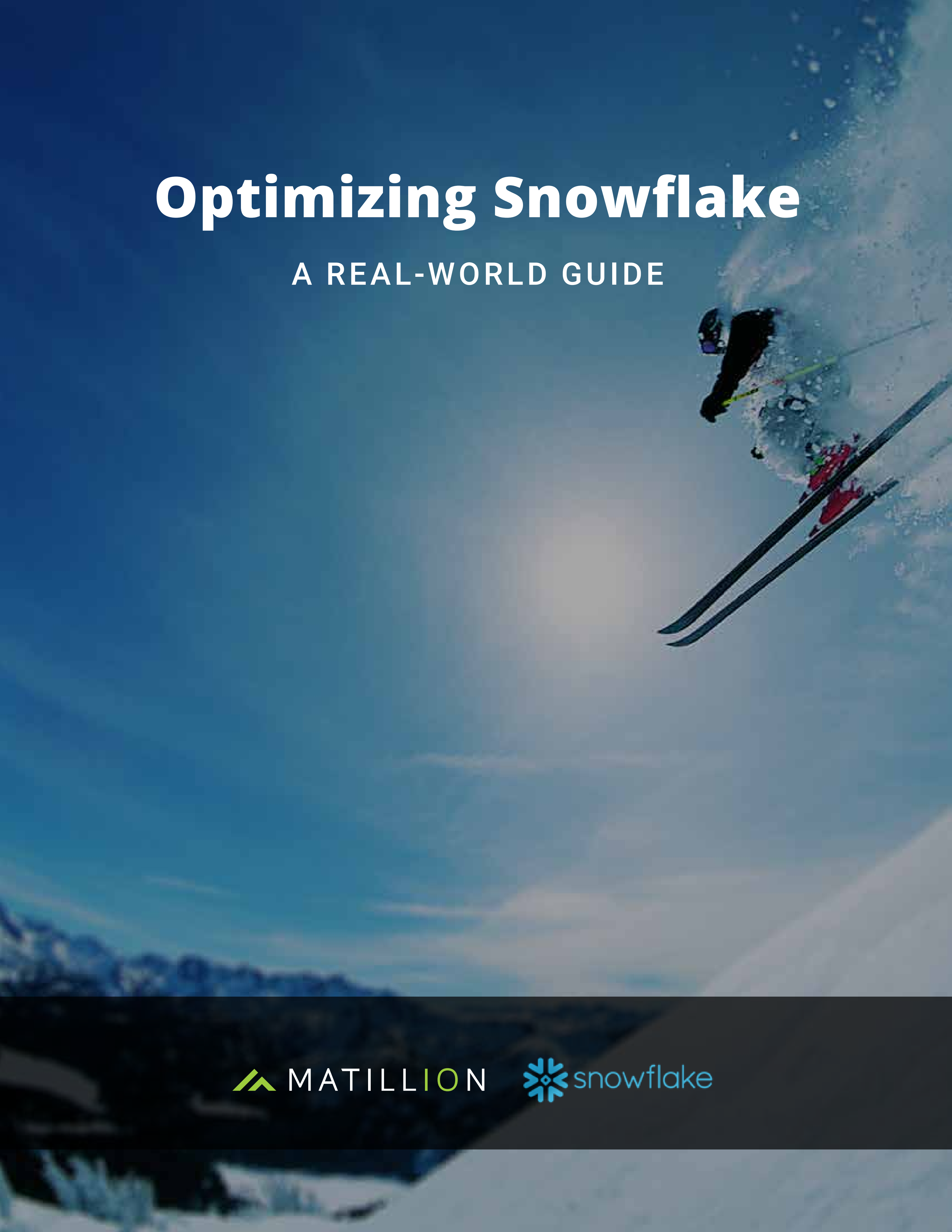

Optimizing Snowflake

A REAL-WORLD GUIDE

MATILLION snowflake

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Introduction

About this book

Chapter 1: Snowflake Architecture. In this chapter, you'll "look under the hood" to understand Snowflake's unique underlying architecture. The primary differences between Snowflake and other cloud offerings is Snowflake's "multi-cluster shared data" approach, which separates compute and storage capabilities to improve concurrency.

Chapter 2: Snowflake Virtual Warehousing. Snowflake is essentially a cluster of compute resource, which makes Snowflake a scalable and powerful solution. Knowing how to size your resources can help you take advantage of Snowflake's highly scalable, low-cost, and automatically managed enterprise data warehouse. Ultimately, this makes your business more performant and cost-efficient.

Chapter 3: Accessing Snowflake. This chapter looks Snowflake access options. This may be different from what you are used to since you will have more options. Once you understand the inner workings of Snowflake and can access it, you can start making the most of it.

Chapter 4: Loading Data. This chapter walks you through ways to bring data into Snowflake. Whether your business is just starting out on Snowflake and you need to populate the data warehouse with historical data or external data from many different sources. It's also useful if you want to improve your data loading processes.

Chapter 5: Exporting Data. This chapter describes differences between exporting data to an internal or external stage or to a local file system or other target. What you want to do with the data may affect which option is best for your use case.

Chapter 6: Storage and Compute Costs. Costs for storage and compute resources couldn't be simpler due to Snowflake's pay-as-you-go pricing model. Although Snowflake is a cost-efficient solution, this chapter provides some tips that can help you keep costs down and under control.

Chapter 7: Best Practices. The final chapter ties together all the information in this eBook into best practices that reduce costs, increase performance, and help you make the most out of your data.

Key

When reading the eBook, look out for colored boxes for additional resources, how to's, best practices, and hints and tips.

🟦	Further details and resources
🟦	'How to' information and examples
🟧	Best Practices and optimizations
🟩	Hints and tips from Matillion

CHAPTER 1

Snowflake Architecture

CHAPTER 1

If you are reading this eBook, you are probably considering or have already selected Snowflake—the data warehouse built for the cloud—as your modern cloud data warehouse. That is an excellent choice. You are ahead of the curve (and your competitors, with their outdated on-premise databases). Now what?

Whether you're a data warehouse developer, a data architect or manager, a business intelligence specialist, an analytics professional, or a tech-savvy marketer, you now need to make the most of the Snowflake platform to get the most out of your data. That's where this eBook comes in handy. It introduces the Snowflake platform and helps you understand the various options available in the platform to ingest, manipulate, and export data that is performant and cost-efficient.

This eBook is brought to you by Matillion. Matillion is an industry-leading data transformation solution for cloud data warehouses. Delivering a true end-to-end data transformation solution (not just data prep or movement from one location to another), Matillion provides an instant-on experience to get you up and running in just a few clicks, a pay-as-you-go billing model to cut out lengthy procurement processes, and an intuitive user interface to minimize technical pain and speed up time to results. Matillion is available globally for Snowflake on AWS Marketplace and Microsoft Azure Marketplace. More information is available at **www.matillion.com**.

Snowflake Architecture

Snowflake is a fully relational, analytical, SQL-based, virtual data warehouse built from the ground up to take advantage of the full elasticity and scalability of the cloud. Snowflake delivers a database-as-a-service (DBaaS) platform to relieve users of the complexity and administrative burdens that plague traditional architectures. Furthermore, Snowflake was built with a new, unique architecture called "multi-cluster shared data."

Snowflake can give your company the flexibility and agility to meet changing data needs. Flexible cloud storage allows you to store nearly unlimited amounts of structured and semi-structured data in a single location, consolidating your disparate data sources. Compute nodes, called "virtual warehouses" execute queries and perform transformations on your data. These compute nodes can be created at any time using either SQL commands or the Snowflake UI. This means your virtual warehouse is scalable, allowing your business to respond to growing data needs, without additional procurement or managerial overhead.

If you have different workloads with different needs, you can size your warehouses to fit your current need. You can even create "multi-cluster warehouses" that scale automatically to accommodate the number of concurrent queries. Best of all, you can turn off any of the virtual warehouses at any time, so you pay only for what you use.

On top of its scalable storage and compute platform, Snowflake handles optimization, security, and availability for your business and provides many other overhead-reducing benefits. This makes it a fully managed solution. Lastly, you can move real-time data, at nearly unlimited scales. With Snowflake Data Sharing, data can be simply shared with another Snowflake account.

CHAPTER 2

Snowflake Virtual Warehousing

CHAPTER 2

Snowflake Virtual Warehousing

In Snowflake, a virtual warehouse, often referred to simply as a “warehouse,” is a cluster of compute resources. It provides necessary resources—such as CPU, memory, and temporary storage — to perform operations in a Snowflake session:

Perform the following actions in Snowflake:

- Executing SQL SELECT statements that require compute resources (for example, retrieving rows from tables and views)
- Loading data into tables (COPY INTO table)
- Performing DML operations (DELETE/INSERT/UPDATE)
- Unloading data from tables (COPY INTO location)

2.1 Virtual Warehousing Sizing

The size of a warehouse can impact the amount of time required to execute queries submitted to the warehouse, particularly for larger, more complex queries. In general, query performance scales linearly with warehouse size, because additional compute resources are provisioned with each size increase.

Virtual warehouses come in various **sizes**: X-Small, Small, Medium, Large, X-Large, 2X-Large, and so on. The size specifies the number of servers that comprise each cluster in a warehouse.

Unlike traditional systems, you are not locked into a specific size. You have the flexibility to change the size of your virtual warehouse at any time: manually via the Snowflake web interface or by using the **ALTER WAREHOUSE** command.

Also, bigger is not always better. While a larger warehouse places a lot of compute resources at your disposal, depending on the size and distribution of your data, a medium-sized warehouse may suffice. Try different sizing options to see what best suits your requirements.

See **Warehouse Considerations** in the Snowflake documentation for more advice about sizing.

2.2 Single vs. Multiple Warehouses

Besides scaling a warehouse (up/down), you may also consider creating virtual warehouses of different sizes and then using whichever one is more appropriate for the task at hand.

For example, you may be loading data from two sets of files: one that is just a few thousand rows and another with millions of rows. Instead of resizing a single, small warehouse to handle the larger files, you may create a separate large warehouse and use that. This would free up your small warehouse to do other relevant tasks, and it would also provide the benefit of having rightly sized warehouses handling your loads in parallel.

This can be especially useful when you load data, and it enables faster parallel loads.

Also, you can use the **Auto-Suspend and Auto-Resume** features to save costs.

Further Reading:

- **Overview of Virtual Warehouses**
- **Warehouse Considerations**
- **Understanding Snowflake Credit and Storage Usage**
- **Multi-cluster Warehouses**

CHAPTER 3

Accessing Snowflake

CHAPTER 3

Accessing Snowflake

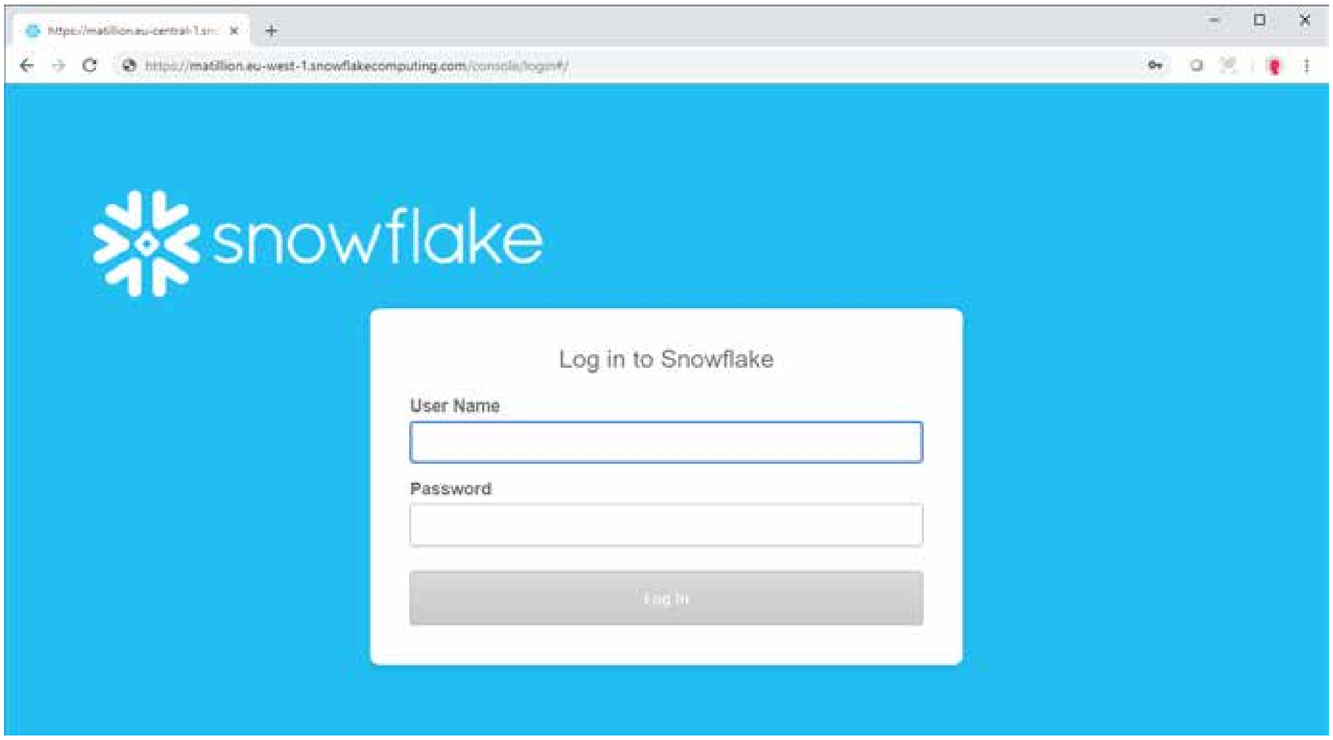
Now that you've had a glimpse under the hood of Snowflake, let's look at the different ways you can access and start using Snowflake. Snowflake allows users to interact with it in a number of ways. This chapter explores some of the options available for connecting to your Snowflake account.

See **Snowflake documentation** for a list of all available access options and further detail on each.

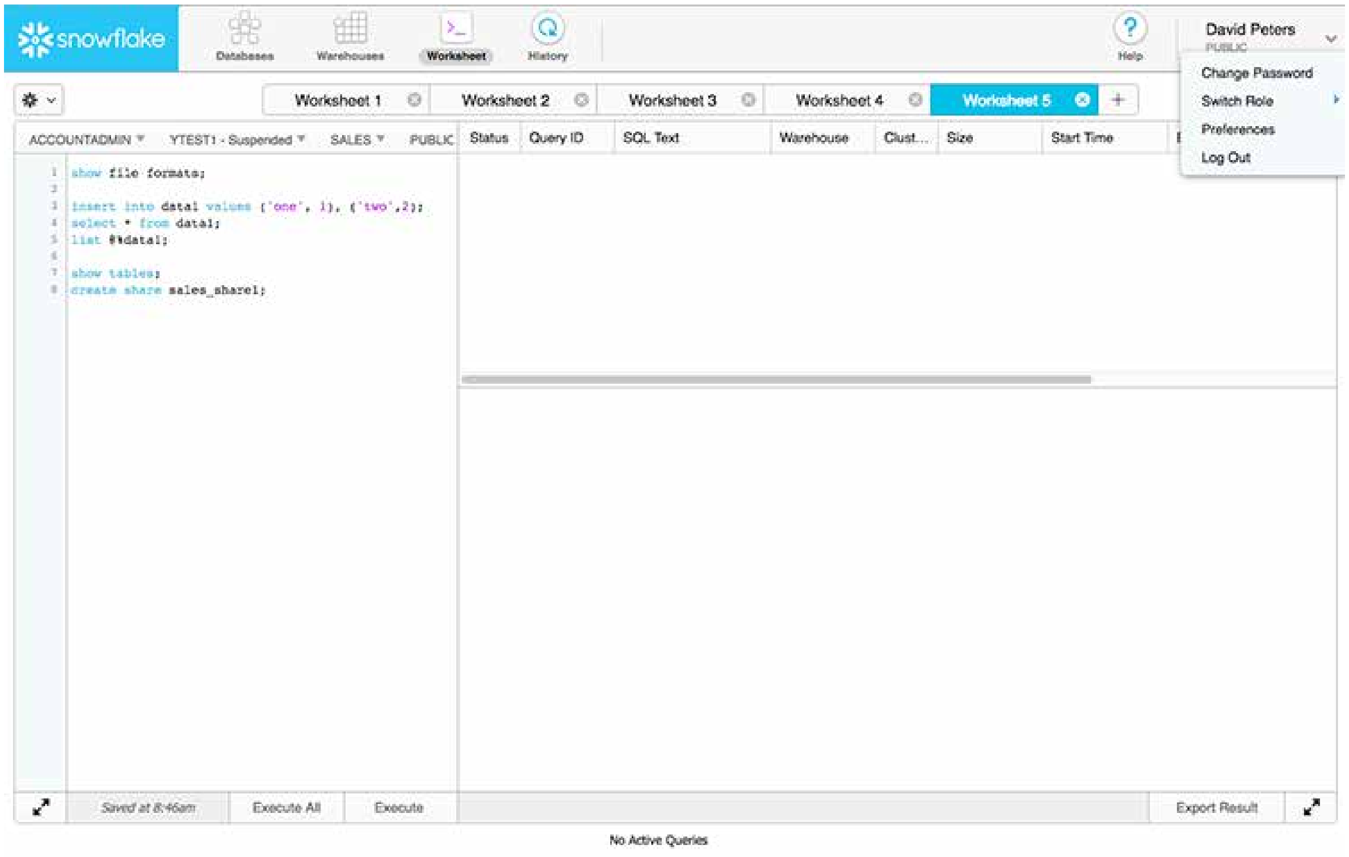
3.1 Snowflake Web Interface

Snowflake's web interface is a powerful and easy-to-use platform for accessing your Snowflake account and the data you've loaded there. This is the default method for accessing Snowflake. Use the following URL in any **supported browser** to access your account using the web interface. For more information on logging in, see **Logging into Snowflake**.

https://**<account_name>**.**<region_id>**.snowflakecomputing.com?**<connection_params>**


https://matillion.eu-west-1.snowflakecomputing.com/console/login#/
snowflake
Log in to Snowflake
User Name
Password
Log In

Once you login, you will be able to manage your databases and warehouses, execute DDL/DML statements using worksheets, review query history, and much more. The screenahot shows the Worksheet page.



```
show file formats;

insert into data1 values ('one', 1), ('two',2);
select * from data1;
list @%data1;

show tables;
create share sales_share1;
```

Check out Snowflake's the web interface tour for more details on working with Snowflake.

3.2 SnowSQL: Snowflake's Command-Line Interface (CLI)

If you are a script junkie, you'll love SnowSQL.

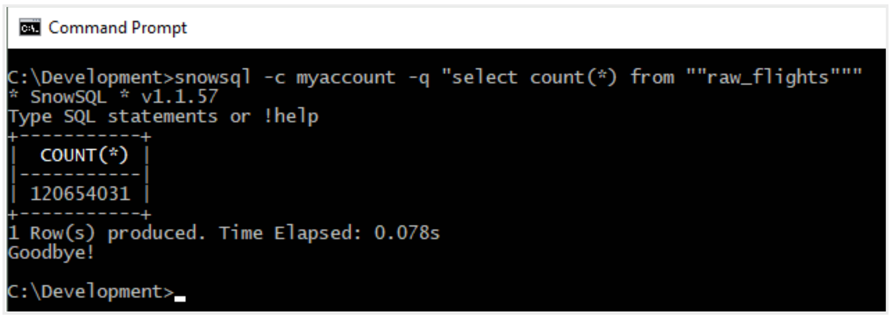
SnowSQL is a modern CLI that allows users to execute SQL queries, perform all DDL and DML operations, including loading and unloading data into and out of Snowflake—and perform many other tasks. SnowSQL may be used to to access your Snowflake database from the command line quickly and, if required, automate operations by running scripts.

See **Installing SnowSQL** for download and installation instructions.

HELPFUL HINT:

Use SnowSQL for writing and running scripts in Snowflake or for automating your data load and other processes.

SnowSQL (that is, the snowsql executable) can be run as an interactive shell or in batch mode. Here's an example of running a simple query where results are printed to stdout (the console). Note that the login credentials represented in the example command by myaccount are stored in the [connections] section of a configuration file.



```
C:\Development>snowsql -c myaccount -q "select count(*) from ""raw_flights"""
* SnowSQL * v1.1.57
Type SQL statements or !help
+-----------+
|  COUNT(*) |
|-----------|
| 120654031 |
+-----------+
1 Row(s) produced. Time Elapsed: 0.078s
Goodbye!

C:\Development>
```

Here's another example that executesascriptstoredinalocalfile (**input_script.sql**) and stores the results in a local file.

Here, a username and password are used instead of stored credentials.

```
snowsql -a abc123 -u jsmith -f //tmp/input_script.sql -o output_file=//tmp/output.csv -o quiet=true -o friendly=false -o header=false -o output_format=csv
```

You may use the **PUT command** to upload local files into an internal stage and the **GET command** to download files from an internal stage to local disk/system. Read more about internal and external stages in the Ch 4: Loading Data.

For more details, see the **SnowSQL user guide**.

OTHER DATA QUERYING AND MANAGEMENT OPTIONS

You may want to query Snowflake from your favorite SQL client or from a reporting or dashboarding tool. If you are a software developer, you may want to access or manage your data in Snowflake using your favorite programming language.

Snowflake provides various drivers or programmatic interfaces, some of which are listed below:

- **Snowflake connector for Python**
- **Snowflake connector for Apache Spark**
- **JDBC driver**
- **Node.js driver**
- **Go Snowflake driver** (interface for developing applications using 'Go' programming language)
- **.NET driver**
- **ODBC driver**

NOTE: USING PROGRAMMATIC INTERFACES

Download the appropriate driver, configure it in your favorite tool or development environment, and start working with your data. See **Snowflake's documentation** for detail.

CHAPTER 4

Loading Data

CHAPTER 4

Loading Data

To start fully benefiting from the power of Snowflake, you'll need to load all your relevant business data into Snowflake. There are several options for loading data into Snowflake tables:

- Bulk load data
- Use Snowpipe to continuously load data
- Load data using the web interface
- Use custom/vendor applications

These options are reviewed in detail below. Choose a method that suits your use case.

With **Matillion ETL for Snowflake** you can also take advantage of components developed to streamline efforts, such as the built-in scheduler to ensure your Snowflake tables are all updated at convenient time intervals.

4.1 Bulk Loading Data

All data platforms provide means to load data in bulk, and files have typically been the medium of choice. Bulk loading data is a fast and cost-effective method for populating your Snowflake warehouse.

You can bulk load data from files into tables in Snowflake using the **COPY INTO table** command. You may execute a COPY command from the Snowflake web interface, from a SnowSQL prompt, or from your favorite programming language by using the appropriate driver, as discussed earlier in the Other Data Querying and Management Options section.

1. Check that the files you intend to load are of a supported format (see below).
2. **Compress files** for faster loading.
3. Check that your target table already exists (use **CREATE TABLE** to create a table).
4. Ensure that the files are already staged in an internal or external stage.
5. Review and (where possible) adhere to Best Practices.

File types supported by the bulk loader:

- Any flat, delimited plain-text format (comma-separated values, tab-separated values, etc.)
- Semi-structured data in JSON, Avro, ORC, Parquet, or XML format (XML is currently supported as a preview feature)

STAGING YOUR DATA

A stage in Snowflake is a (named) location where you store data files before loading them. Use **CREATE STAGE** command to create one.

Snowflake supports internal and external stages, which in turn, can be permanent or temporary. A temporary stage gets dropped automatically at the end of a session.

Internal Stage

An internal stage stores data within your Snowflake environment. Files can be uploaded into an internal stage using SnowSQL and the **PUT command**, or they can be loaded programmatically using one of the drivers.

Loading data via an internal stage:

Step 1: Upload one or more data files to a Snowflake stage (a named internal stage, a stage for a specified table, or a stage for the current user) using the PUT command.

Step 2: Use the **COPY INTO table** command to load the contents of the staged file(s) into a Snowflake table.

When should you use an internal stage?

An internal stage is intended for temporarily holding data files before loading them into tables or downloading to a local system. You will incur standard data storage costs. You should monitor the data files and remove them from the stages once you have loaded the data and you no longer need the files.

Internal Staging Example

Let’s look at an example of using the COPY INTO command to load data from files to tables in Snowflake.

Loading from an internal stage

Assume that you uploaded some files to an internal stage using SnowSQL and the PUT command.

Here are some examples of loading a file called 1.csv from various internal stages—a named stage (@mystage), a table stage (%mytable), and a user stage (~):

```
copy into mytable from ‘@mystage/path 1/file 1.csv’;
copy into mytable from ‘@%mytable/path 1/file 1.csv’;
copy into mytable from ‘@~/path 1/file 1.csv’;
```

External Stage

An external stage stages the data in a location outside of Snowflake. This is usually within Amazon Simple Storage Service (S3) or Microsoft Azure Blob Storage Containers. External stages can be named entities in Snowflake or references to a location or bucket in the relevant service (for example, s3://bucketname/path-to-file).

Accessing an external stage requires credentials. These can be passed via the CREDENTIALS parameter of the **COPY INTO table** command. Alternatively, the CREATE STAGE command allows you to specify the credentials required to access an external stage. Snowflake would automatically use the stored-credentials if they are not passed into the COPY INTO command when loading from this stage. However, many organisations frequently rotate keys for added security which may invalidate the stored key and may introduce additional overhead when storing keys within Snowflake.

Loading data via an external stage:

Step 1: Use the upload interfaces or utilities provided by Amazon or Microsoft to stage your files externally.

Step 2: Use the COPY INTO table command to load the contents of the staged file(s) into a Snowflake table.

When should you use an external stage?

External stages may also double as an additional backup for your data or as a location from where other processes or consumers may consume data in the data files.

Costs related to using an external stage can be found on the bill from the respective vendor. You may use any tools at your disposal to upload files to or download files from an external stage.

External Staging Examples

Let's look at some examples of using the COPY INTO command to load data from files to tables in Snowflake.

Loading data from a file in a named external stage

```
copy into mytable
from '@myextstage/some folder/file 1.csv';
```

Loading from an external stage (Amazon S3)

Note that credentials are passed as part of the command.

```
copy into mytable
    from ‘s3://mybucket 1/prefix 1/file 1.csv’
    credentials = (aws_key_id=’xxxx’ aws_secret_key=’xxxxx’
aws_token=’xxxxxx’);
```

Loading from an external stage (Microsoft Azure)

```
copy into mytable
from ‘azure://myaccount.blob.core.windows.net/my
load/encrypted_files/file 1.csv’;
```

Further Reading:

- **Bulk Loading from a Local File System Using COPY**
- **Bulk Loading from Amazon S3 Using COPY**
- **Bulk Loading from Microsoft Azure Using COPY**

4.2 Using Snowpipe to Load Data

Snowpipe is a service from Snowflake that can be used to load data from files as soon as they are available in a Stage (internal or named-external). The service provides Snowflake-managed compute resources and exposes a set of REST endpoints that can be invoked to initiate loads (COPY). in this way,

Snowpipe provides a serverless data loading option that manages compute capacity on your behalf. Snowflake also provides Java and Python APIs that simplify working with the Snowpipe REST API. This is a great option if you are a programmer building tools or implementing workflows for ingesting data files into Snowflake.

Users can build tools that initiate loads by invoking a REST endpoint; without managing a virtual warehouse or manually running a COPY command every time a file needs to be loaded. The service is managed by Snowflake and it automatically scales up or down based on the load on the Snowpipe service.

DID YOU KNOW...
Snowflake allows you to query the data in files in an internal or external stage? See following for more information:

- **Querying Staged Data**
- **Querying Metadata for Staged Files**

Snowpipe Billing

Snowpipe is billed based on compute credits used per second. Snowflake tracks the resource consumption of loads for all pipes in an account, with per-second/per-core granularity, as Snowpipe actively queues and processes data files. "Per-core" refers to the physical CPU cores in a compute server. You will see a new line item (SNOWPIPE) on your Snowflake bill. Go to the "Billings and Usage" page in the Snowflake web interface to get a detailed breakdown of Snowpipe usage. You can break usage information down to a specific date and hour as well as to the pipe that contributed to your Snowpipe usage.

Central to Snowpipe is the concept of a "pipe". A Snowpipe pipe is a wrapper around the COPY command that is used to load a file into the target table in Snowflake. A few of the options from the COPY command are not supported. See **CREATE PIPE** for more information.

Snowpipe Benefits

- ✓ **Instant insights.** Snowpipe immediately provides up-to-date relevant data to all your business users to access without contention.
- ✓ **Cost-effectiveness.** You pay only for the per-second compute used to load data rather than the costs for running a warehouse continuously or by the hour.
- ✓ **Ease-of-use.** You can point Snowpipe at an S3 bucket from within the Snowflake UI and data will automatically load asynchronously as it arrives.
- ✓ **Flexibility.** Technical resources can interface directly with the programmatic REST API, using Java and Python SDKs to enable highly customized loading use cases.
- ✓ **Zero management.** Snowpipe automatically provisions the correct capacity for the data being loaded. There are no servers or management to worry about.

- ★ Cost
- ★ Performance

Read more about how you can **streamline data loading with Snowpipe**.

LOAD FILES BY INVOKING A REST API

Let's look at how to explicitly invoke Snowflake via the REST API to load files using the Snowpipe service. In this example, we will copy a file to an S3 staging area represented by a named external stage in snowflake and then invoke the Snowpipe REST endpoint to ingest the file.

We are ingesting a JSON file which will be loaded into a Variant column in a table.

Configuring Snowpipe

You may notice that Steps 1, 2, and 3 on the next page are exactly the same as in the previous section except that the pipe is created without auto_ingest=true.

Step 1: Create a named stage in Snowflake.

```
create or replace stage mydb.public.snowstage
 url='s3://snowpipe-demo/'
 credentials = (AWS_KEY_ID = '...' AWS_SECRET_KEY = '...' );
```

Step 2: Create a table.

```
create table mydb.public.mydatatable(jsontext variant);
```

Step 3: Create a pipe.

Create a new pipe in the system for defining the "COPY INTO <table>" statement used by Snowpipe to load data from an ingestion queue into tables. For more information, see **CREATE PIPE**.

```
create or replace pipe mydb.public.mysnowpipe as
    copy into mydb.public.mydatatable
      from @mydb.public.snowstage
      file_format = (type = 'JSON');
```

Step 4: Configure security (per user).

Users cannot authenticate with the REST API using their Snowflake login credentials. Generate a public-private key pair for making calls to the Snowpipe REST endpoints. In addition, grant sufficient privileges on the objects for the data load, for example, the target database, schema, and table; the stage object; and the pipe.

For more information on generating a compliant key pair and associating it with the relevant user, see **Configure Security** in the Snowflake documentation. Also refer to the relevant SDK documentation on key-based authentication.

Invoking the REST API

Once you have configured Snowpipe, upload files to a stage and submit a request to the **insertFiles** REST endpoint to load the staged data files. This is a POST operation and the parameters include paths to the files to be loaded.

Java and Python examples for invoking this endpoint are available in the **Snowflake documentation**.

Further Reading:

- **Loading Continuously Using Snowpipe**
- **Understanding Billing for Snowpipe Usage**
- **How Snowpipe Streamlines Your Continuous Data Loading and Your Business**
- **Video: Automatically Ingesting Streaming Data with Snowpipe**
- **Video: Load Data Fast, Analyze Even Faster**

4.3 Loading Data Using the Web Interface

You may use the Snowflake web interface to issue DML commands such as INSERT and UPDATE or to load data files up to 50MB in size. Both of these options are good for ad hoc data loads and when you are working with small data sets.

The Snowflake web interface provides a simple wizard for loading files into tables. The wizard uploads files to an internal stage (via PUT), and then it uses a COPY command to load data into the table. See the **documentation** for more information on using the web interface to upload files and load data.

4.4 Using Custom/Vendor Applications

You can use your favorite programming language to build your own applications to access and leverage the Snowflake platform. Snowflake provides connectors and drivers for popular languages that can be used to build custom applications.

SnowSQL is a good example of this. It uses the **Python connector** provided by Snowflake to provide an effective CLI.

We can't replace time that you've lost … but we can give you more of it in the future.

Launch Matillion ETL for Snowflake in five minutes from AWS Marketplace or Azure Marketplace.

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- ✓ In-depth integration with AWS and Azure services, designed for the cloud, no compromises
- ✓ Functionality designed to amplify the benefits of Snowflake (semi-structured data support and alter warehouse capabilities)

Find out more at
www.matillion.com/etl-for-snowflake

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CHAPTER 5

Exporting Data

CHAPTER 5

Exporting Data

There are several options for exporting (also called unloading) data:

- Bulk exporting data from a table, a view, or the result of a SELECT statement into files in an internal or external stage
- Using custom code or a client to query a table or a view and then writing the results to one or more files in a local file system or any other target

These options are reviewed in detail below. Choose a method that suits your use case.

5.1 Exporting Data to a Stage

Use the **COPY INTO location** command to perform a bulk export of data (also called data unloading) from a table, a view, or the result of a SELECT statement into files in an internal or external stage (Amazon S3 or Microsoft Azure).

Files exported to an internal stage may be downloaded to a local file system using SnowSQL and the GET command. Files exported to an external stage may be accessed/downloaded via interfaces provided by the respective platform (Amazon S3 or Microsoft Azure).

At the time of this writing, Snowflake can export data as single-character delimited files (CSV, TSV, etc.) or as JSON. Exports can be optionally compressed and are always transparently encrypted when written to internal stages. Exports to external stages can be optionally encrypted as well.

Sign up for a demonstration of **Matillion ETL for Snowflake** and an opportunity to speak to a Solution Architect about your unique use case.

Exporting Data to a Stage Examples

Let's look at some examples of how to export the result of a query into a stage.

Exporting to an internal stage

The following command is an example of exporting the result of a SELECT statement to an internal stage named my_stage, to files that reside in a folder named result and whose names are prefixed with data_, with a file format object named vsv, and using gzip compression. You can then load data from these files into other tables or download the files to your local disk using the SnowSQL **GET** command.

```
copy into @my_stage/result/data_ from (select * from orders)
  file_format=(format_name='vsv' compression='gzip');
```

Exporting to an external stage (Amazon S3)

The following command is an example of exporting from a table named mytable to CSV-formatted files in Amazon S3 by specifying the credentials* for the desired S3 bucket.

```
copy into s3://mybucket/unload/ from mytable
  credentials = (aws_key_id='xxxx' aws_secret_key='xxxxx' aws_token='xxxxxx')
  file_format = csv;
```

Exporting to an external stage (Microsoft Azure)

The following command is an example of exporting from a table named mytable to CSV-formatted files in Microsoft Azure. The command specifies credentials for the targeted Blob storage bucket.

```
copy into azure://myaccount.blob.core.windows.net/unload/
  from mytable
  credentials = (aws_key_id='xxxx' aws_secret_key='xxxxx' aws_token='xxxxxx')
  file_format = csv;
```

NOTE

You can avoid specifying credentials by creating named external stages in advance using the **CREATE STAGE** command. To do this, you specify the external stage location and optionally the credentials required to access this location.

5.2 Exporting Data to a Local File System or Other Target

You may also use your favorite programming language or client to query a table or a view and then write the results to one or more files in a local file system or any other target. This approach may be slower than using the "COPY INTO <location>" command, because data needs to travel to the local machine running your code or client, which then writes to the file system. This approach may not noticeably affect exports for small tables but it will affect exports for larger tables. COPY INTO also benefits from compression when data is exported, which results in reduced network traffic and faster data movement.

You can also issue a "COPY INTO <location>" command using programming interfaces, download the files from the appropriate stage, and then access the data. This may be appropriate if you intend to download large data sets to local files.

Further Reading:

- **Data Unloading**

CHAPTER 6

Storage and Compute Costs

CHAPTER 6

Storage and Compute Costs

This eBook has described methods and best practices for optimizing your usage of Snowflake to control costs. This chapter discusses how billing works, recaps methods for cost optimization, and describes how you can track and control costs. The following information is based on **Snowflake's pricing guide**.

Snowflake's unique architecture allows for a clear separation between your storage and compute resources. This allows Snowflake's pricing model to be much simpler and to include only two items:

- The cost of storage used
- The cost of compute resources (implemented as virtual warehouses) consumed

Snowflake credits are used to pay for the processing time used by each virtual warehouse.

6.1 Storage Costs

All customers are charged a monthly fee for the data they store in Snowflake. Storage cost is measured using the average amount of storage used per month for all customer data consumed or stored in Snowflake, after compression.

Note that features such as, **Time Travel and Fail-safe** may increase costs associated with storage. This is because the data is not immediately deleted, but instead the data is held in reserve to support these features. Also be aware that files in internal stages and features such as Snowflake Data Sharing, also known as the Data Sharehouse™, and cloning will also affect your storage costs.

6.2 Virtual Warehouse (Compute) Costs

Snowflake charges you only when your warehouse is in a "started" state. There is no charge when it is in a "suspended" state. This allows you to create multiple warehouse definitions and suspend them to prevent you from being billed for them. You must issue an ALTER WAREHOUSE RESUME command before you intend to use a suspended virtual warehouse.

There is a linear relationship between the number of servers in a warehouse cluster and the number of credits the cluster consumes. Snowflake uses per-second billing (with a 60-second minimum each time the warehouse starts), so warehouses are billed only for the credits they actually consume. For more information, see **Understanding Snowflake Credit and Storage**.

You can profile a warehouse to understand its usage and credits spent. To profile a warehouse, use the **WAREHOUSE_LOAD_HISTORY** and **WAREHOUSE_METERING_HISTORY** functions. The information provided by these functions can tell you if scaling up a warehouse would benefit any existing loads. Conversely, you may also be able to identify underutilized warehouses and consolidate them, if appropriate. Read more about profiling **here**.

Once you understand how best to use your virtual warehouse for your data needs you can implement best practices for performance and cost efficiency.

NOTE:
The Snowflake Edition your business chooses will impact billing.

- **On Demand:** Usage-based pricing with no long-term licensing requirements
- **Capacity:** Discounted pricing based on an upfront capacity commitment

OTHER FACTORS

The following factors influence the unit costs for the credits you use and the data storage you use:

- Whether you have a Snowflake On Demand account or a Capacity account
- The **Region** in which you create your Snowflake account
- The **Snowflake Edition** that your organization chooses

Most Snowflake customers use Snowflake On Demand initially to develop and test the application workload in order to gain real-world experience that enables them to estimate their monthly costs. When the application workload is understood, customers can then purchase an appropriately sized capacity.

Further Reading:

- **Snowflake's Pricing Guide**
- **How Usage-Based Pricing Delivers a Budget-Friendly Cloud Data Warehouse**

CHAPTER 7

Best Practices

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Best Practices

This chapter lists best practices for optimizing Snowflake. These best practices fit many use cases, but there are some circumstances where they may not apply. Your understanding of Snowflake's architecture should help you determine what is best for your particular use case.

IMPROVING LOAD PERFORMANCE

- ✓ Use bulk loading to get the data into tables in Snowflake.
- ✓ Consider splitting large data files so the load can be efficiently distributed across servers in a cluster.
- ✓ Delete from internal stages files that are no longer needed. You may notice an improvement performance in addition to saving on costs.
- ✓ Isolate load and transform jobs from queries to prevent resource contention. Dedicate separate warehouses for loading and querying operations to optimize performance for each.
- ✓ Leverage the scalable compute layer to do the bulk of the data processing.
- ✓ Consider using Snowpipe in micro-batching scenarios.

★ Cost

★ Performance

IMPROVING QUERY PERFORMANCE

- ✓ Consider implementing clustering keys for large tables.
- ✓ Try to execute relatively homogeneous queries (size, complexity, data sets, etc.) on the same warehouse. Your query may benefit from cached results from a previous execution.
- ✓ Use separate warehouses for your queries and load tasks. This will facilitate targeted provisioning of warehouses and avoid any resource contention between dissimilar operations.

★ Cost

★ Performance

MANAGING A VIRTUAL WAREHOUSE

- ✓ Experiment with different warehouse sizes before deciding on the size that suits your requirements. Remember, you are not tied into a particular size.
- ✓ Use **auto-suspend and auto-resume** to save costs. Depending on your workloads, these may save costs as far as loads are concerned. This may not be as good for queries, though; see the next item below.
- ✓ Understand the impact of caching on queries. Warehouses that use auto-suspend and auto-resume may not benefit from caching. Consider the trade-off between saving credits by suspending a warehouse versus maintaining the cache of data from previous queries for quicker response times.
- ✓ Warehouse suspension and resumption takes time, which is noticeable for larger warehouses. Keep the warehouse running if you need an immediate response.

★ Cost

★ Performance

Conclusion

CONCLUSION

We hope you enjoyed this eBook and that you have found some helpful tips on how to make the most of your Snowflake database. Implementing the best practices and optimizations described in this eBook should help you enhance big data analytics performance and reduce your Snowflake costs.

With Snowflake, you can spend fewer resources on managing database overhead and focus on what's really important: answering your organization's most pressing business questions.

About Matillion

Matillion is an industry-leading data transformation solution for cloud data warehouses. Delivering a true end-to-end data transformation solution (not just data prep or movement from one location to another), Matillion provides an instant-on experience to get you up and running in just a few clicks, a pay-as-you-go billing model to cut out lengthy procurement processes, and an intuitive user interface to minimize technical pain and speed up time to results. Matillion is available globally for Snowflake on **AWS Marketplace** and **Microsoft Azure Marketplace**.

More information is available at **www.matillion.com**.

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Dayna Shoemaker, Product Marketing Manager

Speed. Simplicity. Scalability.

Snowflake is revolutionizing how you share data in the cloud. We are revolutionizing how you use Snowflake.

- ✓ An instant-on purchase experience (via the AWS Marketplace or Azure Marketplace), to get you up and running in just a few click
- ✓ A pay-as-you-go billing model, to eliminate lengthy procurement processes
- ✓ An intuitive user interface, to minimize technical pain and speed up time-to-results

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See first-hand how you can consolidate and aggregate ALL your business' data on Snowflake.

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