

KNIME Snowflake Extension Guide

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Introduction

This guide describes how to work with Snowflake from within the KNIME Analytics Platform. The KNIME Analytics Platform is our open source software for creating data science. Intuitive, open, and continuously integrating new developments, it makes understanding data and designing workflows and reusable components accessible to everyone.

The Snowflake Extension allows you to connect to your Snowflake account to access and manage data directly in Snowflake and if desired sprinkle in some SQL. You can combine data from Snowflake with data from any of the multiple sources supported by KNIME and apply advanced techniques such as statistics, machine learning, model monitoring, and artificial intelligence to make sense of it.

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KNIME is a Snowflake Ready Technology having completed a 3rd party technical validation that confirms the KNIME Snowflake Integration is optimized with an emphasis on functional and performance best practices.

This guide will help you to get started and is divided into the following sections:

- 1. Quickstart with Snowflake in KNIME gives a short introduction to KNIME and how to connect to Snowflake
- 2. Working with Snowflake describes Snowflake specific topics such how to connect to Snowflake and accessing Snowflake Marketplace data
- 3. Advanced setup instructions that might be required for special environments such as if your company uses Azure Active Directory for authentication.

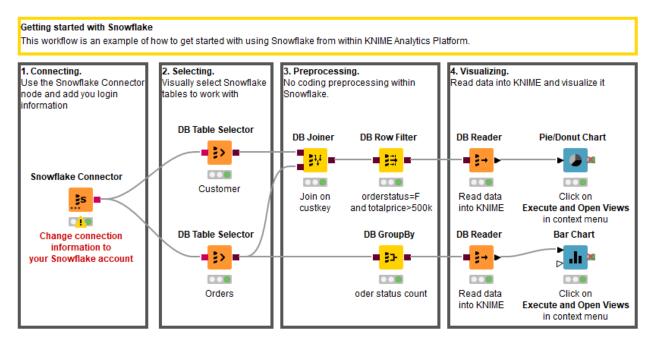
Quickstart with Snowflake in KNIME

Once you have downloaded and installed the KNIME Analytics Platform you can open the Getting started with Snowflake example workflow in the KNIME Hub by clicking this link.

The workflow uses the TPCH sample data, which is shared by default with your account by Snowflake, and performs the following steps:

- 1. Connects to your Snowflake account
- 2. Selects the CUSTOMER and ORDERS table from the sample database
- 3. Preprocesses the data without the need to write any SQL
 - a. Joins the two tables and filters all orders that have the orderstatus=F and a totalprice>500k
 - b. Computes the total number of orders per order status
- 4. Reads the data into KNIME and visualizes it
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If you do not have a Snowflake account you can apply for a 30-day free trial at: https://signup.snowflake.com/



Once the workflow is opened in your web browser simply drag&drop the workflow icon right into the KNIME Explorer on the left hand side of your KNIME Analytics Platform.

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Getting started with Snowflake		
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Getting started with Snowflake ▼ ▲ LCAL, IJ acit WorkStates) This workflow is an example of how to get started with using Snowflake from with ▼ ★ LCAL, IJ acit WorkStates) 1. Connecting, Use the Snowflake Connector India and add you loain 2. Selecting, Visually select Snowflake That is the with 3. Preprocessin No coding prepr No coding prepr No coding prepr 2. Selecting, Visually select Snowflake India and add you loain 3. Preprocessin No coding prepr > ▲ Browrenerive maps: ▲ Browrenerive maps:	-	Overview Used extensions & nodes Legal

If you haven't installed the KNIME Snowflake Integration don't worry, KNIME will prompt you that a node extension is missing and offers you to search and install it automatically. To do so simply click Yes and follow the steps in the installation window by clicking *Next*.

The first thing you need to do is adjust the connection settings of the Snowflake Connector node to point it to your Snowflake account. To do so, double click the node to open its configuration dialog. In the node dialog add your account information as described in the Snowflake Connector node section below. Please notice that the domain *.snowflakecomputing.com* will be appended automatically to the entered full account name.

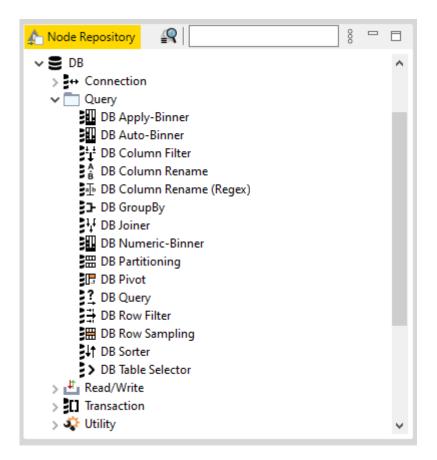
Once this is done, you can execute the whole workflow by clicking the *Execute all executable nodes* button in the toolbar.

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File	Edit	View	Node	Help													
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Alternatively you can also execute the workflow node by node and inspect the intermediate results as described here via the nodes context menu.

To work with other database tables or views simply double click the DB Table Selector node to open its node dialog. In the dialog click the *Select table* button. You can use the Database Metadata Browser to select the tables or views you want to work with and click *OK*. Close the node dialog by clicking *OK* and execute the node. After executing the node you can open the output port view of the node via the *DB Data* entry at the bottom of the context menu. Clicking the *Cache no. of rows* button allows you to have a peak at the data. You can do this at every stage of the workflow to see how your data evolves throughout the workflow.

To perform additional transformations simply drag and drop other database nodes onto the workflow editor. The database nodes are located in the *DB* category of the node repository.



Once a new node is added you can **connect** it by clicking the output port of the first node and releasing the mouse at the input port of the second node. Open the node dialog by double clicking the node to adjust its configuration. For an explanation of the node and its different configuration options click the question mark at the bottom right of the node dialog to open the node description.

For more details on how to create, manipulate and execute KNIME workflows in general see the KNIME Workbench Guide. For more information about how to work with the database nodes see the KNIME Database Extension Guide.

Working with Snowflake in KNIME

This section describes how to work with Snowflake from within KNIME Analytics Platform.

Extension installation

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- This is a one-time setup step that you can skip if you have followed the previous section.

Once you have downloaded and installed the KNIME Analytics Platform as described here you need to install the KNIME Snowflake Integration. To do so you have two options:

KNIME Hub:

- Open the KNIME Snowflake Integration page by clicking here
- From the extension page drag&drop the squared yellow icon to the workbench of KNIME Analytics Platform. A window will open asking if you want to search and install the extension or integration. Click Yes and follow the instructions.

KNIME Snowflake Integration \heartsuit	
v 4.5.1	
This feature contains nodes for accessing Snowflake from KNIME.	Overview

• Restart KNIME Analytics Platform.

KNIME Analytics Platform:

- Extension

• Click *File* on the menu bar and then *Install KNIME Extensions*.... The dialog shown in the figure opens.

🔺 Install				×
Available Software Check the items that you wish to install.				
Name > 000 KNIME & Extensions > 000 KNIME Big Data Extensions > 000 KNIME Community Extensions - Bioinformatics & NGS > 000 KNIME Community Extensions - Cheminformatics > 000 KNIME Community Extensions - Image Processing and Anal > 000 KNIME Community Extensions - Other > 000 KNIME Community Extensions - Other > 000 KNIME Community Extensions Sources > 000 KNIME Labs Extensions Select All Details	Version			~
				0
 ✓ Show only the latest versions of available software ✓ Group items by category ☐ Show only software applicable to target environment 	✓ Hide items that are already installed What is <u>already installed</u> ?			
	< Back Next >	Finish	Cancel	

• Select the KNIME Snowflake Integration extension e.g. by typing Snowflake into the search bar at the top



- · Click Next and follow the instructions
- Restart KNIME Analytics Platform.

For more information on how to install Extensions and Integrations see the KNIME Analytics Platform Installation Guide.

Snowflake Connector node

Once you have installed the KNIME Snowflake Integration, you can find the Snowflake Connector node in the $DB \rightarrow Connection$ subcategory in the Node Repository. The Snowflake Connector node creates a connection to the Snowflake database via the Snowflake JDBC driver.

In the configuration dialog of the Snowflake Connector node you need to provide information such as account name, virtual warehouse, and the user credentials. To open the configuration dialog, double-click the node. For the full account name the domain .snowflakecomputing.com will be appended automatically. Note that your full account name might include additional segments that identify the region and cloud platform where your account is hosted e.g. xy12345.us-east-2.aws, xy12345.us-central1.gcp or xy12345.west-us-2.azure that need to be entered as well.

Once you have provided all necessary information click *OK* and execute the node to establish a connection.

Input Type Ma	poina	Output Type	Mapping	Flow Variab	es	Job Manager	Selection	
	ection Settings			JDBC Parameters			/anced	
Configuration								
Database Dialect:	Snowflake							\sim
Driver Name: Snowflake 3.13.4 [ID: built-in-snowflake-3.13.4]								
Connection								
Full account name								
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Virtual warehouse								
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Default access cont	ol role (optiona	1)						
PUBLIC								\sim
Default database (o	ptional)							
TEST_DB								\sim
Default schema (opt	ional)							
PUBLIC								\sim
Authentication								
None								
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Username: <y< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></y<>								
Password: ••	•••••	•••••	•••••					

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After connecting, the USE WAREHOUSE command can be executed with the DB SQL Executor node to set a different database for the session.

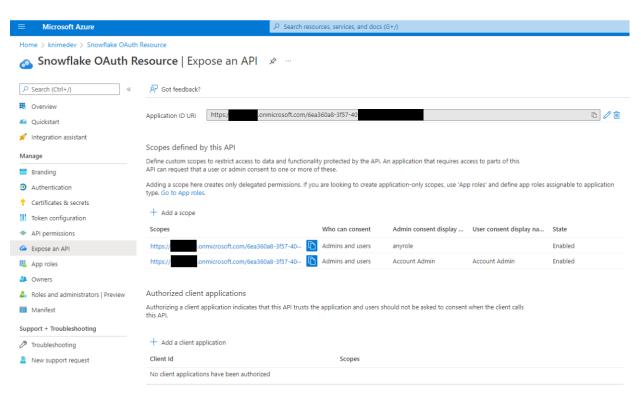
Azure Active Directory Authentication

The Snowflake Connector supports authentication via Azure Active Directory. To use it you have to add a Microsoft Authentication input port to the Snowflake Connector node by clicking the three dots on the node icon and then on *Add Microsoft Authentication port*. Finally, connect the output port of the Microsoft Authentication node with the Snowflake Connector node.



The setup of the Microsoft Authentication node depends on your Azure Active Directory setting. You can request the required information from your Azure Active Directory administrator.

The following images do show an example setup of two Snowflake scopes within Azure Active Directory.



Once you have determined which scope to use, copy the link (e.g. by clicking the blue clipboard icon next to the url). Then open the node dialog of the Microsoft Authentication node and select *Others* in the *Request access to* section. Then paste the previously copied scope link into the text field as shown below.

ettings Flow Variables Job Manager Selection utentication mode: Interactive authentication login Not logged in Token storage Memory (stores token in separate file) Token file to read/write Write to Local File System File Write options Create missing folders Node (stores token in node settings) Clear selected Clear all Request access to Sharepoint files (Read) Anare Bido Storage/Azure Data Lake Storage Gen2 Storage account: Azure SQL Database Power BI	Dialog - 0:26 - Microsoft Authentication	>
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User Groups (Read) Note: Requires admin consent Azure Blob Storage/Azure Data Lake Storage Gen2 Storage account: Azure SQL Database Power BI Others (one per line) https://	Sharepoint files (Read)	
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Storage account: Azure SQL Database Power BI Others (one per line) https://	—	
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	✓ Others (one per line)	
OK Apply Cancel ၇	https://	7-407 / session:role-any
OK Apply Cancel 🕐		
		OK Apply Cancel 🕡

For further details about how to set up Azure Active Directory authentication and configure the *Microsoft Authentication* node see the Azure Active Directory setup section.

Working with Snowflake Data Marketplace Databases

The Snowflake Data Marketplace allows Snowflake users to access curated data from different data providers. Once you have access to a requested database it will show up in the Database Metadata Browse e.g. when clicking the *Select a table* button of the DB Table Selector node. To access any table or view simply double click its name. The database, schema and table/view name is then automatically entered into the corresponding fields in the node dialog. If you are writing your own statements you might need to qualify each table or view using the database and schema name it is located in.

A Dialog - 0:204 - DB Table Selector	-		×
Fil 🛕 Database Metadata Browser 🛛 🗙			
٩	ection		
COVID19_DATA_ATLAS COVID19_DATA_ATLAS COVID19 SNOWFLAKE_SAMPLE_DATA SNOWFLAKE_SAMPLE_DATA SNOWFLAKE_SAMPLE_DATA SNOWFLAKE_SAMPLE_DATA SNOWFLAKE_SAMPLE_DATA TPCDS_SF100TCL SNOWFLAKE_SAMPLE_DATA TPCDS_SF100TCL SNOWFLAKE_SF100 SNOWFLAKE_SF100 SNOWFLAKE_SF100 SNOWFLAKE_SF100 SNOWFLAKE_SF100 SNOWFLAKE_SF100 SNOWFLAKE_SF100	Sele	ect a table	
E UTIL_DB Fetched 1 minute ago			
OK Cancel		?	

Uploading large amounts of data to Snowflake

To upload a large amount of data you can use the DB Loader node. The node either writes a CSV or Parquet file into a Snowflake stage prior loading the data into the specified table using the Snowflakes COPY command.

In the node dialog you can specify the existing database table you want to upload the data to. Depending on your use case you can choose between CSV and Parquet as data exchange formats. CSV processing is faster but might cause problems with complex string values whereas Parquet has better type support but is slower to process.

In the stage section select a stage where you have write access to. The uploaded file will be automatically deleted once the data is loaded into the destination Snowflake table.

▲ Dialog - 0:202 - DB Loader File	_		×
Options Advanced Flow Variables Job Manager Selection			
Target table			
Database: mydatabase			
Schema: myschema			
Table: mytable	Sele	ct a table	
File format			
CSV			
○ Parquet			
User stage			
○ Table stage			
○ Internal named stage			
Internal stage name:			
OK Apply Cancel	(?		

Depending on the selected file format the *Advanced* tab offers you different options to further define the characteristics of the exchanged file such as the compression method, quote characters or file and chunk size.

🛕 Dialog - 0:202 - DE	3 Loader		_		×
File					
Options Advanced	Flow Variables Job Mar	nager Selection			
General Settings					
	Compression meth	od: GZIP 🗸			
CSV Settings					
	Column separator:	,			
	Missing value pattern:				
	Quote:	•			
	Quote replacement:				
	Line ending:	SYST V			
	Character set:	UTF-8 \lor			
Parquet Settings					
	Within file chunk size:	1.024 🛓			
	File size:	1.024 🚖			
	DK Apply	Cancel	0]	

H2O Machine Learning Model Push-down

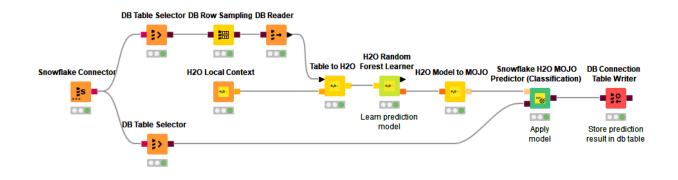
KNIME Analytics Platform supports model push-down into Snowflake. This allows you to perform data prediction within Snowflake without the need to move the data out of Snowflake. Supported are H2O MOJO models that can be learned via the KNIME H2O Machine Learning Integration but also via KNIME H2O Sparkling Water Integration where the model learning is performed at scale within a Spark runtime.

The different Snowflake H2O MOJO Predictor nodes create a temporary User-Defined Function (UDF) in the default database and schema that lives as long as the Snowflake session is not closed. To create the function KNIME uploads the model as well as all required dependencies to a temporary stage created in the default database and schema in Snowflake. To successfully execute the nodes require the USAGE rights on the DATABASE and the SCHEMA.

For more information about the H2O Integration check out the H2O blog post.

The following screenshot shows an example flow that learns a Random Forest model using a

local H2O context which is then registered as UDF and used to predict the classes for a database table with previously unseen data. The prediction result is then stored in a Snowflake table. For another example see the following blog post.



Advanced setup

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This section describes optional tasks that are only needed for specific setups and might not be relevant for you.

Azure Active Directory setup

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This section is intended for a Snowflake and Azure Active Directory administrator.

In order to use Azure Active Directory (Azure AD) authentication you need to create a new application registration for the Snowflake OAuth Resource in your Azure AD as described in Step 1 of the Snowflake documentation. You do not need to create an OAuth Client (Step 2) since KNIME Analytics Platform will be the OAuth client that uses the registered application. But you will need to register the Snowflake OAuth Resource in Snowflake as described in Step 3 and 4 of the documentation.

Once everything is set up correctly you need to enter one scope of the Snowflake OAuth Resource into the *Other* field of the Microsoft Authentication node. The scope is a URL that looks like the following:

```
https://<YOUR_AZURE_ID>.onmicrosoft.com/6ea360a8-3f57-407f-xxxxx-
xxxxxxxxxx/session:role-any
```

For more details on how to use the scopes in KNIME see the Azure Active Directory Authentication section above.

Multi tenant

If you get the following error:

"(Snowflake OAuth Resource) is not configured as a multi-tenant application. Usage of the /common endpoint is not supported for such applications created after '10/15/2018'. Use a tenant-specific endpoint or configure the application to be multi-tenant."

Please enable multitenant authentication for the Snowflake OAuth Resource in you Azure Active directory as shown below.

Home > knimedev > Snowflake OAuth	Resource
Snowflake OAuth Re	esource Authentication 🛷 …
	🖫 Save 🗙 Discard 🔗 Got feedback?
 Overview Quickstart Integration assistant 	Platform configurations Depending on the platform or device this application is targeting, additional configuration may be required such a redirect URIs, specific authentication settings, or fields specific to the platform.
Manage	+ Add a platform
🚍 Branding	
∋ Authentication	Supported account types
 Certificates & secrets Token configuration API permissions Expose an API App roles Owners Roles and administrators Preview 	 Who can use this application or access this API? Accounts in this organizational directory only (knimedev only - Single tenant) Accounts in any organizational directory (Any Azure AD directory - Multitenant) Help me decide Accounts in any organizational directory (Any Azure AD directory - Multitenant) Help me decide Y Due to temporary differences in supported functionality, we don't recommend enabling personal Microsoft accounts for an existing registration. If you need to enable personal accounts, you can do so using the manifest
Manifest Support + Troubleshooting	editor. Learn more about these restrictions.
New support request	Advanced settings Allow public client flows ^①
	Enable the following mobile and desktop flows: Yes No • App collects plaintext password (Resource Owner Password Credential Flow) Learn more ? No keyboard (Device Code Flow) Learn more ? • No keyboard (Device Code Flow) Learn more ? SSO for domain-joined Windows (Windows Integrated Auth Flow) Learn more ?

For more details see the Microsoft documentation.

Single tenant

Since version 4.5.2 of the KNIME Analytics Platform the Microsoft Authentication node also supports single tenant authentication by specifying a custom OAuth2 Endpoint.

To specify a custom OAuth2 Endpoint open the node dialog of the Microsoft Authentication node and go to the *Advanced* tab:

▲ Dialog - 0:26 - Microsoft Authentication (user specific) — □ File	х
Settings Advanced Flow Variables Job Manager Selection	
OAuth2 Endpoint	
Custom:	
https://login.microsoftonline.com/95d14ł 5320/oauth2/v2.0/authorize	
OK Apply Cancel 🕐	

The endpoint can be retrieved from Azure Active Directory by clicking the Endpoints entry of the Snowflake OAuth Resource. Just click the clipboard icon of the OAuth 2.0 authorization endpoint (v2) entry in the Endpoints list:

lome > knimedev >	esource 🖈 …	Endpoints	×
~		OAuth 2.0 authorization endpoint (v2) Copy to	to clipboar
Search (Ctrl+/) «	🔟 Delete 🕀 Endpoints 🔤 Preview features	https://login.microsoftonline.com/95d14b5 bcb5320/oauth2/v2.0/authorize	D
Vverview	🚯 Got a second? We would love your feedback on Microsoft identity platform (previously Azure AD for developer). →	OAuth 2.0 token endpoint (v2)	
Guickstart		https://login.microsoftonline.com/95d14t	D
Integration assistant	∧ Essentials	OAuth 2.0 authorization endpoint (v1)	
Aanage	Display name : Snowflake OAuth Resource	https://login.microsoftonline.com/95d14	D
	Application (client) ID : 6ea360 828f5318	OAuth 2.0 token endpoint (v1)	
Branding & properties	Object ID : c1664	https://login.microsoftonline.com/95d14 b5320/oauth2/token	D
Authentication	Directory (tenant) ID : 95d14b pcb5320	OpenID Connect metadata document	
Certificates & secrets	Supported account types : My organization only	https://login.microsoftonline.com/95d14 bbcb5320/v2.0/.well-known/openid-configuration	D
Token configuration		Microsoft Graph API endpoint	
API permissions	Starting June 30th, 2020 we will no longer add any new features to Azure Active Directory Authentication Library (ADAL) and will need to be upgraded to Microsoft Authentication Library (MSAL) and Microsoft Graph. Learn more	https://graph.microsoft.com	D
Expose an API		Federation metadata document	
App roles	Get Started Documentation	https://login.microsoftonline.com/95d14 b5320/federationmetadata/2007-06/federationmetadata.xm	nl 🗅
Owners		WS-Federation sign-on endpoint	
Roles and administrators Preview	Build your application wi		D
Manifest	Build your application wi	SAML-P sign-on endpoint	
	The Microsoft identity platform is an authentication service, open-source libra solutions, access and protect APIs, and	https://login.microsoftonline.com/95d14 cb5320/saml2	D
upport + Troubleshooting	solutions, access and protect web, and	SAML-P sign-out endpoint	
P Troubleshooting		https://login.microsoftonline.com/95d1- 5320/saml2	n
New support request	🗢 🚯 📷 🖡 📧		

Register your own Snowflake driver

The KNIME Snowflake Integration comes with a built- in Snowflake driver and is thus ready to go. However because of some special circumstances you might be required to use a particular version of the driver which you can do by manually registering your own JDBC driver.

To register your own Snowflake JDBC driver, you need to download the JDBC driver as described in the Snowflake documentation. Once you have downloaded the single jar file. Open KNIME Analytics Platform and go to *File* \rightarrow *Preferences* \rightarrow *KNIME* \rightarrow *Databases*.

A Preferences				_		×
type filter text	Databases				← -	⇒ • •
 > General > Help > Install/Update ~ KNIME > Big Data Chemistry 	Here you can load additiona in the corresponding databa Drivers that have [Profile] as profile.These drivers can be e Profiles preferences page. List of database driver prefer	se specific connect prefix are automatic dited but not delet	or nodes a cally adde	nd the generic DB Conne d via a KNIME Server cust	ctor nod omizatio	e. n
Customization Profiles Data Storage Databases Databases (legacy) JavaScript Views KNIME Explorer KNIME GUI Kerberos Master Key Meta Info Preferences Preferred Renderers	Name	DB Type	Version		Re	Edit Add Move Up own
Python > Vernalis > Workflow Coach > Run/Debug > Team				Restore <u>D</u> efaults Apply and Close	<u>A</u> Car	pply

Clicking *Add* will open a new database driver window where you can provide the JDBC driver path and all necessary information. In the dialog enter a unique identifier and name and make sure to select *snowflake* as database type. Once the database type is selected the URL template is automatically generated to be compatible with the Snowflake driver and usually does not need to be altered. Click *Add file* and browse for the downloaded driver jar file. Finally click *Find driver classes*. Once satisfied, close the dialog by hitting *OK*.

🛕 Register new	database driver	-		\times
Driver				
ID:	my_snowflake_driver	Database type:	snowflake	\sim
Name:	My Snowflake Driver			
Description:				
URL template:	jdbc:snowflake:// <account_name>.snowflakeco</account_name>	mputing.com/?w	/arehouse= <w< td=""><td>are</td></w<>	are
• URL templat	e syntax information 🥐			
Classpath				
C:\KNIME\JD	BC\Snowflake\snowflake-jdbc-3.13.16.jar		Add file	
			Add directory	,
			Remove	11
				- 11
			Up	- 11
			Down	
Driver class:	net.snowflake.client.jdbc.SnowflakeDriver	Find driver cl	asses	
Driver version:	3.13.0			
		ОК	Cance	I

Once the driver is registered you can select it in the Snowflake Connector node.

	JDBC Parameters	Advanced	Input Type Mappin	g Output T	ype Mapping	Flow Variables		
Configuration								
Database Dialect:	Snowflake							\sim
Driver Name:	My Snowflake Driv	er [ID: my_s	snowflake_driver]					~
Connection	My Snowflake Driver [ID: my_snowflake_driver] Snowflake 3.13.4 [ID: built-in-snowflake-3.13.4]							
Full account name	Snowflake 3.13.4	ID: built-in-s	snowflake-3, 13, 4j					
Virtual warehouse				ID: built-in-snowflake-3.13.4 Class: net.snowflake.client.jdbc.Snowfl Version: 3.13.0 URL template: jdbc:snowflake:// <acc< td=""></acc<>				
Default access contr	ol role (optional)							
PUBLIC								~
Default database (o	otional)							
								~
Default schema (opt	ional)							
								~
Authentication								
○ None								
O None								
0								
Credentials	sword							
 Credentials Username Username & pas 	sword							
_	sword							

To set up JDBC drivers on KNIME Server, please refer to the section JDBC drivers on KNIME Server of the KNIME Database Extension Guide.

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