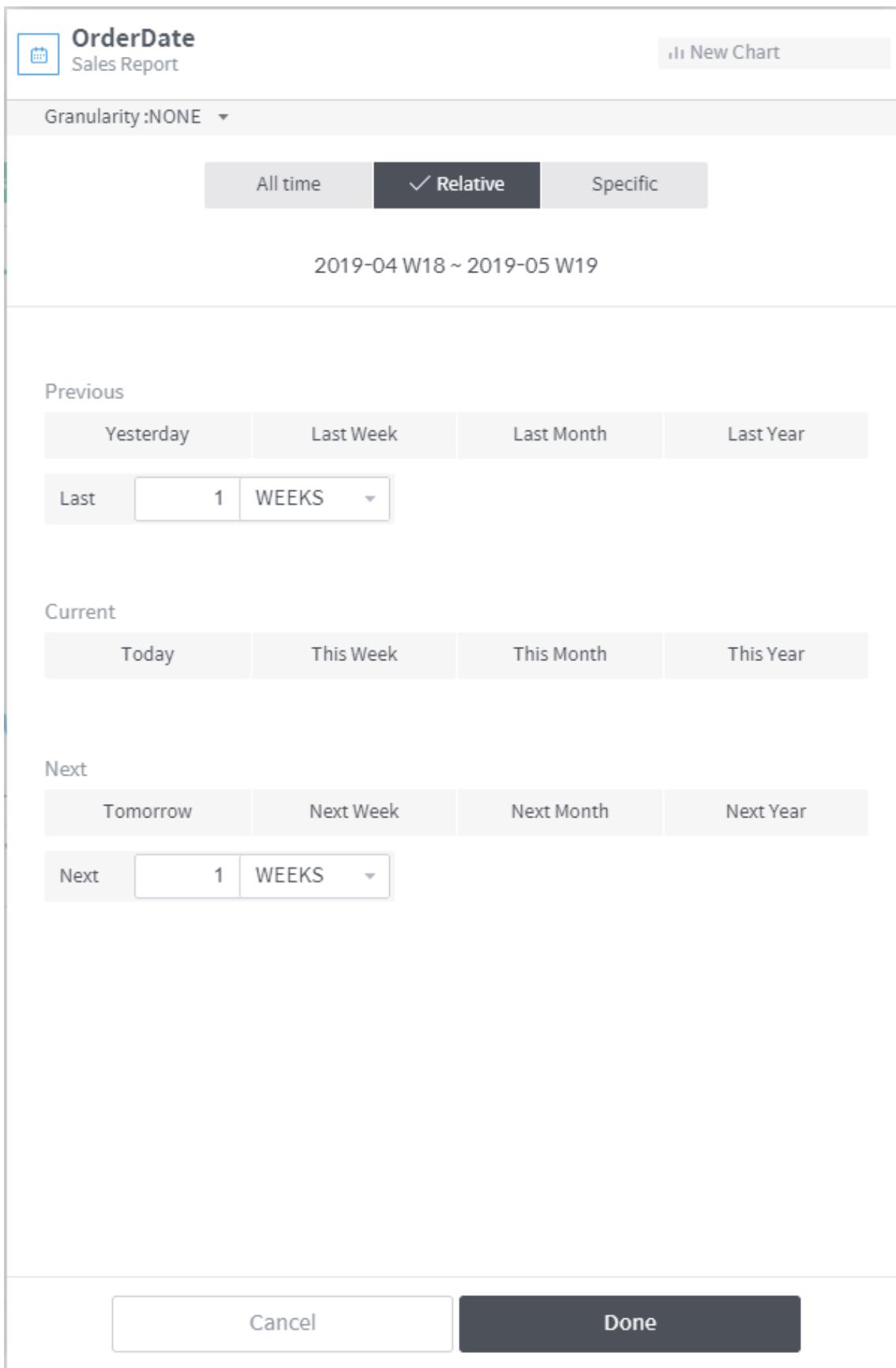
The screenshot shows a user interface for configuring a matcher. It includes three main sections: 'Matcher', 'Condition', and 'Limitation'. The 'Matcher' section has tabs for 'Wildcard' (selected) and 'Regular Expression'. Below these are two dropdown menus: the first is empty, and the second is set to 'AFTER'. The 'Condition' section contains four dropdown menus: 'Select Measure' (empty), 'SUM' (selected), '=' (selected), and '10'. The 'Limitation' section contains four dropdown menus: 'TOP' (selected), '10', 'Select Measure' (empty), and 'SUM' (selected). At the bottom are 'Reset' and 'Apply' buttons.

- **Defined value:** Used to add?as a filter criterion? a data element that is not contained in the column. This allows you to create a filter in advance for a data element that may be added later.

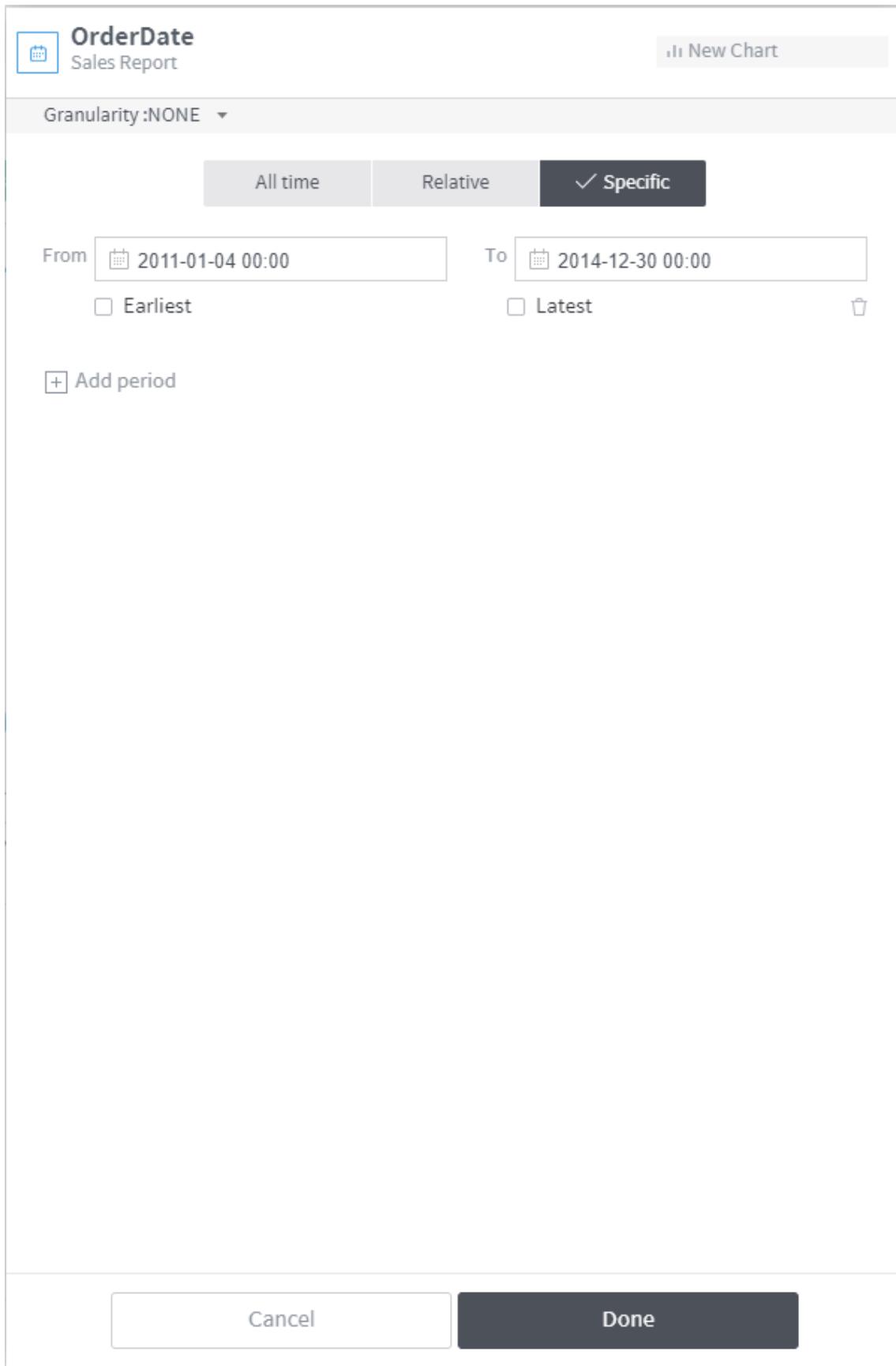
Timestamp column filter settings

Dimensions with a time icon displayed are of a timestamp type for which a timestamp filter can be configured. Although they are set to “All time” by default, you can select Relative or Specific if you wish to display only data from a certain period in the chart.

“Relative” sets a period of time relative to the present and displays only data from the applicable period of time in the chart.



“Specific” directly sets a certain period of time of data and displays only data from the applicable period of time in the chart.



Measure filtering

From the connected data source, select a measure on which to create a filter.

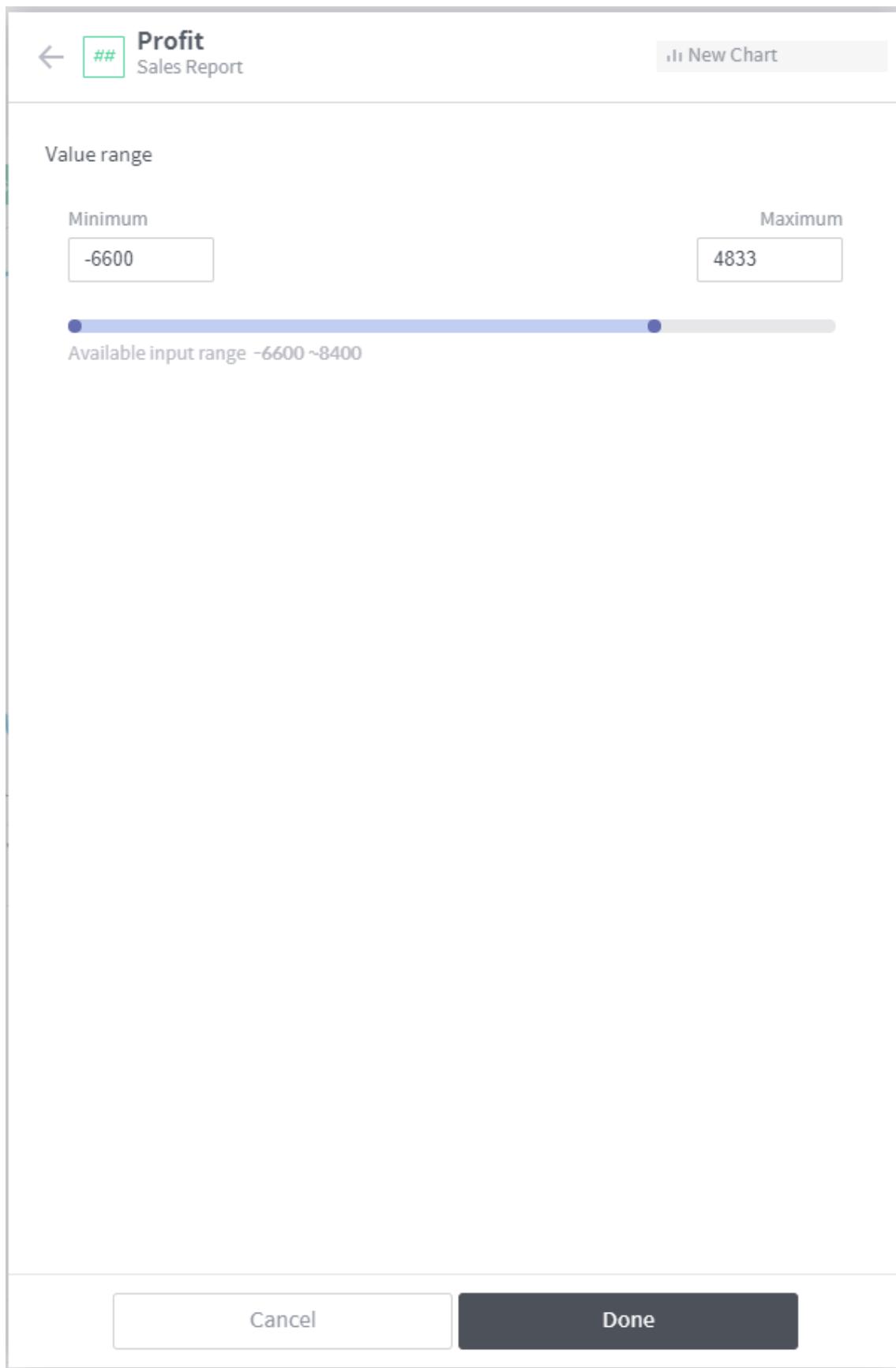
⋮ Add chart filter

Sales Report

Dimension	Measure
Search by field name	
## Discount	+
## Profit	+
## Quantity	+
## Sales	+
## DaystoShipActual	+
## SalesForecast	+
## DaystoShipScheduled	+
## SalesperCustomer	+
## ProfitRatio	+

Cancel

Once you have selected a measure, designate the range of values to filter.



5.4.2 Global filters

Global filters specify which data is to be displayed in all charts of a dashboard. They can be added, edited, or deleted in the filter panel in the dashboard editing window.

The screenshot shows the 'Global filter 3' interface. At the top, there is a heading 'Global filter 3' with a '+' icon to its right. Below the heading, there are three filter widgets listed:

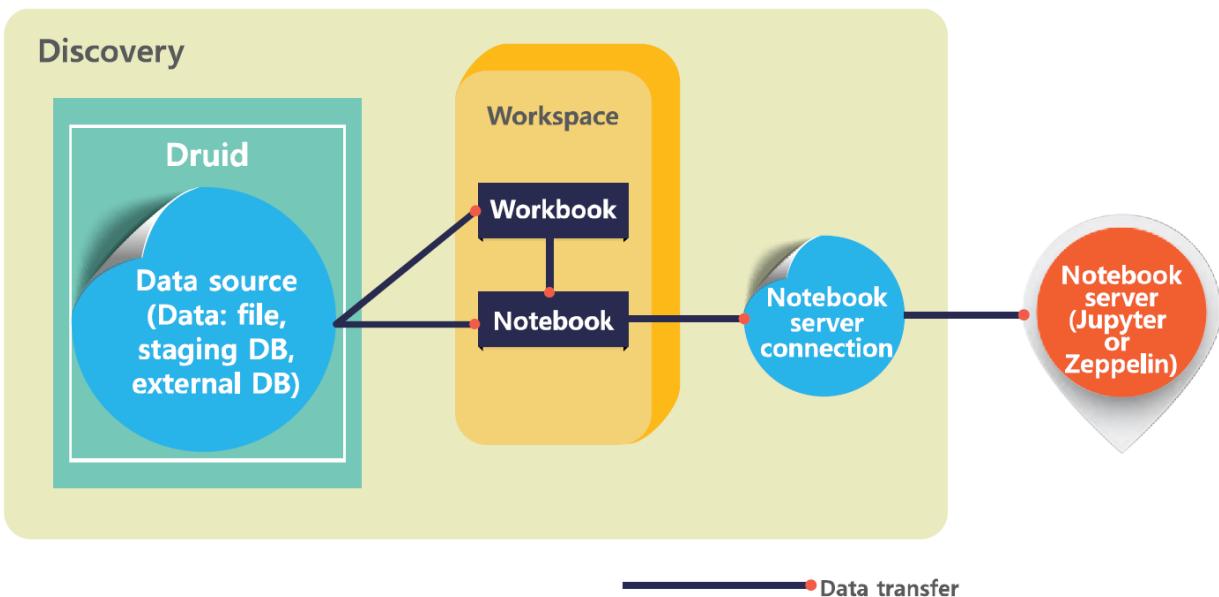
- Country Sales Report**: Filter type is 'ab'. Value '(All)' is selected. There is a search bar labeled 'Search for values' and a page navigation indicator '1 / 1'.
- DaystoShipActual Sales Report**: Filter type is '#'. Value 'United States 9987' is selected.
- OrderID Sales Report**: Filter type is 'ab'.

On the right side of the interface, there are several icons: a chart icon, a text icon, a funnel icon, a gear icon, and a refresh/clock icon.

1. **Number of filter widgets:** Displays how many filter widgets are currently registered in the dashboard next to the global filter heading.
2. **Add a filter widget:** Click the “+” icon at the top right to create a new filter widget in the dashboard. The filter creation popup interface and process for creating filters are the same as the process for creating chart filters described in the previous section.
3. **Filter widget list:** Lists filter widgets registered in the dashboard. Hover the mouse over a widget to display the edit and delete icons. Drag a widget to the widget display area to display the widget in the display area.

Global filters applied to the entire dashboard are also listed when creating an individual filter for a new chart. When creating a global filter, if there are any individual chart filters, it intuitively notifies you of which column the filter was created from.

NOTEBOOK



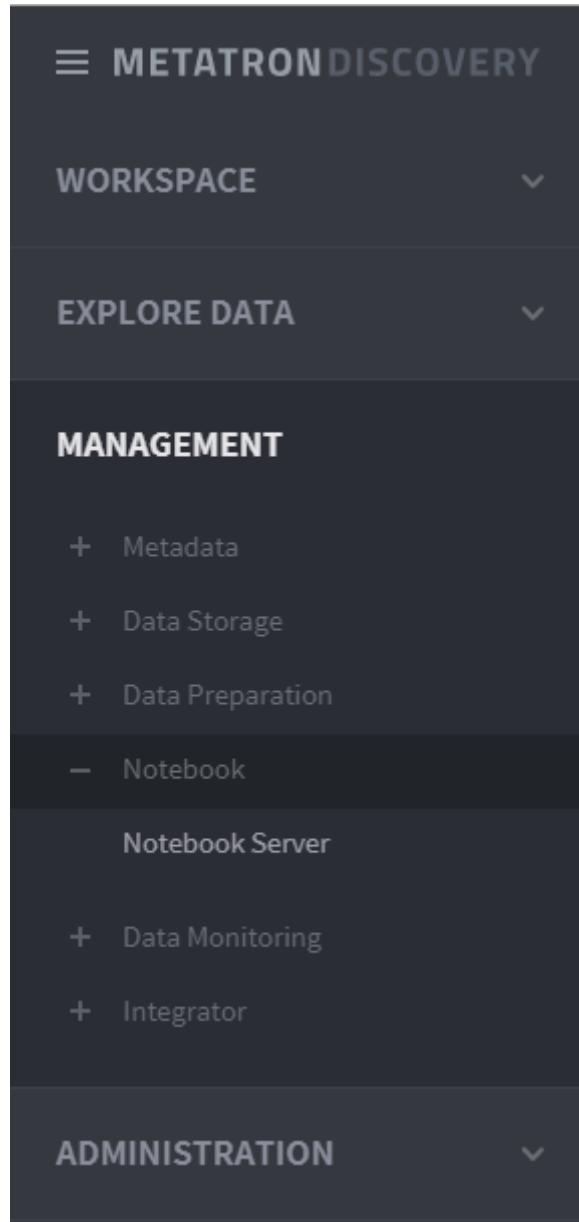
Metatron Discovery supports a notebook function. Notebook is a tool for creating and sharing documents that include live codes, equations, visualizations, and descriptive texts. It is mostly used for data cleaning and manipulation, numerical simulations, statistical modeling, and machine learning.

Metatron Discovery allows users to register and use external Jupyter and Zeppelin servers. Jupyter uses Python and R? programming languages commonly used in data science? while Zeppelin uses Spark (Scala) to help with real-time and interactive analysis and visualization of data. Before running the notebook, its server must be set up.

6.1 Manage notebook servers

To enable the Notebook module, the **administrator** must connect to a “notebook server,” which refers to a server that provides an external analytics tool.

On the left-hand panel of the main screen, go to MANAGEMENT → Notebook → Notebook Server to register a new notebook server or view and edit registered notebook server.



6.1.1 Notebook server list

This page shows a list of notebook servers. The notebook server list can be filtered by server name or type, and clicking on an entry in the list allows you to view and edit the selected server's information. Also, you can delete a notebook server either by clicking its  button that appears when hovering the mouse over the server, or by clicking the Delete selections after selecting the checkboxes next to the servers you want to delete.

Notebook

Notebook Server

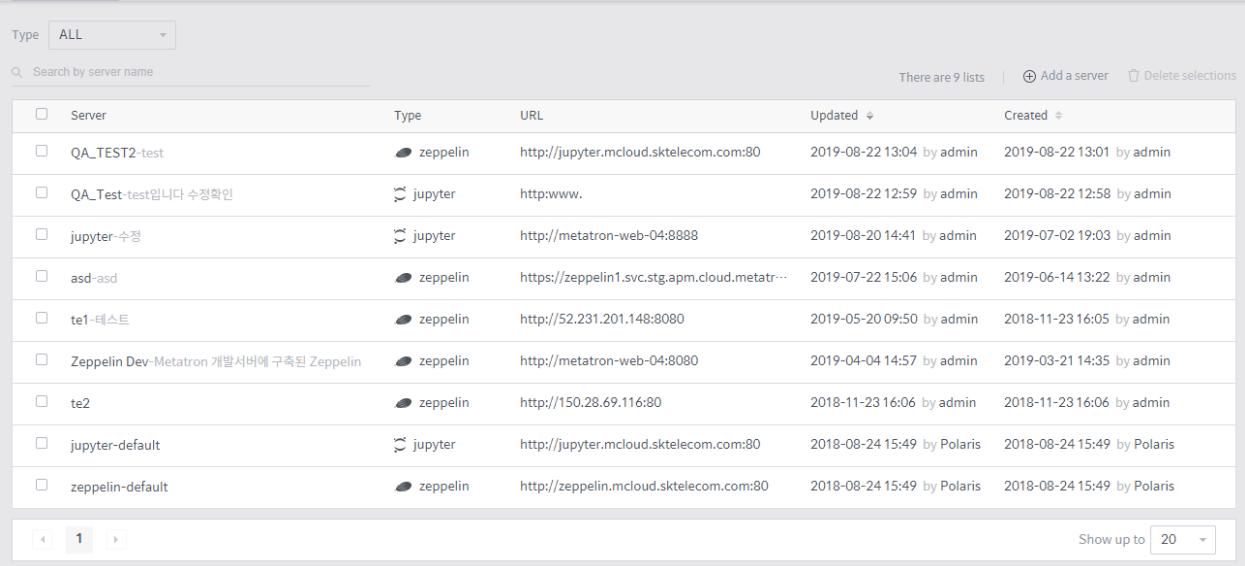
Type	Server	Type	URL	Updated	Created
<input type="checkbox"/>	QA_TEST2-test	 zeppelin	http://jupyter.mcloud.sktelecom.com:80	2019-08-22 13:04 by admin	2019-08-22 13:01 by admin
<input type="checkbox"/>	QA_Test-테스트입니다 수정 확인	 jupyter	http://www.	2019-08-22 12:59 by admin	2019-08-22 12:58 by admin
<input type="checkbox"/>	jupyter-수정	 jupyter	http://metatron-web-04:8888	2019-08-20 14:41 by admin	2019-07-02 19:03 by admin
<input type="checkbox"/>	asd-asd	 zeppelin	https://zeppelin1.svc.stg.apm.cloud.metatr...	2019-07-22 15:06 by admin	2019-06-14 13:22 by admin
<input type="checkbox"/>	te1-테스트	 zeppelin	http://52.231.201.148:8080	2019-05-20 09:50 by admin	2018-11-23 16:05 by admin
<input type="checkbox"/>	Zeppelin Dev-Metatron 개발서버에 구축된 Zeppelin	 zeppelin	http://metatron-web-04:8080	2019-04-04 14:57 by admin	2019-03-21 14:35 by admin
<input type="checkbox"/>	te2	 zeppelin	http://150.28.69.116:80	2018-11-23 16:06 by admin	2018-11-23 16:06 by admin
<input type="checkbox"/>	jupyter-default	 jupyter	http://jupyter.mcloud.sktelecom.com:80	2018-08-24 15:49 by Polaris	2018-08-24 15:49 by Polaris
<input type="checkbox"/>	zeppelin-default	 zeppelin	http://zeppelin.mcloud.sktelecom.com:80	2018-08-24 15:49 by Polaris	2018-08-24 15:49 by Polaris

There are 9 lists |  Add a server |  Delete selections

Type ALL

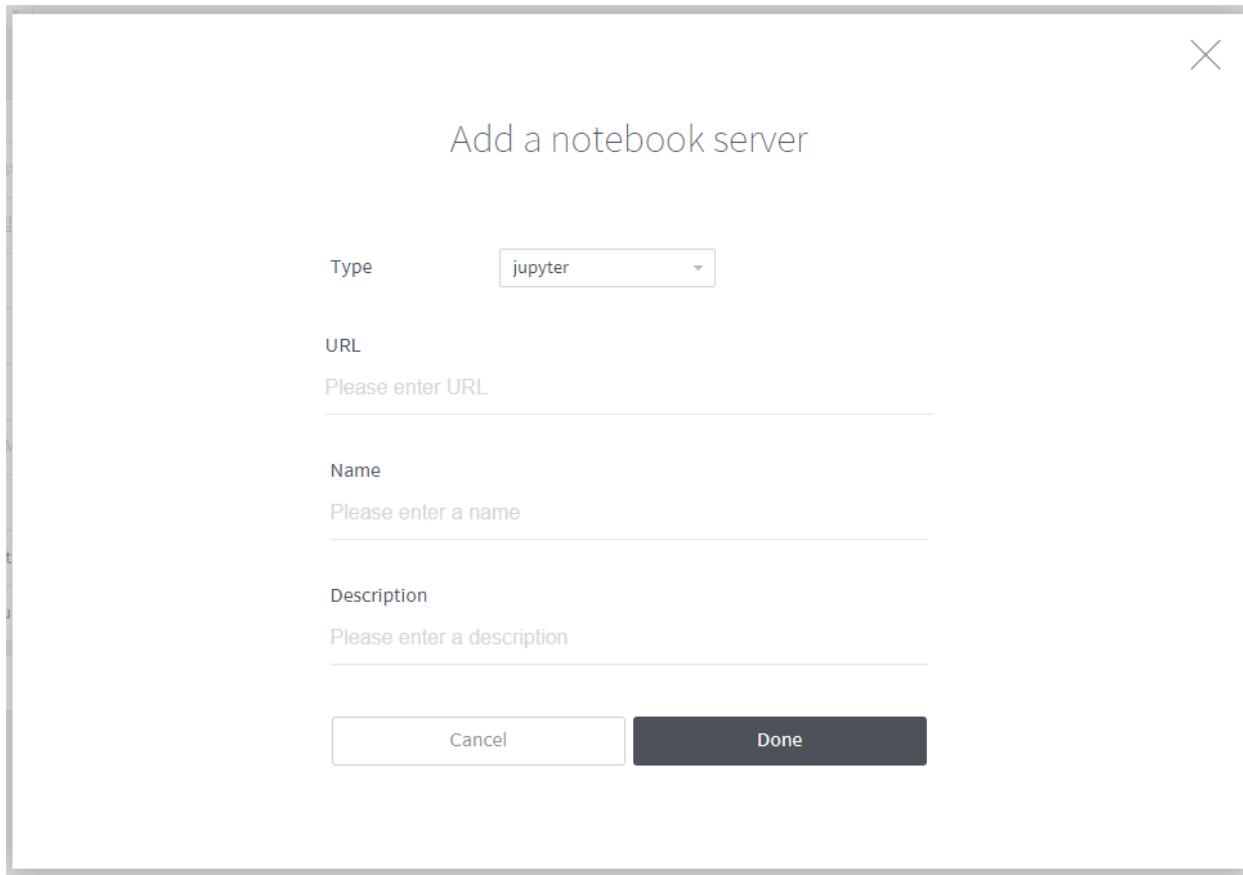
Search by server name

Show up to 20



6.1.2 Add a notebook server

Click the Add a server button in the notebook management home to pop up a window to register a notebook server as follows:

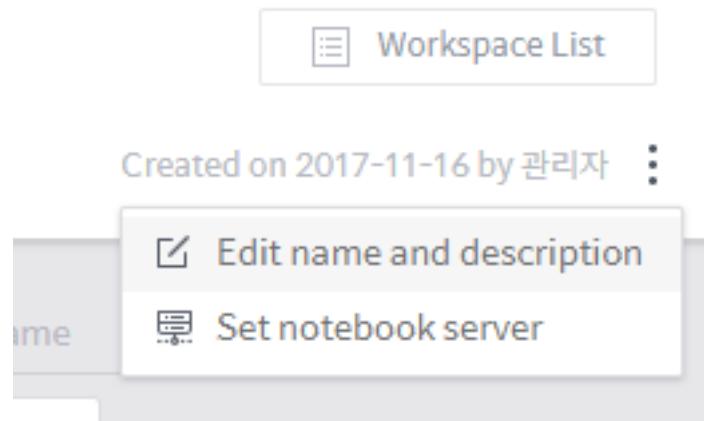


- **Type:** Select the external analytics tool installed in the notebook server to be registered. You can select either **Jupyter** or **zeppelin**.
- **URL:** Enter the URL of the notebook server to be registered. `http://` and `https://` are supported.
- **Name:** Enter a name for the notebook server to be registered.
- **Description:** Enter a description for the notebook server to be registered.

6.2 Register a notebook server

To analyze data in a workspace using a notebook, initial settings are required for the notebook server. The procedure for initial settings for a notebook server is as follows:

1. 워크스페이스의 우측 상단에 있는 버튼을 클릭한 후 노트북 서버 설정을 선택합니다.



- 관리자가 사전에 등록해 둔 Jupyter, Zeppelin 서버 목록 중에서 본인 워크스페이스에서 연결해서 사용하고자 하는 노트북 서버를 선택 후 마침버튼을 클릭합니다.
 - 아무 서버도 선택하지 않고자 한다면, (없음) 항목을 선택하십시오.

Set notebook server

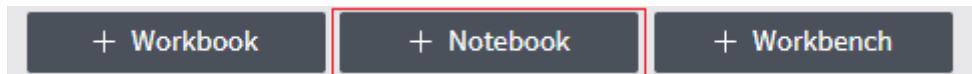
Cancel Done

Server	URL
(None)	
jupyter -수정	http://metatron-web-04:8888
jupyter-default	http://jupyter.mcloud.sktelecom.com:80
QA_Test -test입니다 수정확인	http://www.

6.3 Create a notebook

Once the notebook server has been set up, you can create a notebook. A notebook is created as follows:

1. Click the **+ Notebook** button at the bottom of the workspace. You'll be prompted to create a notebook.



2. Select the type of data set that you wish to analyze in the notebook. You can choose between **Data source**, the unit of data used in Metatron Discovery, **Dashboard**, **Chart**, and **Not selected**. If you want to use Zeppelin, select **Not selected**.

Select a data type



Datasource



Dashboard



Chart



Not selected

Cancel

3. After selecting either **Data Source**, **Dashboard**, or **Chart**, you can see a list of data currently registered in Metatron Discovery. Select the data to analyze and click Next.

The screenshot shows a user interface for creating a new notebook. At the top, there's a small logo and a link to 'Create a Notebook'. Below that is a progress bar. The main area is titled 'Please select a datasource' and contains a search bar and a table of data sources.

No.	Datasource	Type	Used in	Updated
32	aaaaaaaaaa [Open data]	Ingested...	All Notebooks	2018-05-15
31	AirBnB_in_NYC [Open data]	Ingested...	All Notebooks	2018-05-15
30	Economy - Tableau example data [Open data]	Ingested...	All Notebooks	2018-05-15
29	edas_sample_100_01 - 샘플용 [Open data]	Ingested...	All Notebooks	2018-05-16 ✓
28	employee_001 [Open data]	Ingested...	All Notebooks	2018-05-15
27	Excel-test - Excel-test [Open data]	Ingested...	All Notebooks	2018-05-15
26	ignoreInvalidRows_sample [Open data]	Ingested...	All Notebooks	2018-05-15
25	null_test [Open data]	Ingested...	All Notebooks	2018-05-15

Below the table, there's a 'More ▾' button. To the right, a detailed view of the selected datasource 'edas_sample_100_01' is shown:

- Created:** 2018-05-15
- Type:** Ingested type
- Visibility:** Public
- Size:** 31.40 MB
- Rows:** 3,700,900

On the far right, there's a sidebar with a close button (X) containing the following details:

- Dimension: edas_sample_100.event_time
- Dimension: edas_sample_100.dim_01
- Dimension: edas_sample_100.dim_02
- Dimension: edas_sample_100.dim_03
- Dimension: edas_sample_100.dim_04
- Dimension: edas_sample_100.dim_05
- Dimension: edas_sample_100.dim_06
- Dimension: edas_sample_100.dim_07
- Measure: edas_sample_100.measurement

At the bottom, there are 'Cancel' and 'Next' buttons.

4. Enter the information about the notebook that you want to use as an analytics tool for data. The **server type** can only be selected for a notebook server connected at the initial notebook server setup. If **Jupyter** is selected, “R” or “Python” can be selected for analysis, whereas “Spark” (Scala) is used when **Zeppelin** is selected.

 Create a Notebook

○ — ●

Please complete notebook creation

Chart sale performance > sales performance dashboard > q-over-q

Server type

Develop language

Name
Please enter a name

Description
Please enter a description

5. Once a notebook has been created, you can find it in the workspace.

The screenshot shows the 'Admin workspace' in Metatron Discovery. At the top, there are tabs for 'Workbook 55', 'Notebook 14' (which is selected), and 'Workbench 42'. Below the tabs, there's a search bar and a message indicating the workspace was created on 2017-11-16 by 관리자. The main area displays a grid of workspace items. One item, 'dfads', is highlighted with a red box. The 'dfads' item is a 'notebook' last updated a day ago. Other visible items include 'edas' (last updated an hour ago), 'SJ' (last updated 5 hours ago), 'sohnkw' (last updated a day ago), and several 'workbook' and 'workbench' items. At the bottom, there are buttons for 'Select all', 'Clone Workbook', 'Move selections', 'Delete selections', and three buttons labeled '+ Workbook', '+ Notebook', and '+ Workbench'.

6.4 Use a notebook

In a newly created notebook, you can write a script and serve it through a REST API. A notebook can be used as follows:

6.4.1 Detailed notebook page

On the workspace screen, select the notebook you want to use as an analytics tool. Then, the following screen with detailed information appears. You'll see basic information on the notebook: data type, data source name, development language, and analytic code, etc.

The screenshot shows a user interface for managing datasets. At the top, there's a navigation bar with a back arrow, a 'Notebook' button (which is highlighted with a blue border), the dataset name 'dfads', and a preview link 'adsfasdf'. Below this, there are four data entries:

Data type	DATASOURCE
Datasource	Economy
Develop language	SPARK
Code	Detail

A horizontal dotted line separates this from the 'API' section. The 'API' section contains the text 'No API information.' and a large grey button labeled 'Create API'.

6.4.2 Notebook coding

Click **Detail** on the notebook page to pop up a new window for coding in the notebook. At the top of this window, a code to load a dataset is inserted; executing this cell loads a JSON dataset as the dataset object.

```

// 1. load dataset
import app.metatron.discovery.connector._;
val conf = new MetisClientSetting();
conf.setting("host", "metatron-web-01").setting("port", "8080");
val client = new MetisClient(conf);
val dataset = client.loadData(spark, "datasources", "ds-gis-37", "1000")

// 2. analyze
dataset.show()

```

The screen above appears when Zeppelin is selected and includes a cell for loading the data selected when the notebook was created. After coding the program starting from the third cell, click **Save** when you are finished.

6.4.3 Register a notebook API

Once you write a notebook code, you can return the results by calling a REST API. Select a **Return type** by referring to the descriptions below, and enter a **Name** and **Description**.

API information

Return type HTML JSON NONE

Name
Please enter a name

Description
Please enter a description

Cancel Done

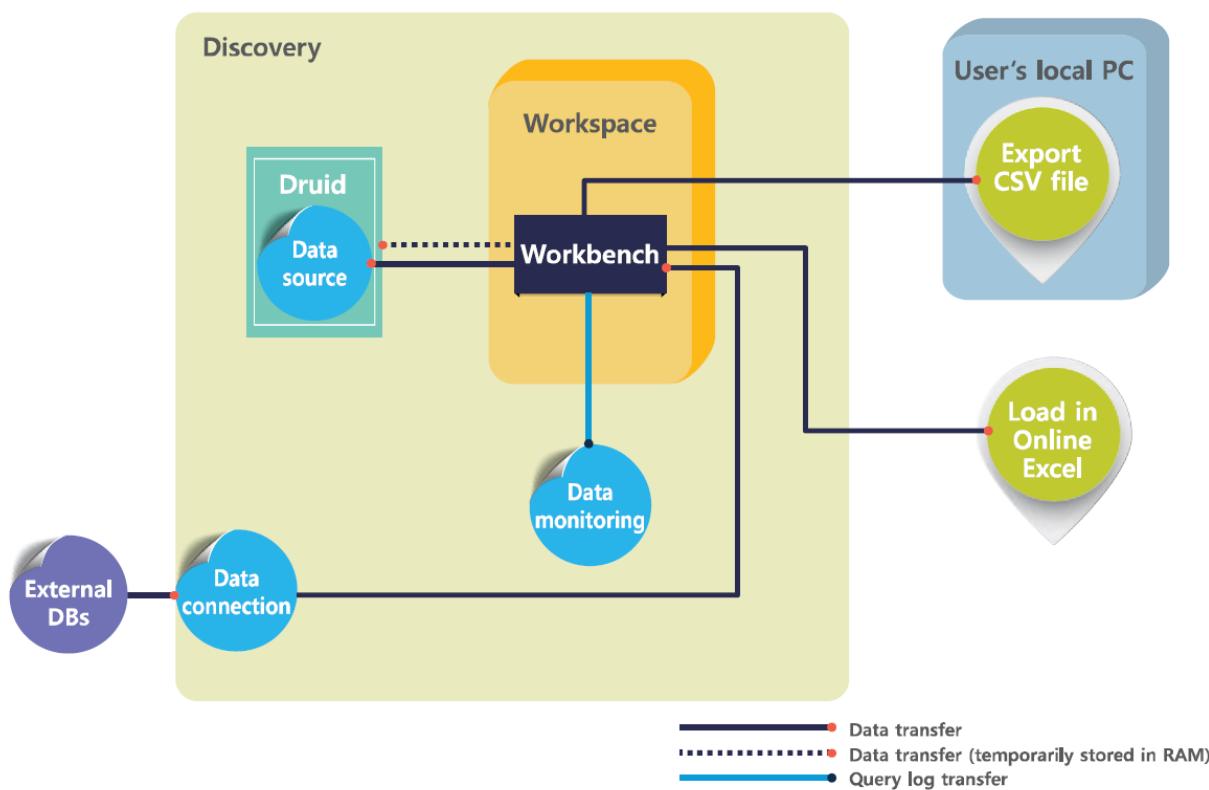
- **HTML:** The results of running the notebook script are returned in HTML.
- **JSON:** The results of running the notebook script are returned in a custom JSON format. In this case, the `response.write(...)` function provided by Metatron Discovery will be used. The following is an example code for using the `response.write` function:
 - R-based notebook: `response.write(list(coefficient = 2, intercept = 0))`
 - Python-based notebook: `response.write({'coefficient' : 2.5, 'intercept' : 0})`
- **None:** Runs the notebook script but does not provide returns.

Once you enter API information and click **Done**, the API is created to provide a REST API URL as shown below. Click **Result** to view the URL execution results in a popup window.

Name	RESTful API
Description	
URL	http://metatron.mcloud.sktelecom.com/api/notebooks/rest/354599d4-444a-43ab-b966-fdadffd12e7e
Return type	HTML
API result	Result

[Edit API](#) [Delete API](#)

WORKBENCH



Metatron Workbench provides an environment for data preparation and analytics based on SQL. Its main functions are as follows:

- Various external databases can be loaded in one space.
- The user can conveniently navigate/select linked tables and columns and view their details.
- Query edit tools are embedded and query results can be viewed interactively and available for various uses:

- Query results can be downloaded into a local file or exported to an online Excel.
- Query results can be interactively visualized to help the analyst see an outline of the resulting data table.
- Query results can be stored as a data source available for analytics in a workbook or notebook.

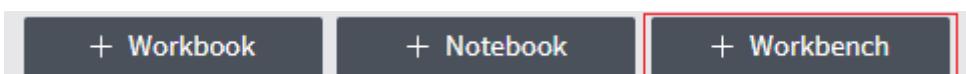
Each document that stores SQL-based analytic queries is called a “workbench.” This chapter introduce how to **create** and **use** workbenches.

7.1 Create a workbench

To use a workbench in the workspace, a workbench-type data connection must be established. See [Data Connection](#) for how to handle it.

To create a workbench:

1. Click the **+ Workbench** button at the bottom of the workspace. You’ll be prompted to select a data connection for data analytics.



2. Select the workbench-type data connection that connects to the data table you want, and click **Next**.

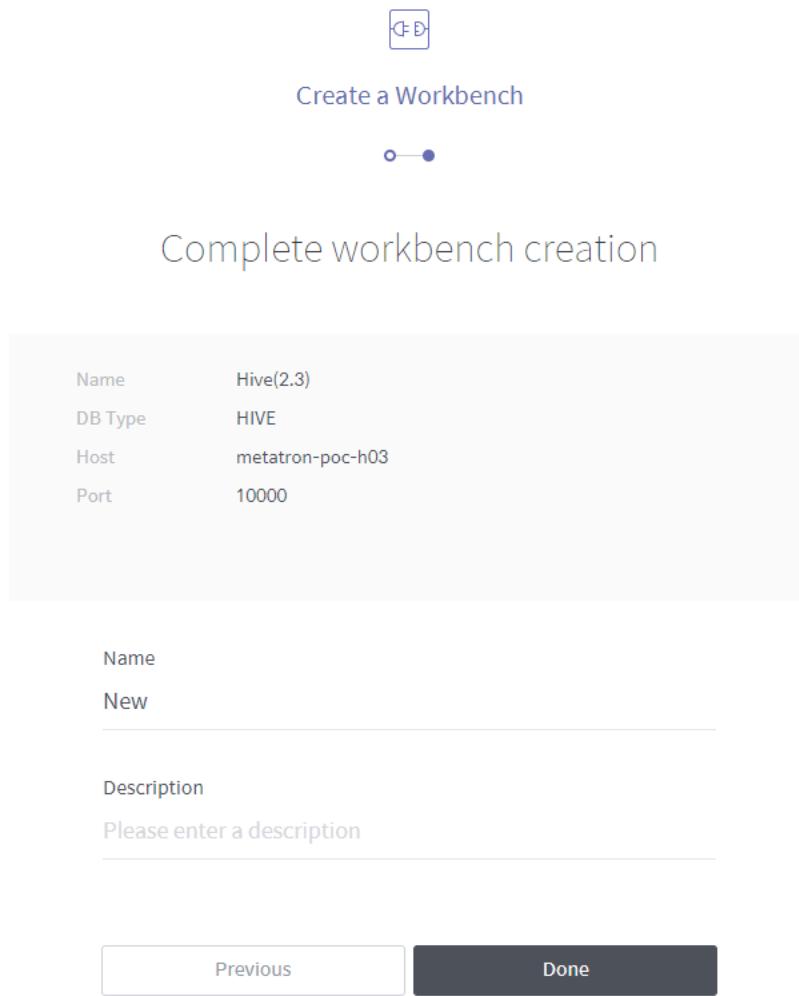
Please select data connection

No.	Data connection	Type	Host	Port	Account type	Updated
5	Tibero_Exntu	TIBERO	exntu.kr	8629	Enter by manager	2018-05-08
4	local_mysql	MYSQL	metatron-po...	3306	Enter by manager	2018-04-10
3	azure-mysql-test	MYSQL	metatron-po...	3306	Enter by manager	2018-03-22
2	Hive(2.3)	HIVE	metatron-po...	10000	Enter by manager	2018-01-10
1	Hive(1.2)	HIVE	metatron-po...	10000	Enter by manager	2017-11-23

More ▾

Cancel Next

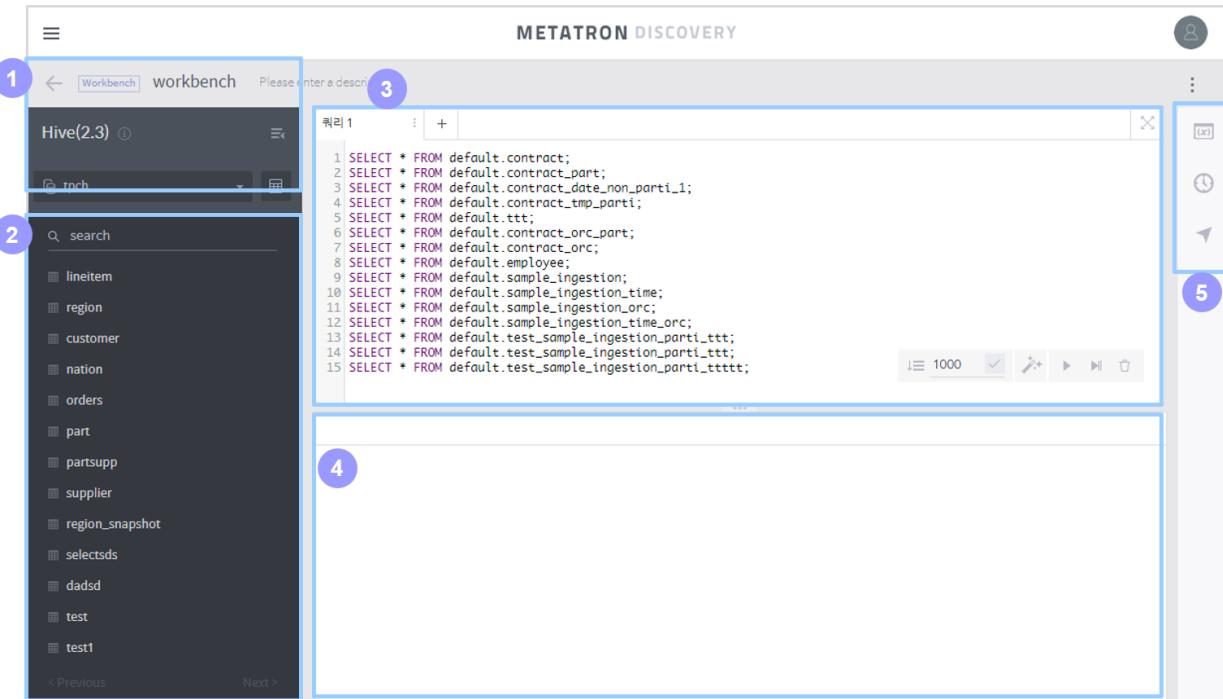
- Search by name of data connection:** Searches the list of data connections available to the workspace by the name you type in.
 - DB type:** Filters data connections by database type (Oracle/MySQL/Hive/Presto/Tibero). Select All to display data connections regardless of database type.
 - Account type:** Filters data connections by account type (All/Always connect/Connect by user's account/Connect with ID and password). Select All to display data connections regardless of account type.
 - Data connection:** Lists data connections filtered by specified criteria.
3. Confirm the information of the selected data connection and enter a name and a description to create a workbench.



4. The created workbench is immediately available.

7.2 Use a workbench

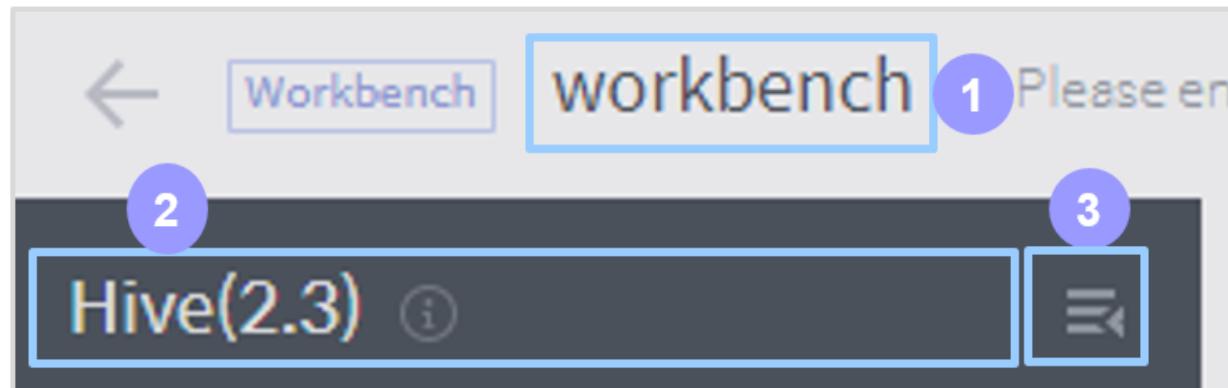
In the workbench, you can edit and manage an SQL database easily, as well as visualize and store the results of a query on it in various forms. The workbench page consists of five sections shown below, and an additional schema browser is provided.



1. Basic information section (See [Basic information section](#))
2. Schema and table section (See [Schema and table section](#))
3. Query editor section (See [Query editor section](#))
4. Query results section (See [Query results section](#))
5. Extra tools section ([Extra tools section](#))
6. Schema browser ([Schema browser](#))

7.2.1 Basic information section

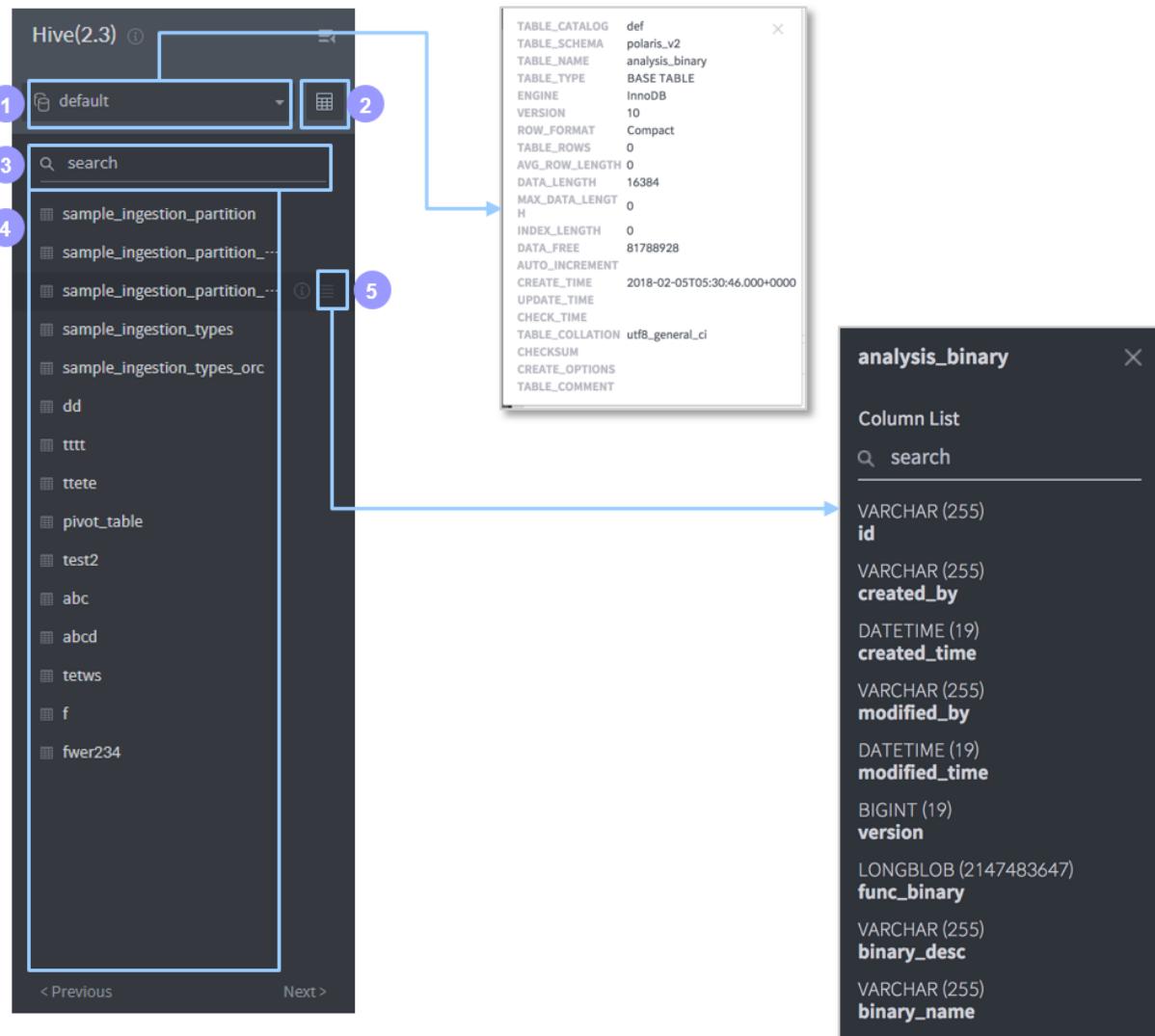
This section displays basic information on the active workbench.



1. **Name:** Name of the workbench. Click on it to change the workbench's name.
2. **Data connection:** Name of the data connection used by the workbench. Click the icon to view its details.
3. : UI button to collapse or expand the panel.

7.2.2 Schema and table section

This section provides a UI to conveniently insert the name of a database, table, or column in the query editor.

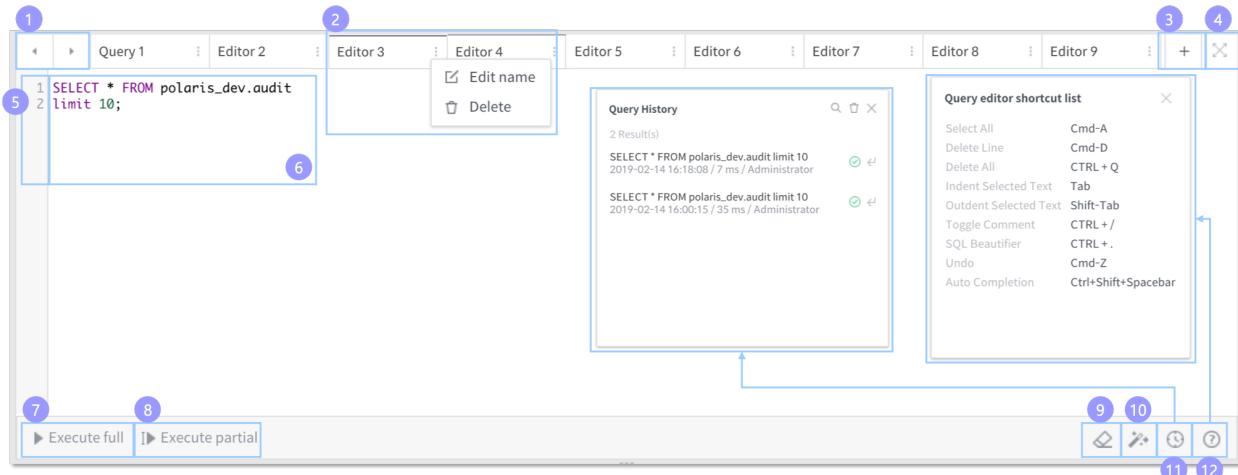


- 1. Database name:** Displays the name of the selected database. By default, the first database of the data connection used by the workbench is selected. Click on it to list all databases included in the data connection. Select a database in the list to replace the currently selected database.
- 2. Schema browser:** A popup browser displaying the table list of the selected database, and information of all the columns and records in each table.
- 3. Search table:** Searches the list of the tables registered in the selected database by the name you type in.
- 4. Table name:** Select a table to automatically insert it in the query editor along with a `SELECT * FROM {table name}` query.
- 5. Column list:** Displays all columns belonging to the table and their respective data types.

Click a column name to automatically insert it in the query editor.

7.2.3 Query editor section

This section allows you to edit and run queries.



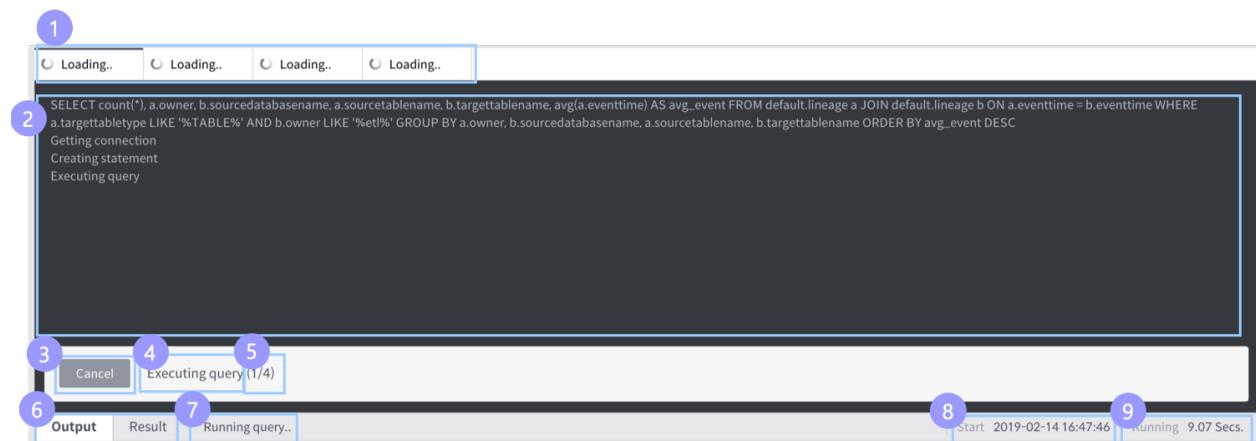
1. : Navigates to tabs of previous or subsequent queries when there are too many tabs. If tabs are not many, this button will not appear.
2. **Tab:** You can run or store queries in separate tabs for more efficient management of them. Click the button to edit the tab title or delete the tab.
3. : Click this button to add a new tab.
4. : Click this button to minimize the query editor or maximize it to full screen.
5. **Query lines:** Displays the numbering of the query code lines.
6. **Editor area:** Write query statements in this area. You can run either single or multiple queries. Insert ; at the end of each query statement to run them separately. Autocomplete is supported.
7. **Execute full:** Execute all queries in the editor. (Shortcut: Ctrl + Enter)
8. **Execute partial:** Executes only the query statement where the cursor is located, or execute queries selected by dragging the mouse. (Shortcut: Command + Enter)
9. **CLEAR SQL:** Clears all query statements.
10. **SQL BEAUTIFIER:** Re-words query statements using standard query syntax.

11. **Query History:** Lists past queries executed in the query editor. If you select a query in the list, it will be inserted in the query editor.
12. **Query Editor Shortcuts:** Shows a list of shortcuts available in the query editor.

7.2.4 Query results section

Once a query is executed, its results are displayed in a query results tab. Query results tabs are cumulatively added, and you can selectively delete specific results tabs. Query results are displayed in a text grid, and they can be previewed in charts, stored into data sources, and exported into CSV files.

During query execution



1. **Query result tabs:** When multiple queries are executed, a different tab is created for each query to show its result. While a query's execution is in progress, “Loading” is displayed in its tab title.
2. **Query log:** Shows an execution log for the query. In the case of a Hive connection, a Hive job log is additionally displayed.
3. **Cancel:** Cancels the execution of the query. The time taken for cancellation may vary with the DB type.
4. **Query execution phase:** Shows the current phase of query execution. There are a total of five query execution phases.
 - Getting connection
 - Creating statement

- Executing query
 - Getting result set
 - Done!
5. **No. of the current query:** Shows the number of the currently executed query when multiple queries are executed.
 6. **Output/Result tabs:** By clicking either tab, you can switch to the query log/result view.
 7. **Query status:** Shows the query's status from among:
 - Running query
 - Query execution failed..
 - Query execution canceled..
 8. **Query start time:** Displays when the query execution started.
 9. **Query running time:** Displays how long it took to execute the query.

After query execution

The screenshot shows the Metatron Workbench interface after a query has been executed. The main area displays a data table with 10 rows of results. The columns are labeled: No., # lineage.eventtime, lineage.cluster, lineage.currentdatabase, lineage.targettabletype, and lineage.expr. The first few rows show entries like '1001 1521503450894 collector adw DFS_DIR'. Below the table, there are tabs for 'Output' and 'Result' (which is selected). At the bottom, there are performance metrics: Start 2019-02-14 17:39:56, Finish 2019-02-14 17:39:58, Running 1.7 Secs., and 2,000 / 2,500 Rows. A search bar at the bottom right is labeled 'Search by column data'. Numbered circles (1-12) point to specific UI elements: 1 points to the 'Result' tab; 2 points to the top navigation bar; 3 points to the 'Output' tab; 4 points to the search bar; 5 points to the 'PREV' button; 6 points to the 'NEXT' button; 7 points to the refresh icon; 8 points to the search icon; 9 points to the 'Start' timestamp; 10 points to the 'Finish' timestamp; 11 points to the 'Running' time; and 12 points to the row count.

1. **Query result tabs:** When multiple queries are executed, a different tab is created for each query to show its result. While a query's execution is in progress, “Loading” is displayed in its tab title.
2. **Data details:** Shows a data table resulting from executing the query. You can copy this data output to the clipboard.

3. **Output/Result tabs:** By clicking either tab, you can switch to the query log/result view.
4. **Search for column data:** Searches for a column or value in the resulting table.
5. **Chart preview:** Draws a virtual chart of the query results. This chart is only for visualization; it is not stored in the workspace. (See [Chart](#) for how to handle it)
6. **Save as Data source:** Stores the query results into a data source in the workspace. A dialog box will pop up to create a data source, and the resulting table is used instead of selecting a data connection and a table. Therefore, you will be immediately prompted to set the schema definition and ingestion cycle. (See [Create a data source](#) for how to handle it)
7. **Export CSV file:** Downloads the resulting table into a local file (CSV).
8. **Data page navigation:** If the resulting data includes more than 1,000 rows, you can navigate the data pages using the Prev and Next buttons.
9. **Query start time:** Displays when the query execution started.
10. **Query finish time:** Displays when the query execution finished.
11. **Query running time:** Displays how long it took to execute the query.
12. **Query data rows:** Shows the number of rows of the resulting data and the current page number.

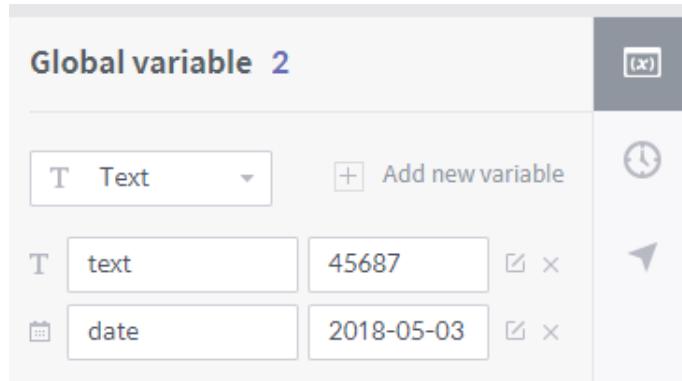
7.2.5 Extra tools section

The extra tools section provides useful tools for the workbench.

- Setting up global variables for repeatedly used statements (See [Setting up global variables](#))
- Navigation to move to another workbench (See [Workbench Navigation](#))

Setting up global variables

If a certain type of statement is repeatedly used with a different value for each query run, set the variable element as a “global variable” for convenient use.



- **Variable type:** You can select either a calendar or text type.
- **Add new variable:** Select the variable type you want and click “Add new variable.” A new global variable will be added in the query editor.
- **Name:** Enter a name for the variable.
- **Variable value:** For a calendar variable, select a date; for a text variable, select a text value.

Workbench Navigation

Used to move to another workbench. Click the target workbench to move to.

Workbench Navigation (15)

 search

No.	Workbench name	Updated
42	workbench	2018-05-16
41	new	2018-05-16
40	metatron_metadata	2018-05-15
39	stage_03	2018-05-15
38	Tibero	2018-05-08
37	로컬 확인용	2018-04-30
36	aaa	2018-04-30
35	gg	2018-04-26
34	test-Magenta	2018-04-20
33	teddypark	2018-04-19
32	test_workspace	2018-04-16
31	경제지표	2018-04-09
30	111	2018-04-05
29	ddd	2018-04-05
28	test	2018-04-04

- **Search for workbench:** Search for a workbench stored in the workspace.
- **Workbench list:** Displays all workbenches stored in the workspace. Click a workbench in the list to move to that workbench.

7.2.6 Schema browser

Displays the table list of the selected database, and information of the columns and records in each table.

Scheme Information					
Columns		Information	Data		
No.	Column Name	Type	Description		
1	base_time	STRING(2147483647)			
2	local_time	STRING(2147483647)			
3	recv_time	STRING(2147483647)			
4	os_name	STRING(2147483647)			
5	os_version	STRING(2147483647)			
6	resolution	STRING(2147483647)			
7	screen_width	BIGINT(19)			
8	screen_height	BIGINT(19)			
9	language_code	STRING(2147483647)			
10	rake_lib	STRING(2147483647)			
11	rake_lib_version	STRING(2147483647)			
12	ip	STRING(2147483647)			
13	recv_host	STRING(2147483647)			
14	token	STRING(2147483647)			
15	log_version	STRING(2147483647)			
16	device_id	STRING(2147483647)			
17	device_model	STRING(2147483647)			
18	manufacturer	STRING(2147483647)			
19	carrier_name	STRING(2147483647)			
20	network_type	STRING(2147483647)			
21	app_version	STRING(2147483647)			
22	browser_name	STRING(2147483647)			
23	browser_version	STRING(2147483647)			
24	referrer	STRING(2147483647)			
25	url	STRING(2147483647)			
26	document_title	STRING(2147483647)			

- **Column:** Shows the names and data types of all columns of the selected table.
- **Information:** Displays attributes of the selected table.
- **Data:** Displays data of the selected table. A maximum of 50 rows can be viewed.

CHAPTER

EIGHT

DATA PREPARATION

Data Preparation is a tool that creates transformation rules to transform files and tables for more convenient analysis of datasets, and saves the results into HDFS or Hive.

Advantages of data preparation in Metatron Discovery

The screenshot shows the Metatron Discovery Data Preparation interface. At the top, it displays the file name "sales.csv", the number of columns (28), rows (100), and types (4). Below this is a grid view of the data with various columns like OrderDate, Category, City, Country, CustomerName, Discount, and OrderID. Each column has a histogram above it showing the distribution of values. To the right of the grid is a "RULE (9)" panel titled "SNAPSHOT (1)". This panel lists nine transformation rules:

- create with sales.csv
- convert row 1 to header
- set type _OrderDate_ to Timestamp
- set type ShipDate to Timestamp
- set type 9 columns to Long
- set type 3 columns to Double
- drop SalesAboveTarget_1
- drop orderprofitable_1
- drop location

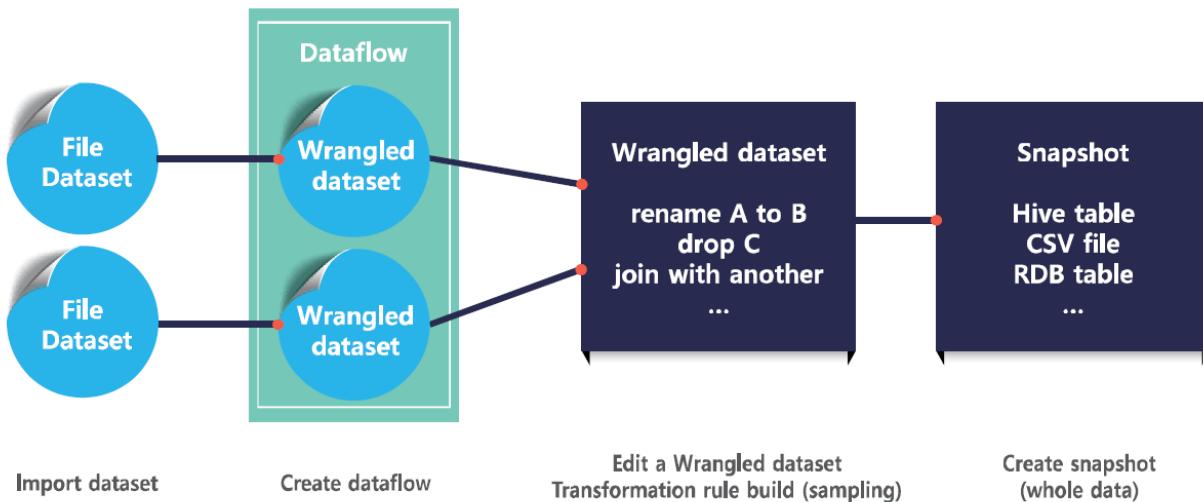
At the bottom of the interface, there are buttons for "Add rule", "Switch to editor", "Cancel", and "Add". A command bar at the very bottom includes a search field and a dropdown menu labeled "Choose Rule Function".

Users can create transformation rules by following the step-by-step process as shown in the above GUI. Since the transformation results from each step are stored in memory together with the data distribution, users can easily check the results through the simple click of a button and perform **undo** and **redo** just like using a text editor.

Based on these characteristics, the data preparation tool offers the following advantages:

- Users unfamiliar with programming or data processing can obtain the desired results.
- Adding a transformation rule usually involves programming or writing an SQL query. However, Metatron Discovery's Data Preparation provides a GUI for **exploratory transformation** that enables the creation of transformation rules simply by clicking a button or typing.
- Basic data transformation is conducted automatically. For instance, a type cast is automatically applied to columns comprised of numerals. This is made possible by the **undo** and rule deletion functions.
- Data of different forms can be combined as desired (e.g. reference file + fact table).
- The results of data refinement can be shared with others, thus reducing the burden of exchanging physical data.
- Storage space is saved and **information life cycle (ILM)** shortened by deleting the actual data and retaining only the transformation rules involved. The actual data can be easily created whenever needed.

Structure of data preparation in Metatron Discovery



As shown in the above figure, data preparation is comprised of a **dataset** built from the target data, a **dataflow** that defines transformation rules for the designated dataset, and a **data snapshot** that shows the transformation results.

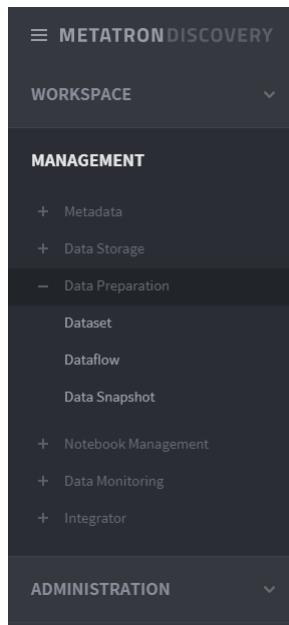
8.1 Create a dataset

A **dataset**, which is the basic unit of data preparation, refers to an entity subject to data operations. Datasets are either **imported datasets** and **wrangle datasets**.

- **Imported Dataset:** A source data entity before the implementation of transformation rules
- **Wrangled dataset:** A data entity subject to analysis following the implementation of transformation rules

A wrangled dataset is created during the **dataflow** setting process, which defines transformation rules, while an imported dataset is created during this dataset creation procedure.

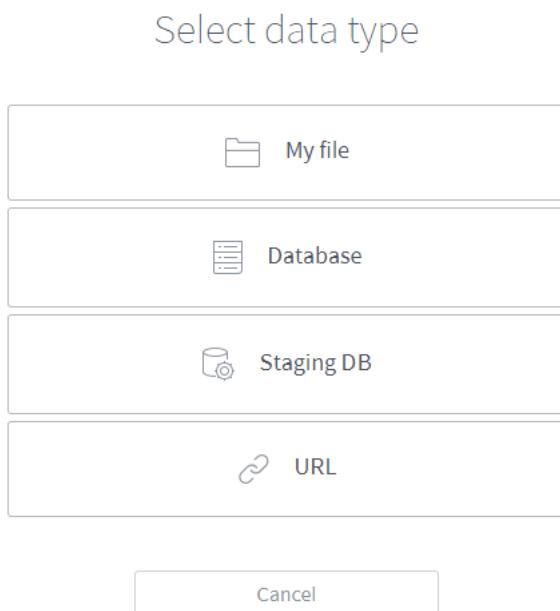
The Dataflow menu can be accessed under **MANAGEMENT** > **Data Preparation** > **Dataset** on the left-hand panel of the main screen.



Next, on the upper right of the dataset page, click the **+ Generate new dataset** button to create a new dataset.

The screenshot shows the Metatron Discovery interface with the 'Data Preparation' section selected. At the top, there are tabs for 'Dataset' (which is underlined), 'Dataflow', and 'Data Snapshot'. Below the tabs is a search bar with the placeholder 'Search by name of datasets'. To the right of the search bar are filter buttons for 'Type' (with 'IMPORTED' checked and 'WRANGLED' uncheckable), a message indicating 'There are 48 lists', and a button to 'Generate new dataset'. A user profile icon is in the top right corner.

In the dataset creation page, select the dataset type.



- **My file:** Create a dataset by opening the user's local file or via a URI (upcoming feature) (See [Create a dataset from a file](#) for a detailed procedure).
- **Database:** Create a dataset using external database access information and queries (See [Create a dataset from a database](#) for a detailed procedure).
- **Staging DB:** Create a dataset from the staging DB built in Metatron (See [Create a dataset from staging DB](#) for a detailed procedure).

Note: The Staging DB is an in-cluster database that stores data temporarily in order to facilitate data loading. Hive is generally used for it.

8.1.1 Create a dataset from a file

Create a dataset by opening the user's local file or via a URI (upcoming feature).

1. On the data type selection page, select **My File**.
2. Select a file to be used as a data source from your local PC. You can click the **Import** button to select a file, or drag and drop the file into the box. Once a file is selected, click Next.

Create file type dataset

Please select data

Import or drop file here

xls, .xlsx, .txt, .csv and .json formats are allowed

Upload Location LOCAL ▾

Cancel Next

3. Check the grid of the uploaded file, and designate a column delimiter. Proceed if the data is successfully displayed.

Create file type dataset
Please select data

sales-data-sample.csv >  sales-data-sample 28 Column(s)

OrderDate	Category	City	Country	CustomerName	#
2011-01-04T00:00:00	Office·Supplies	Houston	United·States	Darren·Powers	
2011-01-05T00:00:00	Office·Supplies	Naperville	United·States	Phillina·Ober	
2011-01-05T00:00:00	Office·Supplies	Naperville	United·States	Phillina·Ober	
2011-01-05T00:00:00	Office·Supplies	Naperville	United·States	Phillina·Ober	
2011-01-06T00:00:00	Office·Supplies	Philadelp...	United·States	Mick·Brown	
2011-01-07T00:00:00	Furniture	Henderson	United·States	Maria·Etezadi	
2011-01-07T00:00:00	Office·Supplies	Athens	United·States	Jack·OBriant	
2011-01-07T00:00:00	Office·Supplies	Henderson	United·States	Maria·Etezadi	
2011-01-07T00:00:00	Office·Supplies	Henderson	United·States	Maria·Etezadi	
2011-01-07T00:00:00	Office·Supplies	Henderson	United·States	Maria·Etezadi	
2011-01-07T00:00:00	Office·Supplies	Los·Ange...	United·States	Lycoris·Saunders	
2011-01-07T00:00:00	Technology	Henderson	United·States	Maria·Etezadi	
2011-01-07T00:00:00	Technology	Henderson	United·States	Maria·Etezadi	
2011-01-08T00:00:00	Furniture	Huntsville	United·States	Vivek·Sundaresam	
2011-01-08T00:00:00	Office·Supplies	Huntsville	United·States	Vivek·Sundaresam	
2011-01-10T00:00:00	Office·Supplies	Laredo	United·States	Melanie·Seite	
2011-01-10T00:00:00	Technology	Laredo	United·States	Melanie·Seite	
2011-01-11T00:00:00	Furniture	Springfield	United·States	Anthony·Jacobs	

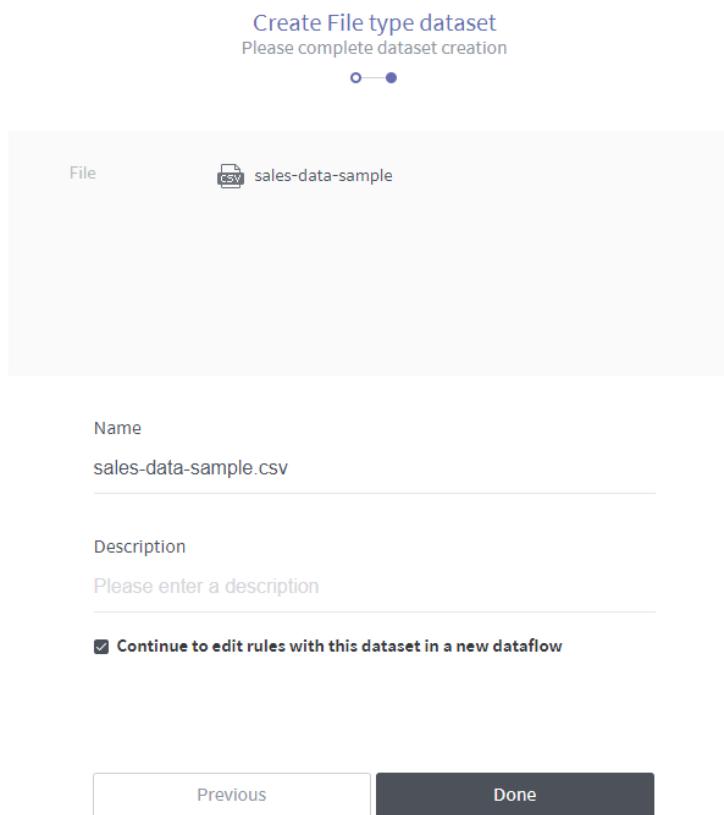
Advanced settings ▲

Column delimiter

Column count

[Previous](#) [Next](#)

4. Enter the **Name** and **Description** of the dataset, and click the **Done** button.



- Once the dataset is created, the dataset list is displayed. You can check that the list contains the newly created dataset.

≡ METATRON DISCOVERY



Data Preparation

Dataset Dataflow Data Snapshot

Name	Used in	Source	Created
IMPORTED sales-data-sample.csv	1	FILE(CSV)	2019-05-06 18:41 by Administrator

8.1.2 Create a dataset from a database

Create a dataset using external database access information and queries.

To create a dataset from a database, you should first create a data connection. See [Create a data connection](#) for a detailed procedure.

Data Storage

Datasource Data Connection

There are 4 lists

Data connection	DB Type	Host/Port(URL)	Created
Hive-metatron-hadoop-01-10000	Hive	metatron-hadoop-04 / 10000	2019-03-13 15:18 by Administrator
Presto-metatron-hadoop-01-8089	Presto	metatron-hadoop-01 / 8089	2019-03-02 16:10 by Administrator
druid connection	Druid	metatron-hadoop-02 / 8082	2019-02-25 13:43 by Administrator
MySQL-metatron-web-03-3306	MySQL	metatron-web-03 / 3306	2019-02-21 10:44 by Administrator

+ New

After establishing the data connection, go to **MANAGEMENT** > **Data Preparation** > **Dataset** > + Generate new dataset.

1. On the data type selection page, select **Database**.
2. Select the data connection, and press the **Test** button to check that the connection is valid.

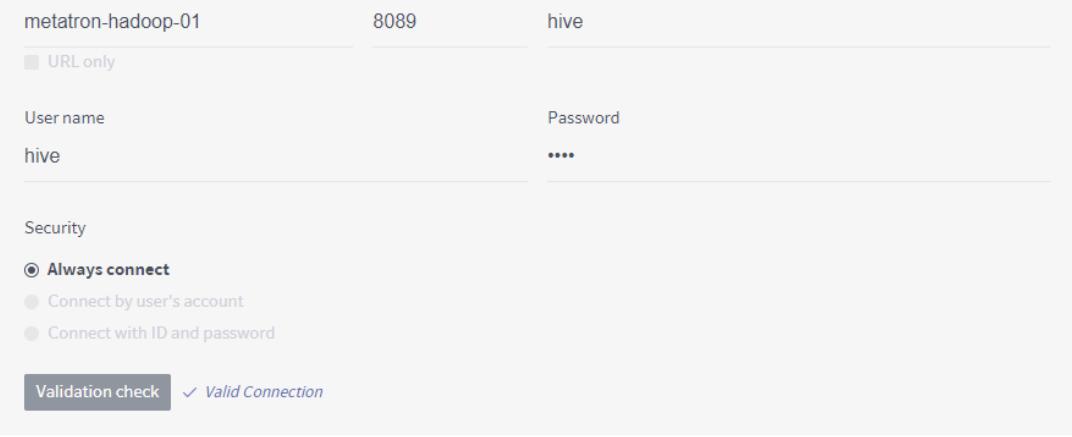
X

Create DB type dataset
Please set data connection

DB connection

MySQL PostgreSQL Hive Presto Druid MSSQL

Host metatron-hadoop-01	Port 8089	Catalog hive
<input type="checkbox"/> URL only		
User name hive	Password ****	
Security		
<input checked="" type="radio"/> Always connect <input type="radio"/> Connect by user's account <input type="radio"/> Connect with ID and password		
<input type="button" value="Validation check"/>	<input checked="" type="checkbox"/> Valid Connection	



3. Select the data. You can either select a table from the connected database, or write a query yourself.

The screenshot shows a user interface for creating a dataset. At the top, it says "Create DB type dataset" and "Please select data". There is a progress bar with three dots, where the middle one is filled black. Below this, there are two tabs: "Table" (which is selected) and "Query". Under "Table", there are dropdown menus for "default" and "addrlist". The main area displays a table with four columns: "ab_street_addr", "ab_split_dong_addr1", "ab_split_dong_addr2", and "ab_apart_nm". The data in the table consists of 20 rows, each containing the same values: "분포로 111", "옹호동 176", "30", and "엘지메트로…". At the bottom, there are "Previous" and "Next" buttons.

ab_street_addr	ab_split_dong_addr1	ab_split_dong_addr2	ab_apart_nm
분포로 111	옹호동 176	30	엘지메트로…
분포로 113	옹호동 176	30	LG메트로시…
분포로 111	옹호동 176	30	엘지메트로…
분포로 113	옹호동 176	30	LG메트로시…
분포로 113	옹호동 176	30	LG메트로시…
분포로 113	옹호동 176	30	LG메트로시…
분포로 113	옹호동 176	30	LG메트로시…
분포로 111	옹호동 176	30	엘지메트로…
분포로 113	옹호동 176	30	LG메트로시…
분포로 113	옹호동 176	30	LG메트로시…
분포로 113	옹호동 176	30	LG메트로시…
분포로 111	옹호동 176	30	엘지메트로…
분포로 111	옹호동 176	30	엘지메트로…
분포로 113	옹호동 176	30	LG메트로시…
분포로 111	옹호동 176	30	엘지메트로…
분포로 113	옹호동 176	30	LG메트로시…
분포로 113	옹호동 176	30	LG메트로시…
분포로 111	옹호동 176	30	엘지메트로…
분포로 111	옹호동 176	30	엘지메트로…

- **Table:** Select a database and a table to display the table's data. Once the data being ingested has been displayed, confirm the data and click **Next**.
 - **Query:** Write a query to import the data you want, and click **Run** to display the data in the lower section. Confirm the data and click **Next**.
4. Enter the **Name** and **Description** of the dataset, and click the **Done** button.

X

Create Database type dataset
Please complete dataset creation

○ — ○ — ●

Type	DB(PRESTO)
Database	default
Table	addrlist
Host	metatron-hadoop-01
Port	8089

Name
addrlist_PRESTO

Description
Please enter a description

Continue to edit rules with this dataset in a new dataflow

Previous Done

- Once the dataset is created, the dataset list is displayed. You can check that the list contains the newly created dataset.



Data Preparation

Dataset Dataflow Data Snapshot

The screenshot shows the 'Dataset' tab selected in the navigation bar. A search bar at the top left contains the placeholder 'Search by name of datasets'. To its right, there are filter buttons for 'Type' (with 'IMPORTED' checked and 'WRANGLED' uncheckable), a message indicating 'There are 50 lists', and a button to 'Generate new dataset'. Below the search bar is a table header with columns: 'Name' (with a dropdown arrow), 'Used in' (with a dropdown arrow), 'Source', and 'Created' (with a dropdown arrow). A single row is visible in the table, representing the dataset 'addrlist_PRESTO'. This row includes the status 'IMPORTED' (highlighted with a blue border), the count '1' under 'Used in', the source 'DB(PRESTO)' with a small blue icon, and the creation timestamp '2019-05-06 18:43 by Administrator'.

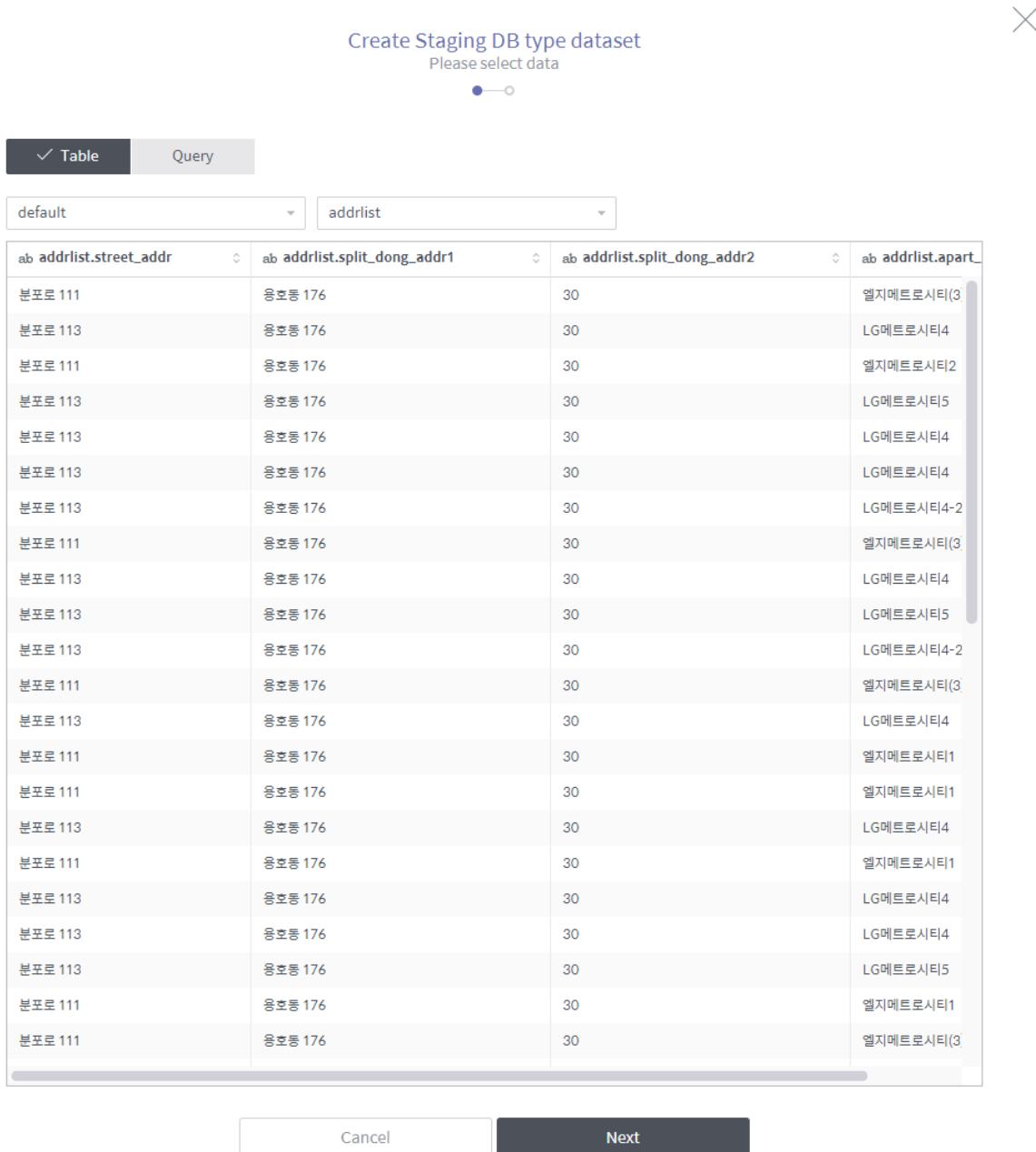
Name	Used in	Source	Created
IMPORTED addrlist_PRESTO	1	DB(PRESTO)	2019-05-06 18:43 by Administrator

8.1.3 Create a dataset from staging DB

Create a dataset from the staging DB built in Metatron.

The creation of a staging DB dataset is the same as dataset creation from a database, but does not involve the selection of a data connection.

1. On the data type selection page, select **Staging DB**.
2. Select the data. You can either select a table from the connected database, or write a query yourself.



- **Table:** Select a database and a table to display the table's data. Once the data being ingested has been displayed, confirm the data and click **Next**.
 - **Query:** Write a query to import the data you want, and click **Run** to display the data in the lower section. Confirm the data and click **Next**.
3. Enter the **Name** and **Description** of the dataset, and click the **Done** button.

Create Staging DB type dataset

Please complete dataset creation

X

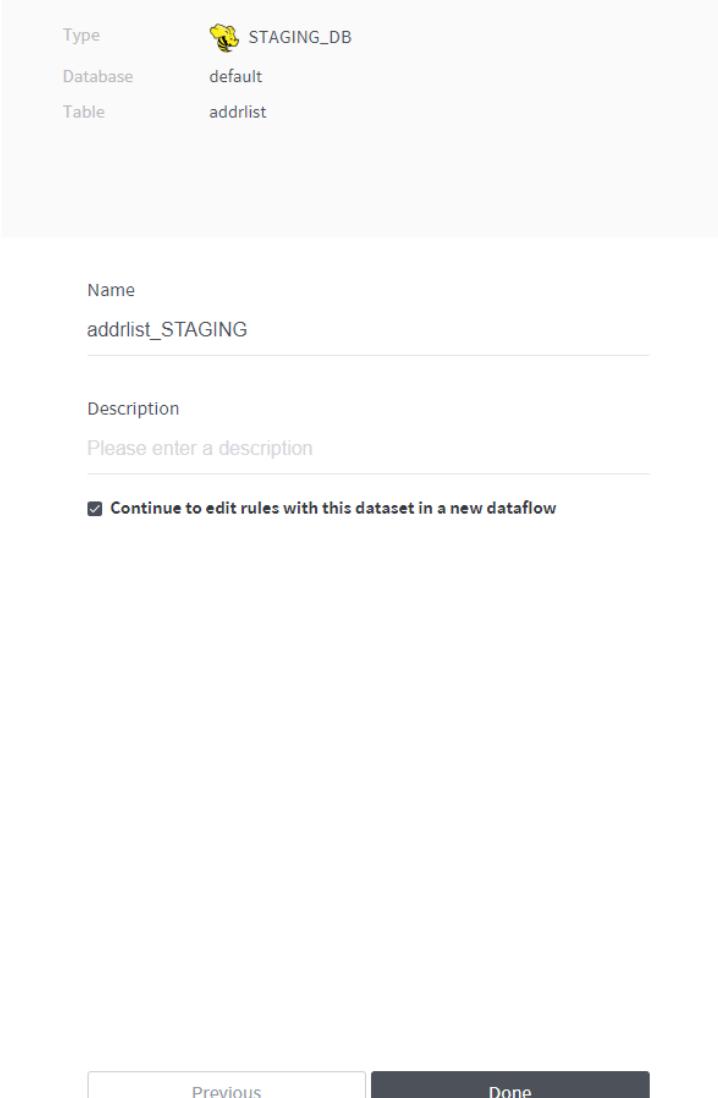
Type	STAGING_DB
Database	default
Table	addrlist

Name
addrlist_STAGING

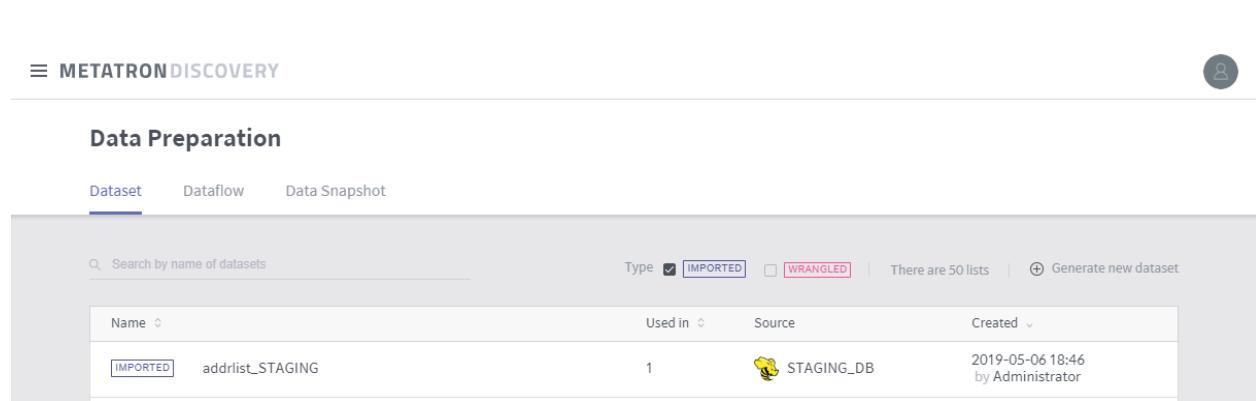
Description
Please enter a description

Continue to edit rules with this dataset in a new dataflow

Previous Done



- Once the dataset is created, the dataset list is displayed. You can check that the list contains the newly created dataset.

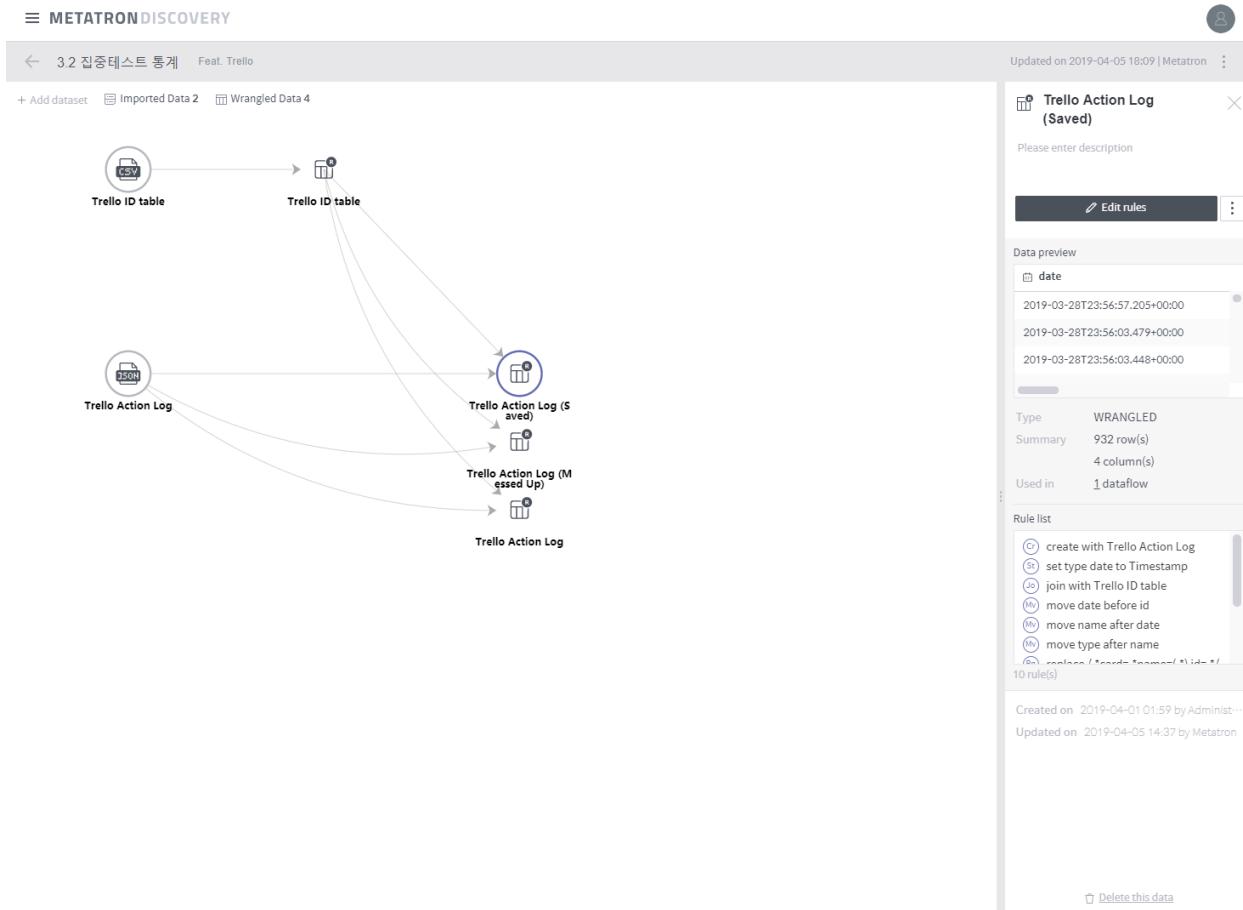


The screenshot shows the Metatron Discovery interface with the 'Data Preparation' tab selected. At the top, there are three navigation tabs: 'Dataset' (selected), 'Dataflow', and 'Data Snapshot'. Below the tabs is a search bar with placeholder text 'Search by name of datasets'. To the right of the search bar are filter options: 'Type' (with 'IMPORTED' checked and 'WRANGLLED' uncheckable), a message 'There are 50 lists', and a '+ Generate new dataset' button. The main area displays a table with the following columns: 'Name', 'Used in', 'Source', and 'Created'. A single row is visible, showing 'addrlist_STAGING' under 'Name', '1' under 'Used in', 'STAGING_DB' with a bee icon under 'Source', and '2019-05-06 18:46 by Administrator' under 'Created'.

8.2 Manage a dataflow

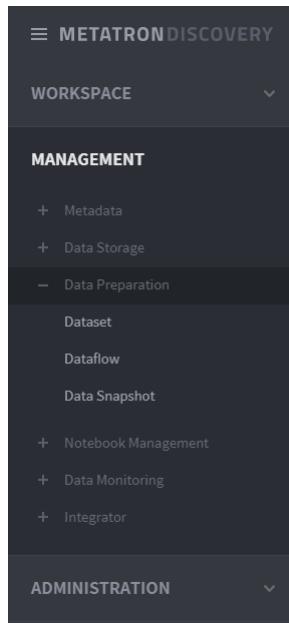
A **dataflow** is the unit of processing a **dataset**. A single dataflow can be associated with multiple datasets to perform transformations. That is, a dataset must belong to a dataflow for transformation rules to be applied. It forms a relationship such as a “join” or “union” with other datasets.

As shown below, the dataflow details page shows the dependency among all datasets in a dataflow, and the transformation rules applied to each dataset.



The following subsections cover the processes involved in defining a dataflow, such as **adding a dataset**, **editing transformation rules**, and **creating a data snapshot with transformation results**.

The Dataflow menu can be accessed under **MANAGEMENT** > **Data Preparation** > **Dataflow** on the left-hand panel of the main screen.



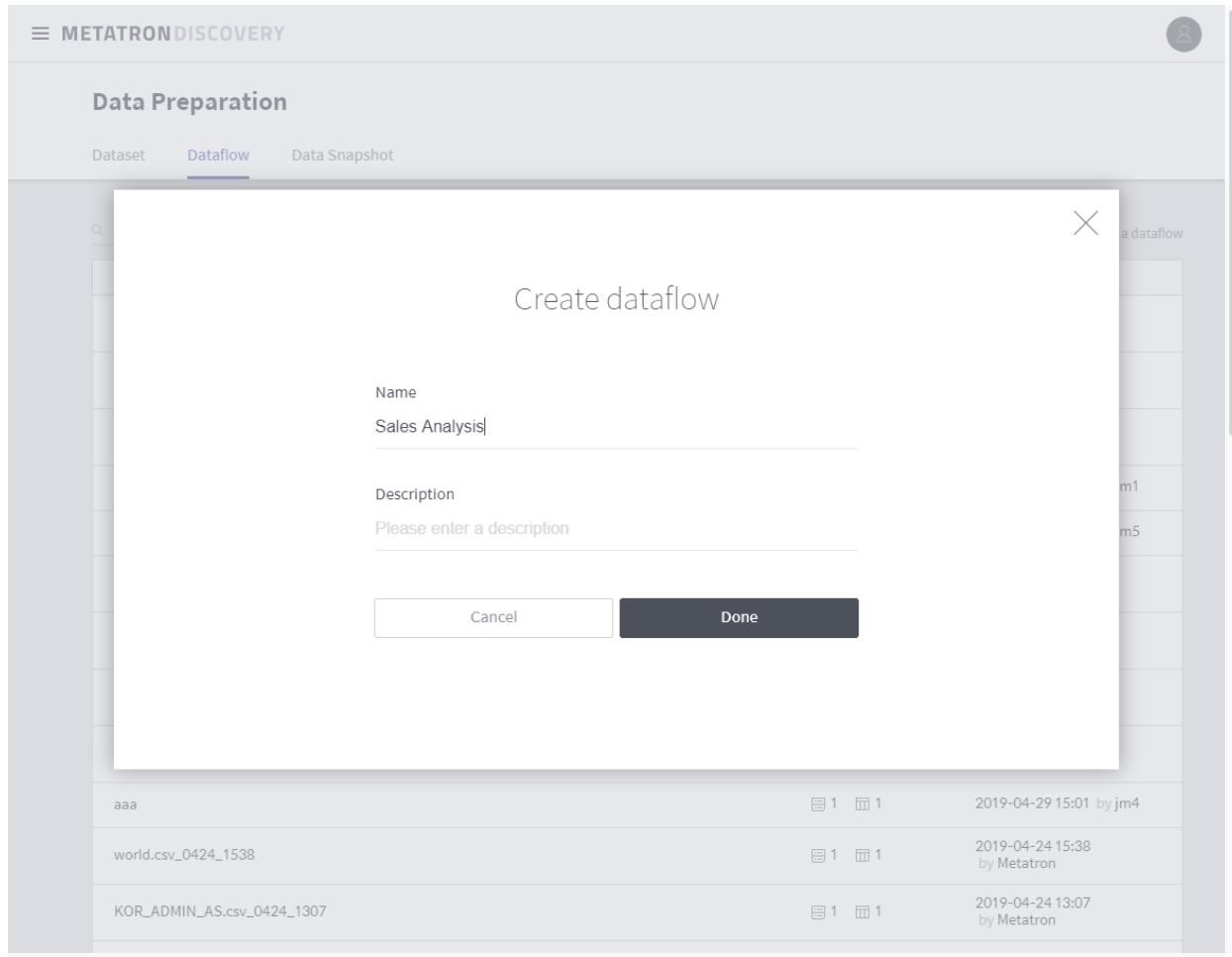
8.2.1 Add a dataset

The first step in defining a dataflow is to add a dataset. This can be conducted using the two methods described below:

- Adding a dataset after creating an empty dataflow
- Creating a dataflow in the dataset details page

Adding a dataset after creating an empty dataflow

1. Click **Add a dataflow** on the upper right of the **Dataflow** page.
2. Enter the **Name** and **Description** for the dataflow, and click **Done** to create an empty dataflow.



3. Click the **Add dataset to this dataflow** button on the center of the page.

≡ METATRON DISCOVERY

← Sales Analysis Please enter a description Updated on 2019-05-06 18:51 | Administrator :



Get started with your dataflow

Add dataset to your flow from your local file, database, or staging database like HIVE

+ Add dataset to this flow

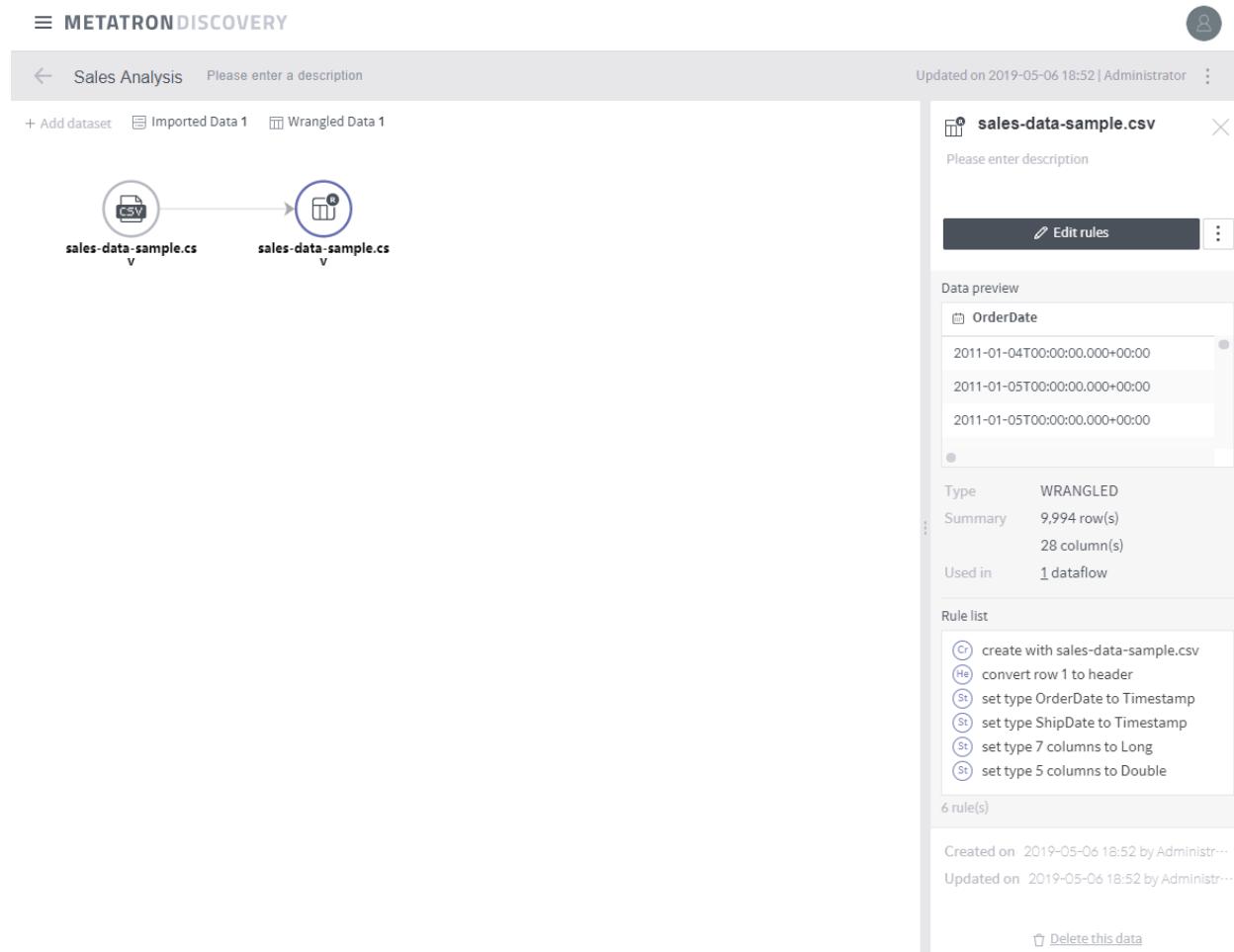
4. Select the datasets to be added.

<input type="checkbox"/>	Dataset	Type	Last updated
<input type="checkbox"/>	addrlist_STAGING	STAGING_DB	2019-05-06 18:46
<input checked="" type="checkbox"/>	sales-data-sample.csv	FILE(CSV)	2019-05-06 18:41
<input type="checkbox"/>	JM_Set1	FILE(CSV)	2019-04-30 14:49
<input type="checkbox"/>	ipm_icpm_filtr_dtl.csv (no bomb)	FILE(CSV)	2019-04-29 22:56
<input type="checkbox"/>	ipm_icpm_filtr_dtl.csv	FILE(CSV)	2019-04-29 22:50
<input type="checkbox"/>	ipm_icpm_filtr_bas.csv	FILE(CSV)	2019-04-29 22:34
<input type="checkbox"/>	ipm_icpm_filtr_bas.bom_16_be.csv	FILE(CSV)	2019-04-29 17:08
<input type="checkbox"/>	ipm_icpm_filtr_bas.csv	FILE(CSV)	2019-04-29 17:06
<input type="checkbox"/>	ipm_icpm_filtr_bas.csv	FILE(CSV)	2019-04-29 16:51
<input type="checkbox"/>	world.csv	FILE(CSV)	2019-04-24 15:38
<input type="checkbox"/>	KOR_ADMIN_AS.csv	FILE(CSV)	2019-04-24 13:07
<input type="checkbox"/>	KOR_ADMIN_AS.csv	FILE(CSV)	2019-04-24 09:14
<input type="checkbox"/>	TimeTestData - Sheet1	FILE(EXCEL)	2019-04-23 10:55

More ▾

1 selections + Create dataset

- When an imported dataset and its corresponding wrangled dataset are created, click the **Edit rules** button to edit rules (see [Edit rules](#) for a detailed procedure).



Creating a dataflow in the dataset details page

In the dataset details page, click the **Create dataflow with this dataset** button to create a dataflow, and proceed until the step before **Edit rules**.

The screenshot shows the Metatron Discovery interface. At the top, there's a header with the Metatron logo and a user icon. Below the header, the dataset name "sales-data-sample.csv" is displayed, along with a placeholder "Please enter a description". The last update was on "2019-05-06 18:41" by "UNKNOWN_USER". A three-dot menu icon is also present.

The main area is divided into two sections: "Information" on the left and "Data" on the right.

Information Section:

Type	FILE(CSV)
File	sales-data-sample.csv
URI	file:///data/metatron-discovery/dataprep/uploads/73375...
Size	3.2 MB
Summary	9,995 row(s) 28 column(s)

Data Section:

OrderDate	Category	City
2011-01-04T00:00:00.000+0:00	Office·Supplies	Houston
2011-01-05T00:00:00.000+0:00	Office·Supplies	Naperville
2011-01-05T00:00:00.000+0:00	Office·Supplies	Naperville
2011-01-05T00:00:00.000+0:00	Office·Supplies	Naperville
2011-01-06T00:00:00.000+0:00	Office·Supplies	Philadelphia
2011-01-07T00:00:00.000+0:00	Furniture	Henderson
2011-01-07T00:00:00.000+0:00	Office·Supplies	Athens
2011-01-07T00:00:00.000+0:00	Office·Supplies	Henderson
2011-01-07T00:00:00.000+0:00	Office·Supplies	Henderson

Used in Section:

+ Add to existing dataflow ↗ Create dataflow with this dataset

Created in Sales Analysis 1+ Updated on 2019-05-06 18:52 | admin

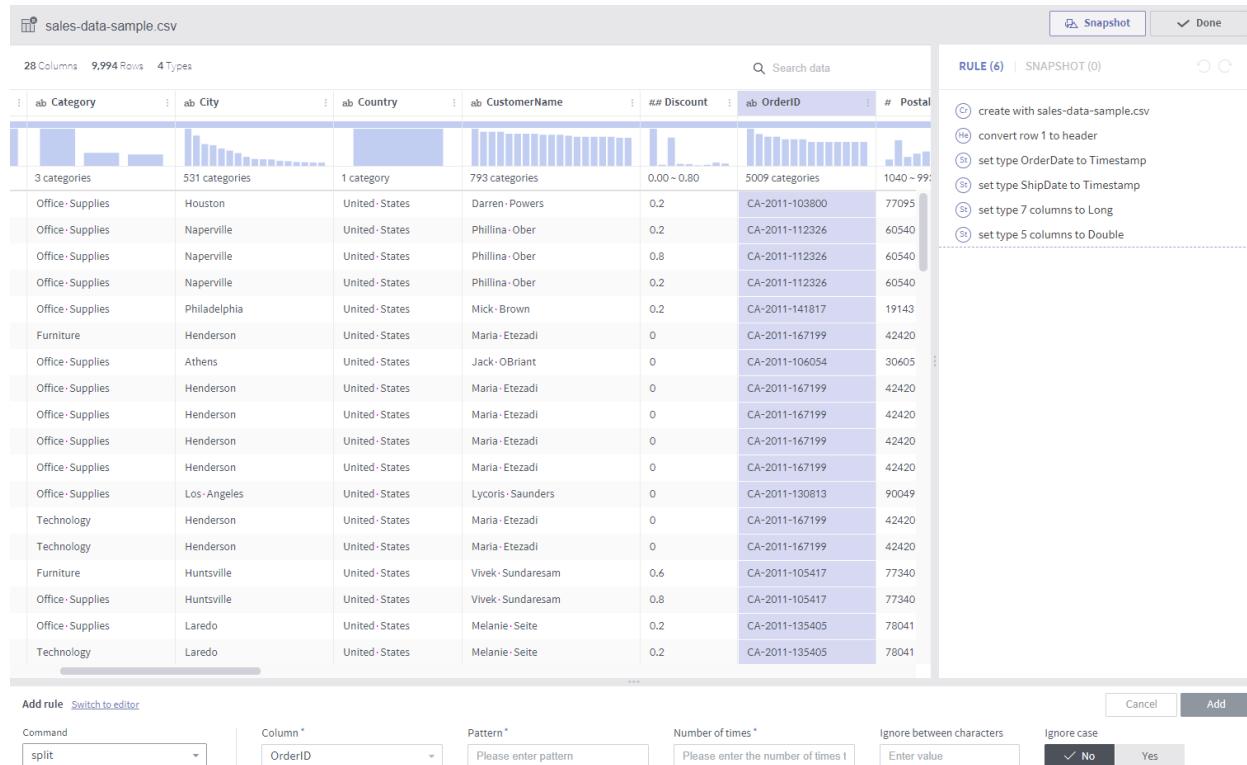
Note: The dataflow is named based on the name of the dataset.

8.2.2 Edit rules

The key task in data preparation is to create rules for data transformation (usually refinement). The transformation rules and input/output specifications are combined to be applied to actual data or other similar data, or scheduling is performed for such tasks.

Below are instructions on creating rules, checking the results, and modifying or deleting rules.

The Edit Rules page consists of the following:



1. Column type, name, and menu button
2. Menu for simple rule creation
3. Rule list and insert button (appears when cursor is placed in between rules)
4. Enabled when undo and redo are available
5. Panel to enter rule details
6. Column value distribution, distinct count, type mismatch, null value, etc.

Create a rule

Using the column header menu

1. Select a target column by clicking the column header.
 - Press the function key to select multiple columns.

- Depending on your OS, click while holding the ^ or key to select/deselect a column (toggle).
- Click while holding the Shift key to select a range.

ab column1	ab column2	## column3	## column4	# column5	# column6	# colum
85 categories	85 categories	33.81 ~ 34.10	128.84 ~ 128.96	162959 ~ 175...	2019 ~ 2019	1 ~ 1
· 2019-01-26 · 16:30	2019-01-26 · 16:30	34.10035	128.95722	162959	2019	1
· 2019-01-26 · 16:30	2019-01-26 · 16:30	34.10035	128.95722	162959	2019	1
· 2019-01-26 · 16:30	2019-01-26 · 16:30	34.10032	128.9572	163000	2019	1
· 2019-01-26 · 16:30	2019-01-26 · 16:30	34.10025	128.95717	163002	2019	1
· 2019-01-26 · 16:30	2019-01-26 · 16:30	34.10023	128.95715	163003	2019	1
· 2019-01-26 · 16:30	2019-01-26 · 16:30	34.10023	128.95715	163003	2019	1
· 2019-01-26 · 16:30	2019-01-26 · 16:30	34.1002	128.95713	163004	2019	1
· 2019-01-26 · 16:30	2019-01-26 · 16:30	34.10017	128.95712	163005	2019	1
· 2019-01-26 · 16:30	2019-01-26 · 16:30	34.10012	128.95707	163007	2019	1
· 2019-01-26 · 16:30	2019-01-26 · 16:30	34.10012	128.95707	163007	2019	1
· 2019-01-26 · 16:30	2019-01-26 · 16:30	34.10008	128.95705	163008	2019	1

2. Click the icon in the header of a selected column to open the header menu, and select a transformation command.

- Among the commands, **drop** and **settype** are performed upon clicking.

937 Columns 5,052 Rows 3 Types

데이터 검색

ab column1	ab column2	## column3	## column4	# column5	# column6	# column7
85 categories	85 categories	33.81 ~ 34.10				
2019-01-26 16:30	2019-01-26 16:30	34.10035				
2019-01-26 16:30	2019-01-26 16:30	34.10035				
2019-01-26 16:30	2019-01-26 16:30	34.10032				
2019-01-26 16:30	2019-01-26 16:30	34.10025	128.95717	163002	2019	1
2019-01-26 16:30	2019-01-26 16:30	34.10023	128.95715	163003	2019	1
2019-01-26 16:30	2019-01-26 16:30	34.10023	128.95715	163003	2019	1
2019-01-26 16:30	2019-01-26 16:30	34.1002	128.95713	163004	2019	1
2019-01-26 16:30	2019-01-26 16:30	34.10017	128.95712	163005	2019	1
2019-01-26 16:30	2019-01-26 16:30	34.10012	128.95707	163007	2019	1
2019-01-26 16:30	2019-01-26 16:30	34.10012	128.95707	163007	2019	1
2019-01-26 16:30	2019-01-26 16:30	34.10008	128.95705	163008	2019	1

3. To add details, fill out the command input panel below, and click the Add button.

클 추가	에디터로 전환	취소	추가
커맨드	컬럼 *	새로운 컬럼 이름 *	
rename	column3	새로운 컬럼 이름을 입력해 주세요	전체 컬럼 변경

4. Some commands can be performed by selecting a distribution bar.

- Click a distribution bar to filter the data based on the selected range (toggle).
- Click the type mismatch or null value graph to set conditions for those values.

ab column1	ab column2	ab column3	ab column4	ab column5	ab column6	ab column7
85 categories	85 categories	4265 categories	4254 categories	4177 categories	1 category	1 category
2017-01-20 10:37	2017-01-20 10:37	34.00172	120.74032	103744	2017	1
2019-01-26 16:39	2019-01-26 16:39	34.08185	128.94647	163946	2019	1
2019-01-26 16:39	2019-01-26 16:39	34.08182	128.94645	163948	2019	1
2019-01-26 16:39	2019-01-26 16:39	34.08178	128.94643	163949	2019	1
2019-01-26 16:39	2019-01-26 16:39	34.08178	128.94643	163950	2019	1

Using the command input panel

- Select a transformation rule (command) in the command input panel.

The screenshot shows a command input panel with a sidebar containing a list of transformation rules:

- (H) header**: Specifies the value of the specified row as the field name.
- (K) keep**: Only rows that satisfy the condition are kept.
- (R) replace**: Replace values that match the pattern in a particular column with new values.
- (Rn) rename**: Rename a column title.
- (S) set**: Replace the value of a particular column with the result of the formula.

Below the sidebar is a table preview showing data rows:

	Office-Supplies	Henderson	United-States	Maria-Etezadi	0
Office-Supplies	Los-Angeles	United-States	Lycoris-Saunders	0	
Technology	Henderson	United-States	Maria-Etezadi	0	
Technology	Henderson	United-States	Maria-Etezadi	0	
Furniture	Huntsville	United-States	Vivek-Sundaresam	0.6	
Office-Supplies	Huntsville	United-States	Vivek-Sundaresam	0.8	
Office-Supplies	Laredo	United-States	Melanie-Seite	0.2	
Technology	Laredo	United-States	Melanie-Seite	0.2	

At the bottom right are "Cancel" and "Add" buttons.

- Add details as needed, and click the Add button.

- Target columns can be selected using the input panel. You can also designate a column by clicking the column header.

The screenshot shows the "Add rule" dialog with the following fields:

- Add rule**: [Switch to editor](#)
- Command**:
- Column ***:
- New column name ***:
- Rename multiple columns**:
- Cancel** and **Add** buttons at the bottom right.

Inserting into a rule list

- In the list of rules of the right, place the cursor over the boundary where you wish to insert a new rule. The **+ Insert rule** button appears. Press this button.

The screenshot shows a list of transformation rules under the heading "RULE (6) | SNAPSHOT (0)". The rules are:

- (Cr) create with sales-data-sample.csv
- [+] Insert rule
- (He) convert row 1 to header
- (St) set type OrderDate to Timestamp
- (St) set type ShipDate to Timestamp
- (St) set type 7 columns to Long
- (St) set type 5 columns to Double

- Select a transformation rule (command) in the command input panel. Add details as needed, and click the **Add** button.
 - When a rule is inserted in this manner, all subsequent rules are affected.
 - Rules that cannot be normally executed are displayed in red. In this case, they will revert to the results obtained in the previous step.

The dialog box shows a "rename" command for the "longitude" column, changing it to "Insert new column name".

Edit a created rule

Editing a rule

- In the list of rules on the right, place the cursor over the rule to be edited. The button appears. Press this button.

RULE (6) | SNAPSHOT (0)



- (Cr) create with sales-data-sample.csv
- (He) convert row 1 to header
- (St) set type OrderDate to Timestamp
- (St) set type ShipDate to Timestamp
- (St) set type 7 columns to Long
- (St) set type 5 columns to Double

2. Edit the rule in the command input panel and press the **Done** button.

- When a rule is edited in this manner, all subsequent rules are affected.

Edit rule Switch to editor	<input type="button" value="Cancel"/> <input type="button" value="Done"/>		
Command	Column *	New type *	Set format *
settype	OrderDate	timestamp	yyyy-MM-dd'T'HH:mm:ss.SSSZ

Deleting a rule

In the list of rules on the right, place the cursor over the rule to be deleted. The button appears. Press this button.

- When a rule is deleted in this manner, all subsequent rules are affected.

RULE (6) | SNAPSHOT (0)

create with sales-data-sample.csv

convert row 1 to header

set type OrderDate to Timestamp



set type ShipDate to Timestamp

set type 7 columns to Long

set type 5 columns to Double

Undo and redo

On the upper right of the rule list are icons to perform **undo** and **redo**.

RULE (6) | SNAPSHOT (0)

create with sales-data-sample.csv

convert row 1 to header

set type OrderDate to Timestamp

set type ShipDate to Timestamp

set type 7 columns to Long

set type 5 columns to Double

To revert to a state before executing a command, press the button.

- The dataset reverts to the state before the last transformation (including rule creation, modification, and deletion).

- All rules that were affected also revert to their previous states.

To perform the same command again, press the  button.

- Pressing  is faster than following the steps to perform the same command again. It is because the transformation results are stored in memory.

8.2.3 Rule types

This section describes each rule in terms of the following.

- Name of rule
- Required arguments
- Optional arguments
- Description
- Notes

The types of rules supported in data preparation are as follows:

- `drop`
- `header`
- `settype`
- `setformat`
- `rename`
- `keep`
- `delete`
- `replace`
- `set`
- `derive`
- `split`
- `merge`
- `extract`

- [countpattern](#)
- [nest](#)
- [unnest](#)
- [flatten](#)
- [aggregate](#)
- [pivot](#)
- [unpivot](#)
- [join](#)
- [union](#)
- [window](#)

In addition to these rules, data preparation provides various expressions, thereby supporting almost every function required for general data preprocessing.

drop

Required arguments

- Column: A list of target columns

Description

- Deletes the selected columns.

header

Required arguments: Row number that contains the column name (1-base)

Description

- This rule sets the content in the designated row as the column name.
- This is useful for reading a CSV file with column names in the first row.
- Unless otherwise specified, data preparation automatically performs header. This rule may be deleted if header results are not desired, but such cases are not common.

settype

Required arguments

- Column: A list of target columns
- New type: Select one out of Long, Double, String, Boolean, and Timestamp

Optional arguments

- Set format: A format string (Joda Time) in the case of timestamp

Description

- This rule changes the type of the selected columns.
- The rule is considered successful even if the result is a type mismatch, which should be separately addressed.

setformat

Required arguments

- Column: A list of target columns
- Set format: A Joda-Time format string

Description

- This rule changes the display format of a Timestamp column.
- The target column must be of the Timestamp type.

Notes

- As shown below, the format input field lists different entries depending on the input. The candidate list is narrowed as more values are entered.

Add rule [Switch to editor](#)

OrderDate	Furniture	Location	United States
2011-01-08T00:00:00.000+00:00	Furniture	Huntsville	MM-dd-yy
2011-01-08T00:00:00.000+00:00	Office · Supplies	Huntsville	MMM-dd-yy
2011-01-10T00:00:00.000+00:00	Office · Supplies	Laredo	MM.dd.yyyy

Command: setformat Column*: OrderDate

Format:

- MM-dd-yy
- MMM-dd-yy
- MM.dd.yyyy
- MMM.dd.yyyy
- MM. dd. yyyy
- MMM. dd. yyyy

rename

Required arguments

- Column: A single target column
- New column name: New name

Description

- This rule changes the name of the selected column.
- To rename two or more columns at once, click the **Rename multiple columns** button at the bottom of the command input panel to display the following popup.

Rename

Cancel
Done

sales-data-sample.csv 28 column(s)

Before	After
OrderDate	OrderDate
Category	Category
City	City
Country	Country
CustomerName	CustomerName
Discount	Discount
OrderID	OrderID
PostalCode	PostalCode
ProductName	ProductName

OrderDate	Category	City	Country	Cust
2011-01-04T00:00:00.000+0...	Office Supplies	Houston	United States	Darre...
2011-01-05T00:00:00.000+0...	Office Supplies	Naperville	United States	Phill...
2011-01-05T00:00:00.000+0...	Office Supplies	Naperville	United States	Phill...
2011-01-05T00:00:00.000+0...	Office Supplies	Naperville	United States	Phill...
2011-01-06T00:00:00.000+0...	Office Supplies	Philadelphia	United States	Mick...
2011-01-07T00:00:00.000+0...	Furniture	Henderson	United States	Maria...
2011-01-07T00:00:00.000+0...	Office Supplies	Athens	United States	Jack...
2011-01-07T00:00:00.000+0...	Office Supplies	Henderson	United States	Maria...
2011-01-07T00:00:00.000+0...	Office Supplies	Henderson	United States	Maria...
2011-01-07T00:00:00.000+0...	Office Supplies	Henderson	United States	Maria...
2011-01-07T00:00:00.000+0...	Office Supplies	Los Angeles	United States	Livcor...

keep

Required arguments

- Condition: A conditional expression returning a Boolean value

Description

- All rows are deleted except the rows that return true for the conditional expression.

The screenshot shows the Metatron Data Preparation interface. At the top, there's a header with the file name "sales-data-sample.csv", a "Snapshot" button, and a "Done" button. Below the header, the data preview shows 28 columns, 9,994 rows, and 4 types. The columns include OrderDate, Category, City, Country, and CustomerName. The sidebar on the right lists "RULE (6) | SNAPSHOT (1)" and contains six steps: "create with sales-data-sample.csv", "convert row 1 to header", "set type OrderDate to Timestamp", "set type ShipDate to Timestamp", "set type 7 columns to Long", and "set type 5 columns to Double". At the bottom, there's an "Add rule" button, a "Switch to editor" link, a "Command" dropdown set to "keep", a "Condition" input field containing "length(8)", and "Cancel" and "Add" buttons.

delete

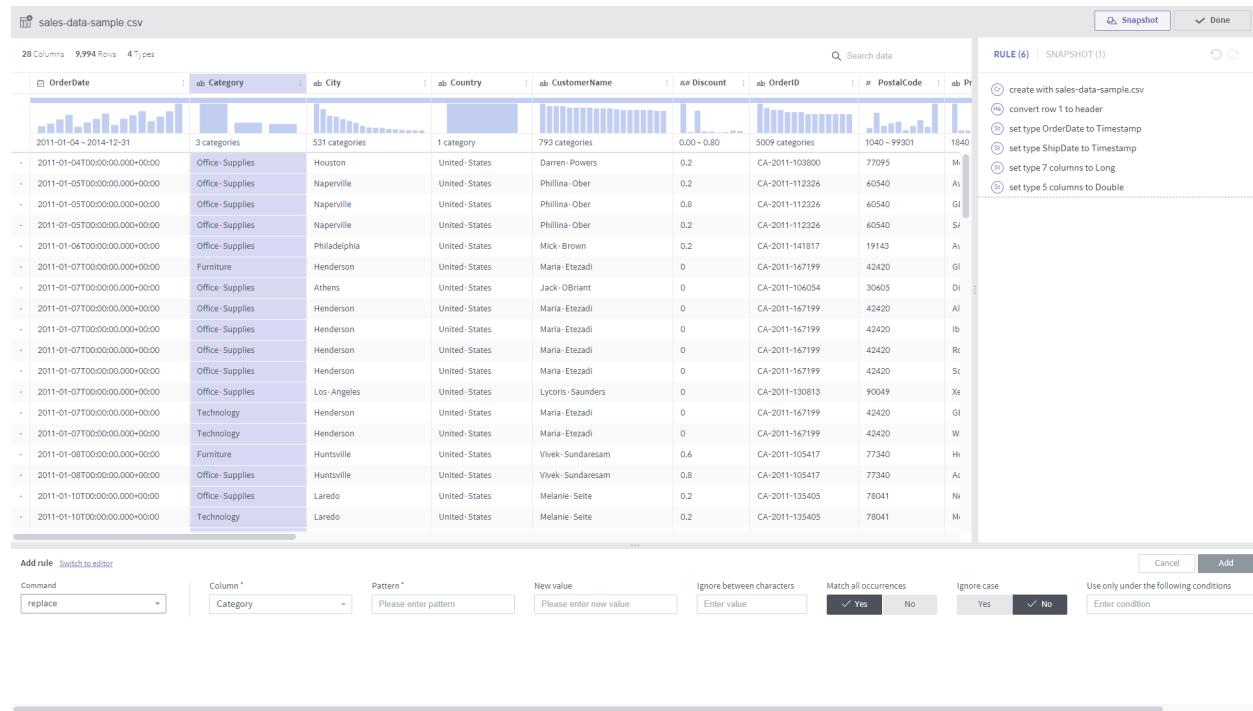
Required arguments

- Condition: A conditional expression returning a Boolean value

Description

- All rows that return true for the conditional expression are deleted. This is the opposite of [keep](#).

replace



Required arguments

- Column: A list of target columns
- Pattern: A string pattern to be replaced
 - In the case of a constant string: Characters enclosed inside ' ('Houston', 'Naperville', 'Philadelphia' etc.)
 - In the case of a regular expression: Characters enclosed inside / (/[,_]+/, /\s+\$/, etc.)
- New value: A new string expression to replace the specified pattern
 - Constant string
 - Regular expression \$1_\$2_\$3, etc.

Optional arguments

- Ignore between characters: Does not make any replacement for content between the characters entered here
- Match all occurrences: Whether all characters of a word must match
- Ignore case: Whether to make the strings case-insensitive

Description

- String replacement is performed for the selected columns.

Notes

- Do not use ' or / in a **new value**.
- Values from other columns are not available as **new values**. `replace` performs string replacement for content in the selected columns only. (cf. `set` rule)

set

The screenshot shows the Metatron Data Preparation interface. On the left, a preview of the 'sales-data-sample.csv' file is displayed with 28 columns, 9,994 rows, and 4 types. The columns include OrderDate, Category, City, Country, CustomerName, Discount, and OrderID. The preview shows various data points such as dates ranging from 2011-01-04 to 2014-12-31, categories like Office-Supplies, cities like Houston, and countries like United States. On the right, a sidebar titled 'RULE (6)' lists six steps: 1. create with sales-data-sample.csv, 2. convert row 1 to header, 3. set type OrderDate to Timestamp, 4. set type ShipDate to Timestamp, 5. set type 7 columns to Long, and 6. set type 5 columns to Double. Below the sidebar, there's an 'Add rule' button, a 'Switch to editor' link, and a form for defining a new rule. The 'Command' dropdown is set to 'set', the 'Column' dropdown is set to 'Category', and the 'Expression' field is empty. There are also fields for 'Please enter expression' and 'Advanced editor' for both the expression and conditions.

Required arguments

- Column: A list of target columns
- Expression: An expression to be applied to the values of the target column. Values from other columns may be referenced. (cf. `replace` rule)

- When multiple columns are involved, use a \$col variable, which will be substituted by the respective target column during each conversion.
- That is, when applying the set command on column1 and column2, \$col becomes column1 during conversion of column1, and \$col becomes column2 during conversion of column2.

Optional arguments

- Use only under the following conditions
 - The set rule is applied only to rows satisfying this condition.
 - This rule may be regarded the same as the WHERE statement in SQL.

Description

- This rule replaces the values in the selected column with results returned by the expression.
- When using a complex expression, click the **Advanced editor** to display the popup shown below:

Insert expression

Cancel Done

```
if( length( City ) ) > 3
```

✓ There is no abnormality in the formula Validation check

Recommendation

Add column

1 / 3

- ab \$col
- ab OrderDate
- ab Category
- ab City
- ab Country
- ab CustomerName
- ## Discount
- ab OrderID
- ## PostalCode
- ab ProductName

Add expression

Search expression

ALL
STRING
length
upper
lower
trim
ltrim
rtrim
substring
concat
concat_ws
LOGICAL
if

In the **Advanced editor**, you can edit the expression in a larger window while viewing the column list and a list of functions and their descriptions, and also run a validity check before implementing the expression.

derive

Required arguments

- Expression: An expression whose resulting values are to form a new column. Similar to the [set](#) rule, values from other columns may be referenced.

- New column name

Description

- While similar to the [set](#) rule, this rule creates a new column instead of replacing an existing one.

Notes

- The new column is inserted after the last existing column in the expression.

split

Required arguments

- Column: A list of target columns
- Pattern: A string expression that serves as a separator that splits the target strings. Allows a regular expression as is the case for the [replace](#) rule.
- Number: Number of columns to be divided into.

Description

- Each row is split by the given **Number** – 1.
- When the pattern is no longer matched, the rest columns contain a null.

Notes

- Note that columns are created as many as the **Number** input.

merge

Required arguments

- Column: A list of target columns
- Delimiter: A constant string with which values of different columns are concatenated.
- New column name

Description

- The target columns are merged with the **Delimiter** into a new column.

Notes

- Similar to the [replace](#) rule, enclosing with a ' may be skipped. That is, strings not enclosed by / or ' are automatically enclosed by '.

extract

Required arguments

- Column: A list of target columns
- Pattern: A string pattern to be extracted. Allows a regular expression as is the case for the [replace](#) rule.
- Number: Number of instances to be extracted

Optional arguments

- Ignore between characters: Does not make any replacement for content between the characters entered here
- Ignore case: Whether to make the strings case-insensitive

Description

- A new column(s) with content matching the given pattern is created.

Notes

- When there are multiple target columns, the resulting columns are inserted after each target column.

countpattern

Required arguments

- Column: A list of target columns
- Pattern: A string pattern to be detected. Allows a regular expression as is the case for the [replace](#) rule.

Optional arguments

- Ignore between characters: Does not make any replacement for content between the characters entered here
- Ignore case: Whether to make the strings case-insensitive

Description

- New columns are created based on the number of matches with the pattern.
- This is highly similar to [extract](#). The only difference is that it counts the number of matches, rather than extracting the matched content.

Notes

- When there are multiple target columns, the resulting columns are inserted after each target column.

nest

Required arguments

- Column: A list of target columns
- Type: Map or Array
- New column name

Description

- The target columns are grouped into a new column of the given type.
- Below are examples of grouping columns into an array and map, respectively.

The screenshot shows the Metatron Data Editor interface. On the left, a preview of the 'sales-data-sample.csv' file is displayed with 30 columns, 9,994 rows, and 6 types. The columns include 'ab Category', 'ab City', '(category + city..map)', '(category + city..array)', and 'ab Col'. The right side shows the rule configuration for 'RULE (13)' with 15 steps:

- 01: create with sales-data-sample.csv
- 02: convert row 1 to header
- 03: set type OrderDate to Timestamp
- 04: set type ShipDate to Timestamp
- 05: set type 7 columns to Long
- 06: set type 5 columns to Double
- 07: convert Category into map
- 08: convert Category into array
- 09: move Category.._map before Category..array
- 10: drop Category.._map
- 11: drop Category..array
- 12: convert Category..City into array
- 13: convert Category..City into map

unnest

The screenshot shows the Metatron Data Preparation interface with the following details:

- File:** sales-data-sample.csv
- Columns:** 30 Columns, 9,994 Rows, 6 Types
- Search:** Search data
- Rule (13) | SNAPSHOT (1)**
- Commands:**
 - create with sales-data-sample.csv
 - convert row 1 to header
 - set type OrderDate to Timestamp
 - set type ShipDate to Timestamp
 - set type 7 columns to Long
 - set type 5 columns to Double
 - convert Category into map
 - convert Category into array
 - move Category_1_map before Category_array
 - drop Category_1_map
 - drop Category_array
 - convert Category, City into array
 - convert Category, City into map
- Add rule:** Switch to editor
- Command:** unnest
- Column:** (cate + city_map)
- Select elements:** Please enter an element to extract
- Tooltip:** Enter the element to extract from the selected column. Array is the index number, and Map is the Key name.

Required arguments

- Column: A single target column
- Select elements: 0-base index for an array, or key value for a map

Description

- A new column is created by extracting the selected elements from an array or a map.

Notes

- The target column must be of the array or map type.

flatten

Required arguments

- Column: A single target column

Description

- Rows are created from elements of an array.

Notes

- The target column must be of the array type.

The screenshot shows the Metatron Data Editor interface. On the left, there is a data preview of a CSV file named "sales-data-sample.csv" with 29 columns, 9,994 rows, and 5 types. The preview shows various columns like "Category", "CustomerName", "array_example", "Discount", and "OrderID". On the right, a sidebar titled "RULE (16) | SNAPSHOT (1)" lists 16 rules with their corresponding actions. Below the sidebar, there are buttons for "Cancel" and "Add". At the bottom, there are two input fields: "Command" set to "flatten" and "Column" set to "array_example".

Category	CustomerName	array_example	Discount	OrderID
States	Darren Powers	["Office Supplies", "Houston", "United States", "Darren Powers"]	0.2	CA-2011-103800
States	Phillina Ober	["Office Supplies", "Naperville", "United States", "Phillina Ober"]	0.2	CA-2011-112326
States	Phillina Ober	["Office Supplies", "Naperville", "United States", "Phillina Ober"]	0.8	CA-2011-112326
States	Phillina Ober	["Office Supplies", "Naperville", "United States", "Phillina Ober"]	0.2	CA-2011-112326
States	Mick Brown	["Office Supplies", "Philadelphia", "United States", "Mick Brown"]	0.2	CA-2011-141817
States	Maria Etezadi	["Furniture", "Henderson", "United States", "Maria Etezadi"]	0	CA-2011-167199
States	Jack O'Briant	["Office Supplies", "Athens", "United States", "Jack O'Briant"]	0	CA-2011-106054
States	Maria Etezadi	["Office Supplies", "Henderson", "United States", "Maria Etezadi"]	0	CA-2011-167199
States	Maria Etezadi	["Office Supplies", "Henderson", "United States", "Maria Etezadi"]	0	CA-2011-167199
States	Maria Etezadi	["Office Supplies", "Henderson", "United States", "Maria Etezadi"]	0	CA-2011-167199
States	Maria Etezadi	["Office Supplies", "Henderson", "United States", "Maria Etezadi"]	0	CA-2011-167199
States	Maria Etezadi	["Office Supplies", "Henderson", "United States", "Maria Etezadi"]	0	CA-2011-167199
States	Lycoris Saunders	["Office Supplies", "Los Angeles", "United States", "Lycoris Saunders"]	0	CA-2011-130813
States	Maria Etezadi	["Technology", "Henderson", "United States", "Maria Etezadi"]	0	CA-2011-167199
States	Maria Etezadi	["Technology", "Henderson", "United States", "Maria Etezadi"]	0	CA-2011-167199
States	Vivek Sundaresam	["Furniture", "Huntsville", "United States", "Vivek Sundaresam"]	0.6	CA-2011-105417
States	Vivek Sundaresam	["Office Supplies", "Huntsville", "United States", "Vivek Sundaresam"]	0.8	CA-2011-105417
States	Melanie Seite	["Office Supplies", "Laredo", "United States", "Melanie Seite"]	0.2	CA-2011-135405
States	Melanie Seite	["Technology", "Laredo", "United States", "Melanie Seite"]	0.2	CA-2011-135405

If the target array column has four elements as shown in the above example, each original row of the array results in four rows. Non-array columns result in the same columns.

sales-data-sample.csv

29 Columns 39,976 Rows 4 Types

# City	# Country	# CustomerName	# array_example	# Discount	# OrderID	# PostalCode
531 categories	1 category	793 categories	1328 categories	0.00 ~ 0.80	5009 categories	1040 ~ 93901
Houston	United States	Darren Powers	Office Supplies	0.2	CA-2011-103800	77095
Houston	United States	Darren Powers	Houston	0.2	CA-2011-103800	77095
Houston	United States	Darren Powers	United States	0.2	CA-2011-103800	77095
Houston	United States	Darren Powers	Darren Powers	0.2	CA-2011-103800	77095
Naperville	United States	Phillina Ober	Office Supplies	0.2	CA-2011-112326	60540
Naperville	United States	Phillina Ober	Naperville	0.2	CA-2011-112326	60540
Naperville	United States	Phillina Ober	United States	0.2	CA-2011-112326	60540
Naperville	United States	Phillina Ober	Phillina Ober	0.2	CA-2011-112326	60540
Naperville	United States	Phillina Ober	Office Supplies	0.8	CA-2011-112326	60540
Naperville	United States	Phillina Ober	Naperville	0.8	CA-2011-112326	60540
Naperville	United States	Phillina Ober	United States	0.8	CA-2011-112326	60540
Naperville	United States	Phillina Ober	Phillina Ober	0.8	CA-2011-112326	60540
Naperville	United States	Phillina Ober	Office Supplies	0.2	CA-2011-112326	60540
Naperville	United States	Phillina Ober	Naperville	0.2	CA-2011-112326	60540
Naperville	United States	Phillina Ober	United States	0.2	CA-2011-112326	60540
Naperville	United States	Phillina Ober	Phillina Ober	0.2	CA-2011-112326	60540
Philadelphia	United States	Mick Brown	Office Supplies	0.2	CA-2011-141817	19143
Philadelphia	United States	Mick Brown	Philadelphia	0.2	CA-2011-141817	19143

RULE (17) | SNAPSHOT (1)

- (C) create with sales-data-sample.csv
- (H) convert row 1 to header
- (S) set type OrderDate to Timestamp
- (S) set type ShipDate to Timestamp
- (St) set type 7 columns to Long
- (St) set type 5 columns to Double
- (Na) convert Category into map
- (Na) convert Category into array
- (M) move Category_1_map before Category_array
- (D) drop Category_1_map
- (D) drop Category_array
- (C) convert Category, City into map
- (C) convert Category, City into map
- (D) drop `(cate + city_map)`
- (D) drop `(cate + city_array)`
- (N) convert 4 columns into array
- (F) convert arrays in array_example to rows

Add rule [Switch to editor](#)

Command

Choose Rule Function

Cancel Add

aggregate

The screenshot shows the Metatron Data Editor interface. At the top, there's a file menu with "File", "Edit", "View", "Table", "Data", "Script", "Help", and "About". Below the menu, a toolbar has icons for "New", "Open", "Save", "Import", "Export", "Copy", "Paste", "Delete", "Refresh", "Search", "Filter", "Sort", "Group", "UnGroup", "Reset", "Zoom In", "Zoom Out", and "Zoom Fit". A status bar at the bottom displays "28 Columns 39,976 Rows 4 Types".

The main area shows a data preview of a CSV file named "sales-data-sample.csv". The columns are: ab ProductName, # Profit, # Quantity, ab Region, # Sales, ab Segment. There are 1840 categories listed. The data includes various products like "Message Book-Wirebound, Four-5-1/2-X-4-Forms/Pg., 200-Dupl.-Sets/Book" and "Avery 508". The "Quantity" column has values ranging from 2 to 20.

To the right of the data preview is a "RULE (18) | SNAPSHOT (1)" panel. It lists 18 rules:

- (C) create with sales-data-sample.csv
- (H) convert row 1 to header
- (S) set type OrderDate to Timestamp
- (S) set type ShipDate to Timestamp
- (St) set type 7 columns to Long
- (St) set type 5 columns to Double
- (Na) convert Category into array
- (Na) convert Category into array
- (M) move Category_1_map before Category_array
- (D) drop Category_1_map
- (D) drop Category_array
- (N) convert Category_City into array
- (N) convert Category_City into map
- (D) drop `(cate+city_map)`
- (D) drop `(cate+city_array)`
- (N) convert 4 columns into array
- (F) convert arrays in array_example to rows
- (D) drop array_example

At the bottom of the rule panel are "Cancel" and "Add" buttons.

Below the data preview, there's a "Add rule" section with "Switch to editor" and a "Command" dropdown set to "aggregate". It also shows an "Expression" field with "sum('Quantity')", a "Group by" field with "OrderDate,City", and a warning icon.

Required arguments

- Expression: A list of aggregate functions
- Group by: A list of columns that group values by.

Description

- A new column is added from the results of grouping by each combination of the elements from the GroupBy columns.
- A column is created for each expression. For example, two columns are created if average and count are designated as expressions.
- The available aggregate functions are as follows:
 - count()

- sum(colname)
- avg(colname)
- min(colname)
- max(colname)

Notes

- Calculations are performed only for sampling results. Therefore, the snapshot?the results for the entire data?may be different.
- Note that () must be inserted when using the count function.
- count(colname) is currently not available.

sales-data-sample.csv

3 Columns 4,723 Rows 3 Types

OrderDate	City	# sum_Quantity
2011-01-04 ~ 2014-12-31	501 categories	4 ~ 224
2012-12-08T00:00:00.000+00:00	Houston	20
2014-10-21T00:00:00.000+00:00	Jacksonville	36
2014-12-11T00:00:00.000+00:00	Fairfield	40
2013-06-04T00:00:00.000+00:00	Los-Angeles	8
2012-11-10T00:00:00.000+00:00	Richmond	20
2014-11-05T00:00:00.000+00:00	Columbia	8
2012-10-19T00:00:00.000+00:00	Dallas	4
2013-07-31T00:00:00.000+00:00	Houston	12
2011-11-23T00:00:00.000+00:00	Scottsdale	12
2013-11-25T00:00:00.000+00:00	New-York-City	44
2014-11-05T00:00:00.000+00:00	Burlington	24
2011-03-21T00:00:00.000+00:00	Hamilton	20
2011-06-30T00:00:00.000+00:00	Los-Angeles	20
2014-09-25T00:00:00.000+00:00	Newark	12
2014-09-29T00:00:00.000+00:00	Jacksonville	8
2013-12-24T00:00:00.000+00:00	Bowling-Green	12
2014-06-12T00:00:00.000+00:00	Peoria	56
2014-06-26T00:00:00.000+00:00	New-York-City	4
2011-01-04 ~ 2014-12-31	Louisville	88

Snapshot Done

RULE (19) | SNAPSHOT (1)

create with sales-data-sample.csv
 convert row 1 to header
 set type OrderDate to Timestamp
 set type ShipDate to Timestamp
 set type 7 columns to Long
 set type 5 columns to Double
 convert Category into map
 convert Category into array
 move Category_1_map before Category_array
 drop Category_1.map
 drop Category_array
 convert Category_City into array
 convert Category_City into map
 drop `(cate+city_map)`
 drop `(cate+city_array)`
 convert 4 columns into array
 convert arrays in array_example to rows
 drop array_example
 aggregate with sum(Quantity) grouped by OrderDate, City

Add rule Switch to editor

Command Choose Rule Function

pivot

The screenshot shows the Metatron Data Editor interface. At the top, there's a file menu with 'File', 'Edit', 'View', 'Table', 'Data', 'Script', 'Help', and a 'Snapshot' button. Below the menu is a search bar labeled 'Search data'. The main area displays a data preview of 'sales-data-sample.csv' with 28 columns, 9,994 rows, and 4 types. The columns include OrderDate, Category, City, Country, CustomerName, and Discount. A sidebar on the right lists rule steps: 1. Create with sales-data-sample.csv, 2. Convert row 1 to header, 3. Set type OrderDate to Timestamp, 4. Set type ShipDate to Timestamp, 5. Set type 7 columns to Long, 6. Set type 5 columns to Double, and 7. Pivot Category, City and compute avg(Discount) grouped by ProductName. At the bottom, there's a 'Add rule' section with a 'Switch to editor' link, a 'Command' dropdown set to 'pivot', and three input fields: 'Column' (ProductName), 'Expression' (avg('Quantity')), and 'Group by' (Category). There are also 'Cancel' and 'Add' buttons.

Required arguments

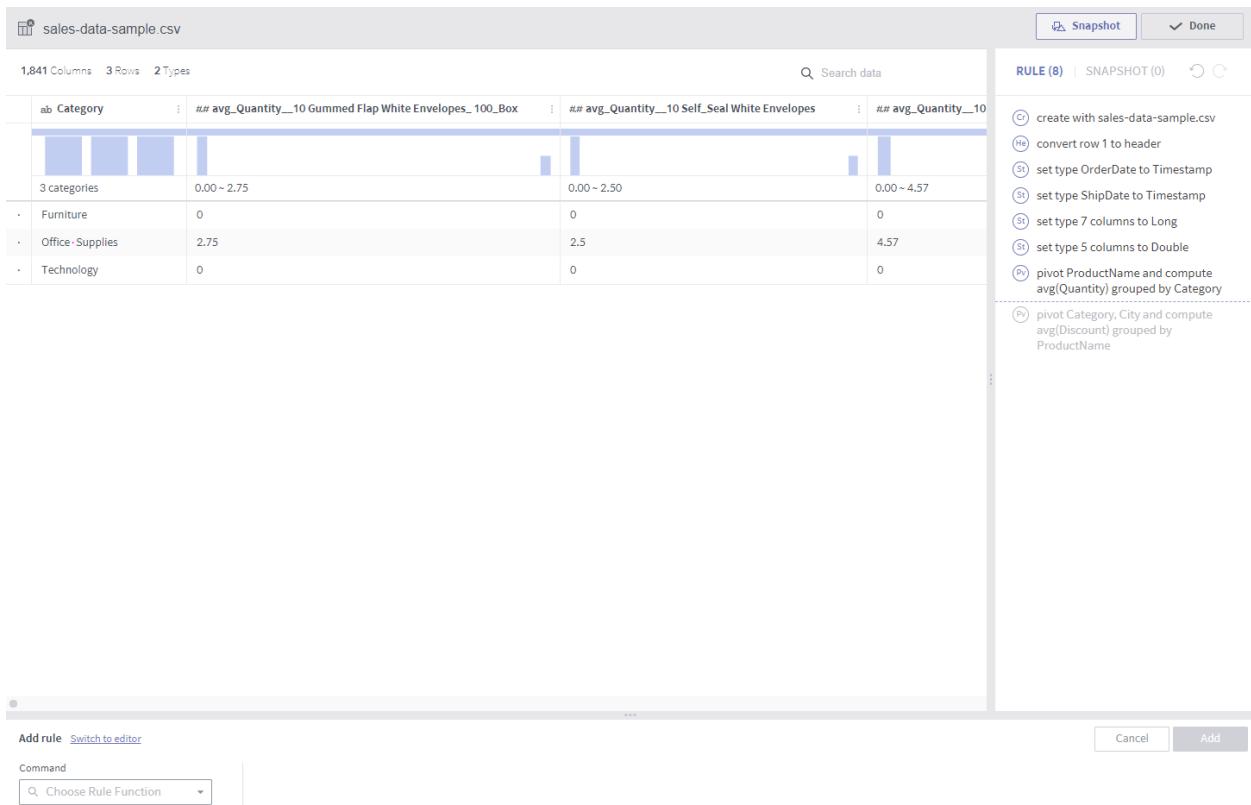
- Column: A list of columns subject to pivoting
- Expression: A list of expressions whose resulting values form new columns (only aggregate functions are available)
- Group by: A list of columns that group values by.

Description

- Group By is performed for each combination of target columns and GroupBy columns. A dataset having the results as column values is created.
- A set of columns is created for each expression. For example, if average and count are designated as expressions and the values in the pivoted columns are divided into ten groups, a total of 20 columns will be created.

Notes

- This is used when performing GroupBy on at least two columns. (1 pivoted column, 1 GroupBy column)
- Here, **Rename multiple columns** is useful as column names tend to get longer.



unpivot

The screenshot shows the Metatron interface with two main panels. The top panel displays a data preview of 'sales-data-sample.csv' with 1,841 columns, 3 rows, and 2 types. The preview table has three columns: 'ab Category', '# avg_Quantity__10 Gummed Flap White Envelopes_100_Box', and '# avg_Quantity__10 Self_Seal White Envelopes'. Below the preview is a list of categories: Furniture, Office-Supplies, and Technology. The bottom panel shows the 'Add rule' dialog for an 'unpivot' command. The 'Column' field contains 'avg_Quantity__10 Gummed...'. The 'GroupEvery' field contains '1'. On the right, there are buttons for 'Cancel' and 'Add'.

Required arguments

- Column: A list of target columns to be converted into values in new columns
- GroupEvery: Number of columns (defaults to 1)

Description

- Two columns are created? one contains the selected column names and the other contains their values. (If GroupEvery is set to 1)
- If GroupEvery is the same as the number of selected columns, each resulting pair of columns contains the name and values of its respective original column. Therefore, If 10 columns are unpivoted with the GroupEvery argument set to 10, for example, a total of 20 columns are created.

Notes

- Using the GroupEvery argument set to a factor of the number of columns will soon be supported.

⟨Where GroupEvery is set to 1⟩

The screenshot shows a data preparation interface with the following details:

- Table Summary:** 9 Columns, 798 Rows, 1 Types.
- Columns:**
 - column5: 52 categories
 - ab column6: 96 categories
 - ab column7: 14 categories
 - ab column8: 4 categories
 - ab column9: 306 categories
 - ab key1: 2 categories
 - ab value1: 136 categories
- Search:** Search data field.
- Rule History:**
 - Cr create with JM_Set1
 - Up convert column1, column2 into rows
 - He convert row 1 to header
 - St set type 7 columns to Long
 - St set type accler to Double
 - Ag aggregate with avg(wt) grouped by year, origin
- Buttons:** Snapshot, Done, Cancel, Add.
- Command Bar:** Choose Rule Function dropdown.

⟨Where GroupEvery is set to the same as the number of columns⟩

JM_Set1

11 Columns 399 Rows 1 Types

Snapshot Done

RULE (7) | SNAPSHOT (0)

Cr create with JM_Set1
Up convert column1, column2 into rows
Up convert column1, column2 into rows
He convert row 1 to header
St set type 7 columns to Long
St set type accler to Double
Ag aggregate with avg(wt) grouped by year, origin

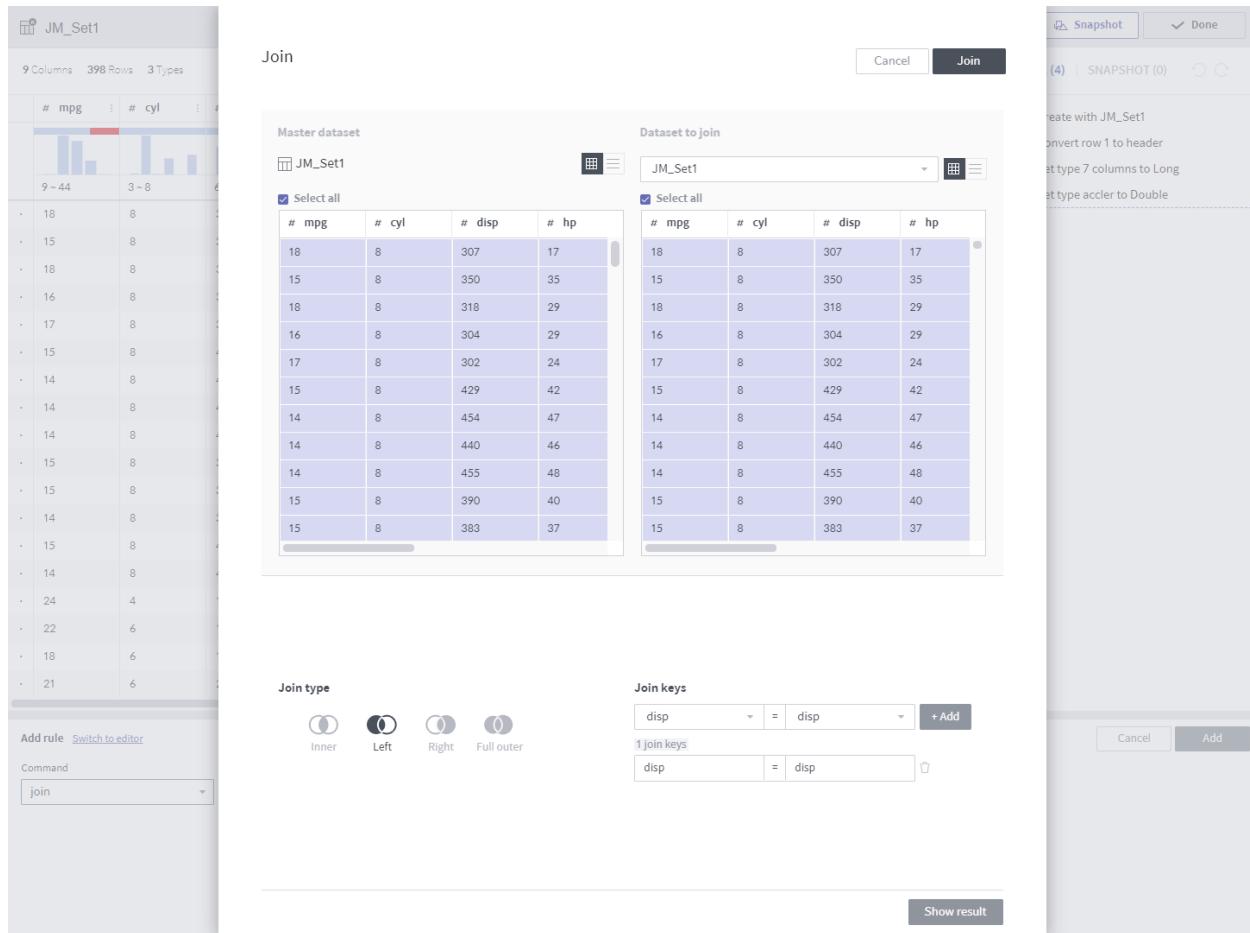
category	4 categories	306 categories	1 category	130 categories	1 category	6 categories
origin	carname		column1	mpg	column2	cyl
1	chevrolet·chevelle·malibu		column1	18	column2	8
1	buick·skylark·320		column1	15	column2	8
1	plymouth·satellite		column1	18	column2	8
1	amc·rebel·sst		column1	16	column2	8
1	ford·torino		column1	17	column2	8
1	ford·galaxie·500		column1	15	column2	8
1	chevrolet·impala		column1	14	column2	8
1	plymouth·fury·iii		column1	14	column2	8
1	pontiac·catalina		column1	14	column2	8
1	amc·ambassador·dpl		column1	15	column2	8
1	dodge·challenger·se		column1	15	column2	8
1	plymouth·cuda·340		column1	14	column2	8
1	chevrolet·monte·carlo		column1	15	column2	8
1	buick·estate·wagon·(sw)		column1	14	column2	8
3	toyota·corona·mark·ii		column1	24	column2	4
1	plymouth·duster		column1	22	column2	6
1	amc·hornet		column1	18	column2	6

Add rule Switch to editor

Command Choose Rule Function

Cancel Add

join



Unlike other rules, join has a separate popup.

Required arguments (select in a popup or enter a value)

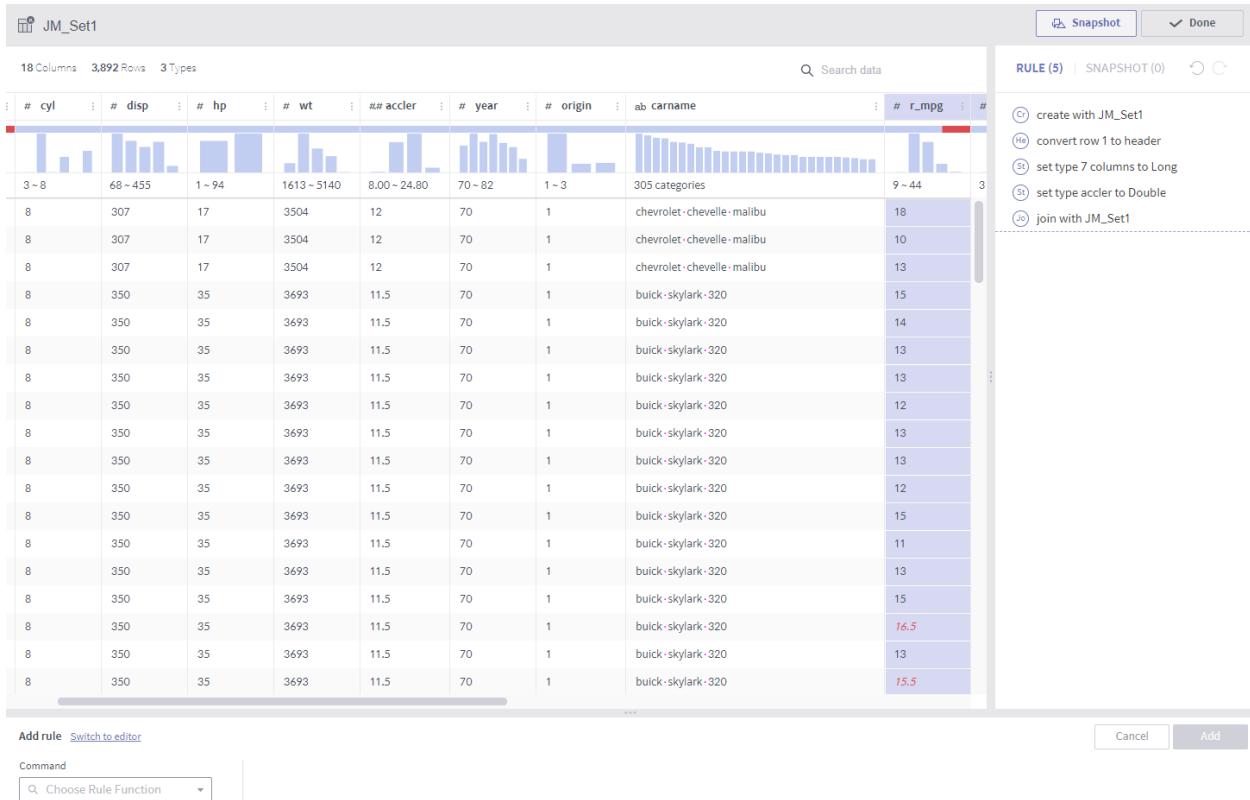
- Dataset to join: A wrangled dataset in the same dataflow
- Columns to join (toggle)
- Join keys: Multiple values may be entered
- Join type: Only inner join supported now

Description

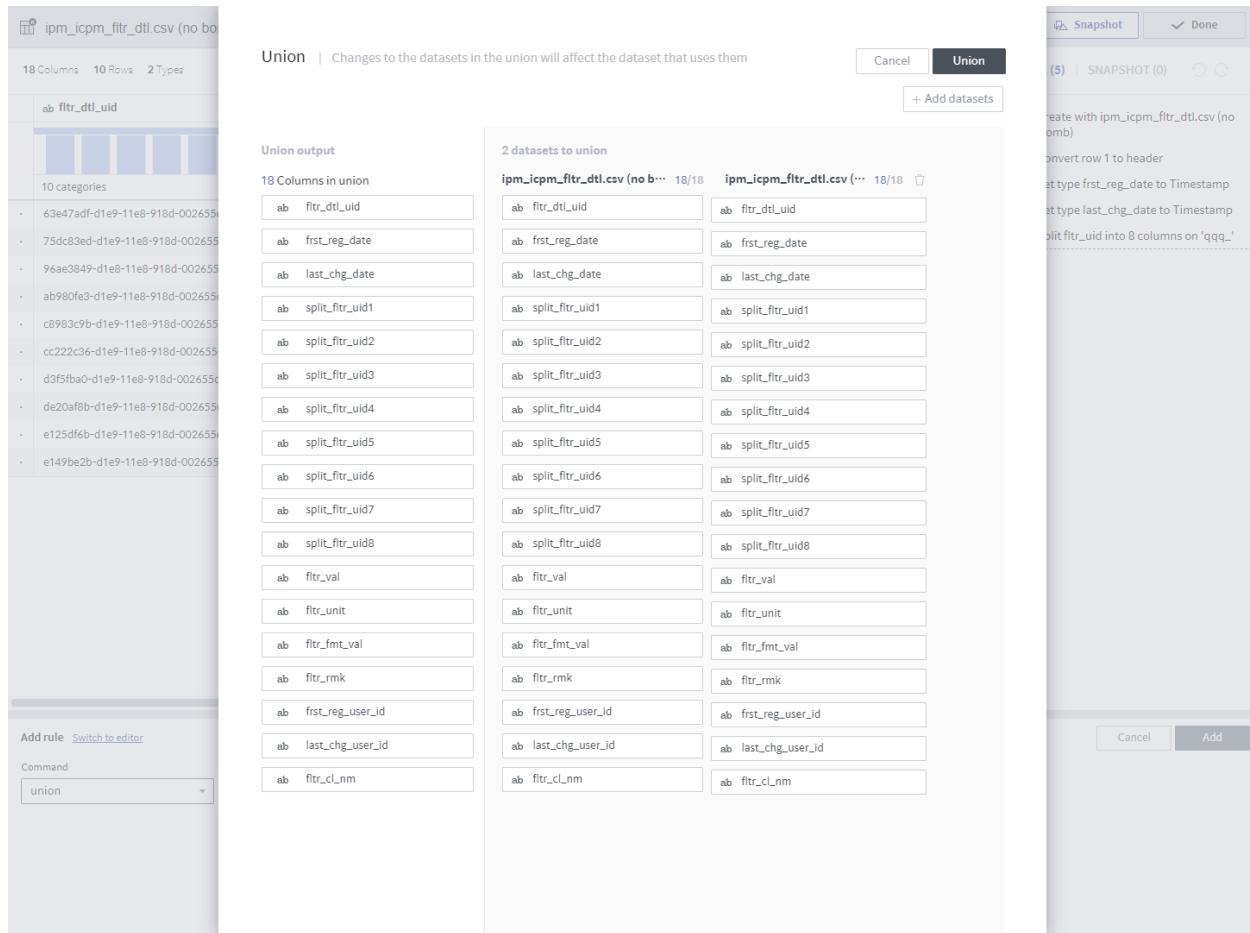
- Joins to the target dataset to create new columns.
- This rule is the same as `join` used by a relational database.
- The results can be previewed by clicking the **Show result** button.

Notes

- The join keys must be included in the columns to join.



union



Similar to [join](#), union has a separate popup.

Required arguments (select in a popup)

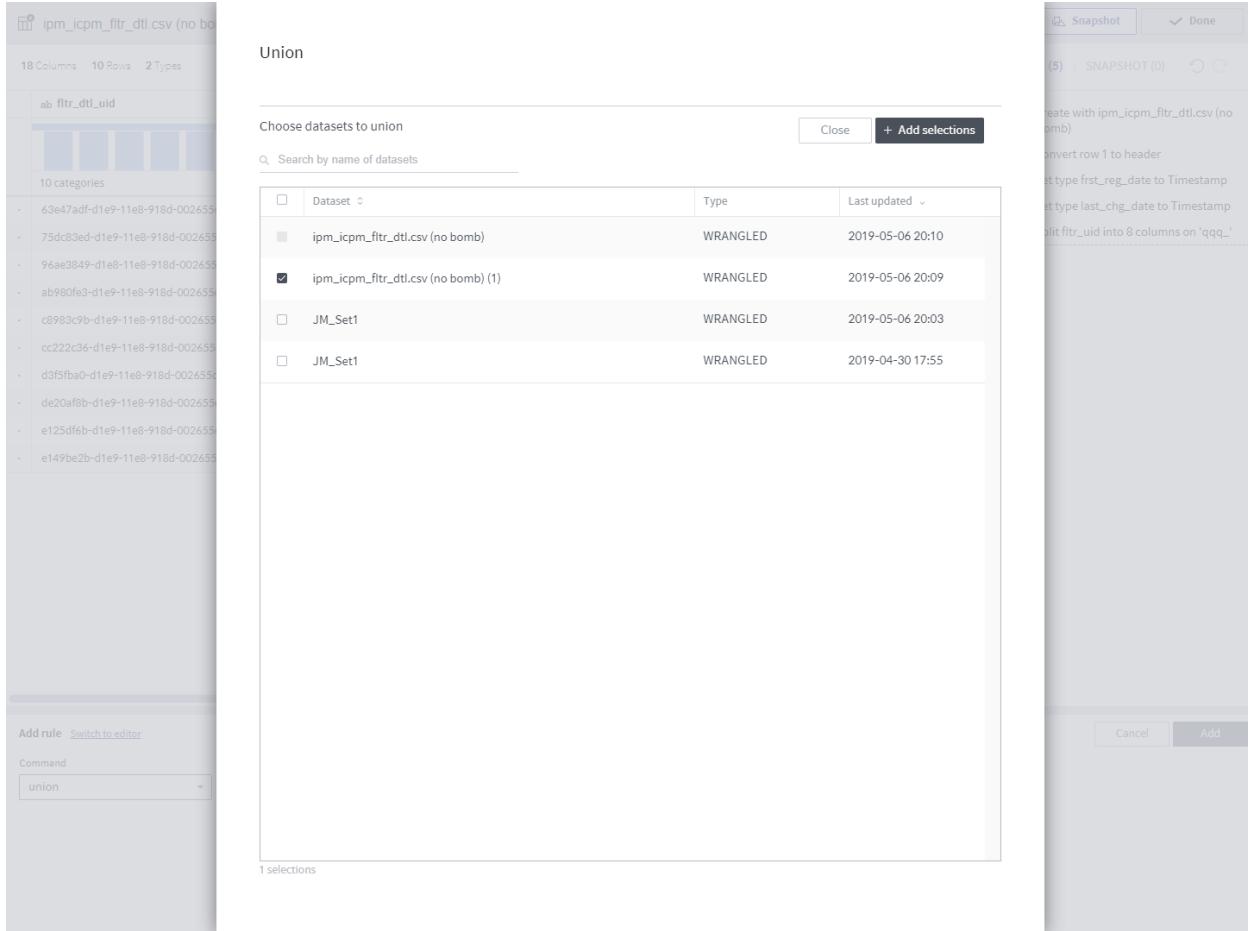
- Datasets to union: Multiple selections allowed.

Description

- The content of the selected datasets is also processed.
- This rule is the same as `union all` used by a relational database.

Notes

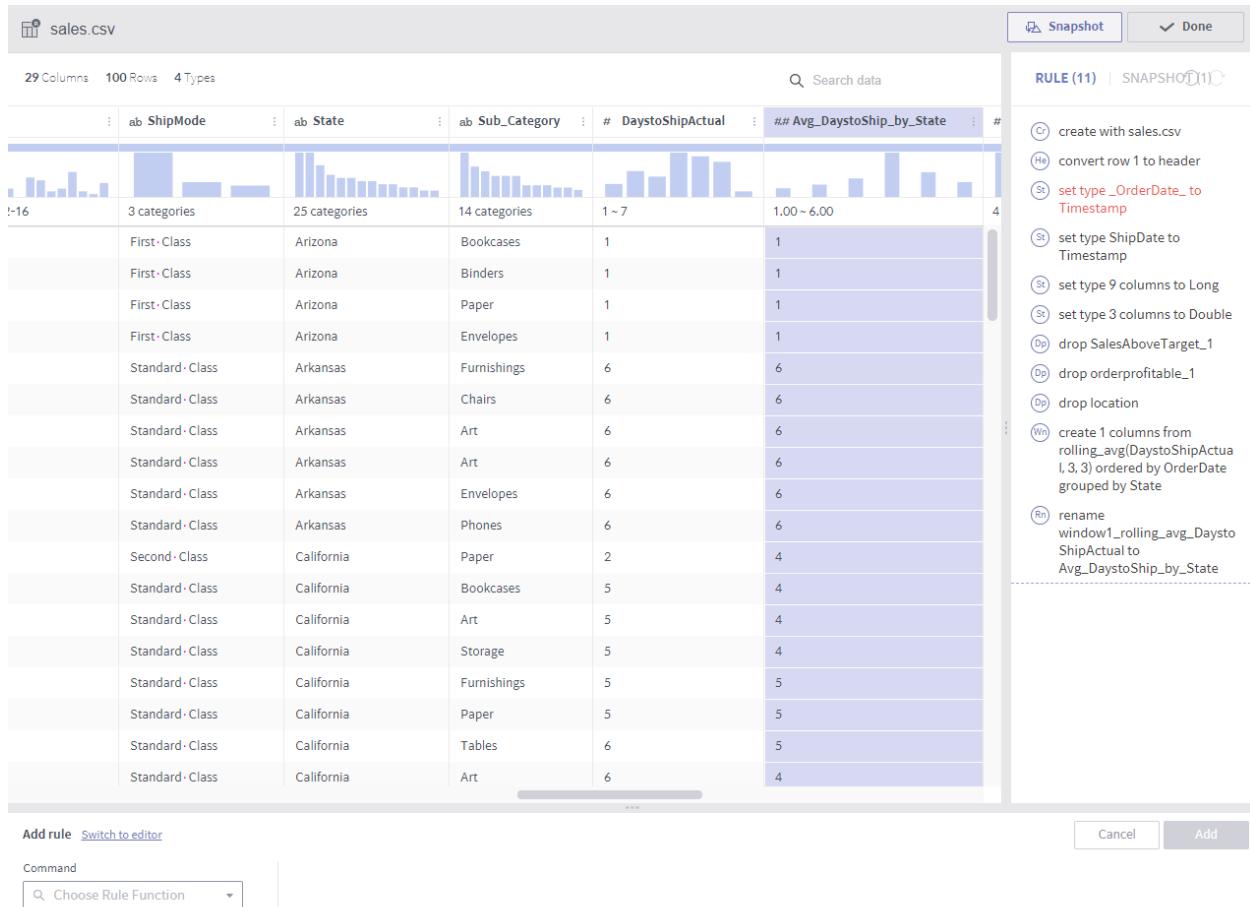
- The target datasets must coincide with the dataset that unions them in terms of column name, type, and number of columns.



window

The screenshot shows the Metatron Data Preparation interface with the following details:

- File:** sales.csv
- Columns:** 28 Columns, 100 Rows, 4 Types
- Search:** Search data
- Rule Editor:**
 - COMMAND: window
 - EXPRESSION: rolling_avg(`DaysToShipActual`)
 - GROUP BY: State
- Context Menu (Open over Row 1):**
 - OrderDate
 - Category
 - City
 - Country
 - CustomerName
 - Discount
- Right Panel (RULE (9) | SNAPSHOT):**
 - Cr create with sales.csv
 - He convert row 1 to header
 - St set type _OrderDate_to Timestamp
 - St set type ShipDate to Timestamp
 - St set type 9 columns to Long
 - St set type 3 columns to Double
 - Dp drop SalesAboveTarget_1
 - Dp drop orderprofitable_1
 - Dp drop location



Required arguments

- Expression: A list of window functions
- Group by: A list of columns that group values by. Row order created within each group. If not specified, the whole data is sorted based on the Sort by setting.
- Sort by: Specifies columns by which the order of rows is determined. If not specified, data is sorted in the order of being inputted.

Description

- Column values are created by calculating with the values of the preceding and following rows.
- The rows are grouped first and then sorted within each group in the specified column order.
 - In the above example, each row value is averaged with the three preceding and following rows

within the same State group.

- If an immediately preceding row does not have the same state, earlier rows are searched.
- The currently available window functions are as follows:
 - `row_number()`
 - `lead(colname, int)`
 - `lag(colname, int)`
 - `rolling_sum(colname, int, int)`
 - `rolling_avg(colname, int, int)`
- In addition to window functions, aggregate functions may be used.

Notes

- When using window functions, error messages may not be properly displayed in the event of insufficient arguments.

8.2.4 Function list

You can create rules using functions. This can be a very useful method

This section describes each function in terms of the following.

- Category
- Description
- Function interface
- Arguments
- Return type
- Example
- Remarks

The following functions are currently supported by data preparation

- `length`
- `if`

- `isnull`
- `isnan`
- `upper`
- `lower`
- `trim`
- `ltrim`
- `rtrim`
- `substring`
- `concat`
- `concat_ws`
- `year`
- `month`
- `day`
- `hour`
- `minute`
- `second`
- `millisecond`
- `now`
- `add_time`
- `sum`
- `avg`
- `max`
- `min`
- `count`
- `math.abs`
- `math.acos`

- [math.asin](#)
- [math.atan](#)
- [math.cbrt](#)
- [math.ceil](#)
- [math.cos](#)
- [math.cosh](#)
- [math.exp](#)
- [math.expm1](#)
- [math.getExponent](#)
- [math.round](#)
- [math.signum](#)
- [math.sin](#)
- [math.sinh](#)
- [math.sqrt](#)
- [math.tan](#)
- [math.tanh](#)
- [time_diff](#)
- [timestamp](#)
- [row_number](#)
- [rolling_sum](#)
- [rolling_avg](#)
- [lag](#)
- [lead](#)
- [ismismatched](#)
- [contains](#)
- [startswith](#)

- `endswith`

Functions can be supplemented on an ongoing basis.

length

Category

- String Function

Description

- Returns the length of the input string

Function interface

- `length(string_value)`

Arguments

- `string_value`: the string whose length you want to find.

Return type

- Integer

Example

- `length(first_name)`

if

Category

- Logical Function

Description

- Examine the conditional statement and return a value corresponding to TRUE or FALSE.

Function interface

- `if(condition)`
- `if(condition, true_value, false_value)`

Arguments

- condition: The condition to check for true / false
- true_value: The value returned if the conditional statement is true.
- false_value: The value returned if the conditional statement is false.

Return type

- Any

Example

- `if(gender=='male') : TRUE`
- `if(age<18, 'kid', 'adult') : 'adult'`

Remarks

- If true_value/false_value does not exist, it returns TURE or FALSE as a result of Boolean type.
- true_value와 false_value의 데이터 타입은 동일해야 합니다.

isnull

Category

- Logical Function

Description

- Determines whether the value of the input column is null. Returns TRUE if null, or FALSE.

Function interface

- `isnull(condition)`

Arguments

- condition: The column to determine if null.

Return type

- Boolean

Example

- `isnull(telephone) : FALSE`

isnan

Category

- Logical Function

Description

- Determines if input value is NaN (Not-a-Number). Returns TRUE if NaN, FALSE otherwise.

Function interface

- `isnan(condition)`

Arguments

- `condition`: The column or formula for which to determine NaN.

Return type

- Boolean

Example

- `isnan(1000/ratio)`

Remarks

- The result of the condition must be a Double Value.

upper

Category

- String Function

Description

- Returns all uppercase letters of the alphabet entered.

Function interface

- `upper(string_value)`

Arguments

- `string_value`: The string to replace with an uppercase letter.

Return type

- String

Example

- `upper(last_name)`
- `upper('Hello world')` : 'HELLO WORLD'

lower

Category

- String Function

Description

- Returns all lowercase letters of the entered string.

Function interface

- `lower(string_value)`

Arguments

- `string_value`: the string you want to replace with lowercase.

Return type

- String

Example

- `lower(last_name)`
- `lower('Hello WORLD')` : 'hello world'

trim

Category

- String Function

Description

- Returns the spaces before and after the input string.

Function interface

- `trim(string_value)`

Arguments

- `string_value`: The string to remove whitespace from.

Return type

- `String`

Example

- `trim(comment)`
- `trim(' . Hi! ') : ' . Hi! '`

ltrim

Category

- String Function

Description

- Remove and return the space before the input string.

Function interface

- `ltrim(string_value)`

Arguments

- `string_value`: The string to remove whitespace from.

Return type

- `String`

Example

- `ltrim(comment)`
- `ltrim(' . Hi! ') : ' . Hi! '`

rtrim

Category

- String Function

Description

- Returns the space after the input string.

Function interface

- `rtrim(string_value)`

Arguments

- `string_value`: The string to remove whitespace from.

Return type

- String

Example

- `rtrim(comment)`
- `rtrim(' . Hi! ') : ' . Hi! '`

substring

Category

- String Function

Description

- Returns part of the input string.

Function interface

- `substring(string_value, begin_index, offset)`
- `substring(string_value, begin_index)`

Arguments

- `string_value`: The string to edit.
- `begin_index`: Start index of the part to extract from the target string. The beginning of the string is 0. If you enter a negative number, it goes back to the last character of the string.
- `offset`: The length of the string to extract from the target string. If not entered, extracts from `begin_index` to the end of the string.

Return type

- String

Example

- `substring(user_id, 0, 5)`
- `substring('hello world', 1, 7) : 'ello w'`
- `substring('metatron', -2) : 'on'`

concat

Category

- String Function

Description

- 입력된 복수의 문자열을 연결하여 반환합니다.

Function interface

- Concatenate and return multiple input strings.

Arguments

- `string_value (X)`: String to concatenate. You can enter multiple n items.

Return type

- String

Example

- `concat(first_name, ' ', last_name) : 'Jane-Doe'`
- `concat('1980', '02') : '198002'`

concat_ws

Category

- String Function

Description

- Concatenates multiple input strings and returns a Separator between them.

Function interface

- concat(separator, string_value1, string_value2)

Arguments

- separator: Separator to insert between strings to be concatenated.
- string_value (X): String to concatenate. You can enter multiple n items.

Return type

- String

Example

- concat_ws(‘,’, first_name, last_name) : ‘Jane, Doe’
- concat_ws(‘-‘, ‘010’, ‘1234’, ‘5678’) : ‘010-1234-5678’

year

Category

- Timestamp Function

Description

- Returns a value corresponding to the year from the entered Timestamp value.

Function interface

- year(timestamp_value)

Arguments

- timestamp_value: 연도를 추출하고자 하는 timestamp

Return type

- Integer

Example

- year(birthday)

month

Category

- Timestamp Function

Description

- Returns the value corresponding to the month in the entered Timestamp value.

Function interface

- `month(timestamp_value)`

Arguments

- `timestamp_value`: the timestamp from which you want to extract the month

Return type

- Integer

Example

- `month(birthday)`

day

Category

- Timestamp Function

Description

- Returns a value corresponding to day from an entered Timestamp value.

Function interface

- `day(timestamp_value)`

Arguments

- `timestamp_value`: the timestamp from which you want to extract the day

Return type

- Integer

Example

- day(birthday)

hour

Category

- Timestamp Function

Description

- Returns a value corresponding to a time from an entered Timestamp value.

Function interface

- hour(timestamp_value)

Arguments

- timestamp_value: timestamp from which you want to extract time

Return type

- Integer

Example

- hour(last_login)

minute

Category

- Timestamp Function

Description

- Returns a value corresponding to minutes from the entered Timestamp value.

Function interface

- minute(timestamp_value)

Arguments

- timestamp_value: the timestamp from which you want to extract minutes

Return type

- Integer

Example

- minute(last_login)

second

Category

- Timestamp Function

Description

- Returns the value corresponding to seconds from the entered Timestamp value.

Function interface

- second(timestamp_value)

Arguments

- timestamp_value: the timestamp from which you want to extract seconds

Return type

- Integer

Example

- second(last_login)

millisecond

Category

- Timestamp Function

Description

- Returns the value corresponding to milliseconds (1/1000 second) from the entered Timestamp value.

Function interface

- millisecond(timestamp_value)

Arguments

- timestamp_value: the timestamp from which you want to extract milliseconds

Return type

- Integer

Example

- millisecond(last_login)

now

Category

- Timestamp Function

Description

- Returns the current time based on the entered Timezone.

Function interface

- now()
- now(timezone)

Arguments

- timezone: 현재시간을 구하고자 하는 Timezone의 full-name.

Return type

- Integer

Example

- now()
- now('Asia/Seoul')

Remarks

- If no Timezone value is entered, returns the time in UTC.

add_time

Category

- Timestamp Function

Description

- Returns the value added or subtracted from the input Timestamp value.

Function interface

- `add_time(timestamp, delta, time_unit)`

Arguments

- `timestamp`: the original timestamp value being targeted
- `delta`: the date / time value to add or subtract
- `time_unit`: The unit of date / time to add or subtract (in string). year, month, day, hour, minute, second, millisecond.

Return type

- Integer

Example

- `add_time(end_date, 10, 'day')`
- `add_time(end_date, -1, 'month')`

sum

Category

- Aggregation Function

Description

- Returns the sum of the target values.

Function interface

- `sum(target_col)`

Arguments

- target_col: Target column to sum

Return type

- Double

Example

- `sum(profit)`

Remarks

- Only available for aggregation and window rules.

avg

Category

- Aggregation Function

Description

- Returns the average of the target values.

Function interface

- `avg(target_col)`

Arguments

- target_col: Target column to average

Return type

- Double

Example

- `avg(profit)`

Remarks

- Only available for aggregation and window rules.

max

Category

- Aggregation Function

Description

- Returns the largest of the target values.

Function interface

- `max(target_col)`

Arguments

- `target_col`: Target column to get the maximum value

Return type

- Double

Example

- `max(profit)`

Remarks

- Only available for aggregation and window rules.

min

Category

- Aggregation Function

Description

- Returns the smallest of the target values.

Function interface

- `min(target_col)`

Arguments

- `target_col`: Target column to get the minimum value

Return type

- Double

Example

- `min(profit)`

Remarks

- Only available for aggregation and window rules.

`count`

Category

- Aggregation Function

Description

- Returns the number of rows in the target.

Function interface

- `count()`

Return type

- Double

Example

- `count()`

Remarks

- Only available for aggregation and window rules.

`math.abs`

Category

- Math Function

Description

- Returns the absolute value of the entered value.

Function interface

- `math.abs(value)`

Arguments

- value: A number whose absolute value you want to find.

Return type

- Double

Example

- `math.abs(-10) : 10`

math.acos

Category

- Math Function

Description

- Returns the arc cosine of the entered value.

Function interface

- `math.acos(value)`

Arguments

- value: The cosine of which you want to find the arc cosine.

Return type

- Double

Example

- `math.acos(-1) : 3.141592653589793`

math.asin

Category

- Math Function

Description

- Returns the arc sine of the entered value.

Function interface

- `math.asin(value)`

Arguments

- `value`: The sine of which you want to find the arc sine, in the range -1 to 1.

Return type

- `Double`

Example

- `math.asin(-1) : -1.5707963267948966`

`math.atan`

Category

- Math Function

Description

- Returns the arc sine of the entered value.

Function interface

- `math.atan(value)`

Arguments

- `value`: The sine of which you want to find the arc sine, in the range -1 to 1.

Return type

- `Double`

Example

- `math.asin(-1) : -1.5707963267948966`

`math.cbrt`

Category

- Math Function

Description

- Returns the cube root of the entered value.

Function interface

- `math.cbrt(value)`

Arguments

- `value`: The number whose cube root you want to find.

Return type

- `Double`

Example

- `math.cbrt(5) : 1.709975946676697`

`math.ceil`

Category

- Math Function

Description

- Returns the value rounded up to be a multiple of day.

Function interface

- `math.ceil(value)`

Arguments

- `value`: The number you want to round to one's place.

Return type

- `Double`

Example

- `math.ceil(15.142) : 16`

`math.cos`

Category

- Math Function

Description

- Returns the cosine of the entered value.

Function interface

- `math.cos(value)`

Arguments

- `value`: the radian angle to get the cosine of

Return type

- Double

Example

- `math.cos(45) : 0.5253219888177297`

math.cosh

Category

- Math Function

Description

- Returns the hyperbolic cosine of the entered value.

Function interface

- `math.cosh(value)`

Arguments

- `value`: The number whose hyperbolic cosine is to be obtained.

Return type

- Double

Example

- `math.cosh(9) : COSH(9) => 4051.5420254925943`

math.exp

Category

- Math Function

Description

- Returns the natural logarithm of e raised to the power of the input value.

Function interface

- `math.exp(value)`

Arguments

- `value`: The number of times to want to log the natural logarithm e.

Return type

- Double

Example

- `math.exp(4) : 54.598150033144236`

math.expm1

Category

- Math Function

Description

- Returns the natural logarithm e, multiplied by the value entered, minus one.

Function interface

- `math.expm1(value)`

Arguments

- `value`: The number of times to want to log the natural logarithm e.

Return type

- Double

Example

- `math.expm1(4)` : 53.598150033144236

math.getExponent

Category

- Math Function

Description

- Returns the largest of exp values that satisfy $2^{\text{exp}} \leq N$ for the entered value N .

Function interface

- `math.getExponent(value)`

Arguments

- `value`: The number corresponding to N when looking for an exp value that satisfies $2^{\text{exp}} \leq N$.

Return type

- Double

Example

- `math.getExponent(9)` : 3

math.round

Category

- Math Function

Description

- Returns the value rounded to the ones place.

Function interface

- `math.round(value)`

Arguments

- `value`: the number to be rounded to

Return type

- Double

Example

- `math.round(14.2) : 14`

math.signum

Category

- Math Function

Description

- Returns the sign of the entered value.

Function interface

- `math.signum(value)`

Arguments

- `value`: the number to extract the sign of

Return type

- Double

Example

- `math.signum(-24) : -1`

Remarks

- If the number entered is 1, it is 1, 0 is 0, and -1 if it is negative.

math.sin

Category

- Math Function

Description

- Returns the sine of the entered value.

Function interface

- `math.sin(value)`

Arguments

- `value`: the radian angle for which you want to find the sine

Return type

- `Double`

Example

- `math.sin(90) : 0.8939966636005579`

`math.sinh`

Category

- Math Function

Description

- Returns the hyperbolic sine of the entered value.

Function interface

- `math.sinh(value)`

Arguments

- `value`: the number whose hyperbolic sine is to be obtained

Return type

- `Double`

Example

- `math.sinh(1) : 1.1752011936438014`

`math.sqrt`

Category

- Math Function

Description

- Returns the square root of the entered value.

Function interface

- `math.sqrt(value)`

Arguments

- `value`: the number whose square root you want to find

Return type

- `Double`

Example

- `math.sqrt(4) : 2`

`math.tan`

Category

- Math Function

Description

- Returns the tangent of the entered value.

Function interface

- `math.tan(value)`

Arguments

- `value`: the radian angle for the tangent value

Return type

- `Double`

Example

- `math.tan(10) : 0.6483608274590866`

`math.tanh`

Category

- Math Function

Description

- Returns the hyperbolic tangent of the entered value.

Function interface

- `math.tanh(value)`

Arguments

- `value`: The angle to get the hyperbolic tangent of.

Return type

- Double

Example

- `math.tanh(4) : 0.999329299739067`

time_diff

Category

- Timestamp Function

Description

- Calculates and returns the difference between two input Timestamp values in milliseconds.

Function interface

- `time_diff(timestamp1, timestamp2)`

Arguments

- `timestamp1`: C = B - A에서 A에 해당하는 시간 값.
- `timestamp1`: C = B - A, the timestamp of B

Return type

- Double

Example

- `time_diff(order_date, shipped_date)`

Remarks

- result value = timestamp2 – timestamp1

timestamp

Category

- Timestamp Function

Description

- Create a new Timestamp value.

Function interface

- `timestamp(value, format)`

Arguments

- `value`: Date/Time value to create as timestamp value.
- `format`: The time format of the value value.

Return type

- `Timestamp`

Example

- `timestamp('2011-01-01', 'yyyy-MM-dd')` : 2011-01-01T00:00:00.000Z

row_number

Category

- Window Function

Description

- Generates serial numbers of rows arranged in order in the partition.

Function interface

- `row_number()`

Return type

- Long

Example

- `row_number()`

Remarks

- Only available with Window Rule.

`rolling_sum`

Category

- Window Function

Description

- Returns the sum of the values of the specified number of rows before and after within the partition.

Function interface

- `rolling_sum(target_col, before, after)`

Arguments

- `target_col`: Target column name to sum.
- `before`: Number of preceding rows to sum.
- `after`: The number of trailing rows to sum.

Return type

- Long/Double

Example

- `rolling_sum (profit, 3, 3)`: Combines profits for a total of seven rows, including three rows before and after the same partition.

Remarks

- Only available with Window Rule.

rolling_avg

Category

- Window Function

Description

- Returns the average of the values of the specified number of rows before and after in the partition.

Function interface

- `rolling_avg(target_col, before, after)`

Arguments

- `target_col`: The target column name for which you want to average.
- `before`: The number of preceding rows to average.
- `after`: number of trailing rows to average.

Return type

- Long/Double

Example

- `rolling_avg (profit, 3, 3)`: average of 7 rows' profits including 3 rows before and after the same partition

Remarks

- Only available with Window Rule.

lag

Category

- Window Function

Description

- Returns the value of the row that is earlier than the specified number in the partition.

Function interface

- `lag(target_col, before)`

Arguments

- target_col: Target column name.
- before: A number that specifies how far back to return the current row.

Return type

- Long/Double

Example

- lag (profit, 2): Returns the profit value of the row above 2 lines in the same partition. If there is no value above line 2, it returns null.

Remarks

- Only available with Window Rule.

lead

Category

- Window Function

Description

- Returns the value of Row after the specified number within the partition.

Function interface

- lead(target_col, after)

Arguments

- target_col: Target column name.
- after: A number that specifies how far behind the current row to return.

Return type

- Long/Double

Example

- lead (profit, 2): returns the profit value of a row below 2 lines in the same partition. If there is no value under line 2, it returns null.

Remarks

- Only available with Window Rule.

ismismatched

Category

- Logical Function

Description

- Returns whether the Value of the specified column matches a specific Column Type.

Function interface

- `ismismatched(target_col, column_type)`

Arguments

- `target_col`: Column name to check type.
- `column_type`: Type to check for match. (Type as string) String, Boolean, Timestamp, Long, Double

Return type

- Boolean

Example

- `ismismatched (birth_date, timestamp)`: false if the value of the row is timestamp, true otherwise.

contains

Category

- String Function

Description

- Returns whether the Value of the specified column contains a specific string.

Function interface

- `contains(target_col, search_word)`

Arguments

- `target_col`: The column name to search for a string.

- `search_word`: The string to search for in the column.

Return type

- Boolean

Example

- `contains (name, 'son')`: True if name contains son. ‘Micheal Jackson’, ‘Son Heung Min’, etc.

startswith

Category

- String Function

Description

- Returns whether the Value of the specified column starts with a specific string.

Function interface

- `startswith(target_col, search_word)`

Arguments

- `target_col`: The column name to search for a string.
- `search_word`: The string to search for in the column.

Return type

- Boolean

Example

- `startswith (name, 'kim')`: True if name starts with ‘kim’. Kim Chul-soo, Kim Soo-ji, etc.

endswith

Category

- String Function

Description

- Returns whether the Value of the specified column ends a specific string.

Function interface

- `endswith(target_col, search_word)`

Arguments

- `target_col`: The column name to search for a string.
- `search_word`: The string to search for in the column.

Return type

- Boolean

Example

- `endswith(customer_code, 'M')`: True if `customer_code` ends with M ‘1340M’, ‘0020M’, etc.

8.2.5 Create a data snapshot

When rule editing is complete, you can create a data snapshot of the finalized dataset, which can then be downloaded to your local PC or ingested into the Metatron engine. Running the data snapshot applies the rules to the entire data, which, in the process of rule editing, applied to a sample dataset of less than 10,000 rows.

Below are instructions on creating a snapshot:

1. Click the **Data Snapshot** button on the upper right of the [Edit rules](#) window.

The screenshot shows the Metatron Data Preparation interface. At the top, it displays the file name "sales-data-sample.csv", the number of columns (28), rows (9,994), and types (2). Below this is a table view with the following data:

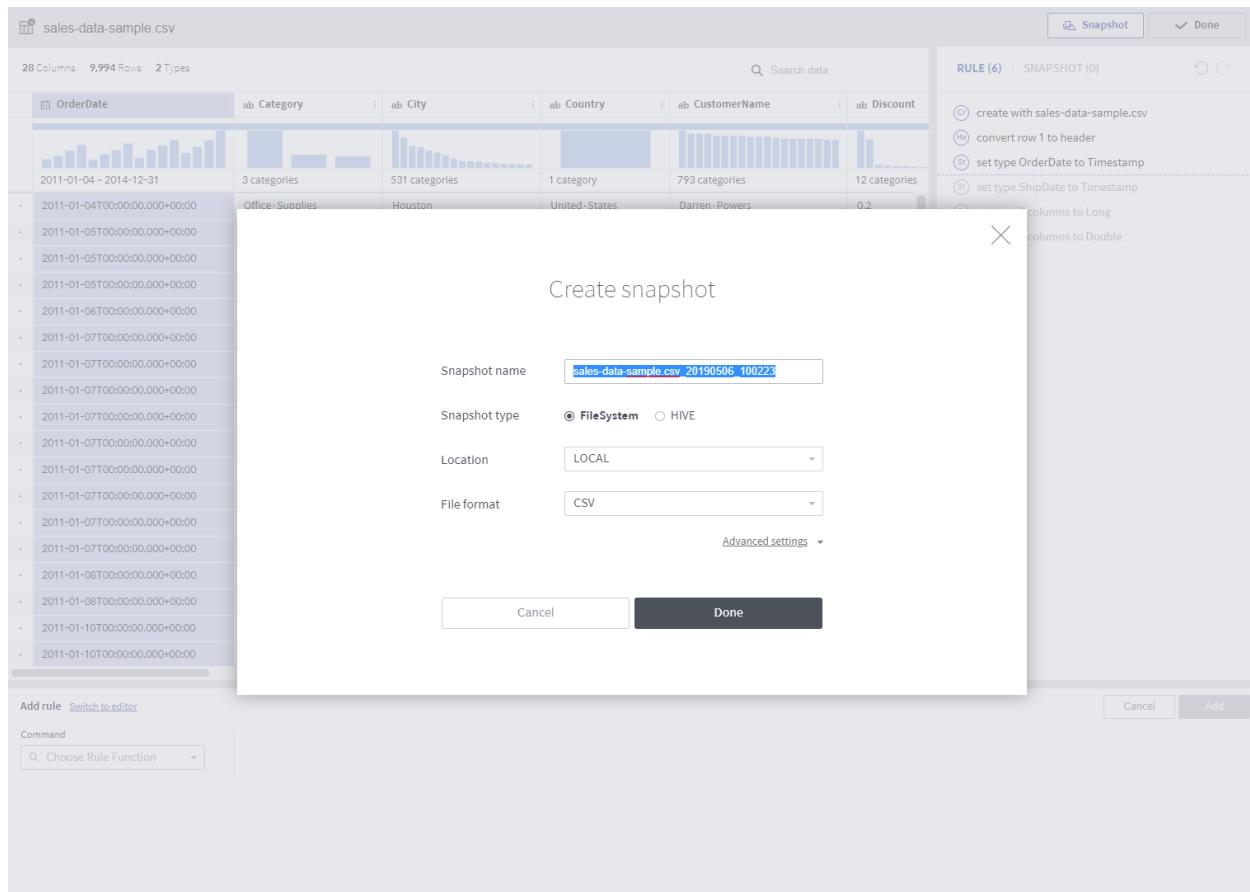
OrderDate	Category	City	Country	CustomerName	Discount
2011-01-04 ~ 2014-12-31	3 categories	531 categories	1 category	793 categories	12 categories
2011-01-04T00:00:00.000+00:00	Office·Supplies	Houston	United·States	Darren·Powers	0.2
2011-01-05T00:00:00.000+00:00	Office·Supplies	Naperville	United·States	Phillina·Ober	0.2
2011-01-05T00:00:00.000+00:00	Office·Supplies	Naperville	United·States	Phillina·Ober	0.8
2011-01-05T00:00:00.000+00:00	Office·Supplies	Naperville	United·States	Phillina·Ober	0.2
2011-01-06T00:00:00.000+00:00	Office·Supplies	Philadelphia	United·States	Mick·Brown	0.2
2011-01-07T00:00:00.000+00:00	Furniture	Henderson	United·States	Maria·Etezadi	0.0
2011-01-07T00:00:00.000+00:00	Office·Supplies	Athens	United·States	Jack·OBriant	0.0
2011-01-07T00:00:00.000+00:00	Office·Supplies	Henderson	United·States	Maria·Etezadi	0.0
2011-01-07T00:00:00.000+00:00	Office·Supplies	Henderson	United·States	Maria·Etezadi	0.0
2011-01-07T00:00:00.000+00:00	Office·Supplies	Henderson	United·States	Maria·Etezadi	0.0
2011-01-07T00:00:00.000+00:00	Office·Supplies	Henderson	United·States	Maria·Etezadi	0.0
2011-01-07T00:00:00.000+00:00	Office·Supplies	Los·Angeles	United·States	Lycoris·Saunders	0.0
2011-01-07T00:00:00.000+00:00	Technology	Henderson	United·States	Maria·Etezadi	0.0
2011-01-07T00:00:00.000+00:00	Technology	Henderson	United·States	Maria·Etezadi	0.0
2011-01-08T00:00:00.000+00:00	Furniture	Huntsville	United·States	Vivek·Sundaresam	0.6
2011-01-08T00:00:00.000+00:00	Office·Supplies	Huntsville	United·States	Vivek·Sundaresam	0.8
2011-01-10T00:00:00.000+00:00	Office·Supplies	Laredo	United·States	Melanie·Seite	0.2
2011-01-10T00:00:00.000+00:00	Technology	Laredo	United·States	Melanie·Seite	0.2

On the right side, there is a sidebar titled "RULE (6) | SNAPSHOT (0)" containing the following history:

- create with sales-data-sample.csv
- convert row 1 to header
- set type OrderDate to Timestamp
- set type ShipDate to Timestamp
- set type 7 columns to Long
- set type 5 columns to Double

At the bottom left, there are buttons for "Add rule" (with "Switch to editor"), "Command", and "Choose Rule Function". At the bottom right, there are "Cancel" and "Add" buttons.

- When a popup is displayed to set snapshot options, select either FileSystem or HIVE (STAGING_DB) under Snapshot type.



- If FileSystem is selected as the snapshot location, the snapshot will be created as **CSV** or **JSON**.



Create snapshot

Snapshot name

Snapshot type **FileSystem** HIVE

Location

File format

- The HIVE option is available only when STAGING_DB is enabled. A snapshot is created in the table when you designate a schema name and table name.

X

Create snapshot

Snapshot name

Snapshot type FileSystem HIVE

DB name

Table name

[Advanced settings](#)

3. When the snapshot is created, you can view the snapshot status and related information in the same window.

 Snapshot  Done

RULE (6) | **SNAPSHOT (1)**

✓ Success

✓ sales-data-sample.csv_20190506_100223 >

2019-05-06 19:03:20

 Go to snapshot list

8.3 Use data snapshot results

A **data snapshot** created through a dataflow can be used as follows:

- Check the data snapshot results
- Ingest into the Metatron engine
- Download as a CSV file

8.3.1 Check the data snapshot results

The status of snapshot creation can be classified as follows:

- **Success** = SUCCEEDED
- **Failed** = FAILED
- **Preparing** = INITIALIZING, RUNNING, WRITING, TABLE_CREATING, CANCELING

You can view the details of snapshot creation through the two paths below:

- Go to the snapshot list under **MANGEMENT** > **Data Preparation** > **Data Snapshot**.

Name	Dataflow Dataset	Status	Elapsed time	Created
sales-data-sample.csv_20190506_100223	Sales Analysis sales-data-sample.csv	✓	00:00:01.00	2019-05-06 19:03 by ...
JM_Set1_20190430_055433	JM_Set1_0430_1449 JM_Set1	✓	00:00:00.00	2019-04-30 14:54 by j...
JM_Set1_20190430_055143	JM_Set1_0430_1449 JM_Set1	✓	00:00:02.00	2019-04-30 14:52 by j...

- Click the **Snapshot (#)** tab on the right of the [Edit rules](#) page in **Dataflow**

In the snapshot details page, you can view details such as data validity ratio and a grid of the created snapshot, and download the results as a CSV file ([Download as CSV](#)).

If valid data has not been created, the snapshot details page displays an error log.

The screenshot shows the 'Trello Action Log (Saved) _20190405_083124' details page. The left panel contains an 'Error log' section with a large amount of Java stack trace code. The right panel contains 'Trello Action Log (Saved)' metadata, a 'Dataset' section with creation and update timestamps, and an 'Origin imported dataset' section with a 'Datasource' entry.

Trello Action Log (Saved)	
Snapshot type	FILE (CSV)
File URI	file:///data/metatron-discovery/dataprep/sn...
Elapsed time	00:00:00.00
Created	2019-04-05 17:31

Dataset	
Created	2019-04-01 01:59
Updated	2019-04-05 14:37

Origin imported dataset	
Datasource	Trello Action Log
Created	2019-04-01 01:55

8.3.2 Ingest into the Metatron engine

(upcoming feature)

8.3.3 Download as a CSV file

In the details page of a successfully created snapshot, the **Download as CSV** option is enabled.

The screenshot shows the Metatron Discovery interface. On the left, there's a sidebar with various icons. In the center, a dataset named "sales-data-sample.csv_20190506_100223" is displayed. The top bar shows statistics: Valid 100%, Mismatched 0%, and Missing 0%. Below this is a "Grid" section containing a table of data with columns: OrderDate, Category, City, Country, CustomerName, Discount, OrderID, and PostalCode. A red box highlights the "Download as CSV" button in the top right corner of the grid. To the right of the grid is a detailed panel with information like Snapshot type (FILE (CSV)), File URI (file:///data/metatron-discovery/dataprep/sn...), and Summary (9,994 row(s), 28 column(s)). At the bottom, there are sections for Rule list, Create datasource, and Origin imported dataset.

The downloaded file is a standard CSV, with each value separated by a “comma” and each row by a “new line.”

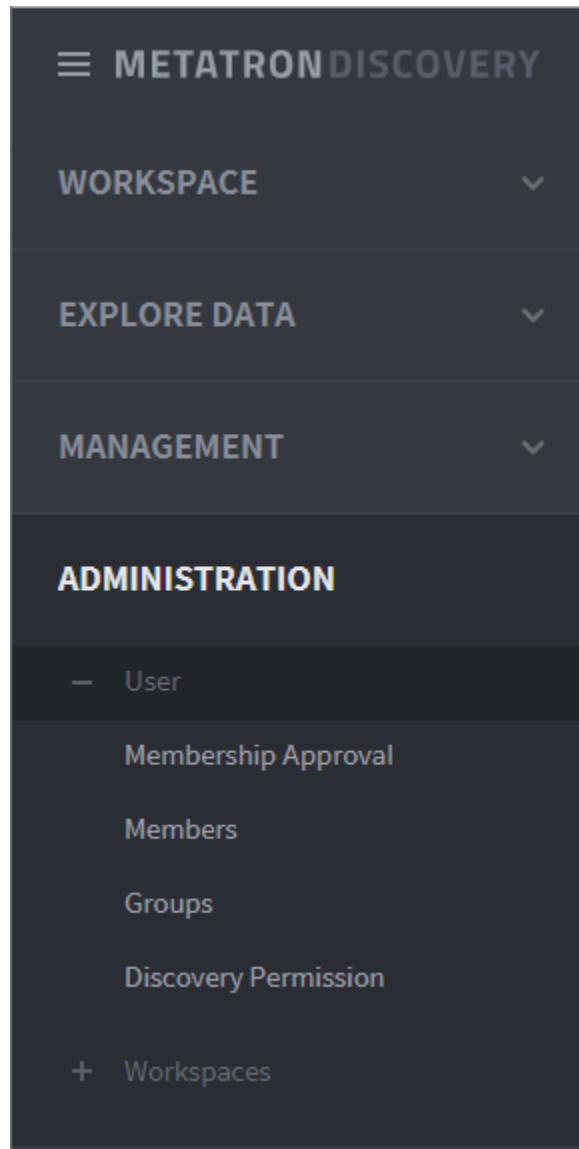
A screenshot of a spreadsheet application showing a single sheet titled "test - Sheet1 (1)". The sheet contains a table with 6 columns and 6 rows. The columns are labeled "column1", "column2", "column3", "column4", "column5_1", and "column5". The data in the table includes various values and some JSON objects. The first row has "test1" in the first column. The second row has "1" in the first column. The third row has "1" in the first column. The fourth row has "1" in the first column. The fifth row has an empty first column.

CHAPTER
NINE

ACCOUNT MANAGEMENT

The administrator can set and manage the membership and permissions of Metatron Discovery users, and these tasks are facilitated by the **Group** functionality.

To manage users, click ADMINISTRATION → USER on the left-hand panel of the main page and select a submenu you want to use.



9.1 Membership Approval

This menu shows applications for membership. As shown below, the list includes the applications that have been rejected or waiting for approval. But, approved users are listed here but can be found in the **Members** menu.

Users

The screenshot shows a table of user applications with the following columns: Username, Full Name, Email, Request date, and Status. The 'Status' column contains links labeled 'Approve' or 'Reject'. The 'Request date' column shows dates ranging from 2019-04-29 to 2019-11-15. Most entries have a 'Rejected' status.

Username	Full Name	Email	Request date	Status
applicant	EE	applicant24@gmail.com	2019-08-21 22:39	✓ Approve ✗ Reject
tester_00	tester_00	skt.metatron@gmail.com	2019-05-14 13:08	Rejected
tester_00	tester_00	skt.metatron@gmail.com	2019-05-14 12:53	Rejected
tester_00	tester_00	skt.metatron@gmail.com	2019-05-14 11:37	Rejected
sehwa.lee	sehwa.lee	sehwa.lee@sk.com	2019-05-09 18:43	Rejected
admin_test	aaa	kyungtaak@gamil.com	2019-04-29 10:13	Rejected
asd	ASD	asd@asd.com	2018-12-10 13:12	Rejected
sbparks	sbparks	sbparks@sbparks.sbparks	2018-12-06 13:23	Rejected
tester	Tester	test@test.com	2018-11-23 13:11	Rejected
pp333	pp333	ppeee@test.com	2018-11-22 14:51	Rejected
pp333	pp333	pp333@pp333.pp333	2018-11-15 15:52	Rejected
pp222	pp222	pp222@pp222.pp222	2018-11-15 15:51	Rejected
pp111	pp111	pp111@pp111.pp111	2018-11-15 15:51	Rejected
pp000	pp000	pp000@pp000.pp000	2018-11-15 15:51	Rejected
p888	p888	p888@p888.p888	2018-11-15 15:50	Rejected
ppp3333	ppp3333	ppp3333@cc.com	2018-11-15 15:02	Rejected

9.2 Members

This menu allows you to view and manage registered users.

Users can sign up for Metatron Discovery in one of the following two ways:

- Administrator's approval of a user's application for membership (see [Membership Approval](#))
- Registration by the administrator (see [Register a member](#))

9.2.1 Members home

The Members home shows a list of Metatron Discovery members. The member list can be filtered by various criteria, and clicking on an entry in the list allows you to view and edit the selected member's

information.

Users

Membership Approval				
Members				
Groups				
Discovery Permission				
Status	<input checked="" type="radio"/> All	<input type="radio"/> Activate	<input type="radio"/> Inactive	
Join date	All	Today	Last 7 days	yyyy-MM-dd hh:mm ~ yyyy-MM-dd hh:mm
				Apply
Search by username or full name				There are 43 lists + Create member
Member (Full name)	Username	Email	Join date	Status
admin	admin	metatron.app@gmail.com	2018-08-24 15:49	Activate ▾
Guest	guest	guest@metatron.com	2018-08-24 15:49	Activate ▾
Polaris	polaris	polaris@metatron.com	2018-08-24 15:49	Activate ▾
Metatron	metatron	metatron@metatron.com	2018-08-24 15:49	Activate ▾
skt_geo_demo	skt_geo_demo	june.woo.lee@sk.com	2018-10-10 14:52	Activate ▾
dskim	qatester	qa@test.er	2018-11-15 09:16	Activate ▾
p333	p333	p333@p333.p333	2018-11-15 15:48	Activate ▾
p444	p444	p444@p444.p444	2018-11-15 15:48	Activate ▾
p666	p666	p666@p666.p666	2018-11-15 15:49	Activate ▾
p777	p777	p777@p777.p777	2018-11-15 15:49	Activate ▾
p999	p999	p999@p999.p999	2018-11-15 15:50	Activate ▾
p000	p000	p000@p000.p000	2018-11-15 15:50	Activate ▾
a111	a111	a111@a111.a111	2018-11-19 13:52	Activate ▾
a222	a222	a222@a222.a222	2018-11-19 13:52	Activate ▾
Tester	tester	test@test.com	2018-11-23 13:13	Activate ▾
p1234	p1234	p1234@p1234.p1234	2018-12-06 11:33	Activate ▾
12dectestcho	12dectestcho	12dectestcho@magenta.works	2018-12-06 14:25	Activate ▾
김연임	deidera	deidera@magenta.works	2018-12-07 13:58	Activate ▾

9.2.2 View and edit member information

Clicking on a member in the list opens the member information page shown below:

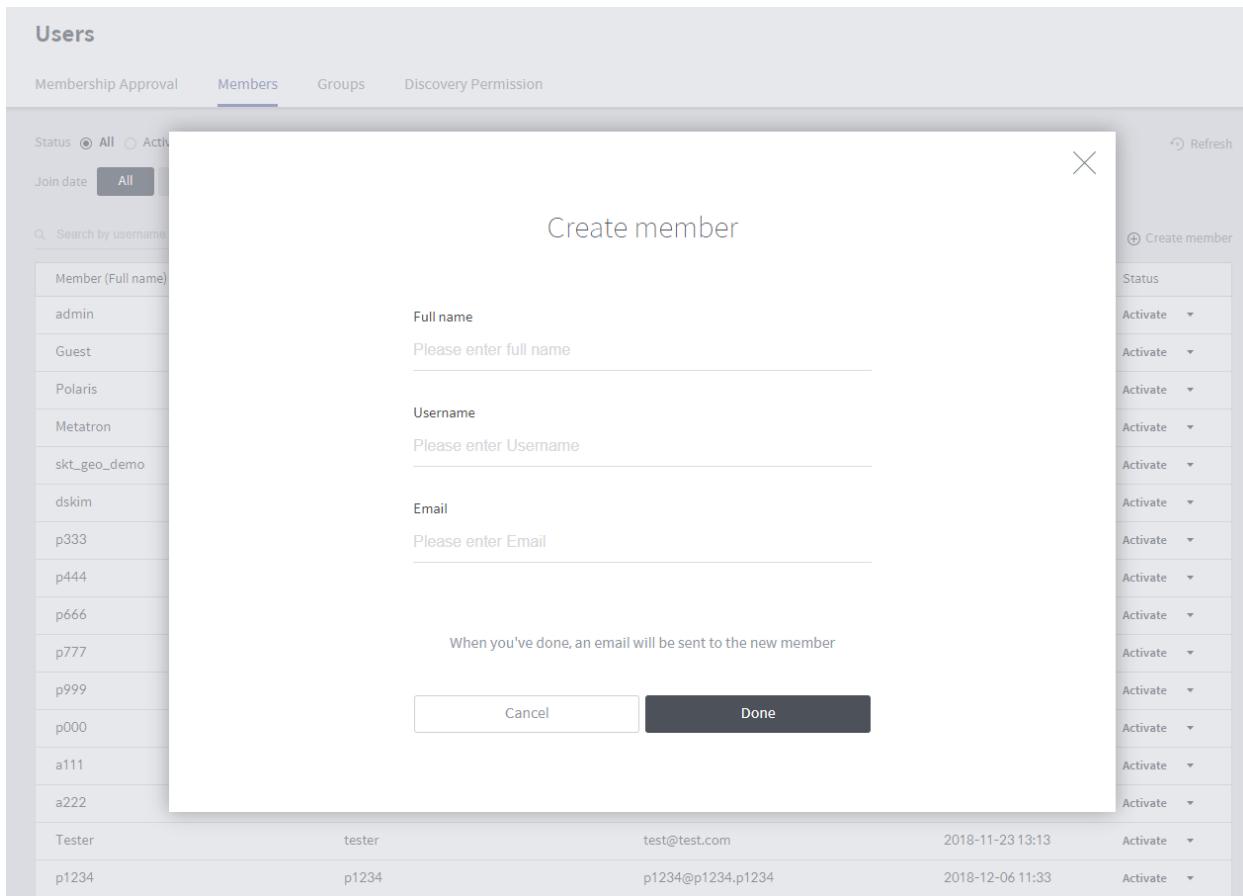
The screenshot shows a user profile page for 'admin'. At the top, there's a back arrow and the text '← admin'. Below that, it says 'Joined on 2018-08-24 15:49'. On the right, there are 'Status' (set to 'Activate'), 'Activate' (button), and 'Reset password' (button). The main section is titled 'Information' and contains a circular profile picture of a blue hydrangea flower. To the right of the picture are five data fields: 'Full Name' (admin), 'Username' (admin), 'Email' (metatron.app@gmail.com), 'Permission' (Manage system, Manage and monitor datasource, Use shared workspace, Use personal workspace, Manage workspace custom schema), and 'Phone' (0000000000). Below this is a 'Groups (1)' section with a gear icon, showing 'System-Admin' with the same permission list.

This page displays some basic information and allows a number of settings.

- **Status setting (Active/Inactive):** An inactive member cannot log in to the system.
- **Reset password:** By clicking this, a user has forgotten the password can receive an email to reset it.
- **Group setting:** Click on the gear icon to add or delete groups to which the member belongs. See [Groups](#) for details on the user group.

9.2.3 Register a member

Click the Create member button on the top right of the page to pop up the member creation dialog box below.



Enter the member's real name, ID, and email address to register the member, and the membership details will be sent to the email address.

9.3 Groups

By grouping Metatron Discovery users, you can use the following convenient features:

- Batch setting of a permission for all users in a group
- Sending an email to all users in a group

9.3.1 Groups home

The Groups home shows the user groups currently registered in Metatron Discovery. The group list can be filtered by various criteria, and clicking on an entry in the list allows you to view and edit the selected

group's information.

Users

Membership Approval	Members	Groups	Discovery Permission
		Groups	
Create date <input type="button" value="All"/> <input type="button" value="Today"/> <input type="button" value="Last 7 days"/> <input type="text" value="yyyy-MM-dd hh:mm"/> ~ <input type="text" value="yyyy-MM-dd hh:mm"/> <input type="button" value="Apply"/> <input type="button" value="Refresh"/>			
<input type="text"/> Search by Username or full name There are 30 lists <input type="button" value="Create group"/>			
Group	Description	Members	Create date
Data-Manager		12	2018-08-24 15:49
General-User		62	2018-08-24 15:49
System-Admin		9	2018-08-24 15:49
#1425		0	2019-03-07 10:42
11222	1122222	0	2018-11-15 15:46
14	14	0	2018-11-15 15:46
1414.14142		0	2019-03-07 10:46
15	15	0	2018-11-15 15:46
16	16	0	2018-11-15 15:46
17	17	0	2018-11-15 15:46
18	18	0	2018-11-15 15:46
19	19	0	2018-11-15 15:47
2	2	0	2018-11-15 15:44
20	20	1	2018-11-15 15:47
21	21	0	2018-11-15 15:47
22	22	0	2018-11-15 15:47
3	3	0	2018-11-15 15:46
4	4	0	2018-11-15 15:46

9.3.2 View and edit group information

Clicking on a group in the list opens the group information page shown below:

← Data-Manager

Created on 2018-08-24 15:49 by **admin** Last update on 2019-06-12 17:04 by **admin**

Information

Name	Data-Manager
Description	
Permission	Manage and monitor datasource, Use shared workspace, Use personal workspace

Members(10)  email to all users

polaris
qatester
deidera
demo
heesoo
jungil.park
choong
sting
kyungtaak
SKH

This page provides the following functions:

- Check the selected group's basic information, assigned permissions, and members.
- Click on the  icon to add or delete members to or from the group.
- Click the email to all users button to send an email to all members of the group.

9.3.3 Register a group

Click the Create group button on the top right of the page to pop up the group creation dialog box below.

The screenshot shows the 'Groups' tab selected in the 'Users' interface. A modal dialog titled 'Create group' is open in the center. The dialog has two input fields: 'Name' (with placeholder 'Please enter group name') and 'Description' (with placeholder 'Please enter description'). At the bottom are 'Cancel' and 'Done' buttons. To the left of the modal is a sidebar with a 'Group' header and a list of existing groups: Data-Manager, General-User, System-Admin, #1425, 11222, 14, 1414.14142, 15, 16, 17, 18, 19, 2, 20, 21, and 22. To the right of the modal is a vertical list of delete icons for each of these groups.

Enter a name and description for the group and click Done to create the new group.

9.4 Discovery Permissions

Metatron Discovery supports four types of permissions shown below, thereby enabling the administrator to grant different user privileges. This menu allows permission settings for individual members or groups.

Users

Membership Approval	Members	Groups	Discovery Permission
There are 4 lists			
Discovery Permission	Description	Member	Group
Manage and monitor datasource	Access with data management menu. Able to create and manage data. In addition, users with this permission can...	0	2
Manage workspace custom schema	Create and manage custom schemas in owner workspaces.	0	1
Use personal workspace	Have a private workspace that only you can access, and you are authorized for its administration.	0	3
Use shared workspace	Create a new shared workspace and access your shared workspace.	1	3

Click on one of the four permissions presented on the home to list the individual members and groups assigned the selected permission.

≡ METATRON DISCOVERY

← Manage and monitor datasource Access with data management menu. Able to create and manage data. In addition, users with this permission can...

Information

Name	Manage and monitor datasource
Description	Access with data management menu. Able to create and manage data. In addition, users with this permission can monitor the usage of data.

Users

Members (0)	No member
Groups (2)	Data-Manager and 1 more groups.

In the **Member** or **Group** section, click on the icon to pop up the following settings dialog box where you can set which members or groups will be assigned the permission.

Set shared member & group

[Cancel](#)[Done](#)

Member 0

Group 2

Search by Username or full name

All (15/43)

#error (test)

12dectestcho (12dectestcho)

a111 (a111)

a222 (a222)

admin (admin)

al.lee (al.lee)

choong (choong)

DD (member)

delete_user2 (delete_user2)

delete_user3 (delete_user3)

Demo (demo)

dskim (qatester)

eeee (eeee)

Guest (guest)

hive (hive)

0 selections

Full Name	UserName
-----------	----------

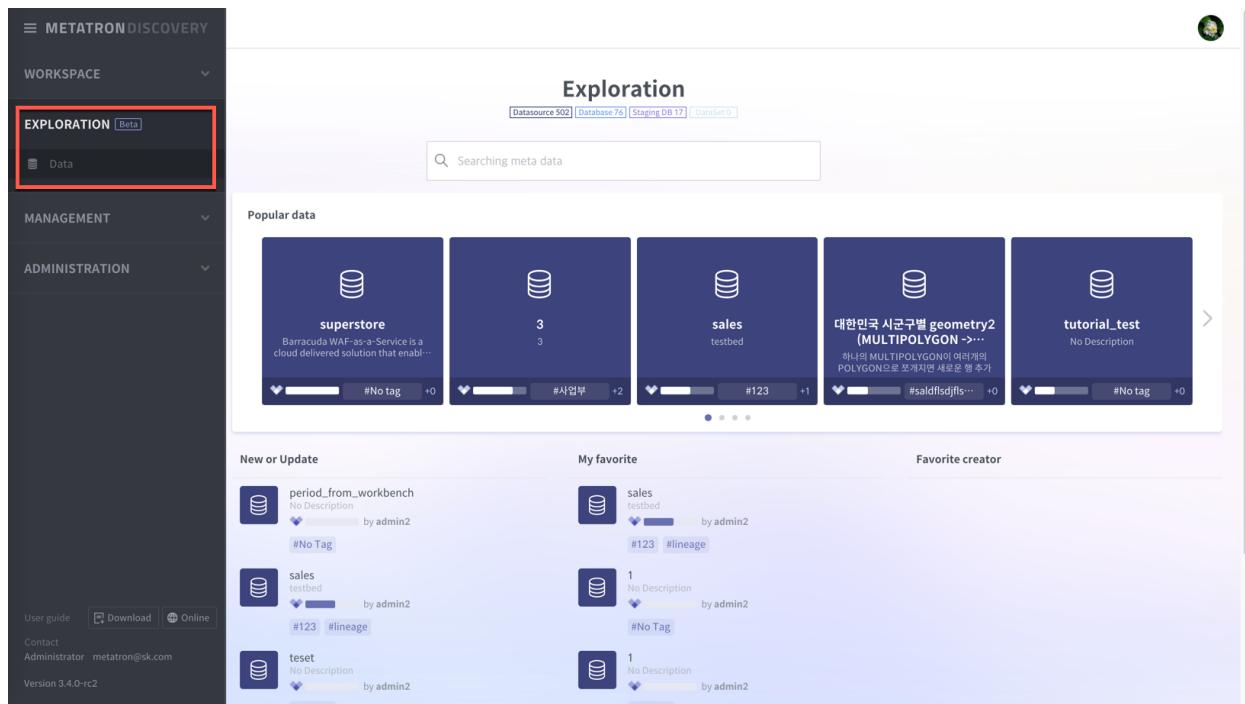
DATA EXPLORATION

The administrator can set · manage the membership and permissions of Metatron Discovery users. By using **group** feature, you can be more effective with administration.

For Data Exploration, click Exploration from the left panel of the main view and select the submenu you want. Also, for smooth data exploration of users, Admin should manage the Metadata. Click Management → Exploration and select a submenu.

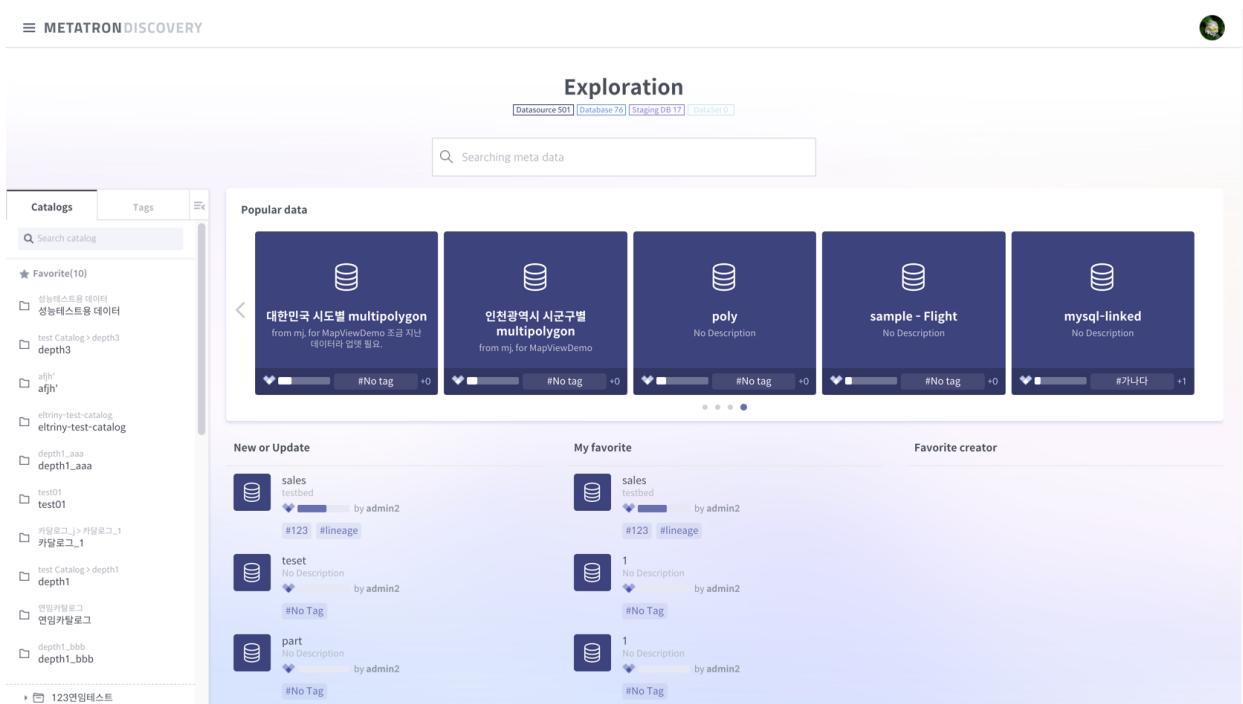
10.1 Data Exploration

The aim of providing data exploration feature is to enable easy data search wherever the data is located at, and for visualizing the found data.



10.1.1 Data Exploration Overview

At the Overview, you can manage data of the current source DB, StagingDB(Slave DB) – provided by Metatron Discovery – and the data in the Engine(Druid).



10.1.2 Data Exploration Detail View

With Data Exploration, you can find the data you want fast.

The screenshot shows the Metatron Discovery interface with the 'superstore' datasource selected. The left sidebar contains a tree view of data sources. The main area has three tabs: 'Overview', 'Columns', and 'Sample data'. The 'Overview' tab is active, displaying details about the datasource:

- Data name:** superstore
- Description:** Barracuda WAF-as-a-Service is a cloud delivered solution that enables anyone to protect their web applications against the OWASP Top 10 DDoS, zero-day attacks, and more in just minutes. Barracuda's WAF-as-a-Service is based on Barracuda's powerful CloudGen WAF in Azure, and it contains pre-built configurations that allow users with no security expertise to deploy the WAF-as-a-Service in a few simple steps.
- Tags:** -
- Data Popularity:**
- Catalogs:** Unclassified

On the right side, there are two sections:

- Top User:** admin2 (Test Scenario or Lesson Book > edu) - 2019-11-13 16:33:35
- Recently Updated:** A table showing recent changes to columns:

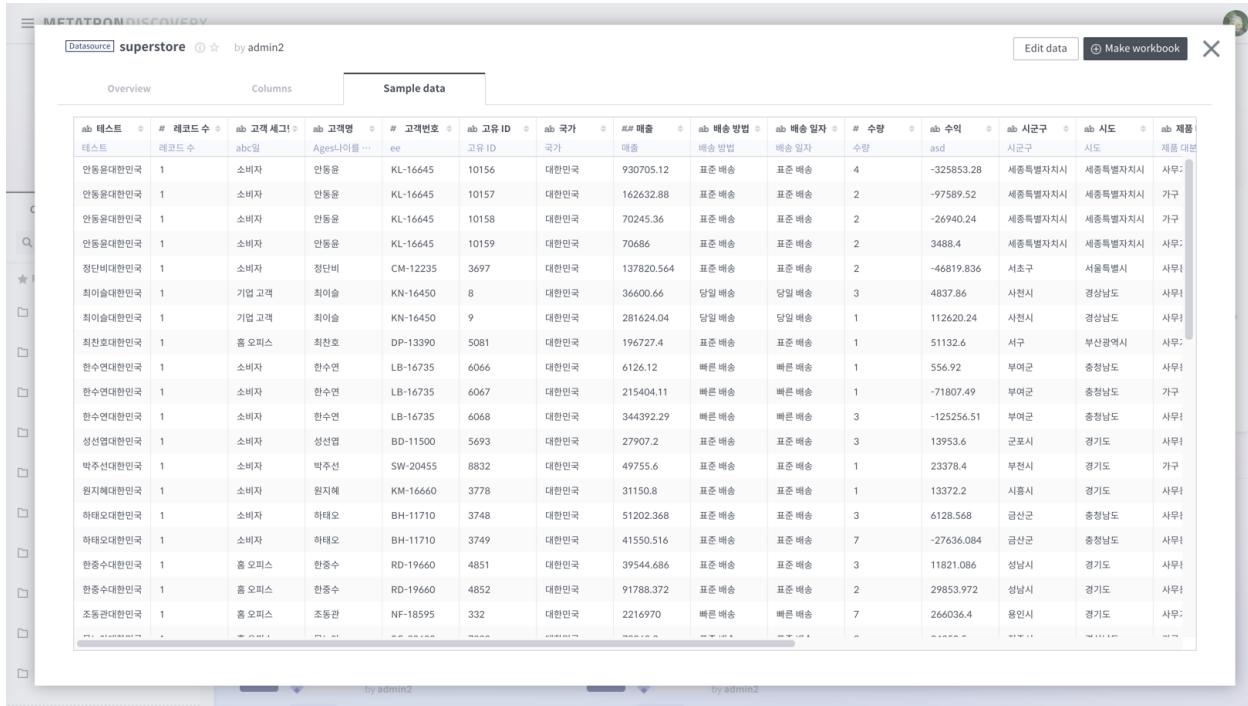
Updated contents	Updated at	User
Column Changed. Column : 제품 코드, Fields : codeTable	2019-10-31 17:51:37	admin2
Column Changed. Column : 고유 ID, Fields : codeTable	2019-10-31 17:31:32	admin2
Column Changed. Column : 수익, Fields : dictionary.name,description,t...	2019-10-31 17:30:26	admin2
Column Changed. Column : 제품 종분류, Fields : dictionary.name,descri...	2019-10-31 17:28:40	admin2
Column Changed. Column : 매출, Fields : codeTable	2019-10-30 17:26:38	admin2
- Recently Used:** A grid of five small dashboard thumbnails labeled 'education 1', 'education 2', 'education 3', 'education 4', and 'education 5'.

Data information is provided with 3 main sections: Overview, Column Scheme, Sample Data. According to each data types, workbook(for Datasource type), workbench(for DB type) action button is enabled.

The screenshot shows the 'Columns' tab for the 'superstore' datasource. The table lists various columns with their properties:

Role	Column popularity	Column name	Logical column name	Dictionary	Type	Code table	Description
Dimension		테스트	테스트	-	ab String	-	-
Measure		레코드 수	레코드 수	-	# Integer	돈	-
Dimension		고객 세그먼트	abc일	qwe	ab String	Ages_10_Code	-
Dimension		고객명	Ages나이를 10살 단위로 ...	Ages_by_10asdasd...	ab String	eltriny-test-boar...	일이상사오육칠팔구십일이상사오육칠팔구십일이상사오육...
Dimension		고객번호	ee	eee	# Integer	LLL	eee
Dimension		고유 ID	고유 ID	-	ab String	iiijhjhj	-
Dimension		국가	국가	-	ab String	-	-
Measure		매출	매출	-	# Double	반송상태코드0L0...	-
Dimension		배송 방법	배송 방법	-	ab String	-	-
Dimension		배송 일자	배송 일자	-	ab String	-	-
Measure		수량	수량	-	# Integer	-	-
Measure		수익	asd	asd	ab String	qqq	asdasd
Dimension		시군구	시군구	-	ab String	-	-
Dimension		시도	시도	-	ab String	-	-

Sample data list displays up to 100 rows. If you are authorized, you can view more and download via ‘Management > Exploration’. If you have ‘Edit data’ button on the top right of the detail view it means that you are authorized. The button leads you to ‘Management > Exploration’.



The screenshot shows the Metatron Data Explorer interface with the following details:

- Header:** METATRON DISCOVERY
- Data source:** superstore
- User:** by admin2
- Buttons:** Edit data, Make workbook, X
- Tabs:** Overview, Columns, Sample data (selected)
- Table Headers:**

ab 테스트	#	레코드 수	ab 고객 세그먼트	ab 고객명	# 고객번호	ab 고유 ID	ab 국가	# ab 매출	ab 배송 방법	ab 배송 일자	# 수령	ab 수익	ab 시군구	ab 시도	ab 제품
--------	---	-------	------------	--------	--------	----------	-------	---------	----------	----------	------	-------	--------	-------	-------
- Table Data:** A large table containing 100 rows of sample data, including columns such as 소비자, 인동윤, KL-16645, 대한민국, 93705.12, 표준 배송, 표준 배송, 4, -32583.28, 세종특별자치시, 사우, etc.

When you jump to other menu, an alert like below appears.

The screenshot shows the Metatron Discovery interface with a data preview window. The preview displays a table with columns such as 'ab 테스트', '레코드 수', 'ab 고객 세그', 'ab 고객명', '고객번호', 'ab 고유 ID', 'ab 국가', '매출', '배송 방법', '배송 일자', '수량', '수익', 'ab 시군구', '시도', and '제품'. A modal dialog box is overlaid on the screen, asking 'Do you want to close and move the current screen?' with 'Cancel' and 'Close and move' buttons.

The second below image is the view when proceeded to ‘Management > Exploration’. Here, you can view more meta information in detail and manage them as the administrator.

The screenshot shows the 'Management > Exploration' view in the Metatron Discovery interface. On the left, there is a sidebar with data details: Data name (superstore), Description (Barracuda WAF-as-a-Service is a cloud delivered solution that enables anyone to protect their web applications against the OWASP Top 10 DDoS, zero-day attacks, and more in just minutes. Barracuda's WAF-as-a-Service is based on Barracuda's powerful CloudGen WAF in Azure, and it contains pre-built configurations that allow users with no security expertise to deploy the WAF-as-a-Service in a few simple steps.), Tags (-), Data Popularity (blue progress bar), and Catalogs (Unclassified). The main area displays two sections: 'Top User' (listing admin2) and 'Recently Updated' (listing five recent changes in codeTable and dictionary.name.description fields). Below these are 'Recently Used' data visualizations for 'education' datasets.

The screenshot shows the Metatron Discovery interface with a single datasource entry. The entry is for 'superstore' and is described as 'Barracuda WAF-as-a-Service'. It has a popularity score of 100 (blue bar). The interface includes tabs for 'Information', 'Data grid', and 'Column details'. A note says 'DataSource is also updated when modified.' A 'Go to Datasource' button is present.

Data type	Name	Tags	Popularity	Modifier	Updated
Datasource	superstore		100	Administraotr	2019-10-30 15:19 by admin2

Source information

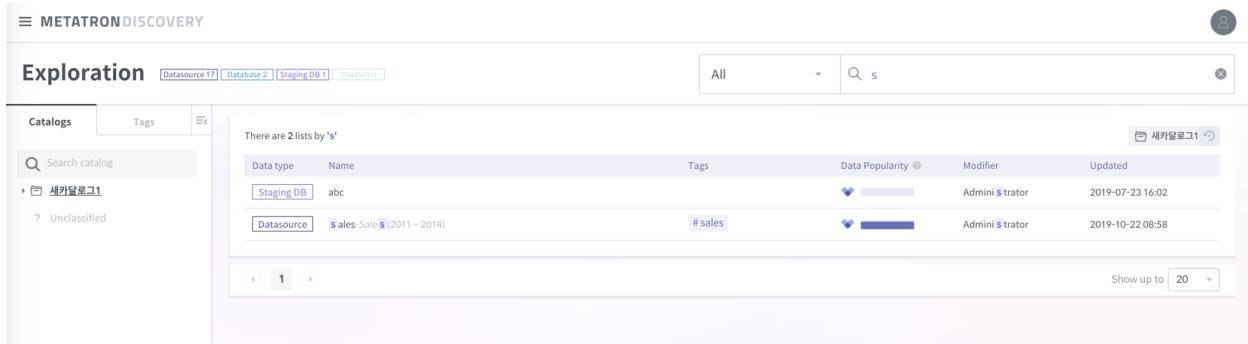
Status	Created at	Updated at
DISABLED	2019-04-16 16:01 by admin2	2019-10-30 15:19 by admin2

Find data fast with search and filter features such as catalog and tag.

The screenshot shows the Metatron Exploration interface. On the left, there are navigation tabs for 'Catalogs' and 'Tags'. The main area displays a list of 20 data sources, each with a popularity score (blue bar) and a timestamp. The data sources include various names like '3.2 \$table test', 'BOOKS', 'Book \$', 'NYC Job \$', 'aaaa \$', 'abc', etc.

Data type	Name	Tags	Popularity	Modifier	Updated
Datasource	3.2 \$table test		100	Administraotr	2019-07-23 14:57
Datasource	BOOKS		100	Administraotr	2019-07-26 17:50
Datasource	Book \$		100	Administraotr	2019-07-26 17:55
Datasource	NYC Job \$		100	Administraotr	2019-07-26 17:45
Database	aaaa \$		100	Administraotr	2019-10-22 14:21
Staging DB	abc		100	Administraotr	2019-07-23 16:02
Datasource	book_inge\$ted		100	Administraotr	2019-11-12 15:23
Datasource	book_linked2		100	Administraotr	2019-11-12 15:22
Database	ckg_\$ample		100	Administraotr	2019-07-23 16:01
Datasource	encoding 인코딩 테스트		100	Administraotr	2019-10-22 08:24
Datasource	futbol_femenino		100	Administraotr	2019-07-26 17:47
Datasource	po \$gresql view test		100	Administraotr	2019-10-07 17:37
Datasource	reale \$tate_trade_2019 03-05	# realestate + 2	100	Administraotr	2019-07-23 14:21
Datasource	\$ales Sales(2011 ~ 2014)	# sales	100	Administraotr	2019-10-22 08:58
Datasource	\$outhkorea_multipolygon		100	Administraotr	2019-07-23 14:28
Datasource	te \$t-Integer 테스트용 데이터소스		100	Administraotr	2019-10-22 08:23

In Metatron Discovery, you can manage data with catalogs. Classify catalogs according to classifications such as groups, and use the catalogs to fast search data.



The screenshot shows the Metatron Discovery interface in 'Exploration' mode. On the left, there's a sidebar with 'Catalogs' selected, showing a list of catalogs: 'Search catalog', '세카달로그1' (which is expanded to show 'abc' under 'Staging DB'), and 'Unclassified'. The main area displays a table of catalogs with columns: Data type, Name, Tags, Data Popularity, Modifier, and Updated. There are two entries: 'Staging DB' (abc) and 'Datasource' (# sales). A search bar at the top right contains 's'. At the bottom right, there's a button for 'Show up to' with a dropdown set to '20'.

Data type	Name	Tags	Data Popularity	Modifier	Updated
Staging DB	abc		low	Administrator	2019-07-23 16:02
Datasource	# sales-Sales (2011 ~ 2014)	# sales	high	Administrator	2019-10-22 08:58

10.1.3 Favorite Data view

This feature is in preparation.

10.1.4 Data Creator view

This feature is in preparation.

10.2 Metadata Management

Metadata was created to manage the data displayed on Exploration view and analyze them in more detail.

The screenshot shows the Metatron Discovery interface in the Exploration workspace. The left sidebar has sections for WORKSPACE, MANAGEMENT, and ADMINISTRATION. Under MANAGEMENT, there are links for Exploration, Metadata, Column Dictionary, Code Table, Catalog, and others. Under ADMINISTRATION, there are links for User guide, Download, and Online. The main area shows a list of items with columns for Tags, Data Popularity, and Updated. A message at the top right says "There are 595 lists".

The screenshot shows the Metatron Discovery interface for the superstore dataset. The top navigation bar shows the dataset name and a brief description: "superstore Barracuda WAF-as-a-Service is a cloud delivered solution that enables anyone to protect th...". The main content area has tabs for Information, Data grid, and Column details. The Information tab is active and shows the following details:

- Metadata information:** superstore
- Popularity:** Popularity (blue progress bar)
- Tags:** # Search by tag name
- Catalogs:** (Add)
- Description:** Barracuda WAF-as-a-Service is a cloud delivered solution that enables anyone to protect their web applications against the OWASP Top 10, DDoS, zero-day attacks, and more in just minutes. Barracuda's WAF-as-a-Service is based on Barracuda's powerful CloudGen WAF in Azure, and contains pre-built configurations that allow users with no security expertise to deploy the WAF-as-a-Service in a few simple steps.

10.3 Column Dictionary

Exploration

Metadata Column Dictionary Code Table Catalog

Updated Date: All Today Last 7 days Past time Current time Apply Refresh

Q Search by Column Name There are 23 lists Create New Column Dictionary

Column Name	Type	Updated
abc일	STRING	2019-09-09 10:50 by admin2
Ages-나이를 10살 단위로 표현나이를 10살 단위로 표현	STRING	2019-11-07 16:17 by admin2
asd -asdasd	STRING	2019-08-28 17:37 by admin2
ee -eee	INTEGER	2018-11-12 10:45 by admin2
eltriny-hide-2 -숨김여부	STRING	2019-04-29 11:04 by admin2
integer_test	TIMESTAMP	2019-08-21 17:18 by admin2
paige -ok	TIMESTAMP	2019-04-18 14:41 by admin2
ship_date -배송일	TIMESTAMP	2019-10-21 14:03 by admin2
string_test_c	STRING	2019-07-01 16:15 by admin2
test -test입니다	TIMESTAMP	2019-08-27 16:31 by admin2
test123123132 -tttttt	STRING	2019-08-28 14:05 by admin2
testttt	TIMESTAMP	2019-07-02 17:45 by admin2
test_time -test_time	TIMESTAMP	2019-07-02 17:39 by admin2
time_format_with_ms -yyyy-MM-dd HH:mm:ss.SSSSSS	TIMESTAMP	2019-06-17 15:19 by admin2

Dictionary Information

Created on 2019-02-21 15:08 by admin2 Last updated on 2019-02-21 15:08 by admin2 Delete this Column Dictionary

Recommended Column Name: 시도코드_시도명

Recommended Short Name: 시도코드

Description: 시도코드를 시도명으로

Code table: 시도코드to시도명

Format Information

Type: String

Used in Metadata (1)

Metadata name	Logical column name	Logical type	Format
전국상권	시도코드	STRING	

☰ METATRON DISCOVERY

← 시도코드

Created on 2019-02-21 15:08 by admin2

Dictionary Information

Recommended Column Name: 시도코드_시도명

Recommended Short Name: 시도코드

Description: 시도코드를 시도명으로 표시합니다.

Code table: 시도코드to시도명

Format Information

Type: String

Used in Metadata (1)

Metadata name	Value
전국상권	전국상권

Choose a code table

Search by Code Table

+ Create New Code Table

Delete this Column Dictionary

Table Name	Description	Preview
Ages_10_Code	나이를 10살 단위로 표현	Preview
codecodecodecodecodecodecode...	123123123213123131313	Preview
eltriny-test-board-hideasdasdasd...	대시보드 hide 테스트	Preview
iiiiiii		Preview
iiiijhjhj		Preview
iiii일	iji	Preview
qqq	qmetest code tbl	Preview
qwe		Preview
rrrr	rrrr	Preview
testCode		Preview
LLL	LLL	Preview
ㅂㅂㅈㄷ	ㅂㅈㄷㅂ	Preview
돈		Preview

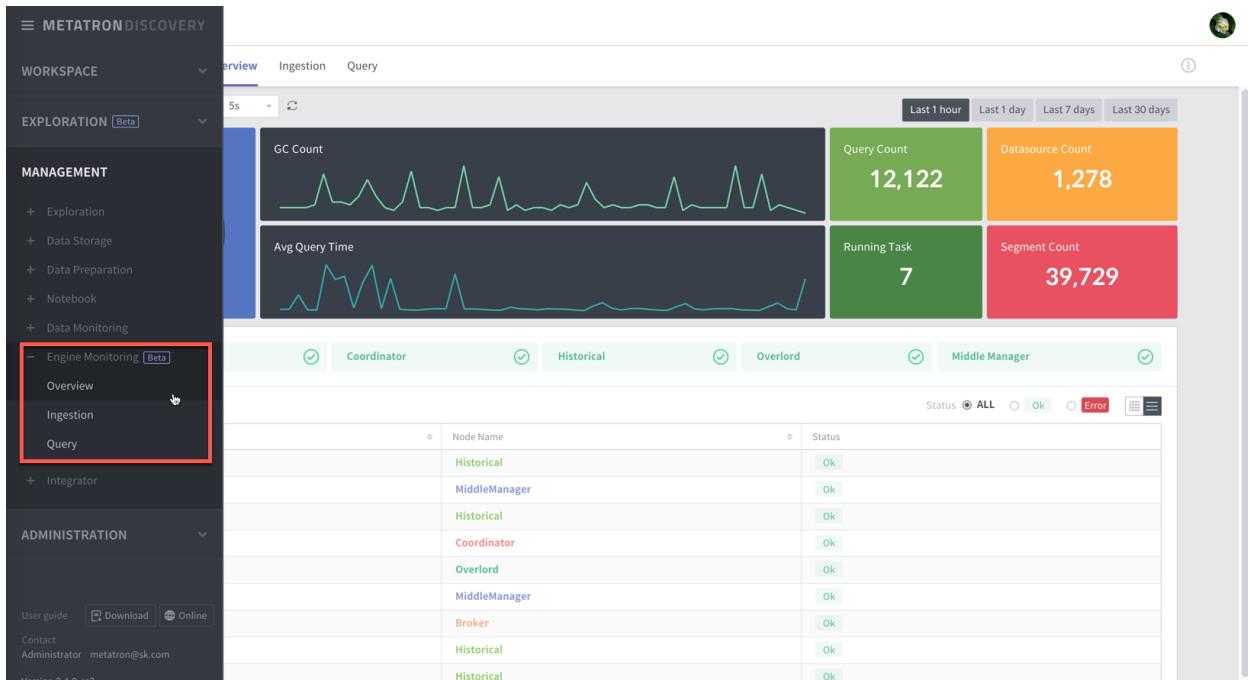
More ▾

Format

10.4 Code Table

ENGINE MONITORING

Engine Monitoring is a feature to monitor the Metatron Engine. Metatron Engine is a time series-based engine using Druid. Engine Monitoring displays Ingestion, Query status monitoring and log details.

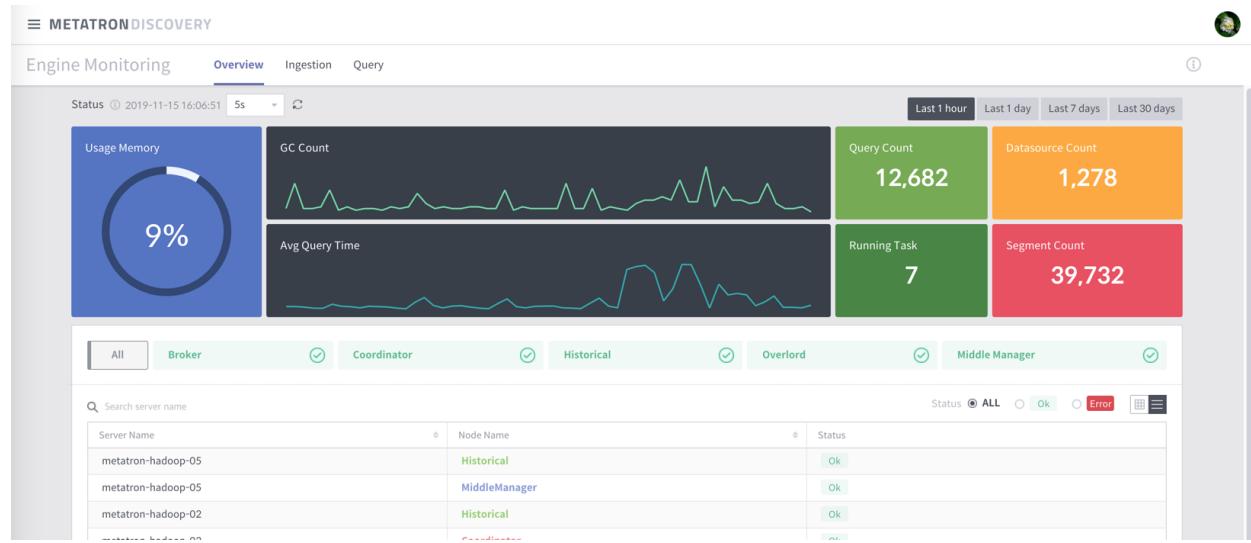


This feature is supported for Metatron Discovery 3.4.0 and above.

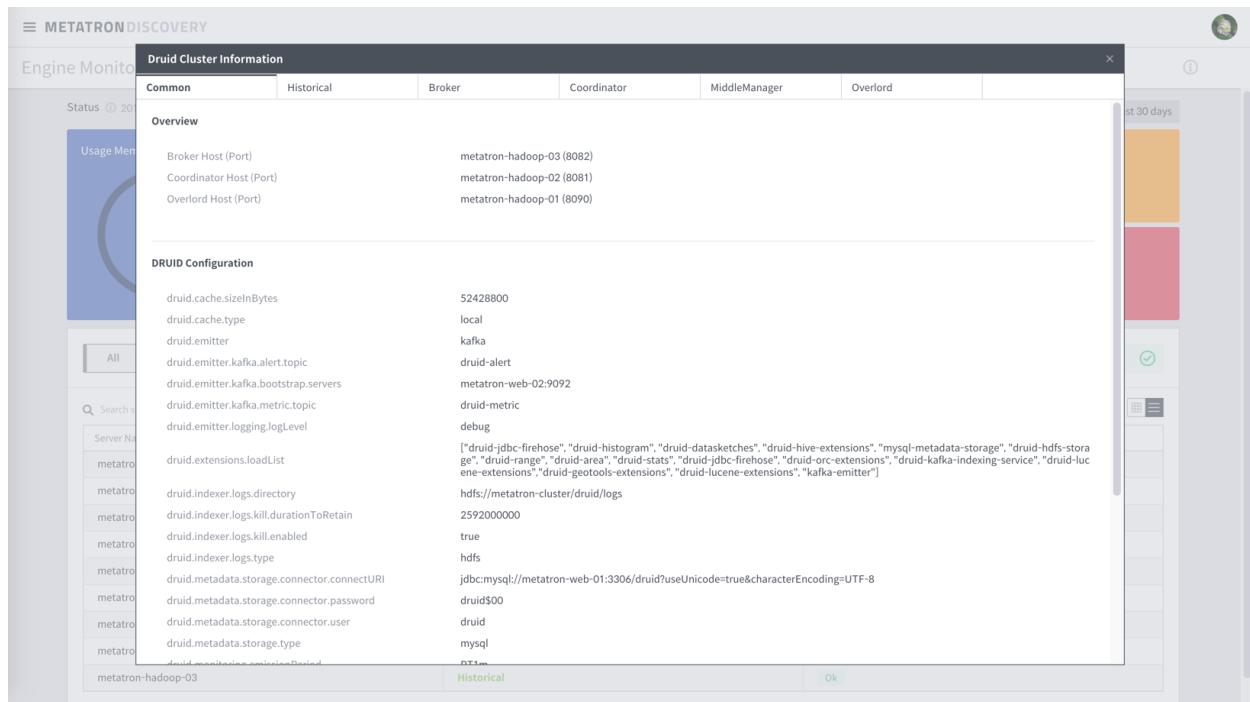
11.1 Overview

11.1.1 Druid Setting Configuration

You can check setting information of Druid here. On the right top side there is a information button (ⓘ). Click the button to check the details.



Below is the view that appears when you click the button. It shows the overall Druid setting information by common detail and 5 nodes section (Historical, Broker, Coordinator, Middle Manager, Overlord).



11.1.2 Historical Usage

Displays the usage of each historical node. Each server entries are acquired from the servers list of the Coordinator.

11.1.3 Cluster Total Usage

Provides Druid historical monitoring feature.

Cluster usage information identifies the following:

- Total usage of cluster
- Usage of each historical

Below is the KPI made by using the servers list of the Coordinator.

Field	Description	Example
Node Count	numbers of historical nodes	
MaxSize		
currSize		
Used		
FreeSize		

11.1.4 Historical Usage

Displays the usage of each historical node. Each server entries are acquired from the servers list of the Coordinator.

11.2 Ingestion

Ingestion is the monitoring of Druid Indexing Service. It provides performance status of the indexing tasks and related information.

Provided information identifies the following:

- **MiddleManager Status**
 - Capacity of each worker and current usage amount
- **Supervisor Status**
 - Status of each supervisor
 - provided feature: terminate (suspend, reset)
- **Task Status**
 - runningTasks, pendingTasks, waitingTasks, completedTasks
 - provided feature: log, kill
- **Lockbox Status**

Ingestion section displays details of both supervisor and middle manager.

11.2.1 Tasks

Tasks can be classified into 4 types of status:

- pending: task waiting to be assigned to a worker
- running: task currently running
- waiting: task waiting on lock
- completed: classified into two states - SUCCESS, FAIL

Task details and menu are as follows.

Field	Description	Example
id	taskId	
type		
dataSource		
createdTime		
queueInsertionTime		
status		
runnerStatusCode		
duration		
locationhost		
locationport		
payload		
status	status	
log		
log last 8k		
kill		
ingestion		

It is displayed as shown below.

Task ID	Status	Created time	Duration	Datasource	Type
index_kafka_dacoe_flink_geo_f13596c212c226d_bnamidan	RUNNING	2019-11-15 13:36:10.897	00:00:00	dacoe_flink_geo	kafka
index_kafka_dacoe_flink_1_1_0651d87a6709f50_lidoamibh	RUNNING	2019-11-15 13:36:10.799	00:00:00	dacoe_flink_1_1	kafka
index_kafka_systemshockrealtimetest20190827_12_0420df52b114173_idfbimlk	RUNNING	2019-11-15 13:36:09.555	00:00:00	systemshockrealtimetest20190827_12	kafka
index_kafka_realtime_server_load_json_01_aad601ac12bb553_ngplhnbd	RUNNING	2019-11-15 12:54:57.041	00:00:00	realtime_server_load_json_01	kafka
index_kafka_stream_test_3_20583fdb4514c5b_cmfmijf	RUNNING	2019-11-15 12:54:56.977	00:00:00	stream_test_3	kafka
index_kafka_systemshockrealtimetest20190827_12_0420df52b114173_nnnglcpm	RUNNING	2019-11-15 12:36:02.378	00:00:00	systemshockrealtimetest20190827_12	kafka
index_kafka_dacoe_flink_geo_f13596c212c226d_hjhbniwf	RUNNING	2019-11-15 12:36:02.378	00:00:00	dacoe_flink_geo	kafka
index_kafka_dacoe_flink_1_1_0651d87a6709f50_gfbclcff	RUNNING	2019-11-15 12:36:02.378	00:00:00	dacoe_flink_1_1	kafka
index_kafka_druid-metric_63bf28627d38b06_alkamjhf	RUNNING	2019-11-15 05:16:47.928	00:00:00	druid-metric	kafka
index_kafka_druid-metric-topic_d70e2fb20fc8d77_goohalon	RUNNING	2019-11-14 17:47:02.250	00:00:00	druid-metric-topic	kafka
index_oivws_2019-11-15T04:30:05.096Z	SUCCESS	2019-11-15 13:30:05.096	00:01:26	_oivws	index
index_batch_test_2019-11-15T04:30:04.118Z	SUCCESS	2019-11-15 13:30:04.118	00:00:08	batch_test	index
index_oivws_2019-11-15T04:20:04.839Z	SUCCESS	2019-11-15 13:20:04.839	00:01:50	_oivws	index
index_batch_test_2019-11-15T04:20:04.056Z	SUCCESS	2019-11-15 13:20:04.056	00:00:08	batch_test	index
index_oivws_2019-11-15T04:10:06.084Z	SUCCESS	2019-11-15 13:10:06.084	00:01:23	_oivws	index

Following image is the detail view. (a case using Kafka)

Information

Queue Insertion Time	2019-11-15T04:55:04.937Z
Created Time	2019-11-15T04:55:04.924Z
Host	metatron-hadoop-05
Location	metatron-hadoop-05:8105
Datasource	stream_test_3
Type	kafka
Processed	0
Unparseable	0
ThrownAway	0

Status (Log 8K)

```

RUNNING
2019-11-15T04:55:1201 INFO [main] com.sun.jersey.guice.spi.container.GuiceComponentProviderFactory - Binding io.druid.server.QueryResource to GuiceInstantiatedComponentProvider
2019-11-15T04:55:1201 INFO [main] com.sun.jersey.guice.spi.container.GuiceComponentProviderFactory - Binding io.druid.server.http.secure.StateResourceFilter to GuiceInstantiatedComponentProvider
2019-11-15T04:55:1234 INFO [main] com.sun.jersey.guice.spi.container.GuiceComponentProviderFactory - Binding io.druid.segment.realtime.firehose.ChatHandlerResource to GuiceInstantiatedComponentProvider
2019-11-15T04:55:1237 INFO [main] com.sun.jersey.guice.spi.container.GuiceComponentProviderFactory - Binding io.druid.segment.realtime.firehose.ChatHandlerResource to GuiceInstantiatedComponentProvider
2019-11-15T04:55:1242 INFO [main] com.sun.jersey.guice.spi.container.GuiceComponentProviderFactory - Binding io.druid.query.lookup.LookupListeningResource to GuiceInstantiatedComponentProvider
2019-11-15T04:55:1245 INFO [main] com.sun.jersey.guice.spi.container.GuiceComponentProviderFactory - Binding io.druid.query.lookup.LookupIntrospectionResource to GuiceInstantiatedComponentProvider
2019-11-15T04:55:1251 INFO [main] com.sun.jersey.guice.spi.container.GuiceComponentProviderFactory - Binding io.druid.server.StatusResource to GuiceManagedComponentProvider
2019-11-15T04:55:1251 INFO [main] com.sun.jersey.guice.spi.container.GuiceComponentProviderFactory - Binding io.druid.server.StatusResource to GuiceManagedComponentProvider with the scope "Undefined"
2019-11-15T04:55:1280 WARN [main] com.sun.jersey.inject.Errors - The following warning have been detected with resource and/or provider classes:
WARNING: A HTTP GET method public void io.druid.server.http.SegmentListerResource.getSegments(long,long,java.util.List<io.druid.server.http.HttpServletRequest>) throws java.io.IOException, MUST return a non-void type.
2019-11-15T04:55:1296 INFO [main] org.eclipse.jetty.server.Server - Started o.e.j.s.ServletContextHandler@3ee0f05f[nullAVAILABLE]
2019-11-15T04:55:1301 INFO [main] org.eclipse.jetty.server.Server - Started o.e.j.s.AbstractConnector@310c0d6f[HTTP/1.1][0.0.0.0:8105]
2019-11-15T04:55:1316 INFO [main] org.eclipse.jetty.server.Server - Started ServerConnector@310c0d6f[HTTP/1.1][0.0.0.0:8105]
2019-11-15T04:55:1317 INFO [main] com.metams.common.lifecycle.LifecycleAnnotationBasedHandler - Invoking start method[public void io.druid.query.lookup.LookupReferencesManager.start()] on object:io.druid.query.lookup.LookupReferencesManager@688bae27]
2019-11-15T04:55:1317 INFO [main] io.druid.query.lookup.LookupReferencesManager - Started lookup factory references manager
2019-11-15T04:55:1317 INFO [main] com.metams.common.lifecycle.LifecycleAnnotationBasedHandler - Invoking start method[public void io.druid.server.listener.ResourceAnnouncer.start()] on object:io.druid.query.lookup.LookupResourceAnnouncer@4be50b35]
2019-11-15T04:55:1324 INFO [main] io.druid.server.listener.ResourceAnnouncer - Announcing start time on [/druid/listeners/lookups/_default/metatron-hadoop-05:8105]

```

Ingestion RUNNING



And below is a case of general Task, not using Kafka.

METATRON DISCOVERY

index_oivws_2019-11-15T05:30:06.027Z

Information

Queue Insertion Time	1970-01-01T00:00:00.000Z
Created Time	2019-11-15T05:30:06.027Z
Host	
Location	
Datasource	_oivws
Type	index

Status (Log 8K)

SUCCESS

```

at io.druid.emitter.kafka.KafkaEmitter.send(TokafkaEmitter.java:178) [kafka-emitter-0.9.1-SNAPSHOT]
at io.druid.emitter.kafka.KafkaEmitter.sendMetric(TokafkaEmitter.java:165) [kafka-emitter-0.9.1-SNAPSHOT]
at io.druid.emitter.kafka.KafkaEmitter.access$500(KafkaEmitter.java:51) [kafka-emitter-0.9.1-SNAPSHOT]
at io.druid.emitter.kafka.KafkaEmitter$32.run(KafkaEmitter.java:136) [kafka-emitter-0.9.1-SNAPSHOT]
at io.druid.emitter.kafka.KafkaEmitter$32.run(KafkaEmitter.java:136) [kafka-emitter-0.9.1-SNAPSHOT]
at java.util.concurrent.Executors$RunnableAdapter.call(Executors.java:511) [?:1.8.0_171]
at java.util.concurrent.FutureTask.run(FutureTask.java:266) [?:1.8.0_171]
at java.util.concurrent.ScheduledThreadPoolExecutor$ScheduledFutureTask.access$301(ScheduledThreadPoolExecutor.java:180) [?:1.8.0_171]
at java.util.concurrent.ScheduledThreadPoolExecutor$ScheduledFutureTask.run(ScheduledThreadPoolExecutor.java:294) [?:1.8.0_171]
at java.util.concurrent.ThreadPoolExecutor.runWorker(ThreadPoolExecutor.java:1491) [?:1.8.0_171]
at java.util.concurrent.ThreadPoolExecutor$Worker.run(ThreadPoolExecutor.java:624) [?:1.8.0_171]
at java.lang.Thread.run(Thread.java:748) [?:1.8.0_171]
2019-11-15T05:31:30.17 INFO [main] org.apache.kafka.clients.producer - Invoking stop method/public void io.druid.emitter.kafka.KafkaEmitter.close() on object[io.druid.emitter.kafka.KafkaEmitter@11d2714a].
2019-11-15T05:31:30.17 INFO [main] org.apache.kafka.clients.producer - Closing the Kafka producer with timeoutMillis = 9223372036854775807 ms.
2019-11-15T05:31:30.17 INFO [main] io.druid.cli.CliPeon - Finished peon task
Heap
garbage-first heap total 1024K used 521K(52240K) 32 survivors (32769K)
region size 1024K 510 young (52240K) 32 survivors (32769K)
Metaspace used 82543K capacity 63962K committed 64128K reserved 1105920K
class space used 7715K capacity 8059K committed 8064K reserved 1048576K

```

Ingestion SUCCESS

11.2.2 Supervisors

You can monitor the running Supervisors. Details and menu available for monitoring is as follows:

Field	Description	Exam- ple
Status	All of the supervisors provided by ‘get supervisorIDs’ are at running state	
Datasource		
Detailed Status	Details provided by status API	
Lag	Lag details of kafka, acquired using emitter	
Spec		
Shutdown	Terminates supervisor. Kills related tasks as well.	

It is displayed as shown below.

The screenshot shows the METATRON DISCOVERY interface under the 'Engine Monitoring' tab. The 'Supervisor' tab is selected. A search bar at the top right allows searching by supervisor ID or datasource name. Below the search bar is a table listing supervisor details. The columns are 'Supervisor ID', 'Topic', and 'Datasource'. The table contains 15 rows of data. At the bottom right of the table, there is a 'Show up to' dropdown set to 20.

Supervisor ID	Topic	Datasource
realtime_server_load_json_01	realtime_server_load_json	realtime_server_load_json_01
systemshockrealmtest20190827_12_d4b1541cf684fc78a75d99a7e87cb0a	realtime_sample_12	systemshockrealmtest20190827_12
stream_test_3	druid-alert-testbed	stream_test_3
systemshockrealmtest20190926_1_b3586bb3da924f4b8004a5e0c61fe6a5	realtime_sample_4	systemshockrealmtest20190926_1
druid-metric_9c6a65cf396446a597ba35767770e7df	druid-metric	druid-metric
dacoe_flink_1_1_ba83f75e45fb43cf947fd94928007afdf	dacoe_flink_1	dacoe_flink_1_1
druid-metric-topic_e150b351d0c641dbc5b71abaceea90b	druid-metric-topic	druid-metric-topic
systemshockrealmtest20190926_2_58da1b76127f49b38f85b8bd88e71435	realtime_sample_20190926_02	systemshockrealmtest20190926_2
dacoe_flink_geo_7962ed01dace46b899781bfce8af49c9	dacoe_flink_1	dacoe_flink_geo

The screenshot shows the METATRON DISCOVERY interface for the supervisor with ID 'systemshockrealmtest20190827_12_d4b1541cf684fc78a75d99a7e87cb0a'. The 'Information' section displays the topic 'realtime_sample_12' and the datasource 'systemshockrealmtest20190827_12'. The 'LAG' section shows a graph of lag over time, with a peak labeled '2019-11-15 15:45' and 'LAG : 2823'. The 'Active Tasks' section lists a task with ID 'index_kafka_systemshockrealmtest20190827_12_0420df5b114173_Indkoame'.

11.2.3 MiddleManagers

List of workers.

Worker Host	Worker IP	Version	Capacity(Used/Total)	Availability Groups	Running Tasks	Completed Time
metatron-hadoop-04:8091	localhost	0	4/10	4	4	2019-11-15 13:56:05.217
metatron-hadoop-05:8091	localhost	0	6/10	6	6	2019-11-15 13:51:55.992

information

Host	metatron-hadoop-04:8091
IP	localhost
Capacity	4/10
Version	0
Availability Groups	4

Running Tasks

- index_kafka_realtime_server_load_json_01_ba4ad60c3804abb
- index_kafka_dacoe_flink_1_1_0651d87a6709f50
- index_kafka_stream_test_3_db5459136c28e81
- index_kafka_druid-metric_63bfff28627d3806

Last Completed Task Time: 2019-11-15T07:01:32.648Z

11.3 Query

The screenshot shows the Metatron Discovery Engine Monitoring interface. The top navigation bar includes 'METATRON DISCOVERY', 'Engine Monitoring', 'Overview', 'Ingestion', and 'Query'. The 'Query' tab is selected. Below the navigation is a search bar with filters: 'Result: ALL', 'Service: ALL', 'Type: ALL', and 'Started time: ALL'. A 'Search' button and a placeholder 'Search query ID or datasource name' are also present.

ID	Result	Service	Host	Type	Datasource	Started time	Duration (ms)
43a0b41f-a226-491c-8e3a-c5cd7397262f	Success	druid/prod/broker	metatron-hadoop-03:8082	segmentMetadata	ettest	2019-11-15 14:31:59.360	1
ec81be45-d6e2-4094-9135-9d6750186003	Success	druid/prod/broker	metatron-hadoop-03:8082	segmentMetadata	stcaz	2019-11-15 14:31:59.142	1
13d75e7b-5965-41e6-845f-5769dc54308a	Success	druid/prod/broker	metatron-hadoop-03:8082	segmentMetadata	JustATestName	2019-11-15 14:31:58.928	0
bdcdbe5d-3541-4040-a2f2-c662569169f4	Success	druid/prod/broker	metatron-hadoop-03:8082	segmentMetadata	dd11	2019-11-15 14:31:58.721	0
94d9b85a-3250-4c95-89cf-a01d2c92e177	Success	druid/prod/broker	metatron-hadoop-03:8082	segmentMetadata	hive_preset_engine_dri...	2019-11-15 14:31:58.504	3
b8185af4-788d-49f7-90fc-6f2beb795936	Success	druid/prod/broker	metatron-hadoop-03:8082	segmentMetadata	stage_part_test2	2019-11-15 14:31:58.274	0
394da03a-b9e6-4aed-81d8-598b52d01d78	Success	druid/prod/broker	metatron-hadoop-03:8082	segmentMetadata	dss_parete1	2019-11-15 14:31:58.060	0
77004272-dad1-4106-b0cc-1898ecd8929a	Success	druid/prod/broker	metatron-hadoop-03:8082	segmentMetadata	order	2019-11-15 14:31:57.828	0
32f9b133-bb91-45ad-9283-45c87b34c0f4	Success	druid/prod/broker	metatron-hadoop-03:8082	segmentMetadata	ggrgg	2019-11-15 14:31:57.606	0
49df052b-b4ef-42ad-9df4-8624e1d42bd3	Success	druid/prod/broker	metatron-hadoop-03:8082	segmentMetadata	대한민국 시군구별 multip...	2019-11-15 14:31:57.389	0
33b63a6f-3849-47d5-a8ac-26b4054858a8	Success	druid/prod/broker	metatron-hadoop-03:8082	segmentMetadata	hhhh_vhyad	2019-11-15 14:31:57.168	0
ff000db3-96db-4c55-ac89-8798e1853b8a	Success	druid/prod/broker	metatron-hadoop-03:8082	segmentMetadata	Query Parsed(eventtime)	2019-11-15 14:31:56.952	1
682b0d2d-2461-4192-acca-5c7426f1ae90	Success	druid/prod/broker	metatron-hadoop-03:8082	segmentMetadata	correlation matrix for m...	2019-11-15 14:31:56.732	0

A modal window titled 'Query Information' displays detailed information for the first query:

Query ID	43a0b41f-a226-491c-8e3a-c5cd7397262f
Result	Success
Service	druid/prod/broker
Host	metatron-hadoop-03:8082
Type	segmentMetadata
Datasource	ettest
Started Time	2019-11-15 14:31:59.360
Duration	1 ms

Part II

EX-pack for Workflow Integrator

INTRODUCTION OF INTEGRATOR EXPANSION PACK

The Integrator Expansion Pack provides a GUI for easier control over Apache Oozie, the workflow scheduling system for Hadoop jobs. It is a module that processes data in the workflow for use in Metatron Discovery. Users can easily design and set up a routine to repeatedly perform Hadoop jobs, thereby obtaining data required for Metatron Discovery tasks on a regular basis.

The key features of the Integrator Expansion Pack are as follows:

Editing and scheduling a workflow simultaneously

The intuitive chart editor can be used to easily create workflows and schedule runs.

Managing multiple clusters at once

The source of raw data and the destination table can be freely designated for each node in the workflow, by which multiple clusters can be managed at once.

Workflow sharing

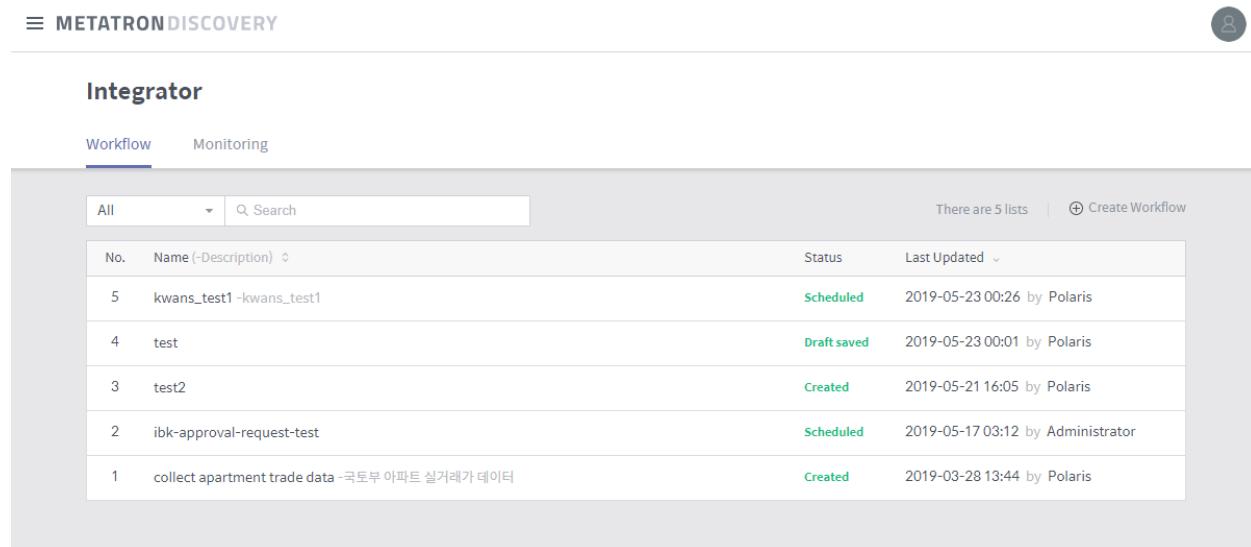
Established workflows can be shared and managed by multiple users within your organization.

Alarms and reports

The result of executing a reserved workflow is reported through various channels such as SMS, e-mail, and messenger.

WORKFLOW LIST

The **Workflow** tab on the main page of Integrator lists registered workflows as shown below. The **Status** column gives the brief progress of each workflow.



The screenshot shows the 'Integrator' application interface with the 'Workflow' tab selected. At the top, there is a search bar labeled 'Q, Search' and a button for 'Create Workflow'. Below the search bar, a table lists six registered workflows. The columns are 'No.', 'Name (-Description) ○', 'Status', and 'Last Updated ▼'. The workflows are:

No.	Name (-Description) ○	Status	Last Updated ▼
5	kwans_test1 -kwans_test1	Scheduled	2019-05-23 00:26 by Polaris
4	test	Draft saved	2019-05-23 00:01 by Polaris
3	test2	Created	2019-05-21 16:05 by Polaris
2	ibk-approval-request-test	Scheduled	2019-05-17 03:12 by Administrator
1	collect apartment trade data -국토부 아파트 실거래가 데이터	Created	2019-03-28 13:44 by Polaris

Click on one of the workflows in the list to enter the workflow editor. See [Workflow editor](#) for details on the workflow editor.

Click **+ Create Workflow** on the upper right to open a dialog box to create a new workflow. Enter the name and description of the workflow, and click **Done** to create the new workflow.

The screenshot shows the Metatron Discovery Integrator interface. At the top, there is a navigation bar with the title "Integrator". Below the navigation bar, there are two tabs: "Workflow" (which is selected) and "Monitoring". A search bar and a dropdown menu are also present in the header.

The main area displays a table of existing workflows. The columns are "No.", "Name (-Description)", "Status", and "Last Updated". One workflow is listed:

No.	Name (-Description)	Status	Last Updated
5	kwans_test1 -kwans_test1	Scheduled	2019-05-23 00:26 by Polaris

A modal dialog box titled "Create Workflow" is open in the center. It contains fields for "Name" and "Description", both of which have placeholder text "Please enter a name" and "Please enter a description" respectively. At the bottom of the dialog are two buttons: "Cancel" and "Done".

WORKFLOW EDITOR

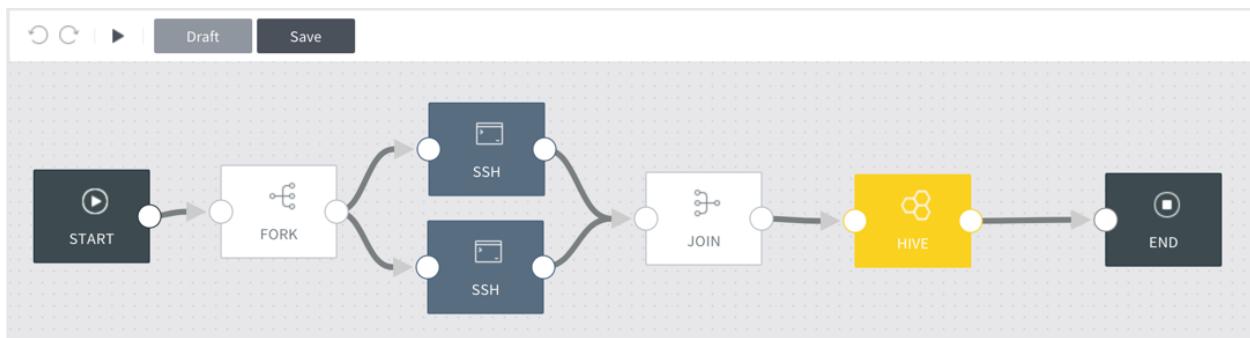
Through the GUI of the workflow editor, you can conveniently edit the selected Hadoop workflow and schedule runs. Click one of the workflows listed in [Workflow list](#) to enter the workflow editor. The following is displayed.

The screenshot displays the Metatron Discovery Workflow Editor interface. At the top, there's a navigation bar with a user icon and the text "Updated on 2019-03-05 09:35 by Polaris". Below the navigation bar, the main area is divided into several sections:

- Workflow Diagram Area (Top Left):** Shows a workflow with three nodes: "START" (black), "JAVA" (red with a coffee cup icon), and "END" (black). The "JAVA" node is highlighted with a red box and circled with a purple circle containing the number 2.
- Workflow Settings Panel (Bottom Left):** Contains fields for "Tags" (with placeholder "# Please enter a tag"), "Execution ID" (set to "metatron"), and an "Alert" switch (set to "OFF").
- History Table Panel (Bottom Right):** Titled "Manual run", it shows a table of workflow runs with 8 entries. The table includes columns for "Job ID", "Start Time", "Elapsed Time", and "Status". The first few rows show statuses like "SUCCEEDED", "FAILED", and "RUNNING". A circled "4" is over the table header.

1. **Workflow node selection area:** Choose nodes to add to the workflow. Click to expand the panel and view the names of all nodes. The nodes are categorized into two types.

- **Action nodes (categorized as “Task” in editor):** Define tasks involved in collecting, processing, and ingesting raw data in the Hadoop cluster. See [Action nodes](#) for details.
 - **Control flow nodes (categorized as “General” in editor):** Define the start and end of a workflow and determine the flow path of action nodes. See [Control flow nodes](#) for details.
2. **Workflow chart canvas:** The sequence between added nodes is defined. As shown in the figure below, drag the desired nodes to the canvas, and connect the nodes according to the desired sequence to complete the workflow chart.



Undo or redo actions using the buttons on the top, and click to run the current workflow. And click the **Draft** button to save the current workflow, and the **Save** button to save it as the actual workflow.

3. **Workflow settings area:** Set up the task details of individual nodes selected in the workflow chart canvas. See relevant node items in [Action nodes](#) and [Control flow nodes](#) for details.
4. **Workflow run details area:** View the run details of the defined workflow.

- **Manual run tab:** Click on the top left of the editor to view the details of manual runs.
- **Scheduled run tab:** Schedule workflow runs at desired times using the UI, and view the details of scheduled runs. See [Schedule a workflow run](#) for details.

Below is a comprehensive list of topics on using the workflow editor.

14.1 Action nodes

Action nodes in Integrator define tasks involved in collecting, processing, and ingesting raw data in the Hadoop cluster. The supported Hadoop jobs and individual system tasks (Java, Shell, etc.) are as follows:

- [Sqoop](#)
- [MR](#)
- [EXEC](#)
- [Java](#)
- [HIVE Query](#)
- [SSH](#)
- [Spark](#)
- [Sub-Workflow](#)
- [DistCp](#)
- [HDFS](#)
- [Done](#)
- [Druid](#)

14.1.1 Sqoop

Retrieves data from RDP or runs a simple query.

14.1.2 MR

Runs JAR files in a local directory.

14.1.3 EXEC

Runs local files such as Python and shell.

14.1.4 Java

Runs a Java class. (Note that the main function must be defined.)

14.1.5 HIVE Query

Runs a HIVE query.

14.1.6 SSH

Runs a command remotely. Note that SSH passwordless login must be set up for the remote server.

14.1.7 Spark

Runs SPARK.

14.1.8 Sub-Workflow

Used for association with existing workflows. When running an association of multiple workflows, it defines each workflow as a task.

14.1.9 DistCp

Copies files from the source Hadoop cluster to the target Hadoop cluster.

14.1.10 HDFS

Used to manage Hadoop files.

14.1.11 Done

Creates a Done file upon completion.

14.1.12 Druid

Used for incremental ingestion of data into the Druid engine.

14.2 Control flow nodes

The control flow nodes of Integrator define the start and end of a workflow and determine the flow path of action nodes. The supported nodes are as follows:

- Start
- End
- Decision
- Fork
- Join

14.2.1 Start

The start point of all workflows. Required to run a workflow.

14.2.2 End

The end point of all workflows. Required to end a workflow.

14.2.3 Decision

Branches the workflow based on conditions. It uses as many switch case statements as the number of branches.

14.2.4 Fork

Branches the workflow without conditions for concurrent, parallel execution.

14.2.5 Join

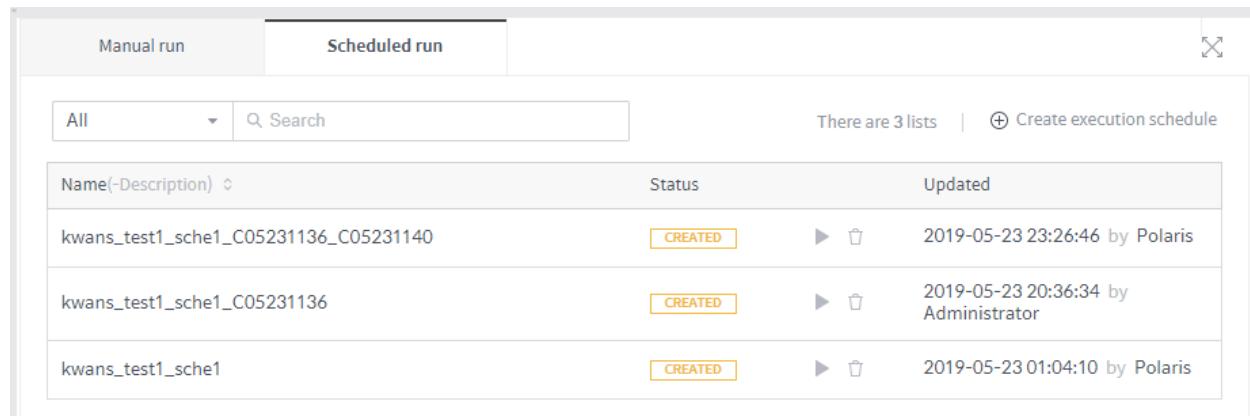
Joins several nodes.

14.3 Schedule a workflow run

Workflow runs can be scheduled to repeatedly run a workflow at certain intervals. The results of scheduled runs can be reported through SMS, messenger, and e-mail.

14.3.1 List of scheduled runs

Click the **Scheduled run** tab in the run details area on the bottom right of the workflow editor, and a list of scheduled runs will be displayed as follows. The list displays the run status of each scheduled run. Click ► to execute the scheduled run, and ✎ to delete.



Name(-Description)	Status	Updated
kwans_test1_sche1_C05231136_C05231140	CREATED	2019-05-23 23:26:46 by Polaris
kwans_test1_sche1_C05231136	CREATED	2019-05-23 20:36:34 by Administrator
kwans_test1_sche1	CREATED	2019-05-23 01:04:10 by Polaris

14.3.2 Add a scheduled run

Click + **Create execution schedule** in the scheduled run area. A dialog box to create a new scheduled run is displayed as follows. Fill out each field as instructed below, and click **Create**.

Create a New Execution Schedule

[Cancel](#)[Create](#)

Name

Description

Tags #

Workflow

Period From To

Frequency

Concurrency

Timeout(min)

Datasets[+ Add](#)

Configuration [Move to Variables](#)

<input type="checkbox"/>	<input type="text" value="Key"/>	<input type="text" value="Value"/>	X
--------------------------	----------------------------------	------------------------------------	-------------------

[+ Add](#)

Variables [Move to Configuration](#)

<input type="checkbox"/>	<input type="text" value="Key"/>	<input type="text" value="Value"/>	X
--------------------------	----------------------------------	------------------------------------	-------------------

[+ Add](#)

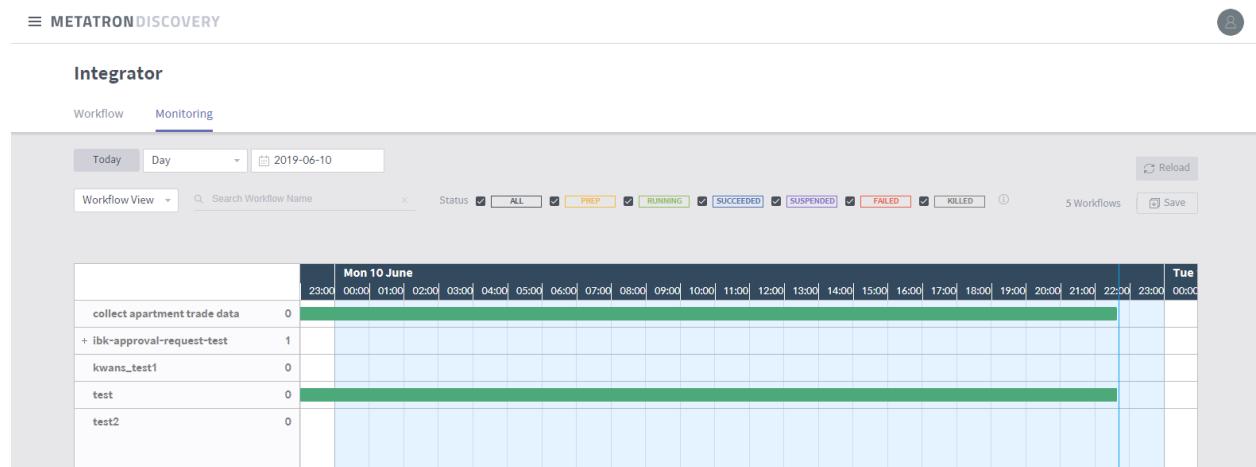
Alert OFF [—](#)

- **Name:** Enter a name for the scheduled run.
- **Description:** Describe the scheduled run.
- **Tags:**

- **Workflow:** Select a workflow to schedule to run.
- **Period:** Set the start and end times of the scheduled run.
- **Frequency:** Set the frequency of the scheduled run.
- **Concurrency:**
- **Timeout (min):**
- **Datasets:**
- **Configuration:**
- **Variables:**
- **Alert:**

MONITORING

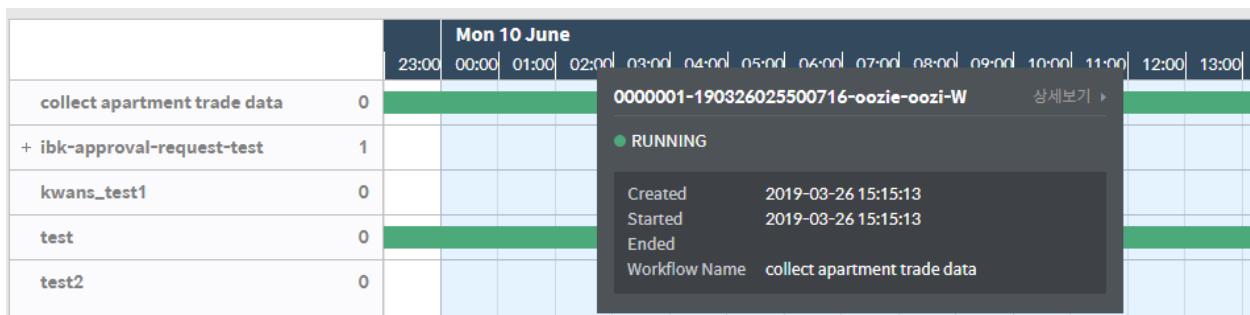
The **Monitoring** tab on the main page of Integrator displays runs and schedule information in graph form for each workflow.



The status bars of the graph represent scheduled or manual runs, and related information is presented as follows:

- Position and length: The status bar spans the duration of the run represented on the timeline.
- Color: The status bar is displayed in the same color as the color of the **Status** item in the top legend. For example, a status bar in green indicates that the run is ongoing.

Hovering the cursor over the status bar displays the run details as shown below. Click **View details** on the top right of the dialog box to view more detailed information.



16.1 Hand over data source ingestion

- Background processing to prevent system overload when ingesting huge amounts of data

16.2 Linkage with workbench

- Repeated execution of specific queries
- Handing over the execution of time-consuming queries

16.3 Linkage with data preparation

- Repeated use of wrangled datasets

Part III

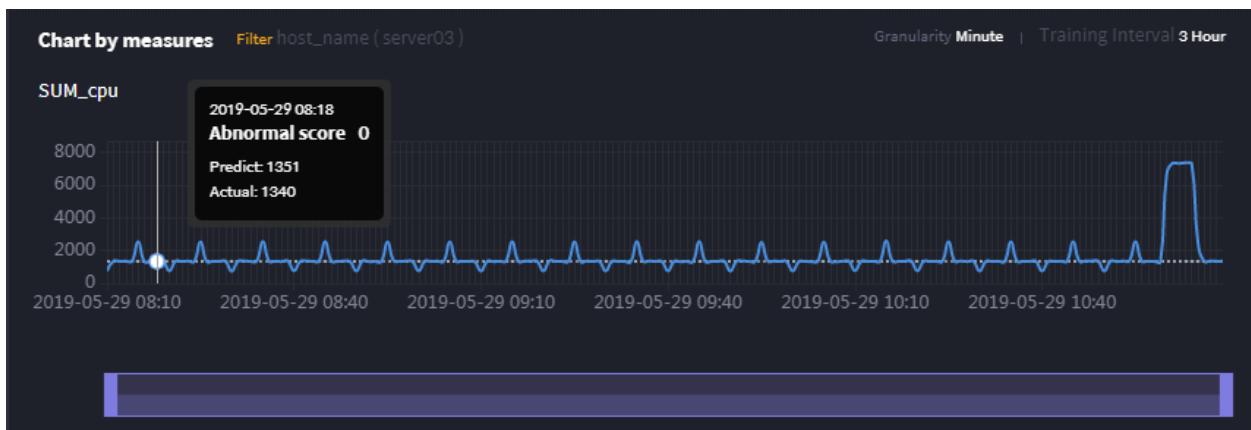
EX-pack for Anomaly Detection

INTRODUCTION OF ANOMALY EXPANSION PACK

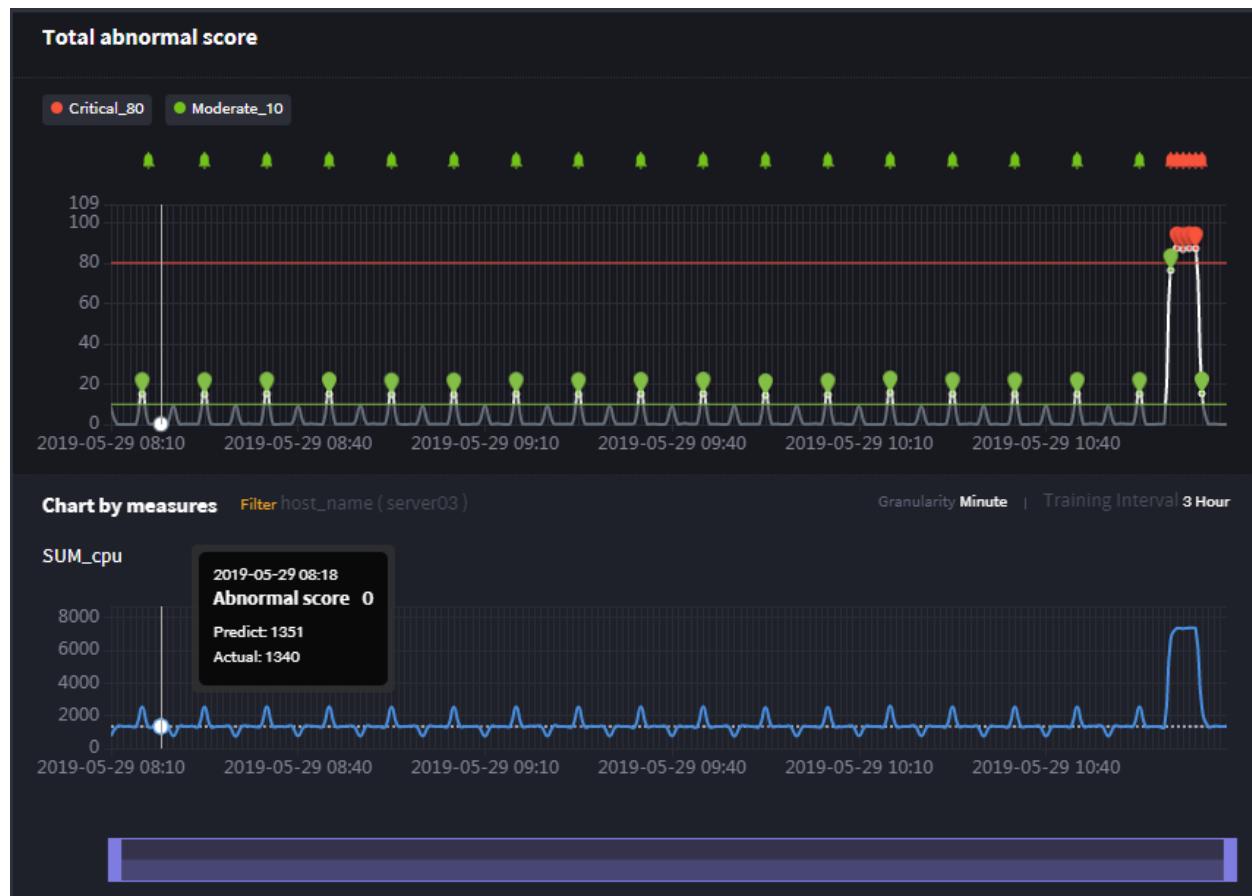
The Anomaly Expansion Pack is a tool that detects abnormal data flow and immediately alerts users. For this detection, it uses prediction models built based on machine learning.

17.1 Basic principles

As shown below, Anomaly predicts an aggregate of the target data source in real time and monitors the actual value.



Here, the value marked as **Predict** is the data aggregate predicted through machine learning, and the value marked as **Actual** is the actual monitored value. As shown below, the **total abnormal score** increases with the difference between the two values. That is, the data aggregate is considered as deviating from the normal range if the actual value is significantly different from the predicted value.



In this example, a Moderate alarm is triggered when the abnormal score reaches 10, and a Critical alarm when the score reaches 80.

The alarms are reported through various channels to the user, so that immediate action can be taken in response to anomalies.

17.2 Key functions

The key functions of Anomaly are as follows:

Machine learning

User convenience enhanced with automatic recommendation of a prediction model based on machine learning

Alarms & reports

Immediate alarm triggering and report generation in case of anomaly

Analyze

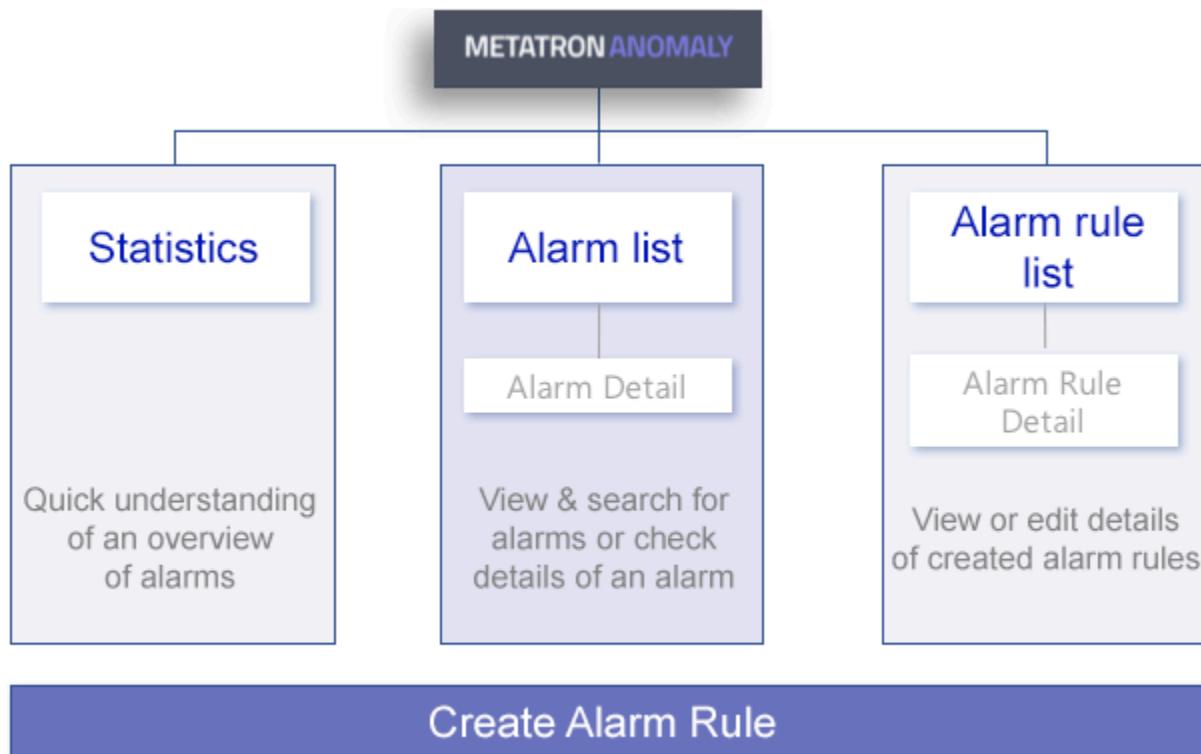
Chart generation and analysis service linkable with Metatron Discovery

Linkage with learning system

New forms of analysis possible through linkage with external analytics systems

17.3 Structure

The menus in Anomaly are organized as follows:



Users can easily navigate across menus, use references to detailed items, and gain organic understanding of alarms including their rule settings, past occurrences, and overall statistics.

CREATE AN ALARM RULE

Alarm rules can be easily created in Anomaly by following the procedures below:

- Select a data source
- Select a measure(s) to monitor
- Specify a training interval
- Select a model
- Set alarm rule conditions
- Complete the alarm rule

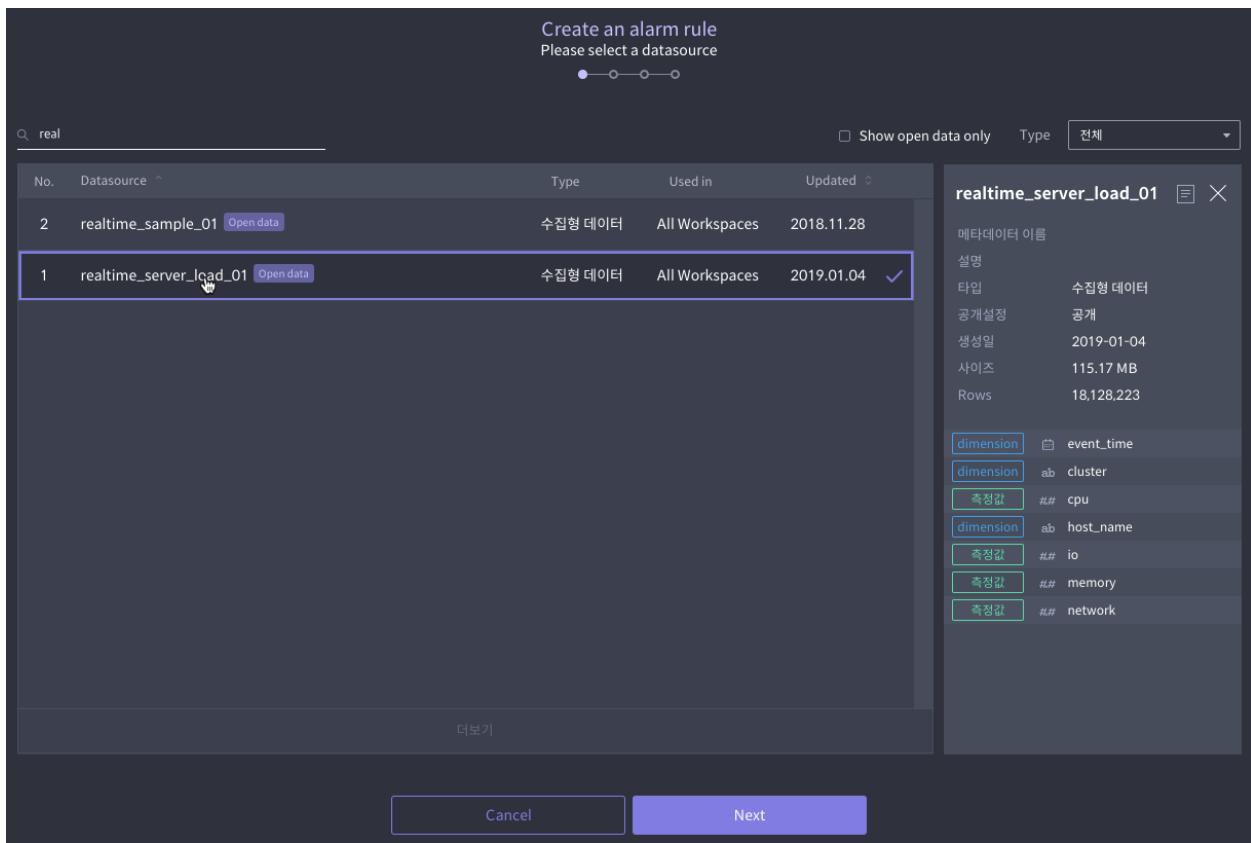
18.1 Select a data source

Follow the procedure below to create an alarm rule:

1. Click **Create Alarm Rule** on the upper right of Anomaly.



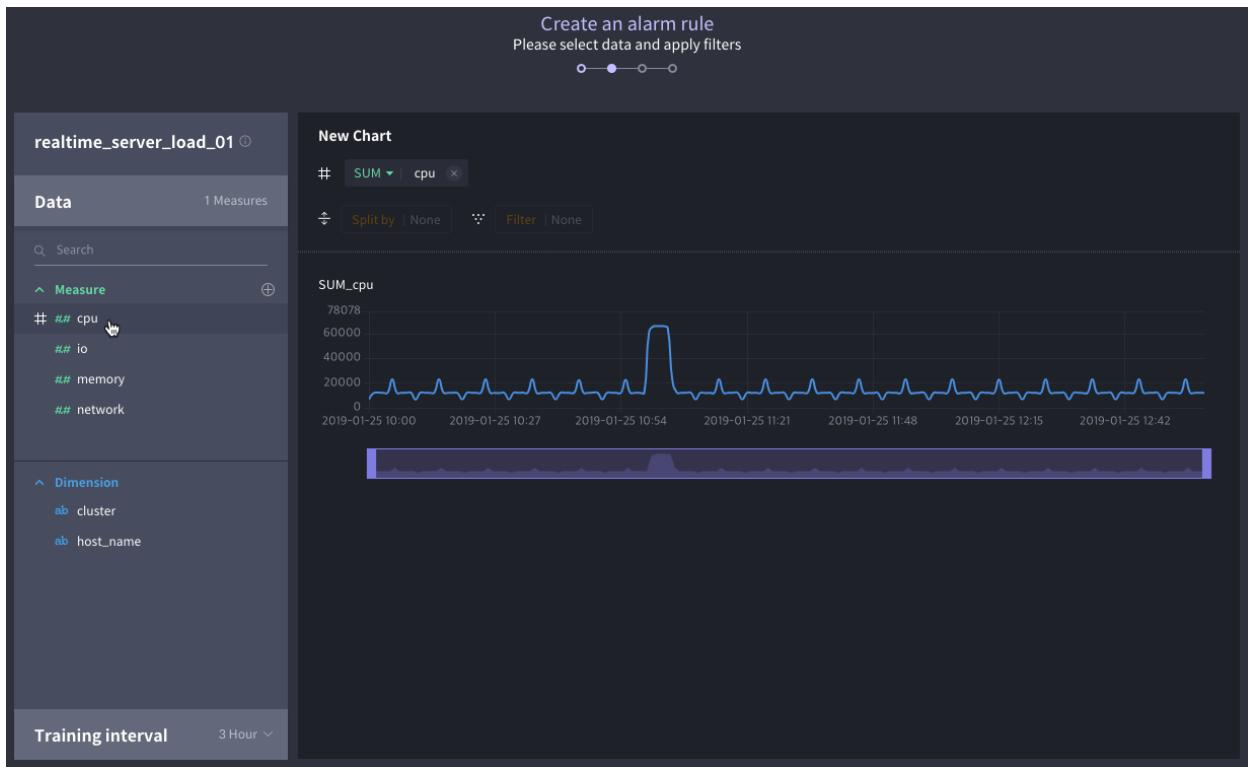
2. Select the data source you want to monitor.



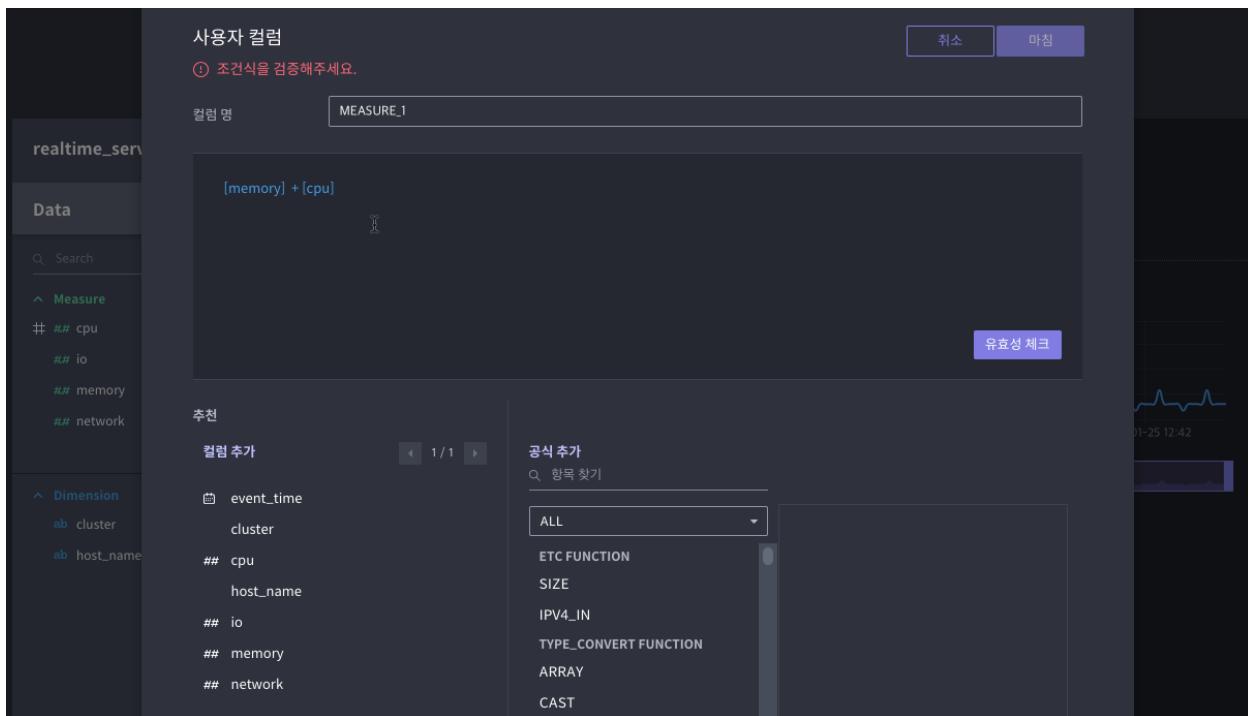
18.2 Select a measure(s) to monitor

Once a data source is selected, the following page is displayed with the **Data** panel opened on the left. Use this panel to select a measure(s) to monitor as follows:

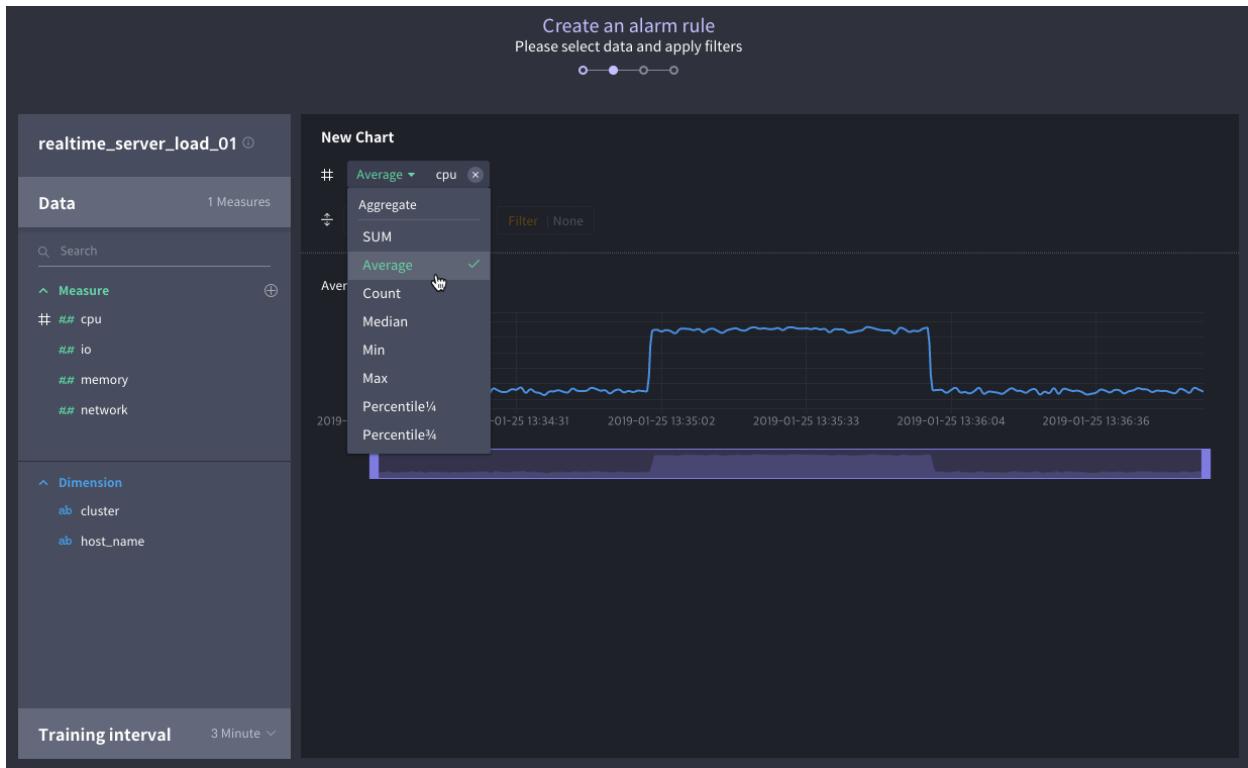
- Under the **Measure** area, choose a column to apply an alarm to. The selected column is automatically placed on the Aggregate shelf.



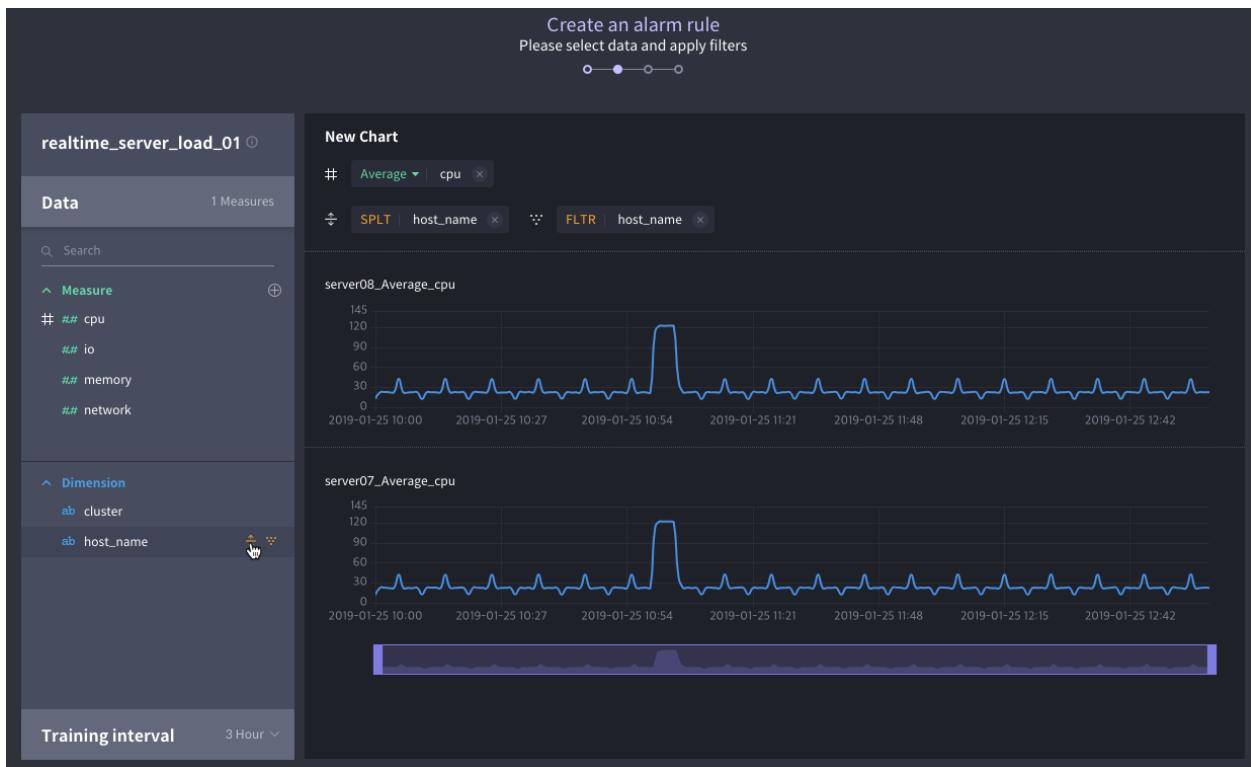
2. If required, a custom column can be created by applying an expression to an existing column. On the upper right of the **Measure** area, click and set up a custom column in the dialog box.



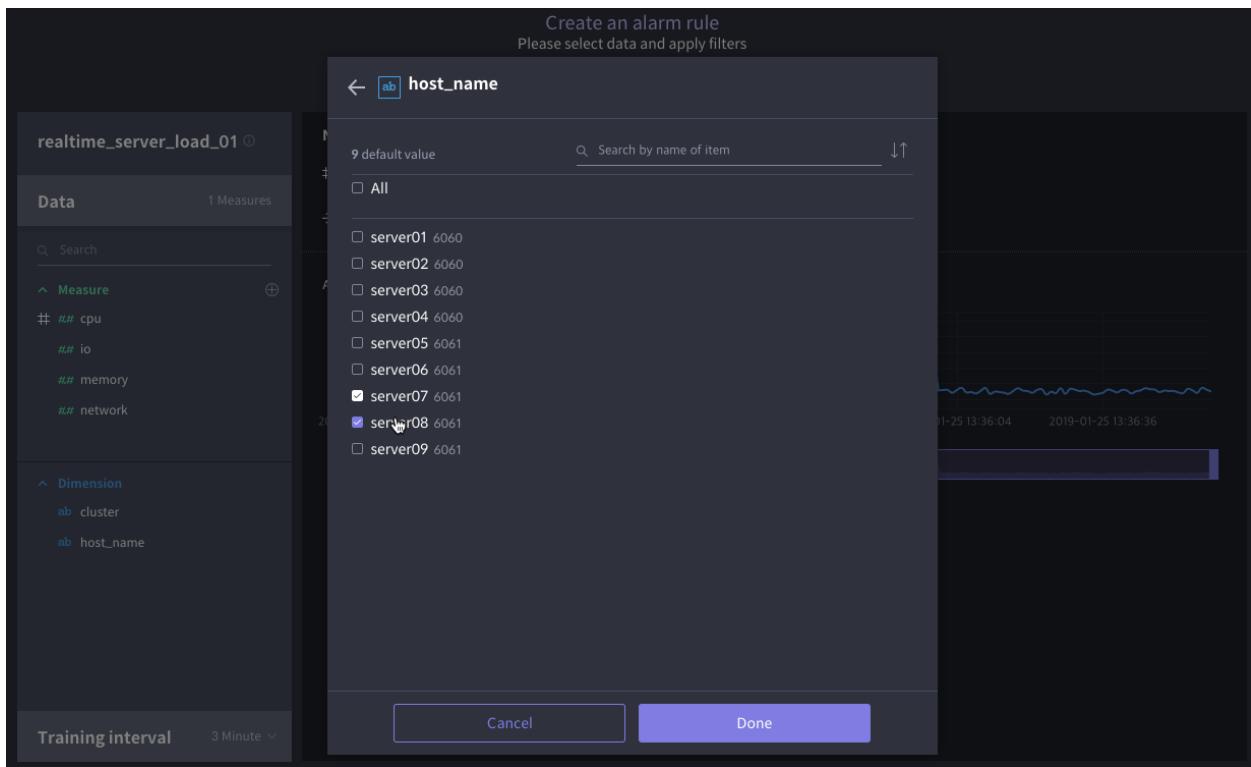
3. Click the aggregation type menu of each column on the Aggregate shelf and select a desired type.



4. If required, aggregate data can be split based on a dimension. Under **Dimension**, hover the cursor over the column you want to use as a splitter, and click .



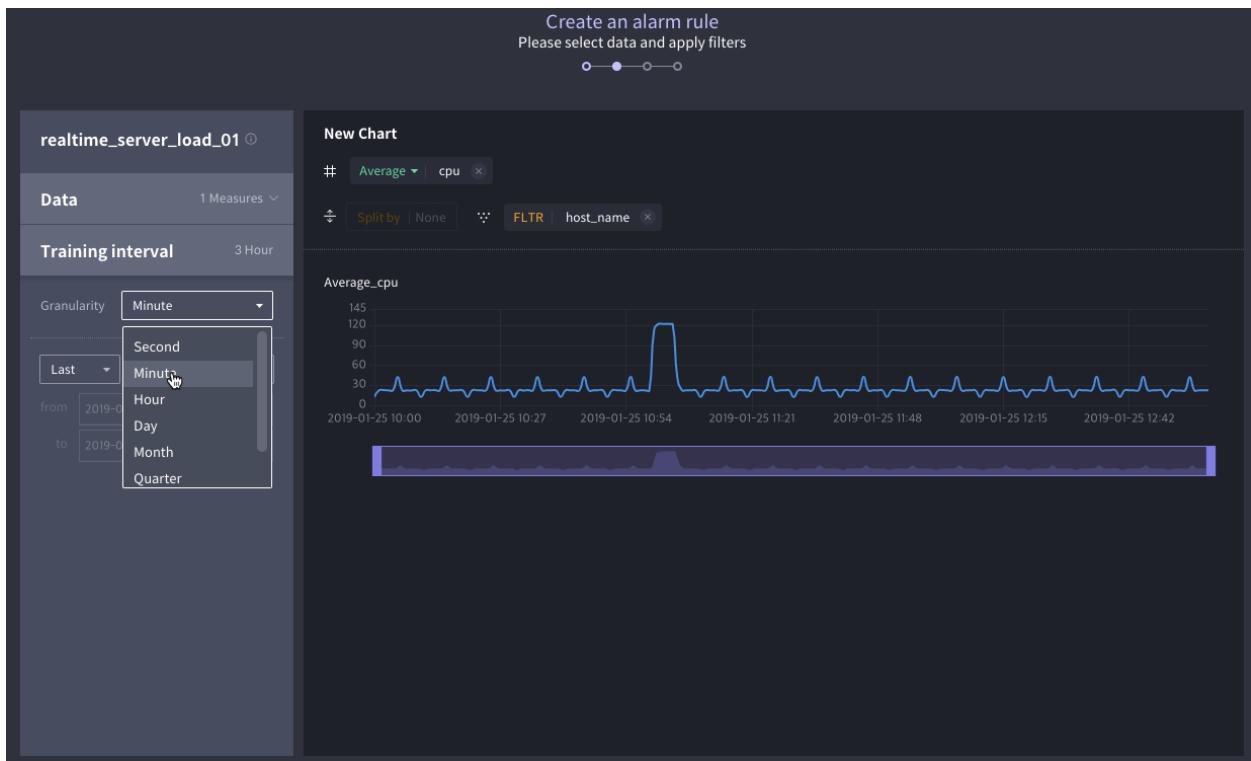
5. If required, aggregate data can be filtered based on a dimension. Under **Dimension**, hover the cursor over the column you want to use as a filter, and click . Next, select the elements you want to monitor.



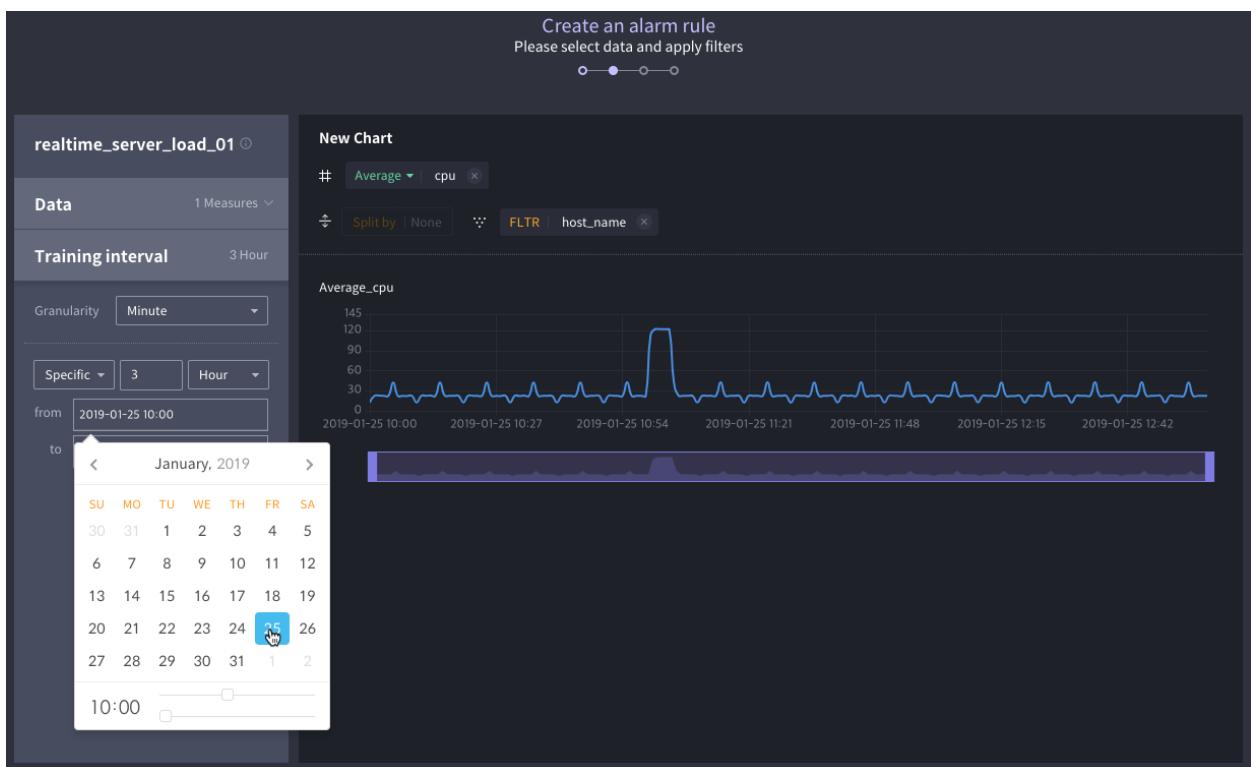
18.3 Specify a training interval

Once a measure(s) is selected, open the **Training interval** panel and choose a range of data to be used for prediction model training.

1. Choose a training interval for the model under **Granularity**.



2. Set a date range for data to be used in training.

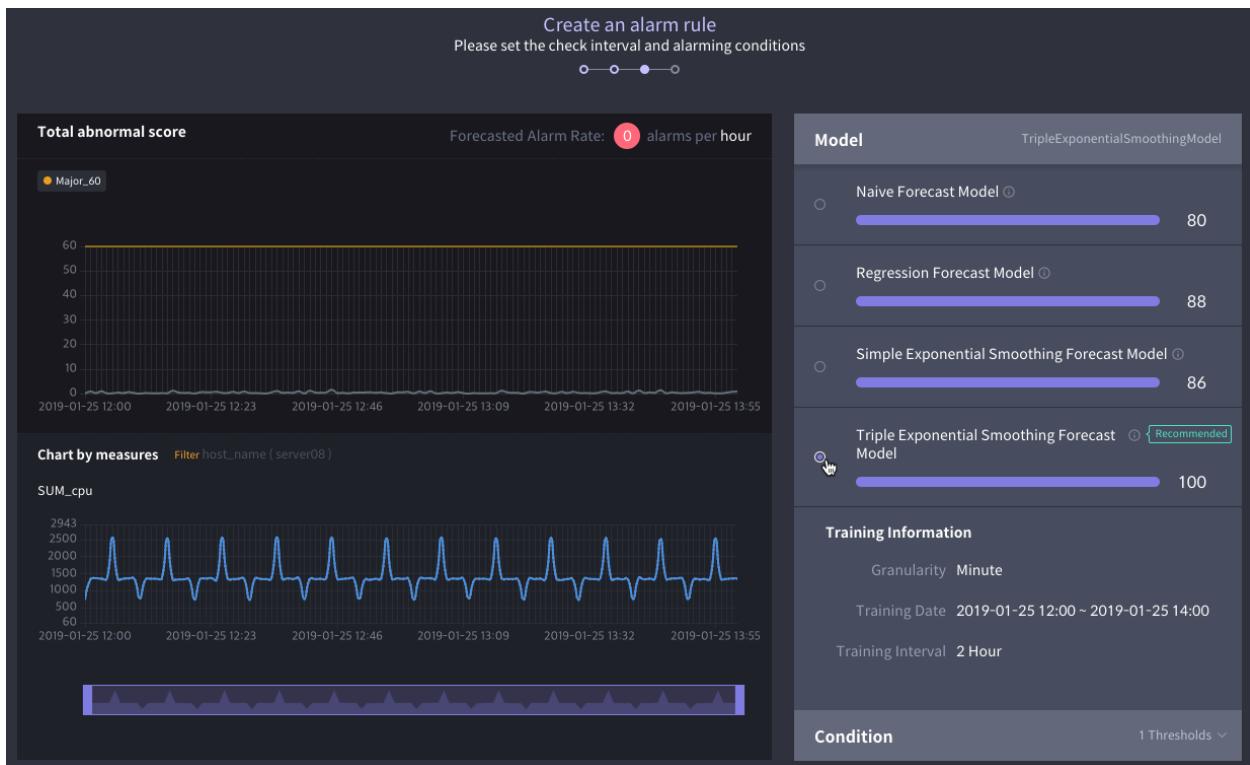


3. Click **Next** to continue.

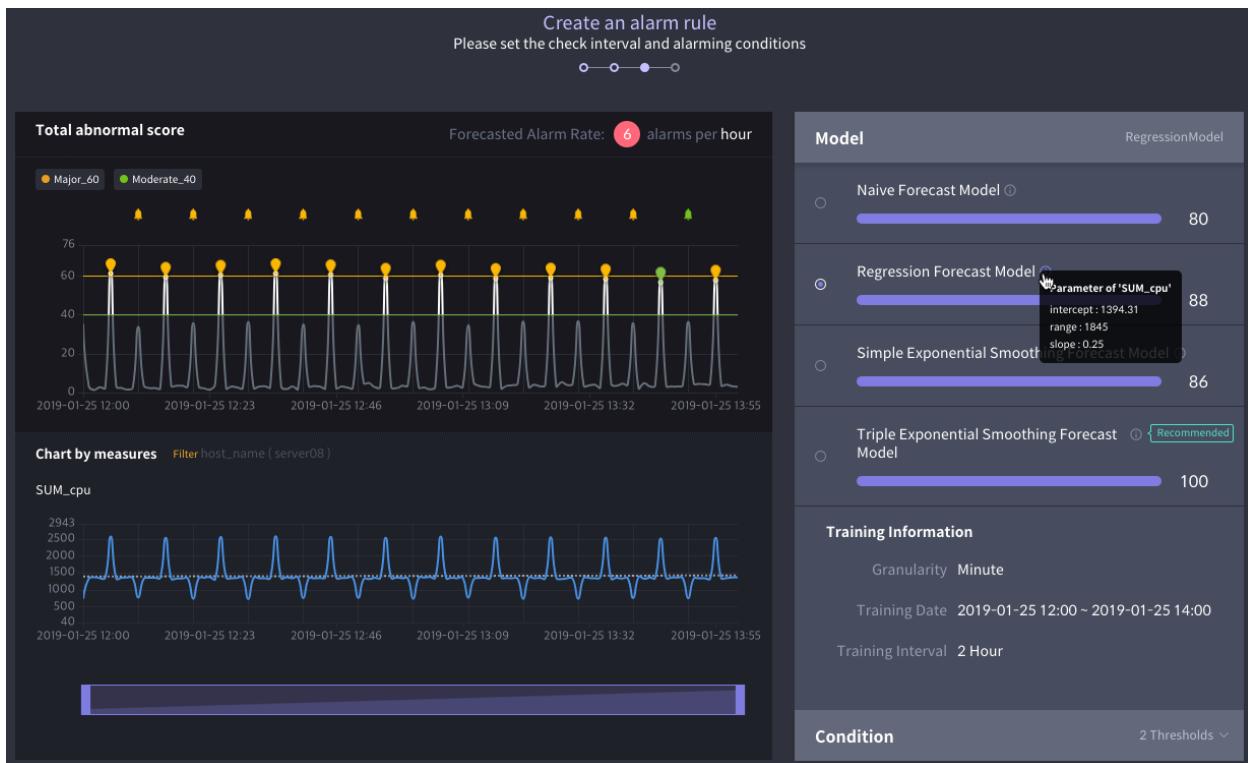
18.4 Select a model

Now, proceed to the **Model** panel and choose a prediction model. Anomaly trains each model using the given training data set and calculates the results. Below are two methods of choosing an appropriate prediction model.

- The model with the highest accuracy (out of 100 points) is automatically displayed on the right, and marked as **Recommended**.



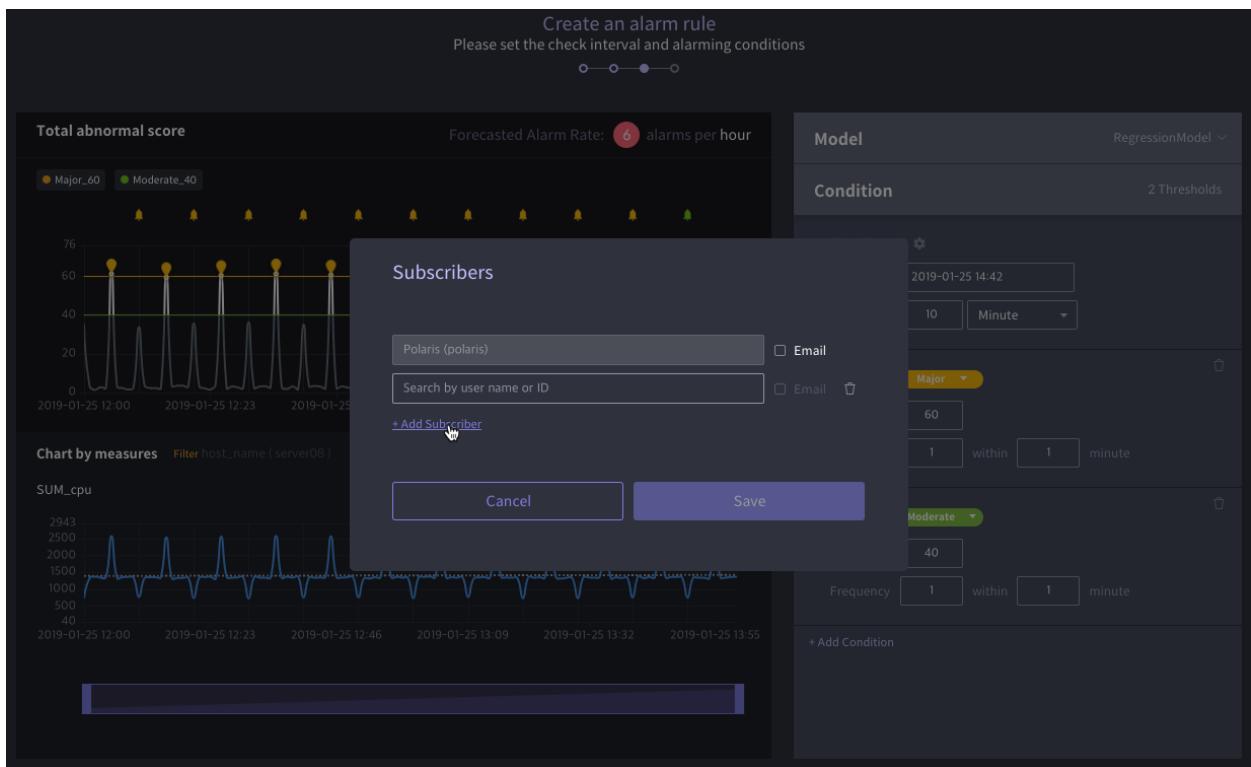
- Hovering the cursor over each item provides detailed information, and you can select the desired model.



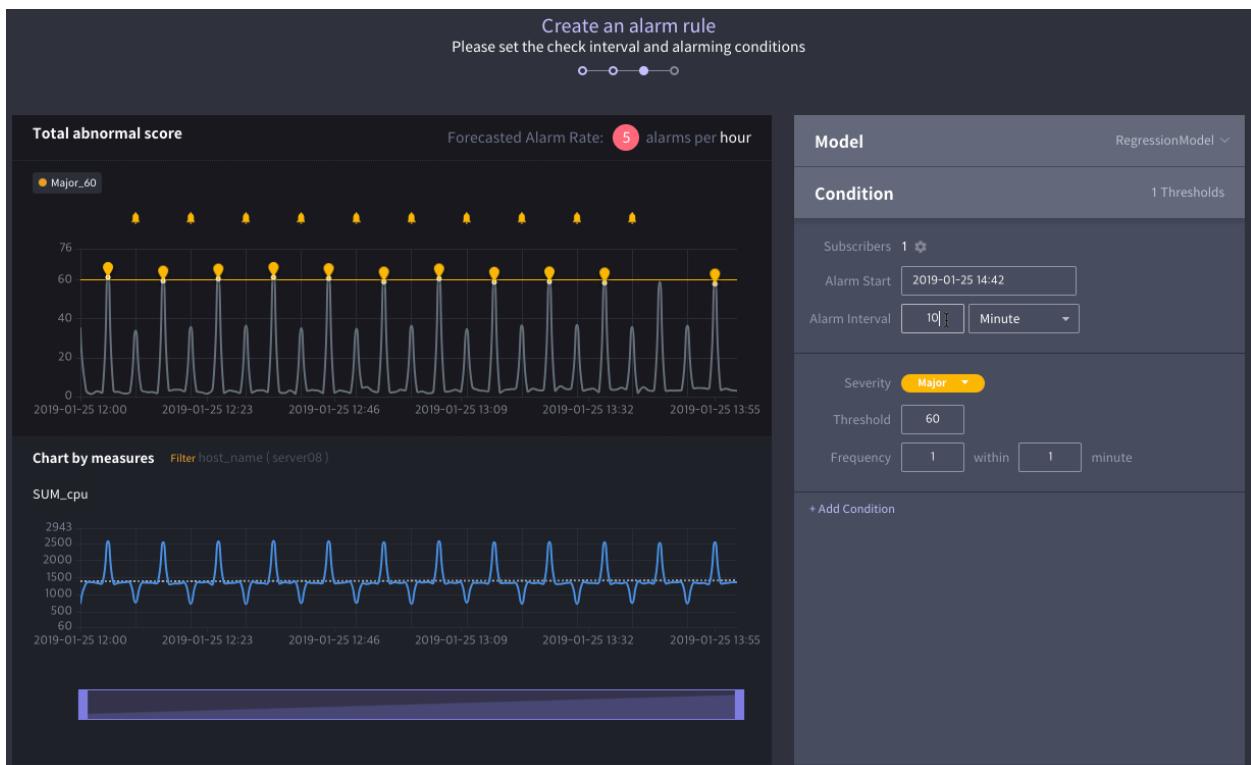
18.5 Set alarm rule conditions

After selecting a prediction model, set up conditions for alarm triggering in the **Condition** panel.

1. Click on the right of **Subscribers** to open the following dialog box, and set up subscribers and method of notification.

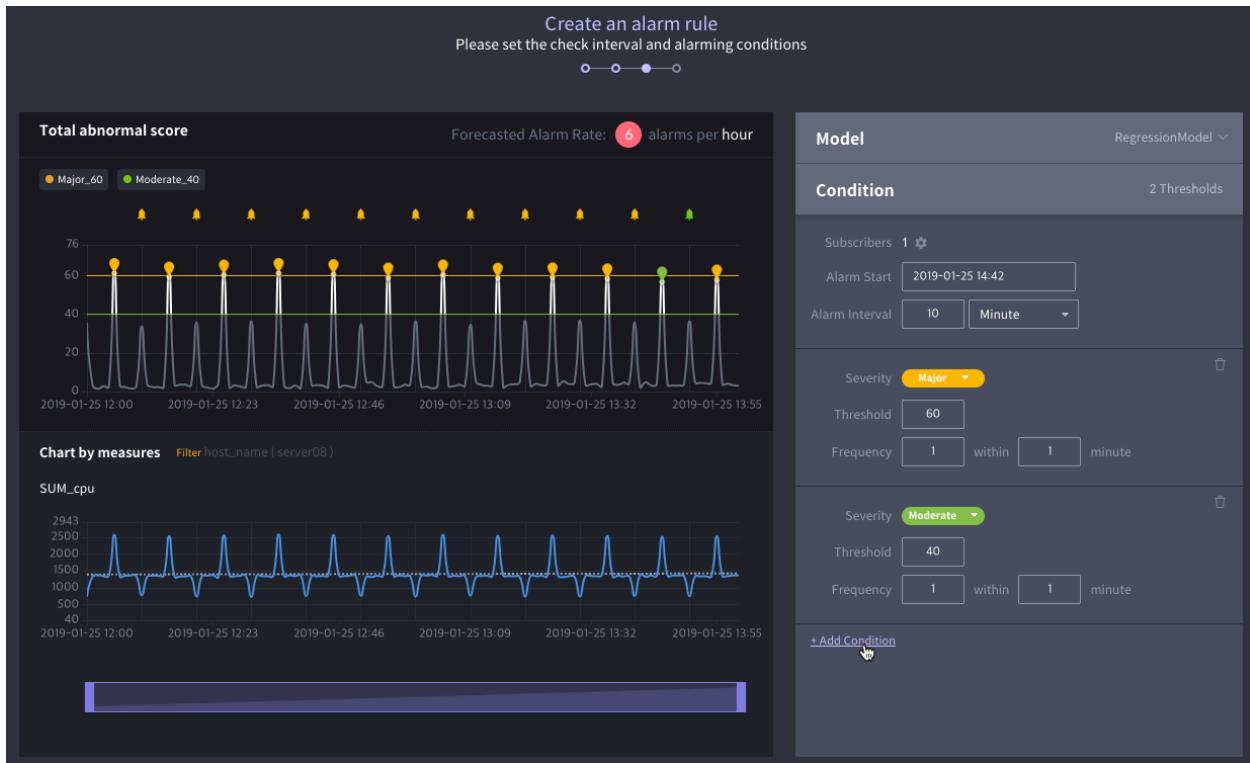


2. Read the description below, and set up the alarm time and interval.



- **Alarm Start:** The alarm feature is turned on at this time. Alarms can be triggered beginning from the start time.
- **Alarm Interval:** When a condition is met, alarms are set off at the intervals set by this field.

3. Read the description below, and set up trigger conditions based on abnormal scores of data being monitored. By default, one condition is given, and more conditions can be added by clicking **+ Add Condition**.



- **Severity:** Set up the alarm severity corresponding to the given condition.
- **Threshold:** The monitored data is considered abnormal when this setting is exceeded.
- **Frequency:** Set how many times the abnormal score should exceed the threshold within the specified period to set off an alarm. For example, "3 within 5 minute" means that an alarm is set off if the abnormal score exceeds the threshold 3 times within 5 minutes.

4. Click **Next** to continue.

18.6 Complete the alarm rule

Once the alarm rule is set up, proceed as follows:

1. Enter the name and description of the alarm rule, and click **Done**.

The screenshot shows the first step of a four-step wizard titled "Create an alarm rule". The title bar says "Please set the check interval and alarming conditions". Below the title, there is a progress bar consisting of four circles, with the fourth circle being filled black. A large gray box contains the following configuration details:

Datasource	realtime_server_load_01
Measure	cpu
Conditions	2
Forcasted rate	6 alarms per hour
Notification	1

Below this, there are two input fields:

Name: my_sample_rule_01

Description: Please enter a description

2. The newly created alarm rule is displayed on the top of the alarm rule list. The current status remains as **Prepared** up to the first alarm.

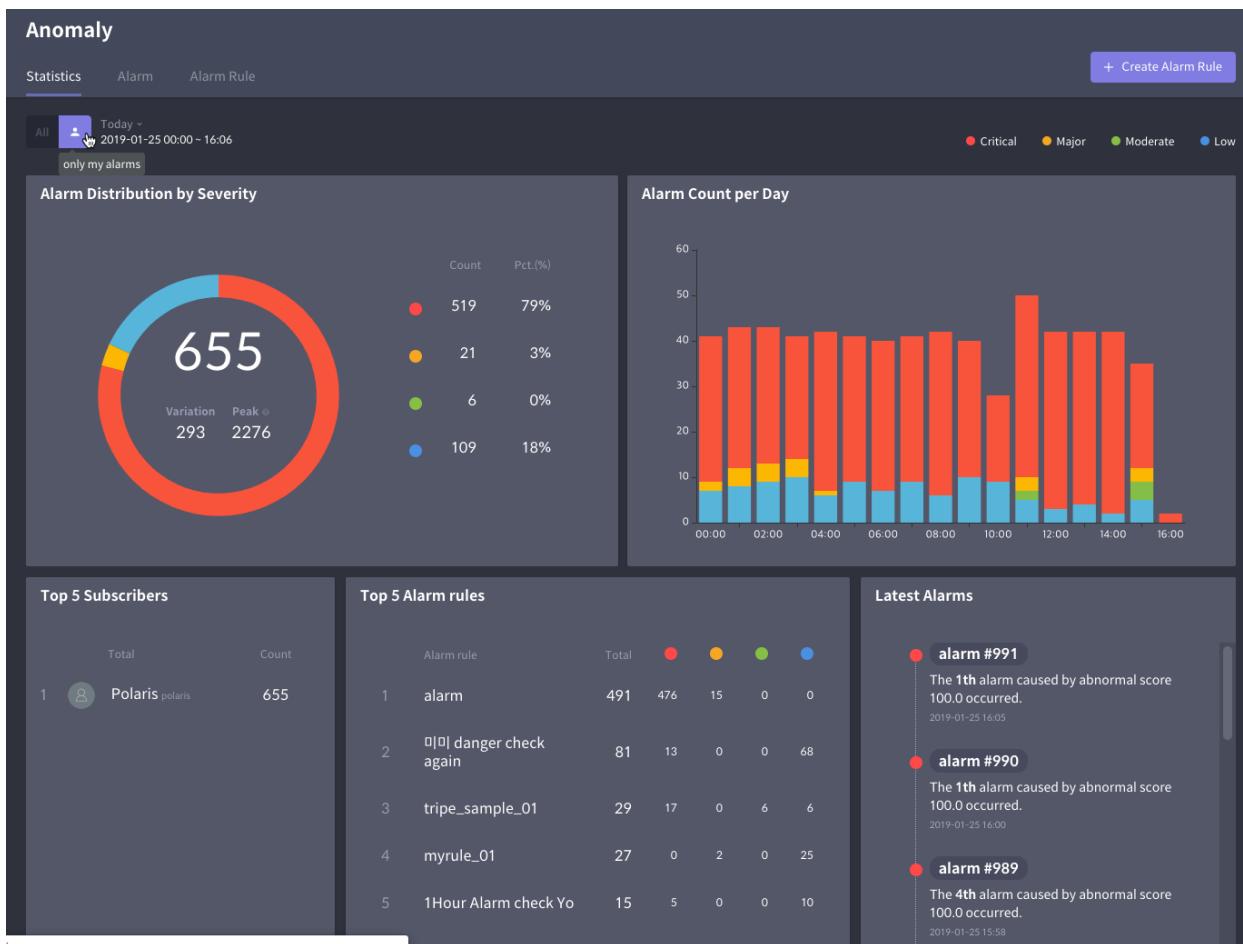
Anomaly								
Statistics		Alarm		Alarm Rule				
All		Current Status		Q				
There are 13 items								
Current Status	Alarm Rule Name	DataSource	Measure	Alarm Interval	Condition	Alarm	Updated	
Prepared	my_sample_rule_01	realtime_server_load_01	cpu	10 Minute	2	0	2019-01-25 14:48 by polaris	
Normal	미묘 danger check again	realtime_server_load_01	cpu	1 Minute	4	865	2019-01-25 14:46 by system	
Normal	myrule_01	realtime_server_load_01	cpu	10 Minute	3	95	2019-01-25 14:21 by system	
Normal	tripe_sample_01	realtime_server_load_01	cpu	1 Minute	4	127	2019-01-25 11:29 by system	
Normal	sample_012	realtime_server_load_01	io,cpu	5 Minute	1	29	2019-01-25 11:15 by system	
Abnormal	alarm	realtime_server_load_01	cpu	1 Minute	2	979	2019-01-25 02:39 by system	
Abnormal	1Hour Alarm check Yo	realtime_server_load_01	cpu	1 Hour	2	3	2019-01-23 18:30 by system	
Normal	server07_anomaly_real	realtime_server_load_01	cpu	2 Minute	2	221	2019-01-23 13:12 by system	
Normal	server07_anomaly	realtime_server_load_01	cpu	2 Minute	2	129	2019-01-23 13:12 by system	

NINETEEN

STATISTICS

The **Statistics** tab menu displays general statistics regarding alarms. This page gives users a view of various statistics regarding alarms including their severity, occurrence time, and rules.

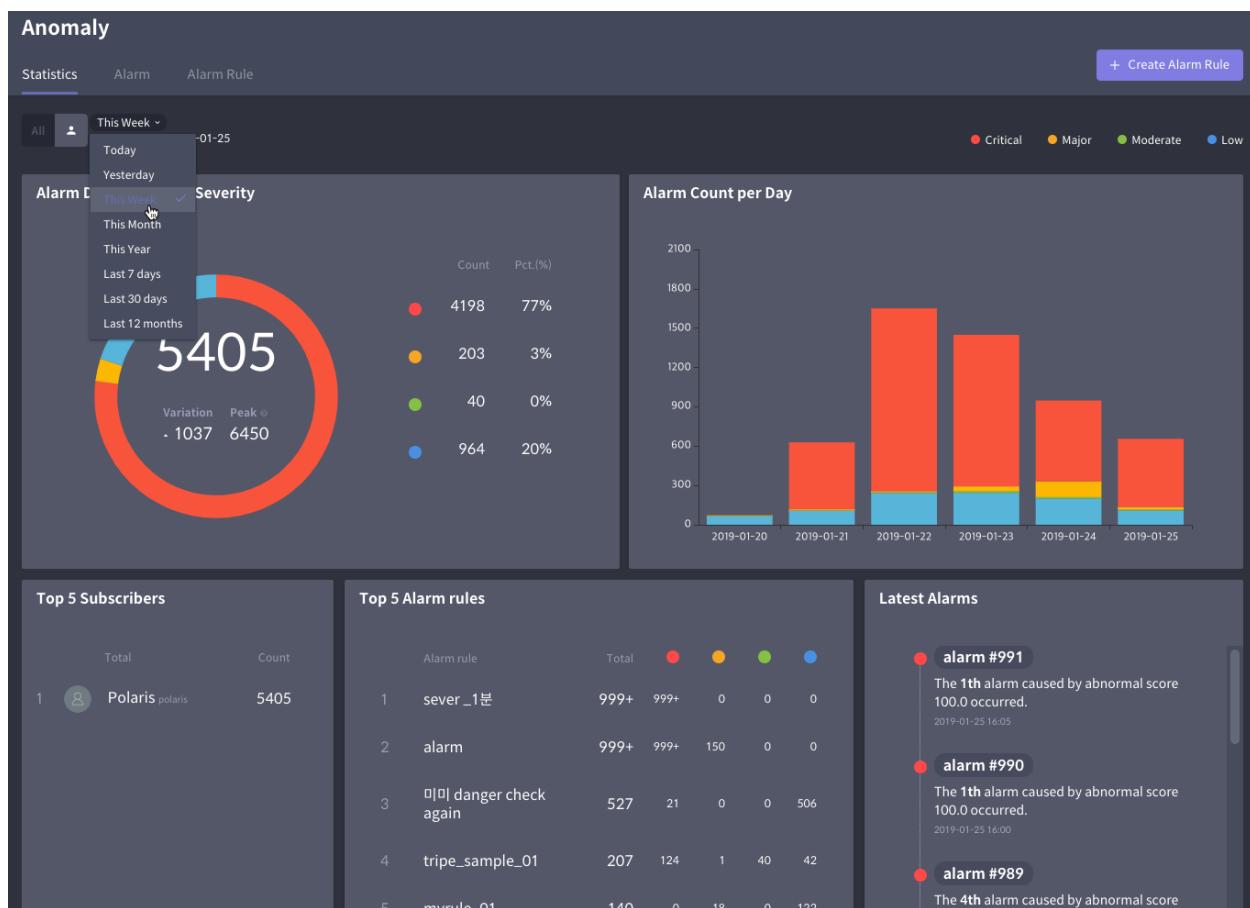
The page is comprised as follows:



- **Alarm Distribution by Severity:** The distribution of alarms by severity is displayed.

- **Alarm Count per Time:** The alarm frequency by time is displayed.
- **Top 5 Subscribers:** The top 5 subscribers who have been notified of the highest number of alarms are displayed.
- **Top 5 Alarm Rules:** The top 5 alarm rules that resulted in the highest number of alarms are displayed.
- **Latest Alarms:** The most recent alarms are displayed.

The period used to generate statistics can be modified in the period menu on the top of the page.



CHAPTER
TWENTY

VIEW/EDIT ALARM RULE DETAILS

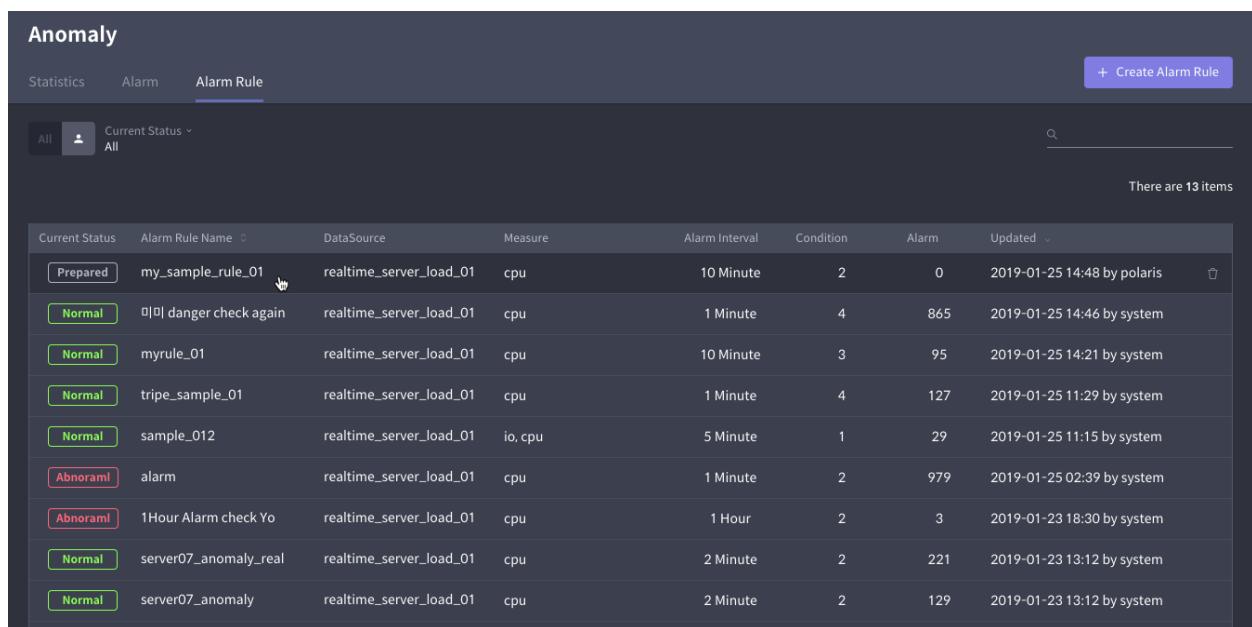
The **Alarm Rule** tab menu displays and allows to edit the registered alarm rules. This menu also provides an overview of abnormal scores calculated using the selected prediction models.

The alarm rule menu consists of the following two pages:

- [Alarm rule list](#)
- [Alarm rule details](#)

20.1 Alarm rule list

The **Alarm Rule** tab presents a list of registered alarm rules.



The screenshot shows the 'Anomaly' interface with the 'Alarm Rule' tab selected. At the top, there are tabs for 'Statistics', 'Alarm', and 'Alarm Rule'. A purple button labeled '+ Create Alarm Rule' is on the right. Below the tabs, there are filters for 'Current Status' (set to 'All') and a search bar. A message indicates 'There are 13 items'. The main area is a table with columns: Current Status, Alarm Rule Name, DataSource, Measure, Alarm Interval, Condition, Alarm, and Updated. The table lists 13 rows of alarm rules, each with a small icon and a delete button.

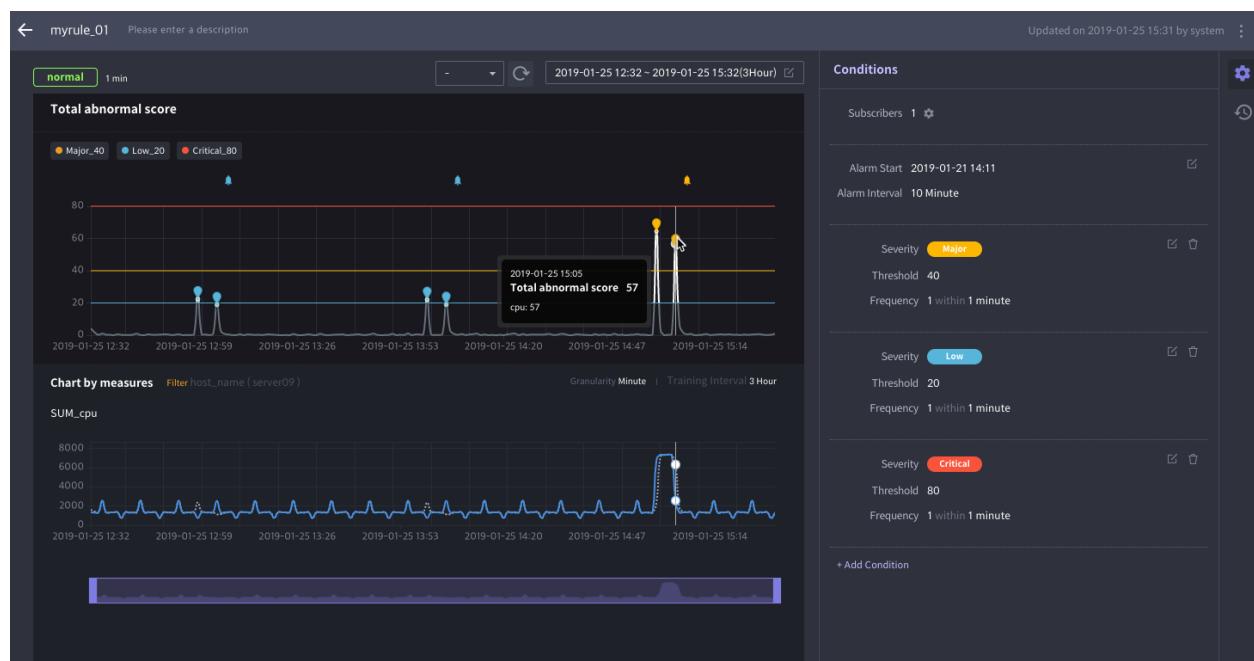
Current Status	Alarm Rule Name	DataSource	Measure	Alarm Interval	Condition	Alarm	Updated	⋮
Prepared	my_sample_rule_01	realtime_server_load_01	cpu	10 Minute	2	0	2019-01-25 14:48 by polaris	✖
Normal	danger check again	realtime_server_load_01	cpu	1 Minute	4	865	2019-01-25 14:46 by system	✖
Normal	myrule_01	realtime_server_load_01	cpu	10 Minute	3	95	2019-01-25 14:21 by system	✖
Normal	tripe_sample_01	realtime_server_load_01	cpu	1 Minute	4	127	2019-01-25 11:29 by system	✖
Normal	sample_012	realtime_server_load_01	io,cpu	5 Minute	1	29	2019-01-25 11:15 by system	✖
Abnormal	alarm	realtime_server_load_01	cpu	1 Minute	2	979	2019-01-25 02:39 by system	✖
Abnormal	1Hour Alarm check Yo	realtime_server_load_01	cpu	1 Hour	2	3	2019-01-23 18:30 by system	✖
Normal	server07_anomaly_real	realtime_server_load_01	cpu	2 Minute	2	221	2019-01-23 13:12 by system	✖
Normal	server07_anomaly	realtime_server_load_01	cpu	2 Minute	2	129	2019-01-23 13:12 by system	✖

The items displayed in the list are described below, and they can be used to filter or search for rules.

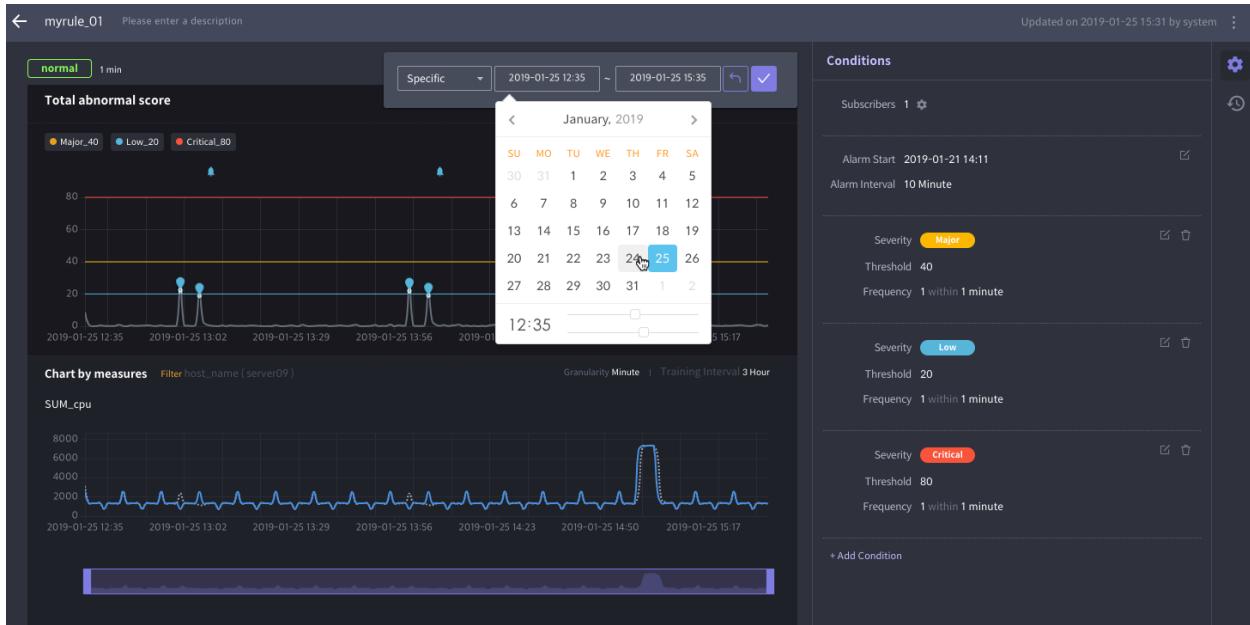
- **Current Status:** Monitoring results according to the rule
- **Alarm Rule Name:** Name of the rule
- **Data Source:** Data source being monitored
- **Measure:** Measure column being monitored
- **Alarm Interval:** Intervals at which alarms are set off
- **Condition:** Number of alarm triggering conditions applied to the rule
- **Alarm:** Number of alarms triggered by the rule
- **Running:** Monitoring status of the rule
- **Updated:** When and who last updated the rule

20.2 Alarm rule details

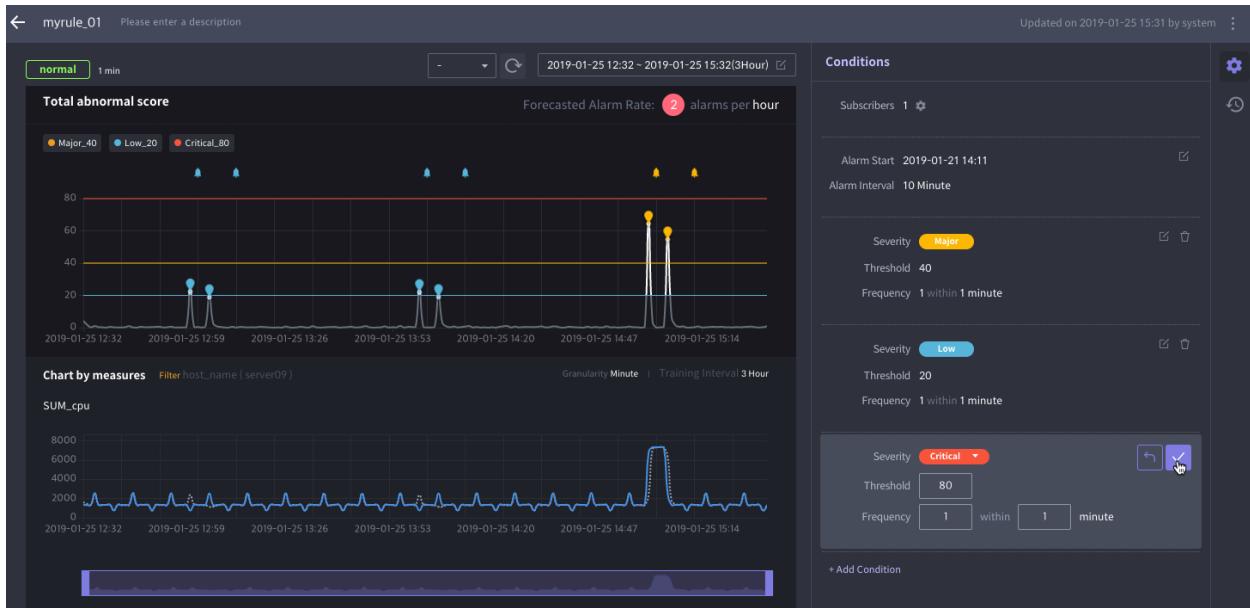
Select an alarm rule from the list to view detailed information and edit the settings. The left area of the page visualizes monitoring results, and the right presents settings of the alarm rule conditions.



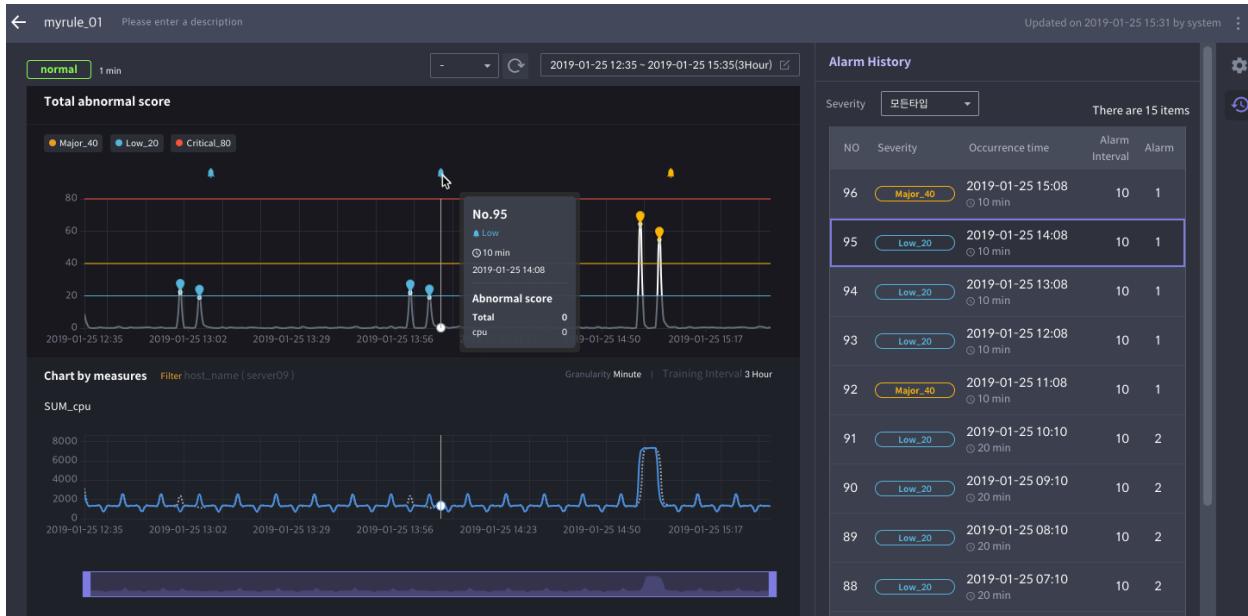
The top of the monitoring status area displays the monitoring period. Click  to change the period.



The current settings of the alarm rule can be modified under alarm rule condition settings. See [Set alarm rule conditions](#) for details.



Click  on the right bar to switch the **Conditions** panel to the **Alarm History** panel, where a list of alarms triggered to date is displayed (click  to revert to the **Conditions** panel).



VIEW ALARM DETAILS

The alarm history can be viewed in the **Alarm** tab menu. Unlike the [Statistics](#) page, which gives an overview of alarm-related statistics, this menu is optimized for viewing and exploring individual alarms.

This menu consists of the following two pages:

- [Alarm list](#)
- [Alarm details](#)

21.1 Alarm list

The **Alarm** tab displays the alarms triggered to date. Using the **Alarm rule / Timeline** toggle box on the top of the page, the alarms can be sorted by alarm rule or time triggered.

- [Alarm rule](#) (sorted by alarm rule)

The screenshot shows the 'Anomaly' dashboard with the 'Alarm' tab selected. At the top, there are tabs for 'Statistics', 'Alarm', and 'Alarm Rule', along with a '+ Create Alarm Rule' button. Below the tabs, there are filters for 'All', 'User', 'Alarm rule', and 'Show Unchecked Only', along with a search bar.

Latest Alarms:

- Low_2 | 2019-01-25 15:28 | ▲ 1 ○ 1 min | danger check again #867 | realtime_server_load_01
- Critical_50 | 2019-01-25 15:27 | ▲ 5 ○ 300 min | 1Hour Alarm check Yo #3 | realtime_server_load_01
- Moderate_40 | 2019-01-25 15:16 | ▲ 4 ○ 4 min | tripe_sample_01 #132 | realtime_server_load_01
- Critical_80 | 2019-01-25 15:11 | ▲ 4 ○ 4 min | tripe_sample_01 #131 | realtime_server_load_01
- Major_40 | 2019-01-25 15:11 | ▲ 1 ○ 10 min | myrule_01 #96 | realtime_server_load_01

alarm 989:

- Critical_80 | 2019-01-25 15:58:58 | ▲ 4 ○ 240sec | alarm #989 | realtime_server_load_01
- Critical_80 | 2019-01-25 15:51:57 | ▲ 1 ○ 60sec | alarm #988 | realtime_server_load_01
- Critical_80 | 2019-01-25 15:31:58 | ▲ 1 ○ 60sec | alarm #987 | realtime_server_load_01
- Critical_80 | 2019-01-25 15:01:58 | ▲ 2 ○ 120sec | alarm #986 | realtime_server_load_01
- Critical_80 | 2019-01-25 15:01:58 | ▲ 1 ○ 60sec | alarm #985 | realtime_server_load_01

危险 danger check again 868:

- Low_2 | 2019-01-25 15:45:00 | Low_2 | 2019-01-25 15:28:00 | Critical_80 | 2019-01-25 15:06:00 | Low_2 | 2019-01-25 14:04:00 | Low_2 | 2019-01-25

- Timeline (sorted by time triggered)

The screenshot shows the 'Anomaly' dashboard with the 'Timeline' tab selected. At the top, there are tabs for 'Statistics', 'Alarm', and 'Alarm Rule', along with a '+ Create Alarm Rule' button. Below the tabs, there are filters for 'All', 'User', 'Timeline', and 'Show Unchecked Only', along with a search bar.

Today 167:

Yesterday 666:

This Week 1160:

Timeline:

- 2019-01-24 08:58 | Critical_80 | ○ 60sec | ▲ 1 | alarm #364 | realtime_server_load_01
- 2019-01-24 08:57 | Critical_80 | ○ 60sec | ▲ 1 | alarm #363 | realtime_server_load_01
- 2019-01-24 08:56 | Low_2 | ○ 1 min | ▲ 1 | [D] danger check again #743 | realtime_server_load_01
- 2019-01-24 08:55 | Critical_80 | ○ 60sec | ▲ 1 | alarm #362 | realtime_server_load_01
- 2019-01-24 08:53 | Critical_80 | ○ 120sec | ▲ 2 | alarm #361 | realtime_server_load_01
- 2019-01-24 08:51 | Critical_80 | ○ 120sec | ▲ 2 | alarm #360 | realtime_server_load_01

Click **+ Load more** at the end of the category to view more alarm items in the same category.

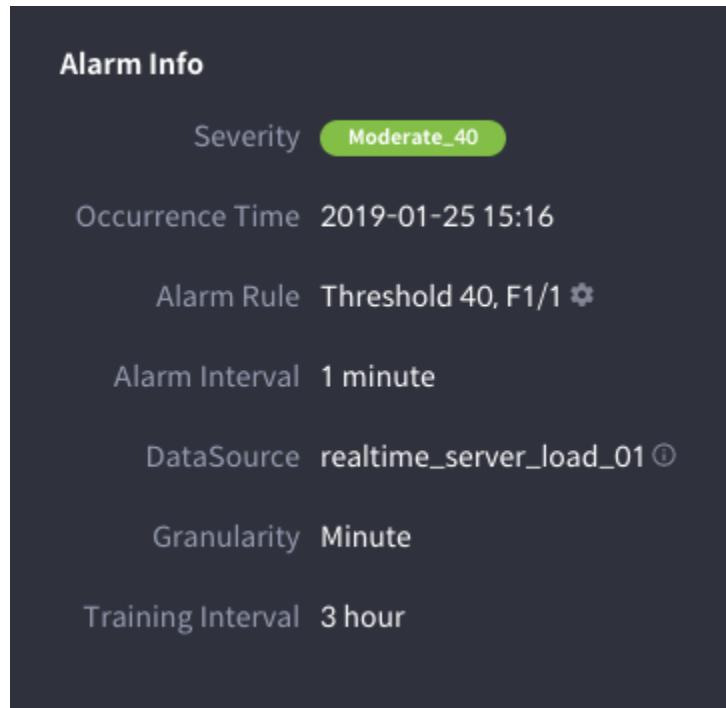
Severity	Timestamp	Count	Duration	Alarm ID	Description
Critical_80	2019-01-25 15:58:58	▲ 4	○ 240sec	alarm #989	realtime_server_load_01
Critical_80	2019-01-25 15:51:57	▲ 1	○ 60sec	alarm #988	realtime_server_load_01
Critical_80	2019-01-25 15:31:58	▲ 1	○ 60sec	alarm #987	realtime_server_load_01
Critical_80	2019-01-25 15:01:58	▲ 2	○ 120sec	alarm #986	realtime_server_load_01
Critical_80	2019-01-25 14:58:58	▲ 1	○ 60sec	alarm #985	realtime_server_load_01
Critical_80	2019-01-25 14:57:57	▲ 2	○ 120sec	alarm #984	realtime_server_load_01
Critical_80	2019-01-25 14:55:59	▲ 1	○ 60sec	alarm #983	realtime_server_load_01
Critical_80	2019-01-25 14:53:58	▲ 2	○ 120sec	alarm #982	realtime_server_load_01
Critical_80	2019-01-25 14:51:59	▲ 1	○ 60sec	alarm #981	realtime_server_load_01
Critical_80	2019-01-25 14:50:58	▲ 1	○ 60sec	alarm #980	realtime_server_load_01
Critical_80	2019-01-25 14:48:58	▲ 4	○ 240sec	alarm #979	realtime_server_load_01
Critical_80	2019-01-25 14:43:58	▲ 1	○ 60sec	alarm #978	realtime_server_load_01
Critical_80	2019-01-25 14:41:58	▲ 1	○ 60sec	alarm #977	realtime_server_load_01
Critical_80	2019-01-25 14:30:58	▲ 1	○ 60sec	alarm #976	realtime_server_load_01
Critical_80	2019-01-25 14:28:57	▲ 1	○ 60sec	alarm #975	realtime_server_load_01
+ Load more					

21.2 Alarm details

Select an alarm item in list to view its detailed information. Each area in the alarm details page is described below:

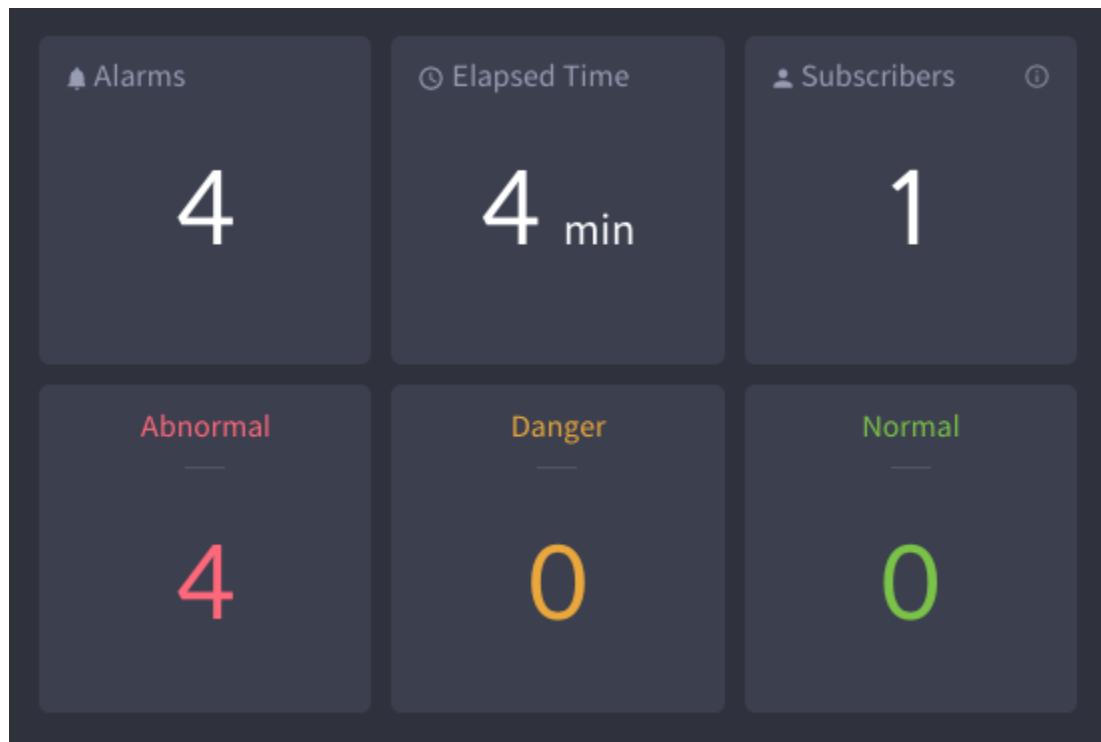
21.2.1 Alarm Info area

This area presents alarm severity, time of occurrence, and the settings of the causing rule.



21.2.2 Alarm status boxes

These boxes display occurrence details of the selected alarm item. If alarms are triggered continuously at the given intervals, the number of alarm items remains at 1. In the figure below, alarms were set off continuously over 4 intervals (**Alarms**). Since the alarm interval is 1 minute, 4 alarms were triggered for a total of 4 minutes (**Elapsed Time**).



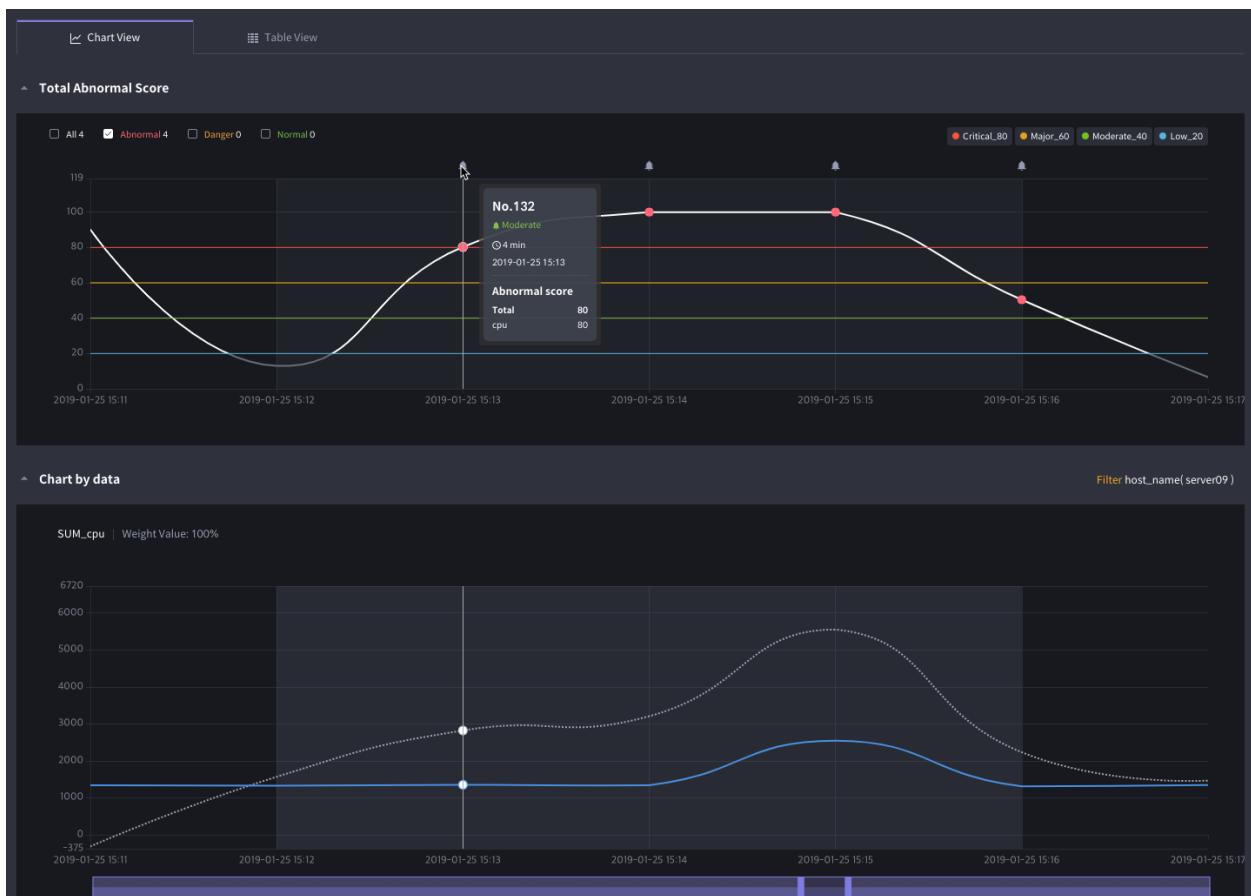
21.2.3 Alarm History area

This area presents the history of alarms triggered by the selected rule.

Alarm History					
NO	Severity	Occurrence time	Alarm Interval	Alarm	
132	Moderate_40	2019-01-25 15:16 ⌚ 4 min	1 minute	4	
131	Critical_80	2019-01-25 15:11 ⌚ 4 min	1 minute	4	
130	Critical_80	2019-01-25 15:06 ⌚ 2 min	1 minute	2	
129	Critical_80	2019-01-25 15:03 ⌚ 1 min	1 minute	1	
→ 2019-01-25 15:01					

21.2.4 Chart View tab

This tab presents a chart of the abnormal score for the monitored aggregate data falling under the alarm period. The chart includes alarms triggered from reaching score limits (Critical, Major, Moderate, Low). See [Basic principles](#) for details on chart generation.



- **Total abnormal score:** Displays the abnormal score calculated for all measures included in alarm rules.
- **Chart by measures:** Presents the trends of the predicted and actual values for each individual measure included in the alarm rule.

21.2.5 Table View tab

The tab area presents the actual value, predicted value, and abnormal score for each alarm triggered.

		Occurrence time	Total Abnormal Score	SUM_cpu (Weight Value: 100%)		
				Actual	Predict	Abnormal Score
1	●	2019-01-25 15:13	80	1352	2820	80
2	●	2019-01-25 15:14	100	1341	3207	100
3	●	2019-01-25 15:15	100	2545	5548	100
4	●	2019-01-25 15:16	50	1311	2233	50

