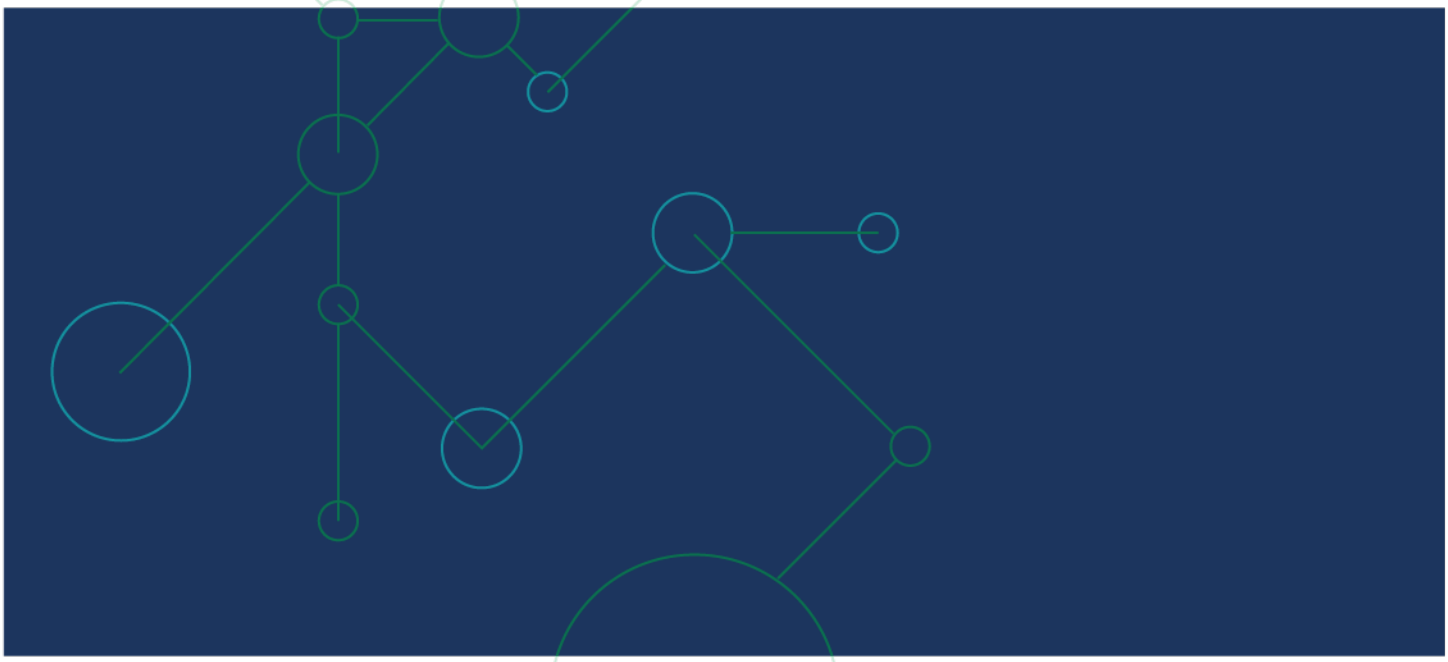
WHITE PAPER

Qlik Sense Best Practices Guide

David Freriks
Dalton Ruer
Partner Engineering - Qlik

Keith Smith
Partner Engineering - Snowflake Computing



Qlik

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Summary

Qlik and Snowflake make a powerful combination when deploying modernized data and analytics pipelines across an enterprise. Due to emerging technologies and urgency of data, there are many architectural avenues available when deploying Qlik and Snowflake together. This document will highlight and clarify the options and best practices and discuss high level concepts, practical applications, and help distinguish when to use which approach with Qlik and Snowflake.

This document will be updated as new capabilities emerge to both Snowflake and the Qlik Sense platform. This document also assumes a working knowledge of both Qlik and Snowflake technologies by the reader.

Introduction

Qlik Sense sets the benchmark for third-generation analytics platforms, empowering everyone in your organization to make data-driven decisions. Built on our unique Associative Engine, it supports a full range of users and use-cases across the life-cycle from data to insight: self-service analytics, interactive dashboards, conversational analytics, custom and embedded analytics, mobile analytics, reporting and alerting. It augments and enhances human intuition with AI-powered insight suggestions, automation, and natural language interaction. And Qlik Sense offers unmatched performance and governance, with the convenience of SaaS or on-premises deployment, or both

Qlik Sense is a complete data and analytics platform enabling users of all levels to explore data with agility and high performance. **Snowflake** is a cloud based,

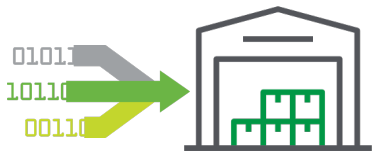
massively scalable platform that provides effective management of enterprise class data.

Qlik and Snowflake together provide a balance to optimize the “speed of thought” exploration capabilities when Qlik’s associative engine with its powerful search and AI capabilities is combined with Snowflake’s powerful and scalable database engine technology.

Blending the ideas “getting the data you need when you need it” and “getting the data how you need it” with two cutting edge technology platforms creates unique solutions that deliver enterprise analytics, reporting, dashboarding, and data science to the business.

Qlik & Snowflake

Accelerate Business Value with Real-time Data Integration and 3rd Generation BI



Get the data you need

- Continuous data ingestion
- Data Warehouse Automation
- Performance with scale

Uncover more insights

- Analytics for all
- Augmented Intelligence
- Smart data querying

Manage data intelligently

- Self-service catalog
- Flexible, rules-based governance
- Optimize Snowflake usage

Qlik Architecture

Qlik Sense sets the benchmark for third-generation analytics platforms,empowering everyone in your organization to make data-driven decisions. Built on our unique Associative Engine, it supports a full range of users and use-cases across the life-cycle from data to insight:self-service analytics, interactive dashboards, conversational analytics, custom and embedded analytics, mobile analytics, reporting and alerting. It augments and enhances human intuition with AI-powered insight suggestions, automation, and natural language interaction. Further, Qlik Sense unmatched performance and governance, with the convenience of SaaS or on-premises deployment. Qlik Sense consists of Qlik-managed cloud-based solutions: *Qlik SenseEnterprise SaaS* & *Qlik Sense Business*, and a customer-managed solution: *Qlik Sense Enterprise Client-Managed*.

THE ASSOCIATIVE DIFFERENCE®

Relational databases and queries were designed in the 1980s for transactional systems, not modern analytics. Query-based tools leave data behind and limit your users to restricted linear exploration, resulting in blind spots and lost opportunities.

Qlik Sense runs on the unique Qlik Associative Engine, enabling users of all skill levels to explore their data freely without limitations. The Qlik Associative Engine brings together unlimited combinations of data — both big and small — without leaving any data behind. It offers unprecedented freedom of exploration through interactive selection and search, instantly recalculating all analytics and revealing associations to your user in green (selected), white (associated), and gray (unrelated). By keeping all visualizations in context together and retaining both associated and unrelated values in the analysis, the Qlik Associative Engine helps your users discover hidden insights that query-based tools would miss.

The Qlik Associative Engine is purpose-built for highly scalable, dynamic calculation and association on massive data volumes for large numbers of users. This unique technology is our primary advantage, with more than 25 years of innovation and investment.

Associative, in-memory apps

Qlik couples in-memory data caching technology with an Associative Engine that lets you analyze and freely navigate data intuitively. In its second generation, the proven Qlik Associative Engine

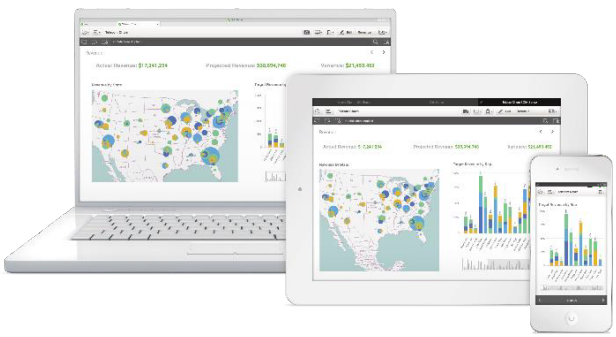
allows users to easily explore data and create visualizations based on data from multiple data sources simultaneously. These sources range from Excel® and Access® to databases such as Oracle® and SQL Server to big data sources such as Databricks®, Snowflake®, data lakes with S3, etc.

Qlik Sense uses columnar, in-memory storage. Unique entries are only stored once in-memory, and relationships among data elements are represented as pointers. This allows for significant data compression, more data in RAM, and faster response times for your users.

In some big data scenarios, data should remain at the source, which is why Qlik uses a built-in technique called On-Demand Application Generation. Data sources can be queried based on your users' selections, yet still provide an associative experience to your user. Qlik's Dynamic Views feature expands this capability further for the biggest data sources available.

User Interfaces

Access to the Qlik Sense Enterprise SaaS environment is through a zero-footprint web browser interface (known as the Qlik Sense Hub). The Qlik Sense web browser interface makes all aspects of development, drag-and-drop content creation, and consumption possible. Qlik Sense features a responsive design methodology to automatically display and resize visualizations with the appropriate layout

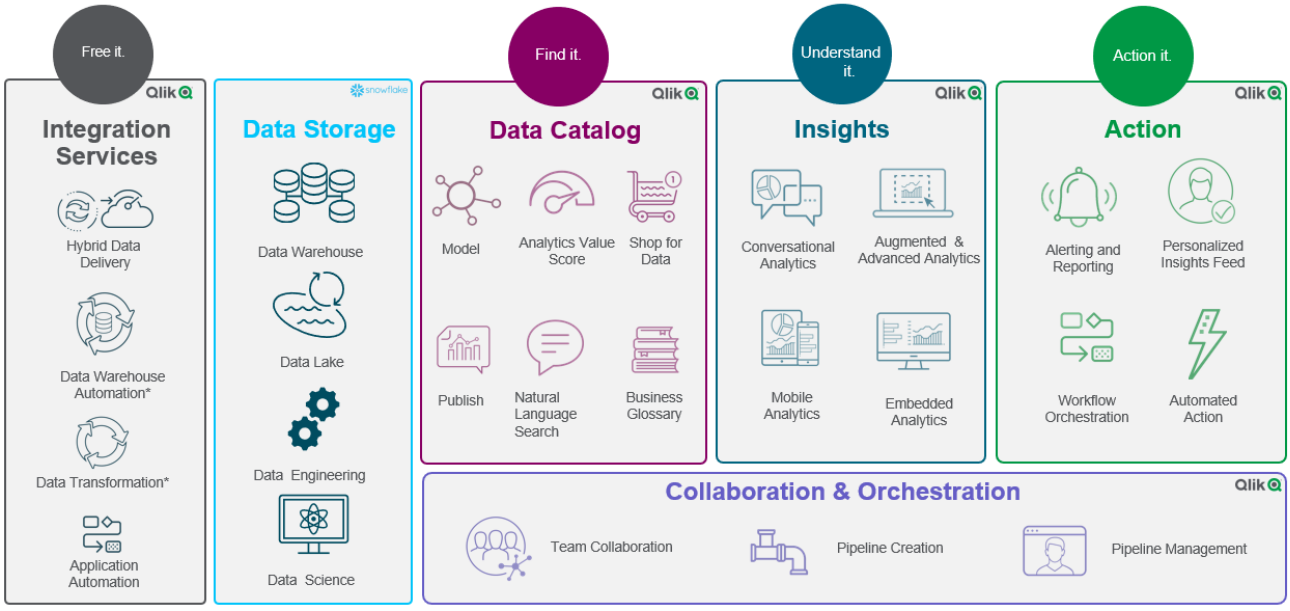


and information to fit the device — whether it is a browser on a laptop or desktop, tablet, or smartphone. Built with current standards of HTML5, CSS3, JavaScript®, and web sockets, Qlik Sense enables you to build and consume apps on any device.

In addition to the web-based interface, Qlik Sense supports conversational analytics which integrates with major chat platforms such as Slack and MS Teams and data alerting capabilities to allow users to subscribe to and be notified of key changes to their data.

A quick reference to the entire Qlik Platform including Data Integration capabilities, cataloging, and extending Qlik Sense showcases the power of our integrated suite for Snowflake.

Qlik's complete Data Integration and Analytics Pipeline with Snowflake Cloud Data Platform:



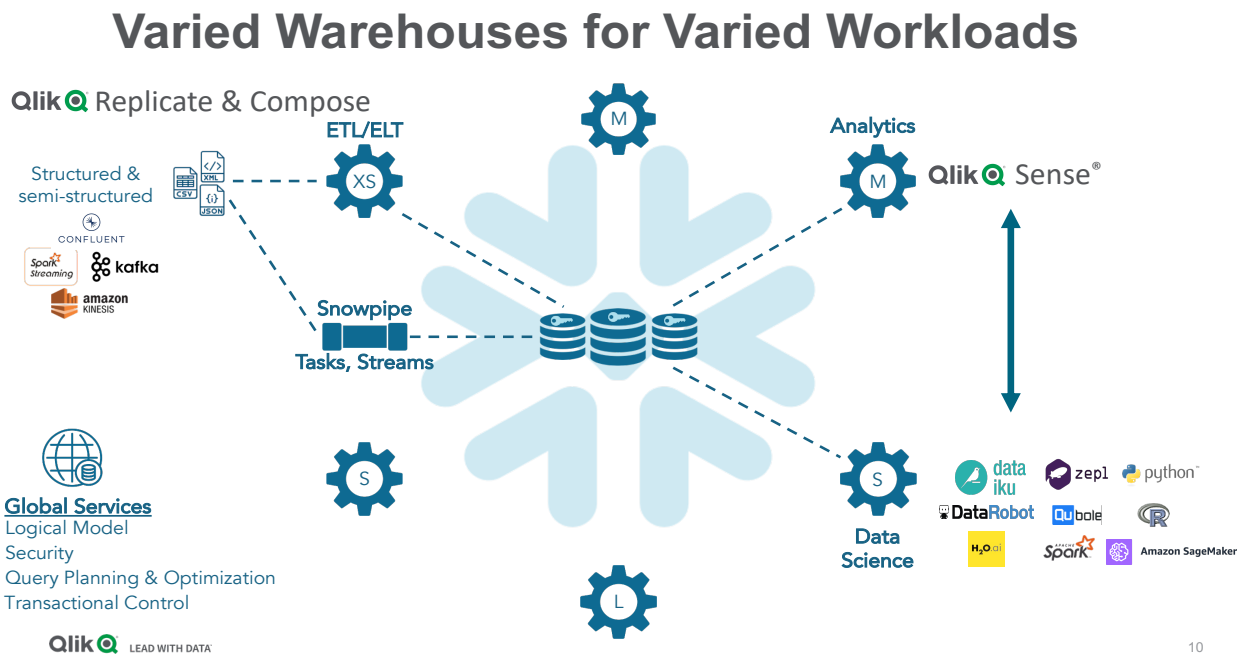
Snowflake Architecture

Snowflake Cloud Data Platform

Snowflake is a fully relational ANSI SQL platform that allows you to leverage the skills and tools your organization already uses. Updates, deletes, analytical functions, transactions, complex joins, and native support for semi-structured formats allow a customer full capability to make use of all of their enterprise data.

Snowflake eliminates the administration and management demands of traditional data warehouses and big data platforms. As a true data warehouse-as-a-service built for the cloud, the separation of compute and storage allows for minimal tuning on terabytes and even petabytes of information. With built-in performance, there's no infrastructure to manage or knobs to turn. Snowflake automatically handles infrastructure, optimization, availability, data protection and more so you can focus on using your data, not managing it.

Snowflake can support all of your business data, whether from traditional sources or newer machine-generated sources, without requiring cumbersome transformations and tradeoffs. Further, Snowflake's Data Marketplace allows you to access hundreds of partners and suppliers' data as well as 3rd party data that you be leveraged to enrich your data.



Snowflake's patented multi-cluster, shared data architecture separates storage and compute, making it possible to scale up and down on-the-fly without downtime or disruption. Automatically scale to support any amount of data, workloads and concurrent users and applications without requiring data movement, data marts or data copies.

Per Snowflake:

> *"Usage-based pricing for compute and storage means you only pay for the amount of data you store and the amount of compute processing you use. Say goodbye to upfront costs, over-provisioned systems or idle clusters consuming money."*

Snowflake Time Travel

Snowflake Time Travel enables accessing historical data (i.e., data that has been changed or deleted) at any point within a defined period. It serves as a powerful tool for performing the following tasks:

- Restoring data-related objects (tables, schemas, and databases) that might have been accidentally or intentionally deleted.
- Duplicating and backing up data from key points in the past.
- Analyzing data usage/manipulation over specified periods of time.

Querying Historical Data

When any DML operations are performed on a table, Snowflake retains previous versions of the table data for a defined period of time. This enables querying earlier versions of the data using the AT | BEFORE clause.

This clause supports querying data either exactly at or immediately preceding a specified point in the table's history within the retention period. The specified point can be time-based (e.g. a timestamp or time offset from the present) or it can be the ID for a completed statement (e.g. SELECT or INSERT).

For example:

- The following query selects historical data from a table as of the date and time represented by the specified timestamp:
  ```
  select * from my_table at(timestamp => 'Mon, 01 May 2015 16:20:00 -0700'::timestamp_tz);
  ```

- The following query selects historical data from a table as of 5 minutes ago:
  ```
  select * from my_table at(offset => -60*5);
  ```

Snowflake Semi-Structured Data

Data can come in multiple forms from numerous sources, including an ever-expanding amount of machine-generated data from applications, sensors, mobile devices, etc. To support these new types of data, semi-structured data formats, such as JSON, Avro, ORC, Parquet, and XML, with their support for flexible schemas, have become popular standards for transporting and storing data.

Snowflake provides native support for semi-structured data, including:

- Flexible-schema data types for loading semi-structured data without transformation.
- Automatic conversion of data to optimized internal storage format.
- Database optimization for fast and efficient SQL querying.

The VARIANT data type can be leveraged to represent arbitrary data structures which can be used to import and operate on semi-structured data. Snowflake stores these types internally in an efficient compressed columnar binary representation of the documents for better performance and efficiency. Snowflake's optimization for storage of these data types is completely transparent and produces no user-visible changes in semantics.

More details on traversing semi-structured data can be found here.

High Level Qlik & Snowflake Integration Options

Qlik and Snowflake offer a variety of integration capabilities suited for specific scenarios to maximize resources, maintain performance, and fulfill the business requirements across the organization. The number of concurrent users, data refresh frequencies, performance, user experience, and total cost will all contribute to deciding which integration options to take advantage of.

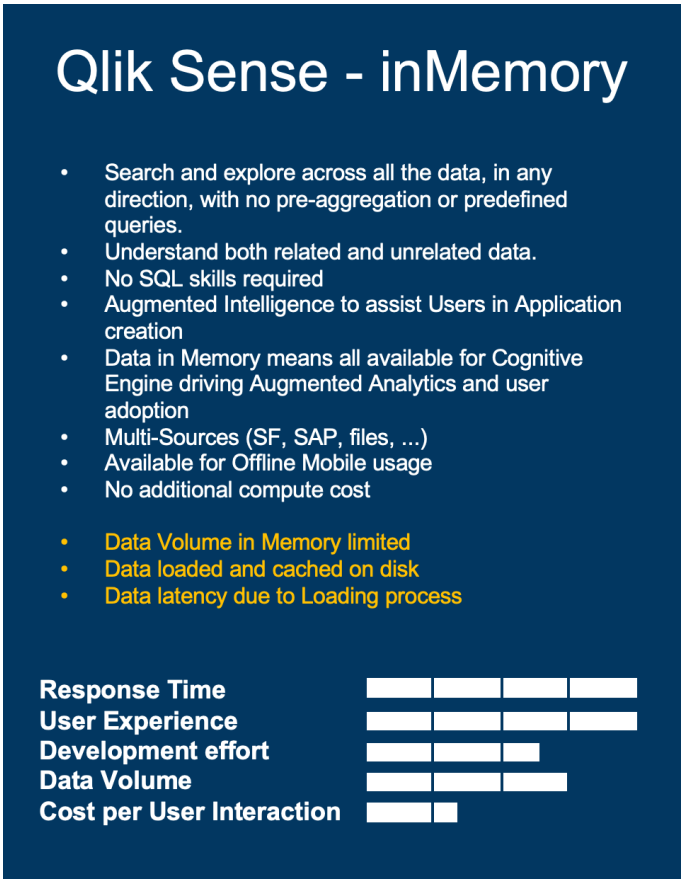
Qlik provides several ways to load and consume data from Snowflake. The table below describes each integration configuration, feel free to use this as a reference guide.

Integration Option	Method	Use Case
In-Memory	Full / Incremental Load (QVD)	Most common and best performing. Batch reloads leveraging a QVD for incremental updates and optimized for analytics engine.
In-Memory + Snowflake	Full / Incremental Load (Time Travel)	Snowflake optimized reload – especially useful when data is needing to be compared current vs historical state and/or for incremental reloads
In-Memory + Snowflake	Partial/Merge Load (Time Travel)	Situations where data is needed in near-time, or data is needing to be compared current vs historical state
On-Demand	ODAG	Structured Drill to Detail for access to large data volumes
On-Demand	Dynamic Views	Supporting details on demand inside existing app as a chart(s)
In-Mem + Live1	In-Mem + Live Query	Realtime data mixed with in-memory data querying against Snowflake directly (3rd Party)
Live1	Live Query Only	Only live data querying against Snowflake directly
Direct Query	Direct Query Engine	Live SQL push down queries against Snowflake using Qlik SaaS (NEW – July 2022)

[1] Available at this time for client-managed only through partner offering such as the Stretch LiveQuery Connector for Snowflake.

Summary of Qlik & Snowflake Usage Options

In-Memory options for how to load data into Qlik Sense:



Full reload every time on a schedule:

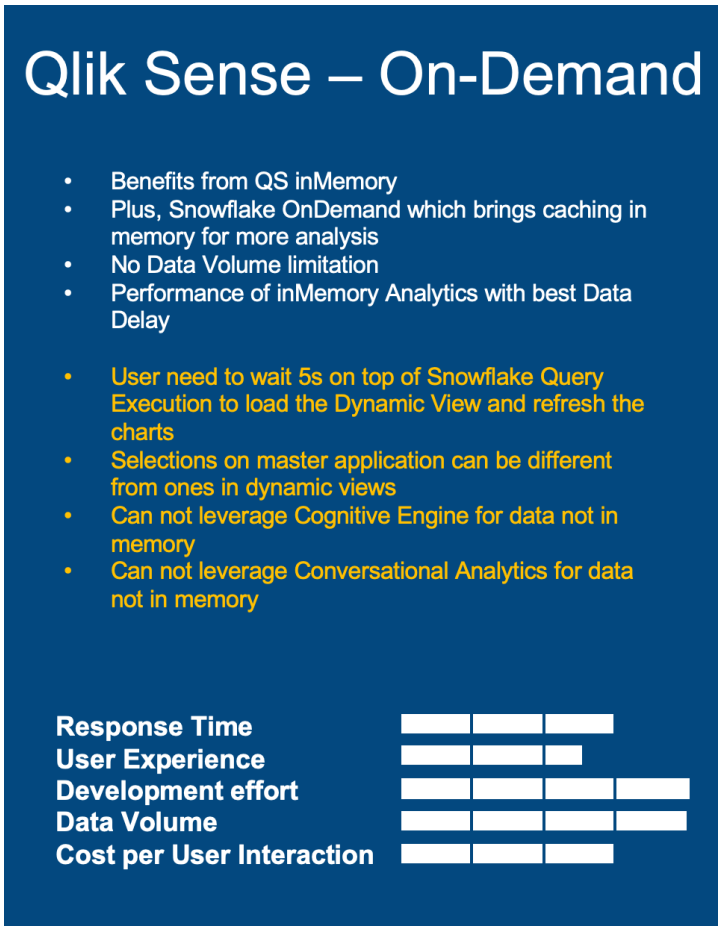
- Could lead to long load times depending on data volume.
- Recommended if the data is highly volatile or has a high amount of changes.

Incrementally load only new data

- Reload deltas on a schedule: This can be set up by a Qlik developer in the ELT script. Allows Qlik to only update the changes in the data. This method allows for near-time refresh of data into the Qlik engine and visualization layer.

On-demand Apps

On-demand apps help business users and IT departments derive value from big data environments in numerous ways. On-demand apps:



On Demand App Generation (ODAG)

- Detailed Data on Demand: This is a technique typically used in big/huge data scenarios where a Qlik app is built to contain summarized data. There is a Qlik "details" app as a template and that takes parameters passed from the summary app and runs live on demand against Snowflake. The user is then presented with the appropriate slice of data based on those selections. This method is good for summary-detail analytics.

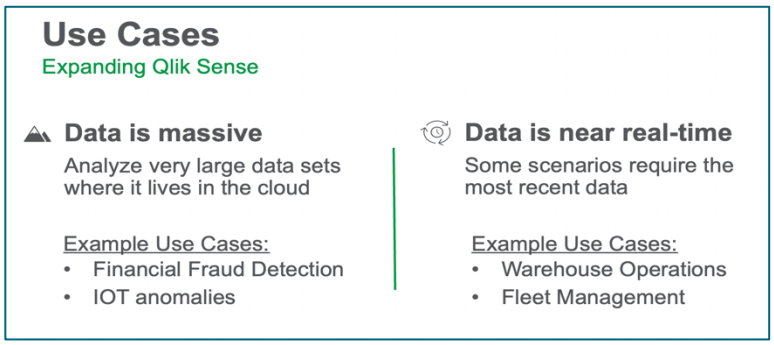
Dynamic Views

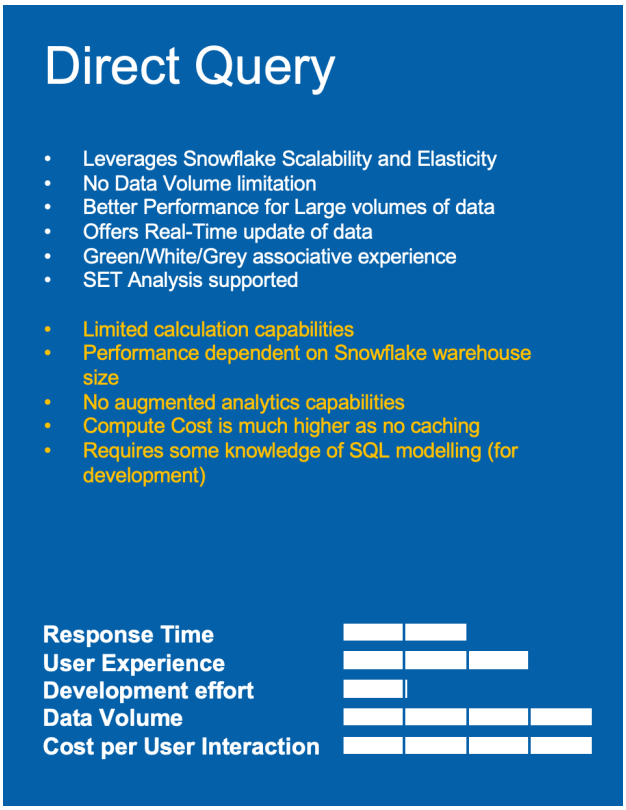
- Live Data Visualizations: This option is used when live / near-time data is needed as part of the Qlik app. Using the ODAG framework, live data under certain query volume thresholds can be triggered to update based on user interactions with the application. As users make selections they will be prompted and if they choose to, Qlik will reload data live from Snowflake to match their selections.

NEW - Qlik SaaS Direct Query

With the July 12th Qlik SaaS update, Qlik will be adding a new feature for Snowflake called Direct Query. Direct Query in Qlik Sense allows users to build analytics applications that directly query cloud databases using SQL, as users interact through visualizations and filtering.

Direct Query uses all the same UI elements from Qlik SaaS but executes those element with runtime SQL against Snowflake. The best part is that the user still gets all the power and feedback of the Qlik Associative Engine and all the relationships that are highlighted with the green, white, grey experience Qlik users love!

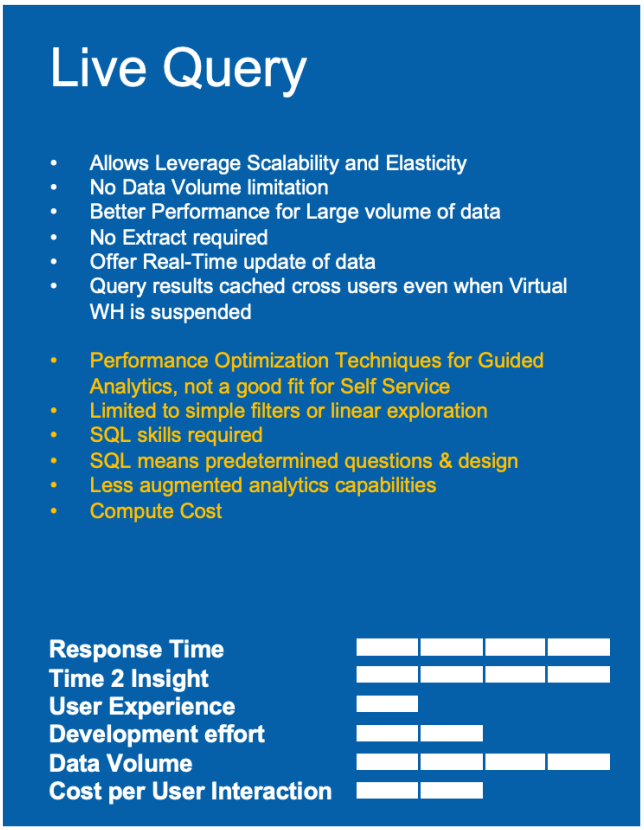




Modelling is done via a modified Data Manager panel and requires understanding of primary/foreign key relationships and join strategies. All charts/KPI's create the SQL that is pushed down to Snowflake for execution. This method WILL increase Snowflake costs, and is dependent on the warehouse sizing and performance tuning applied to the data sets inside Snowflake.

Live Query via Analytic Connector Apps – Qlik Sense Client Managed

This option is available currently by using partner offerings such as the Stretch LiveQuery Connector for Snowflake. This 3rd Party connector enables live queries directly from the Qlik Sense front-end to Snowflake. No need to move data to QVDs with LiveQuery. The product is a service residing on a server and works with Qlik Sense in Windows using Server-Side Extension (SSE) integration. You can find more details on their website: https://stretchqonnect.com/products/livequery-for-qlik-sense/



Seamless integration between live queries and in-memory

The Stretch LiveQuery connector enables near-seamless integration between live queries and in-memory data. This is done in real-time as the user is using the application.

In-memory cache

The Stretch LiveQuery connector has an in-memory result cache. This means that repeated queries can return results without accessing the warehouse. This reduces the load on the data warehouse and increase the responsiveness of the Qlik front-end. The cache has a configurable time-to-live, when a query result in the cache surpasses this time, the result is evicted form the cache and the query is parsed on the data warehouse. This enables the administrators to balance the requirement between real-time data and load/cost on the data warehouse.

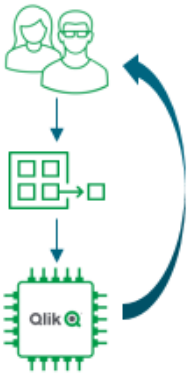
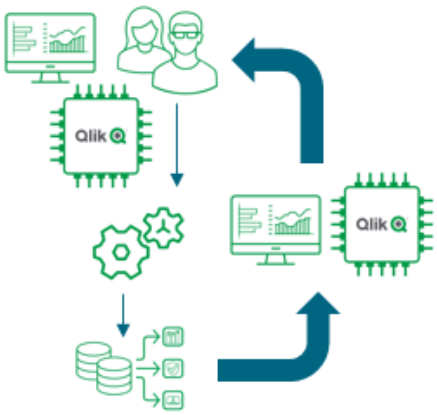
Deep Dive Snowflake & Qlik Method Decision Tree:

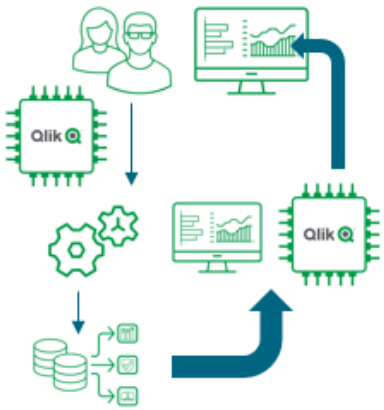
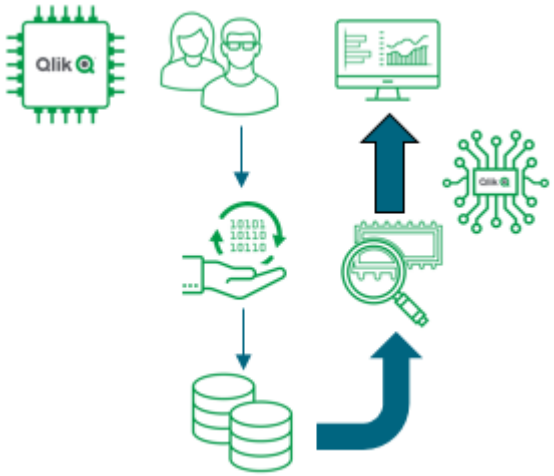
Many organizations have well established data pipelines and a user base begging for access to data and insigts. But between the databases and the dashboards, lay the the integrations and load architectures that make consuming data possible. This next section is to help you understand several integration options available in Qlik Sense and which to use when deploying Qlik and Snowflake together.

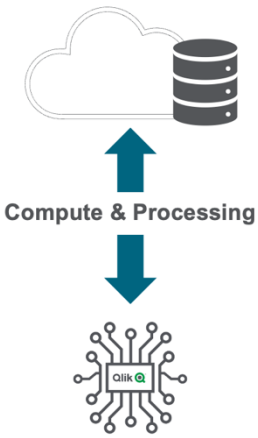
Some of the main variables when deciding will be the total number of concurrent users, system performance thresholds, costs, and the actual business requirements.

Let's begin with a high level understanding of each of the Qlik integration options before discussing which business use cases they might apply to:

Incremental Load (Scheduled Data Load) Cached In-Memory	An Incremental Load is a scheduled process where Qlik loads the latest data for all of the tables needed, merges the changes to existing QVD's (the previously loaded data/cache), then rewrites those QVD's/Cache.  • All applications and users would have access to the new information for those tables. • When dealing with large data sources, this is a great balance between fresh and fast as only the changed data is loaded on a pre-defined schedule after the initial bulk load.

Merge Reload (Live Data Load) Cached In-Memory + New Data Added In-Memory when user asks	A Merge Reload is a process activated by end users where Qlik loads the changed data for a subset of tables and the data is brought into the Associative Engine for that user.  • This technology provides a balance between fresh and fast while also ensuring that the end user is confident that they are seeing the most recent values because they initiate the action rather than it being scheduled. • * **Note:**Merge Reloads typically only load the data for speed and do not regenerate QVD's that would be loaded in the future. Thus, a scheduled Incremental Load is still required so that all other users opening the application have all of the data.
On Demand Application Generation - ODAG (Live Data Load) Cached In-Memory For selections + Live Data based on Selections in second application when user asks	On Demand Application Generation is a process where an end user passes the selections they have made to a pre-defined template application. Qlik then copies that template, loads data for that specific cohort and presents it to the end user as a new application.  • The calling application may be fully in-memory with aggregates, offering speed of thought action, while the spawned application then pulls Live details only if and when they are needed.

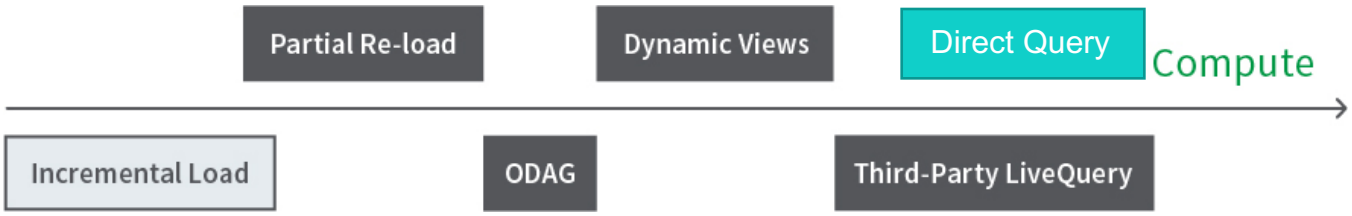
Dynamic Views (Live Data Load) Cached In-Memory For selections + Charts from Live Data based on Selections when user asks	Dynamic Views is a process similar to ODAG but instead of surfacing a new application to the end user, selected charts from a template application are displayed in the application they are currently using. If the user changes their selections they can ask for the Dynamic Views to be refreshed.  • This option capitalizes on the functionality of ODAG, while also rendering the "live" cohort of data in the context of the application where the users made their selections.
Third Party Solutions (Live Data Load) Cached In-Memory + Charts from Live Data pulled immediately based on selections	There is a Server Side Extension (SSE) provided by Qlik Partner Stretch called "LiveQuery." The SSE currently supports both Snowflake and Google Big Query. So if those are data sources for your applications, this third party extension can help you meet business needs. It does as the name suggests and queries data sources in a live manner. The queries can be isolated, or they can be tied to the user's selection. They are automatically fired whenever the user's selections are changed. The results of the queries are brought back to memory directly and they bypass the Associative Engine so they are not selectable or searchable. If the queries are used as expressions for Master Items, users can ask for Insights that involve them, and can be combined with other measures.  • This solution is similar to Dynamic Views, with the added benefit that it is kept current with end users selections without them having to take any additional actions.

Direct Query – Qlik SaaS – Real-time Push Down SQL Queries to Snowflake	Direct Query in Qlik Sense allows users to build analytics applications that directly query cloud databases using SQL, as users interact through visualizations and filtering. Customers need direct access to cloud databases to perform queries at the database level for specific use cases. But they also need to intelligently manage compute costs, performance, and user experience. 

So which one is right for YOU?

As a primer to choosing the right solution for the right problem, let's begin with some very high level guidance starting with a focus on how much compute and thus cost is driven by each of the solutions. Because in many cases the difference between "We WANT Live Data" and "1 minute old will be FINE" may come down to the implementation cost. In another use case Live Data is a MUST have regardless of the compute resources and cost associated in solving the problem.

The following chart contains no scale on purpose. It is simply for portraying the concept that each technology will have increasing amounts of computing requirements associated with them.



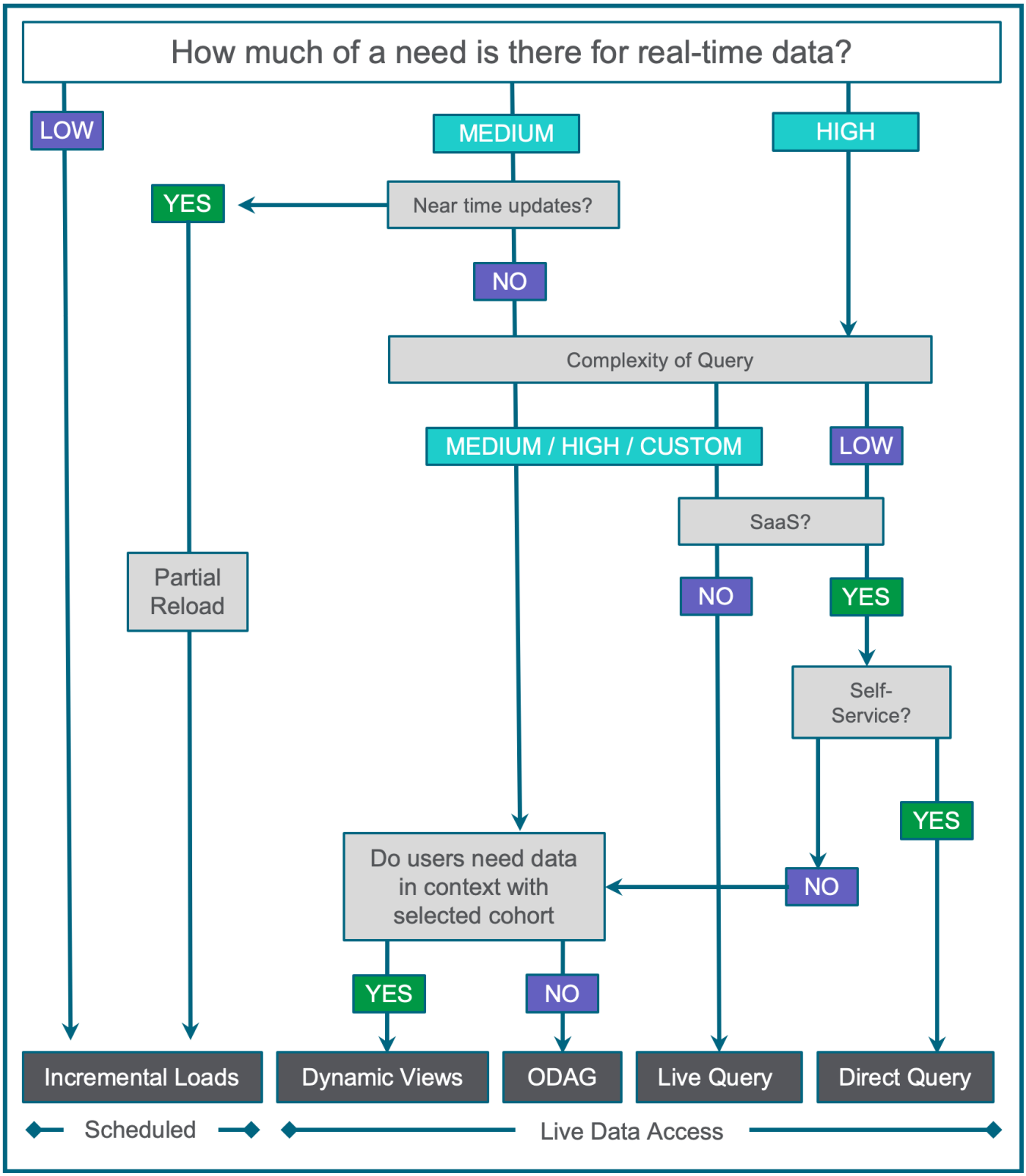
Asking the question "Why does each solution increase the amount of compute/cost?" Well, doing an Incremental Load means that Qlik only asks for the changes from our source 1 time per scheduled reload. As Partial Re-Load's of data are kicked off by the end user, the same data would need to be consumed by multiple users, thus increasing the compute needed. On Demand Application Generation (ODAG) applications will load all of the data for a defined cohort even if it hasn't changed in years. Dynamic Views require the same data loading as ODAG applications, and as they can be refreshed as often as desired by the end user to keep in synch with their selections they require more computing power. Finally, as the third party Server Side Extension is kept in synch with end user selections, every single end user selection requires the queries to be fired against the data source. Thus, requiring the most computing power.

Remember though, that was only a primer. It is entirely possible that one of your business use cases only requires a single Live Query for an aggregrate in an application that is only used by a small set of end users. Thus changing which technology you may wish to use. Bringing us to the next point: Business driven use cases are often complex and require the answers to many questions.
The following visual is intended to help provide you a thorough Business Driven Technology Guidance response on an application by application basis. It balances needs and compute power, while answering another, more complex set of questions.

Notice under "Need for Live Data Acces"s and "# of Users" we use the terms Low/Medium/High with no specific values. You the customer can choose to adjust the meaning of those values based on the budget to pay for the computing power. This balancing act if you will can get complicated, perhaps even more complicated than the chart. The point is that Qlik provides the architectural flexibility to help your organization find and maintain that balance.

Technology Guidance on Integration Options - Qlik:

For applications that require access to near/real-time data.



The following provides a little more understanding for each of the decision points in the chart.

"Need for Live Data Access" - There are two different considerations for needing to read data live. One is based on need and simply implies that for the given application anything less than up to the second values simply won't be accepted. That may be due to political reasons, or actual life changing decisions made in a healthcare setting. The second is altogether different. It is because there is too much data to fit into memory and so subsets of it will need to be read when they are needed.

"Need to filter values from Live Data WITH in-memory selections" - This is a huge decision point. ODAG, Dynamic Views and LiveQuery do not allow end users to select values from the real-time data that was just read, and have those selections apply to the parent application. ODAG is a separate application entirely. Dynamic Views show charts from the template application but those charts are not tied to the parent context meaning while you can filter items in the Dynamic View charts, they will remain as separate filters for the parent application.

"Complexity of Queries" – This simply refers to the fact that some queries are straight forward and do not require a lot of compute power to perform "Select Sum(Field) From Table." While others might require a lot of joins and/or complicated SQL functions that require a lot of compute. Each customer, and each project might require a different scale for what Low means vs High.
"# of Users" – Represents the number of users that will be utilizing the application. Again, each customer/project will need to derive for themselves how

much compute power they wish to pay and thus how many users requesting live values they can sustain. 100 concurrent users may seem low to Customer A, but high to Customer B.

"Self Service" - If end users will have access to be able to edit the selection clause, and security to the underlying data is an issue, then the 3rd Party LiveQuery solution is not the right choice.

"SaaS" – At the time of writing, the Stretch LiveQuery is not supported in SaaS as it an external Server Side Extension. Thus, it isn't an option.

"**Do users need to retain the analysis path/context with the newly selected cohort of data"** - ODAG and Dynamic Views are essentially the same thing with the exception that Dynamic Views display charts from the template application inside the calling application so end users can see the cohort they selected and see the details that are loaded live. While ODAG provides a fully designed application that is popped up, it is separate from the calling application and the user may lose the context of why they had chosen a particular cohort.

The following walks through some hypothetical use case that lines up with each of the architectural solutions.

Scenario 1 – **ODAG**: Drill to Detail Reporting/Analysis

Starting with a summary application of key metrics, a user chooses a selection of criteria which then is passed to a secondary application that is generated on demand. A customer example of when to use ODAG:

> A Human Resources department has an existing application that is used by 1,290 HR administrators, managers and employees through the company who make a lot of selections. The application is currently on a one-hour incremental load schedule. They want to use real time data instead of waiting for reloads to see potential overtime issues. The details are a known subset of content in a specific format that shows potential issues, therefore ODAG provides an interim reload ability in an easily consumable detailed Qlik application.

Scenario 2 – **Dynamic Views**: Transactional Details in Context

This scenario is best suited for when details for specific transactions need to be viewed in context with the original Qlik Sense application as a chart inside the application. A customer example of when to use Dynamic Views:

> A customer has several hundred billion records from a transactional system stored in Snowflake which is too much for a single Qlik application. This data is reloaded on a schedule with the aggregates of KPI's and other relevant data but not the transactions themselves. Dynamic Views are used to get the transactions of a cohort of dimensional values that limit the records to a threshold (say under 100k rows) to be analyzed in any chart on demand. The users of the application need to be able to see the details in the context of the cohort selected.

Scenario 3 – **LiveQuery**: Real-Time Status

Sales leaders are asking for an application with several KPI's. They want the new application because the existing application that contains billions of rows of sales transactional data takes too long to load, and they are required to navigate to multiple screens to get the KPI's they need. The application will only be used by Directors and above in the corporation which equates to about 50 people. Expectations are that the users for this application will not interact with filters much, they just need very current metrics.

Scenario 4 – **Partial Reload/Merge**: Closing Books / Financial Reporting

Finance leaders closing the books at the end of the month need access to up to the minute general ledger details. The Qlik application contains very complicated calculations, hierarchies, and transformations not easily replicated with SQL. The application will only be used by Accountants and Sr Executive in the corporation which equates to about 25 people. Data is changing rapidly throughout the close cycle and the users need to see where the company stands at any point in time. End users have a very high level of interactivity are required to analyze the data to find issues.

Personas by Usage: Consumers, Analysts, Designers

Many roles support the data to insight pipeline - from developers to analysts to business casual consumers. Each role though requires certain capabilities within the platform but also levels of access to live data. See the table below to learn which use case fits each persona.

Consumer	Uses prebuilt dashboards, mashups, or pushed content (Reports/Alerts)
Analyst	Deep dives into content, can create own content, understands data literacy
Designer	Builder and deployer of prebuilt content and complex design/data transforms

*This chart assumes a superset of capabilities (i.e. Designer has Analyst and Consumer capabilities, where Consumers only have the singular capability)

Use Case	In-Mem (FL/IL)	In-Mem (TT IL)	In-Mem (TT Merge)	ODAG	Dynamic Views	In-Mem + Live[1]	Live Only[1]	Direct Query[2]
Business Monitoring	C	C	A			C	C	C
Business Alerting	C	C						
Business Reporting	C	C				C	C	
Embedded / Mashups	C	C	C			C	C	
Ad-hoc Analysis	A	A	A	A	A	A	A	A
Insight Suggestions	C	C	A			C	C	
Insight Exploration	A	A	A					
Storytelling	A	A	A			A	A	
Assisted Data Prep	A							
Data Ingestion (LS)	D	D	D	D	D	D	D	D
Use Advanced Analytics (SSE)[1]	C	C						
Develop Advanced Analytics (SSE)[1]	A	A	A					
Data Modelling and ETL	D	D	D	D	D	D	D	D
Application Design & Development	D	D	D	D	D	D	D	D

[1] Only available on client managed
[2] Only available on SaaS

FL: Full Load
IL: Incremental Load
TT: Snowflake Time Travel
Live: LiveQuery

Performance Considerations / Best Practices by Technique

As previewed, Qlik and Snowflake together offer a range of ingestion techniques with varying levels of loading data into memory with Qlik's analytics engine and purely loading near/real-time data. There are clear strengths and advantages for each technique in addition to some having limited use cases.

It's necessary to understand the caching process between Snowflake and Qlik to distinguish how to optimize each system to support your analytics needs.

Data Caching for Performance & Compute Cost Consideration

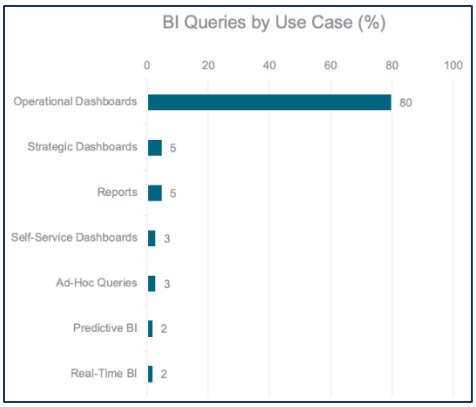
There are 3 different caches involved in processing a query in Snowflake:

- **Snowflake Metadata cache**
  - In the global services layer
  - Stores statistical information on micro-partitions; used to build the query execution plan.
  - Will eventually be "swapped out" by other queries over time; you have NO CONTROL over this cache.
- **Snowflake Data cache (table scan; partitions of a table)**
  - This is a "traditional" data cache, at the micro-partition-level.
  - This IS specific to the virtual warehouse (compute) used to process the query. As a result, if the virtual warehouse is suspended, the cache is (typically) lost. Be aware that suspending and immediately resuming might result in the warehouse never actually suspending (as an optimization) and therefore not flushing the cache.
- **Snowflake Result set cache**
  - This is the "all or nothing" result

- This is maintained by the global services layer of the Snowflake architecture, stored in blob storage (AWS S3, Azure Blob, Google GCS), and is NOT specific to any single virtual warehouse (compute) used to process the query.
- Results are retained for 24 hours, but you can tell the query processor to NOT pull from this cache.

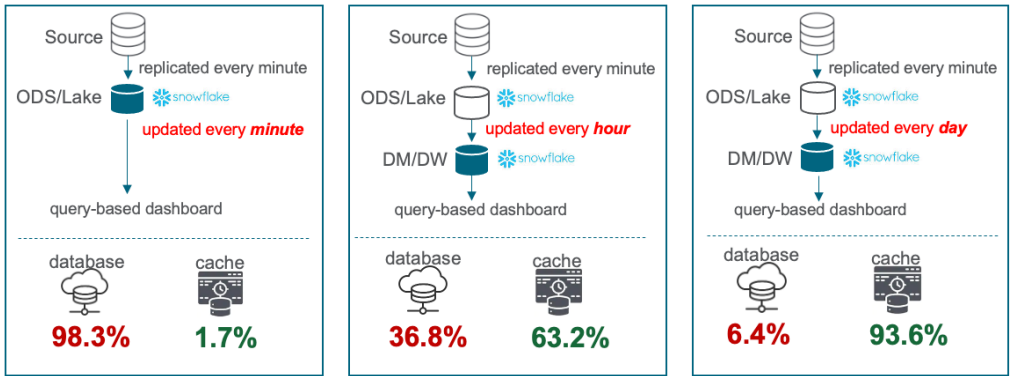
Why is Caching So Important for Dashboards?

Caching and Query times are directly related and when breaking down the allocation of queries across analytics applications the majority of query volumes originate from Operational Dashboards used by large concurrent users.



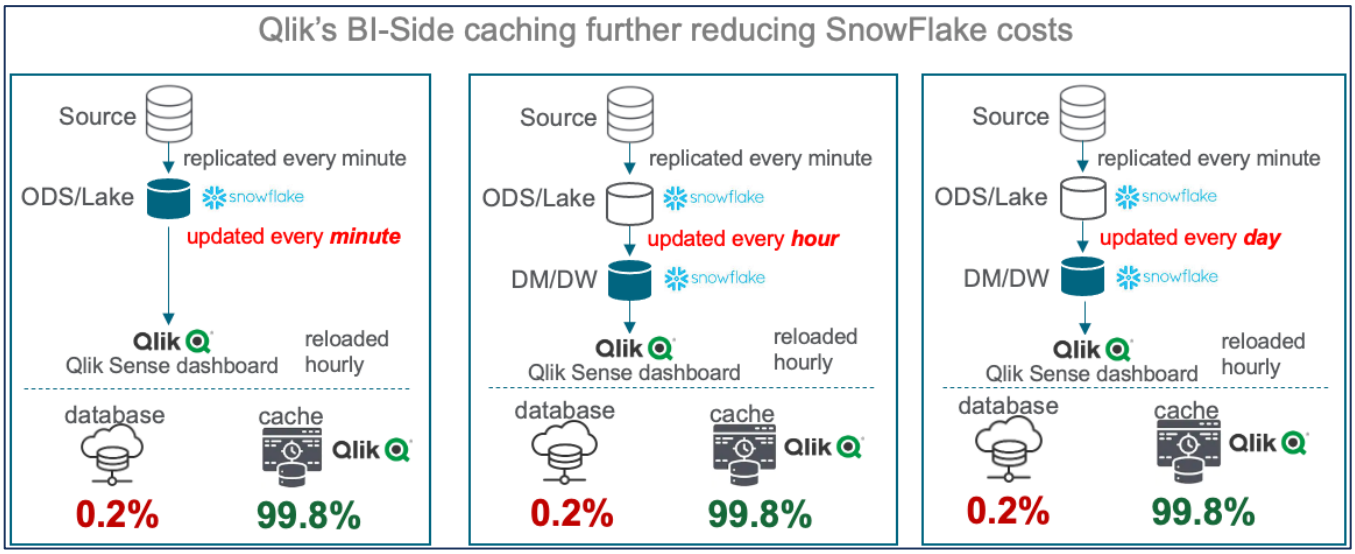
These types of queries are billed by consumption pricing and can be very compute intensive and may require a larger Snowflake warehouse or a multi-cluster warehouse, especially for larger number of users.

Why is Caching So Important in Snowflake?



There is a huge advantage in ***speed*** and ***cost*** to isolate rapid-changing data to a separate DB, because changing data can affect the caching of results.

Why is Qlik Sense So Great with Snowflake?



Using Qlik's in-memory cache reduces your Snowflake costs to just reload activity. All queries between reloads are 100% cached in Qlik's in-memory model, freeing up the Snowflake warehouses to suspend themselves and/or serve other needs, regardless of the update frequency of the underlying data, i.e., if the database tables are reloading daily/hourly then there is no reason for live access queries.

Key Considerations for Caching & Cost Management with Snowflake

Realtime Data Kills Cache, and Costs Cash

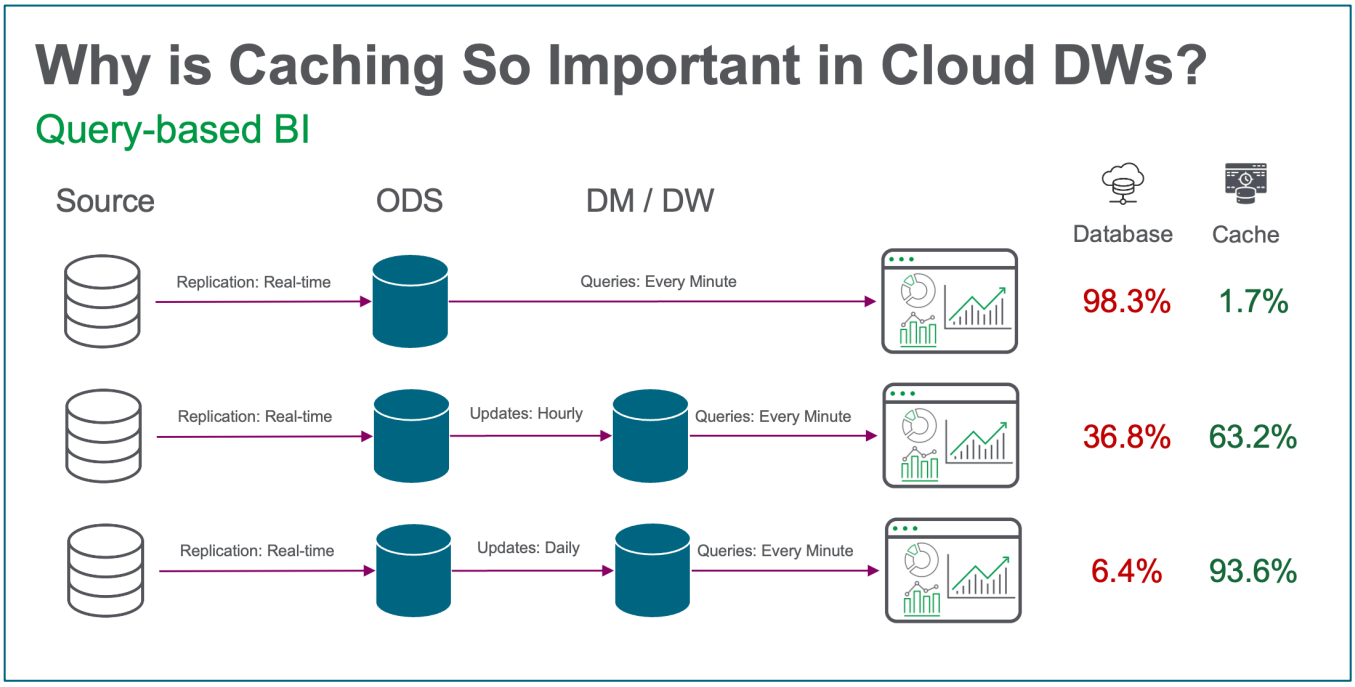
- Snowflake has very good data & result caching, which are potentially impacted if the underlying data is changing rapidly. The result cache will be more severely affected while only the modified micro-partitions of the virtual warehouse cache will be affected.
- Costs are significantly more to have the data updated every 5 min (vs hourly)!

- Do NOT update/consume on same DB – use an intermediary engine like Qlik Compose to reduce compute costs and balance loads.

Scenarios to Avoid

Direct Query Tool Access against Near/Real Time Data

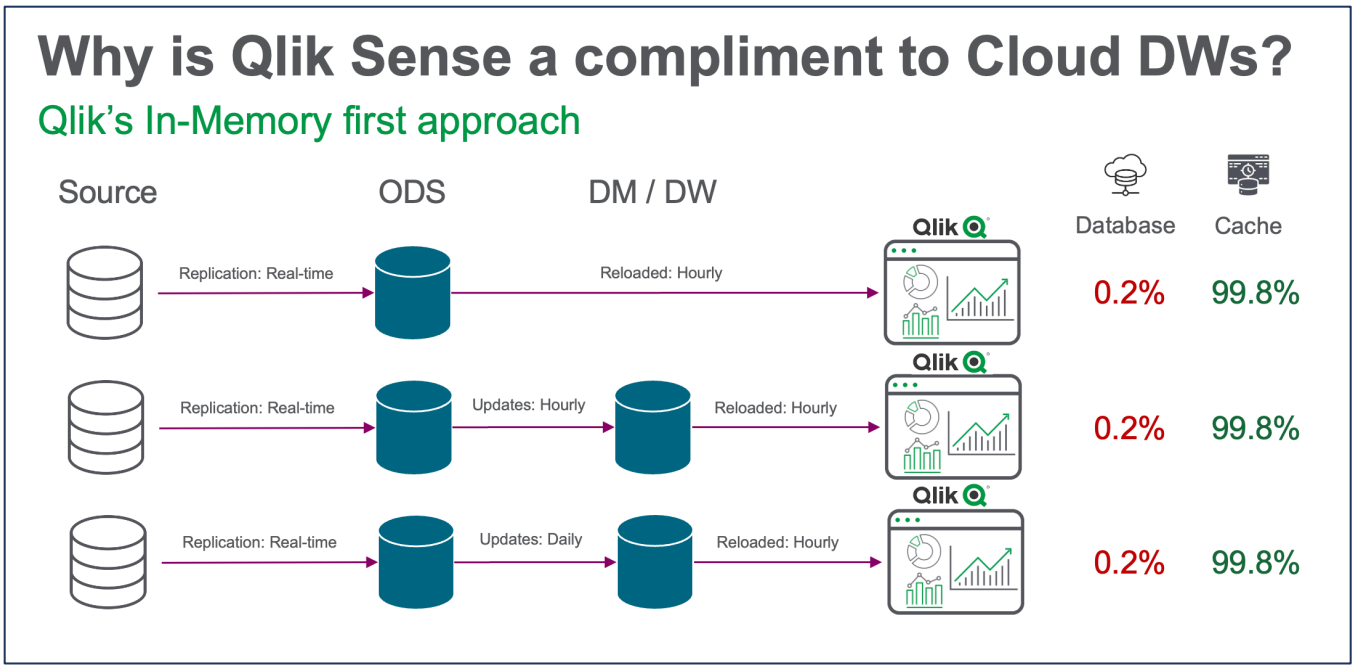
- More limited Snowflake caching
- More expensive (more credits used)
- Potentially slower performance



Best Practice Scenario

Qlik Sense in-memory (or blended use case covered later)

- Best use of Snowflake caching
- Less Expensive (less credits used)
- Best performance



Enable Bulk Reader Option

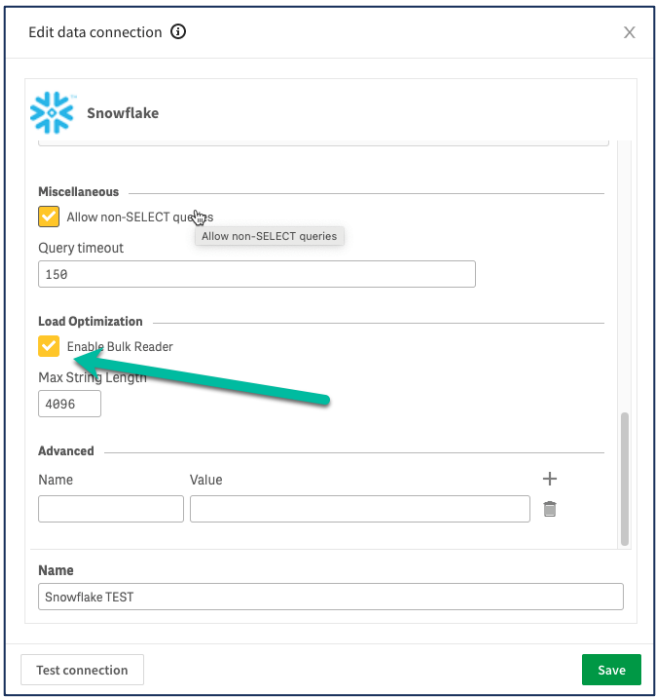
This biggest performance improvement option (Qlik SaaS only) during data load is to Enable Bulk Reader option which can result in up to a 50% improvement of Bulk Data loading for large data sets.

Load optimization settings

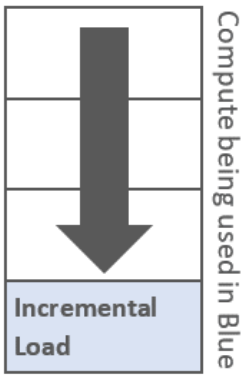
Load properties that can be configured

Property	Description	Required
Enable Bulk Reader	Select this to include larger portions of data in the iterations within a load. This may result in faster load times for larger datasets. If not selected, data will be loaded row by row.	No

In the Qlik Sense Snowflake data connection setup, that option is found here:


Edit data connection
Snowflake
Miscellaneous
Allow non-SELECT queries
Allow non-SELECT queries
Query timeout
150
Load Optimization
Enable Bulk Reader
Max String Length
4096
Advanced
Name
Value
Name
Snowflake TEST
Test connection
Save

Incremental Load Options



The following sections will discuss in detail the above strategies on how to leverage Snowflake data depending on use case.

Incremental Loads using QVD's

This is the most common technique used in Qlik environments to only load delta data.

Qlik has a data format called QVD that is binary and optimized for re-ingestion locally. It is a commonly used by Qlik developers as it allows for snapshotting data, reuse of data structures after transformation, combination and pre-calculation of data, and **incremental loads**.

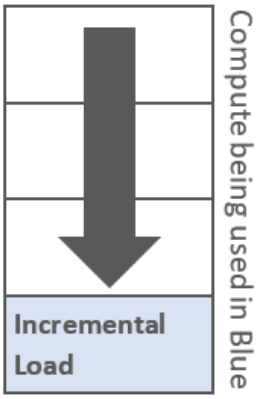
Here is the basic process of how it works:

1) Table of data is identified as large enough to not reload entirely every time.
2) Load all the data the first time, store data into QVD file on disk
3) On subsequent loads:
    a. Identify a column in the table used for knowing that it is a new record. It can be an incrementing, numerical ID value in the table, or possibly a date/time field.
    b. After the data is loaded from, get the *highest value* for the aforementioned column and store it in a variable (e.g. "LastDate")
    c. CONCATENATE LOAD the new data from Snowflake but selecting from the big table and adding a WHERE clause and including the variable from above; For example, "select * from table where datetimefield > $(LastDate);"

d. Save the QVD, overwriting the previous QVD. If desired, snapshot by saving an additional QVD with a timestamp or similar. This way you easily can go back to previous loads if desired.
e. Repeat for any other tables that have a high number of values.

The above is the basic concept; However, there are nuances to account for, so the following information will dive deeper into the variants.
Here is a help document describing the process: https://help.qlik.com/en-US/sense/May2022/Subsystems/Hub/Content/Sense_Hub/LoadData/use-QVD-files-incremental-load.htm

QVD-based Incremental Load - Insert Only



This method offers a lot more control with the ability to specify a field to do the incremental load on. There are 2 example versions for incremental load logic with dates to illustrate the flexibility and some ideas on how to do it. There are other fields to use that might suit your data better.

This version uses the last timestamp from the source data table itself.

```
// Example using the last actual create date of the record in the table on Snowflake

// Do the initial load from the QVD:
FactTable:
LOAD
   PrimaryKeyInt,
   X,
   Y,
   CreateTimeStamp
FROM File.QVD;

// Get the max timestamp from the data in the QVD
Max:
Load
   max(CreateTimeStamp) as maxtime
Resident FactTable;

// Set the variable to the maxtime derived above:
```

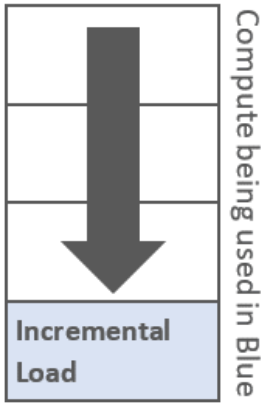
```
LET ts = peek('maxtime',0,'Max');

// Append ("Concatenate") the records since the last load from Snowflake table into the FactTable:
Concatenate (FactTable)
SQL SELECT
  PrimaryKeyInt,
  X,
  Y,
  CreateTimeStamp
FROM SnowflakeDB.TableName WHERE CreateTimeStamp >= $(ts);

STORE FactTable INTO File.QVD;
```

This next version sets the **last execution time** and current **reload start time** variable and uses them both for the date range in the where clause from Snowflake.

```
// Example using the reload execution start and end times.

//Set start time variable:
Let ThisExecTime = Now();

// Do the initial load from the QVD:
FactTable:
LOAD
  PrimaryKeyInt,
  X,
```

```
  Y
FROM File.QVD;

// Append (“Concatenate”) the records since the last load from Snowflake table into the FactTable:
Concatenate (FactTable)
SQL SELECT
  PrimaryKeyInt,
  X,
  Y
FROM SnowflakeDB.TableName WHERE CreateTimeStamp >=
$(LastExecTime)
AND ModificationTime < $(ThisExecTime);

STORE FactTable INTO File.QVD;

// Set reload execution end time to now *if all goes well*:

Let LastExecTime = ThisExecTime;
```

QVD-based Incremental Load - Insert and Update



This technique is a little trickier conceptually but is a simple script:

Qlik loads records inserted into the database or updated in the database after the last script execution.

A ModificationTime field (or similar) is required for Qlik to recognize which records are new.

A primary key field is required for Qlik to sort out updated records from the QVD file.

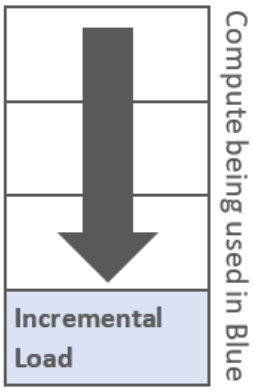
This solution will force the reading of the QVD file to standard mode (rather than optimized), which is still considerably faster than loading the entire database.

Example:

```
// Set the reload start time
Let ThisExecTime = Now( );

// Ingest just the new records into Qlik first
FactTable:
SQL SELECT
  PrimaryKey,
  X,
  Y
FROM SnowflakeDB.TableName WHERE ModifiedTimeStamp >=
$(ThisExecTime);

// Add in the records from the previously saved QVD --- *ONLY* when that record doesn't exist in the cohort brought in from Snowflake:
```

```
Concatenate
LOAD
  PrimaryKey,
  X,
  Y
FROM File.QVD
WHERE NOT Exists(PrimaryKey);

STORE FactTable INTO File.QVD;

If ScriptErrorCount = 0 then
STORE QV_Table INTO File.QVD;
Let LastExecTime = ThisExecTime;
End If
```

QVD-based Incremental Load - Insert, Update and Delete



What if records were **deleted** from the source database **between script executions**? In this case we need to:

- Have Qlik remove records deleted from the database after the last script execution
- A field ModificationTime (or similar) is required for Qlik Sense to recognize which records are new
- A primary key field is required for Qlik Sense to sort out updated records from the QVD file
- This solution will force the reading of the QVD file to standard mode (rather than optimized), which is still considerably faster than loading the entire database

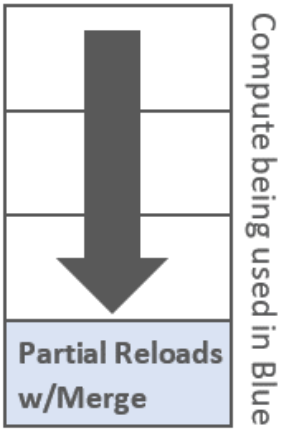
Example:

```
// Set the reload start time
Let ThisExecTime = Now( );

// Ingest just the new records into Qlik first
FactTable:
SQL SELECT
  PrimaryKey,
  X,
  Y
FROM SnowflakeDB.TableName
WHERE CreateTimeStamp >= $(LastExecTime)
AND ModificationTime < $(ThisExecTime);

// Add in the records from the previously saved QVD --- *ONLY* when that record doesn't exist in the cohort brought in from Snowflake:
```

```
Concatenate
LOAD
  PrimaryKey,
  X,
  Y
FROM File.QVD
WHERE NOT EXISTS(PrimaryKey);

// Do an inner join so that only the PrimaryKey values that still exist in the database will remain
Inner Join SQL SELECT PrimaryKey FROM SnowflakeDB.TableName;

STORE FactTable INTO File.QVD;

Let LastExecTime = ThisExecTime;
```

Incremental Loads using "Partial Load"

Partial Load is helpful when you have new data to append to an existing table but do *not* want to load the rest of the tables. This is helpful when you have faster moving data in one table and a large data set from many sources in the rest of the data model.



Examples:

```
ADD LOAD * from Snowflake.FactTable where createdatetime > $(lastreloaddatetime);
```

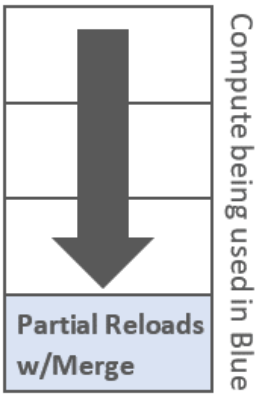
The above will run when the “Partial” option has been set on a reload AND will run when the partial flag is not set.

ADD ONLY LOAD * from Snowflake.FactTable where createdatetime > $(lastreloaddatetime);

The above will run ONLY when the Partial flag has been set and will *not* be run when partial is set to false in the reload.

Time Travel with Merge Best Practices

Traditionally Qlik developers have utilized a Last Modified Timestamp field so that they could load only the changed values. However, there are many times that data tables don't have a Last Modified Timestamp so then Full Reloads were the only option.



However, Snowflake offers Change Processing as part of their Time Travel functionality. It's the ability to simply get the Change Data Capture information returned in a query. When it is enabled, it adds metadata columns behind the scenes to your tables that allow you to modify your typical SQL Selection and say, “give me only the changes that have occurred since X time."

```
78 SELECT "METADATA$ACTION", cast(CURRENT_TIMESTAMP() as varchar(100)) as "Timestamp_c",
79      "Hospital_Account_ID", "Primary_ICD_Diagnosis_Code", "Admit_ICD_Diangosis_Code",
80       "Primary_ICD_Procedure_Code", "Primary_Payor_ID", "Total_Account_Balance_$",
81       "Total_Account_Adjustment_$", "Total_Account_Charge_$",  "Total_Account_Payment_$", "HRRP_Condition"
82       FROM "GENERALHOSPITALDB"."dbo"."Accounts"
83       CHANGES(INFORMATION => DEFAULT) AT(TIMESTAMP => '2021-06-29 18:14:18.779 -0400'::timestamp_tz)  END(TIMESTAMP => CURRENT_TIMESTAMP())
84       where not("METADATA$ISUPDATE" = TRUE and "METADATA$ACTION" = 'DELETE')
```

Results Data Preview

Query ID SQL 853ms 3 rows

Filter result... Copy

Row	METADATA$ACTIC	Timestamp_c	Hospital_Account_	Primary_ICD_Diagn	Admit_ICD_Diango	Primary_ICD_Proce	Primary_Payor_ID	Total_Account_Bal	Total_Account_A
1	INSERT	2021-06-29 18...	11111111	777.77	V22.1	74.1	300010	2112700.0000	-65.2000
2	INSERT	2021-06-29 18...	11111122	660.11	660.13	74.1	300029	17600.0000	0.0000
3	INSERT	2021-06-29 18...	11403777	852.05	959.9	39.79	300063	11723577.7000	0.0000

You may be curious about the where function that is asking for the changes, except for Deletes when the action was an update. The key is that Snowflake stores Updates as Deletes and Inserts. So, we only want the Inserts (real insert or updated information) and the real Deletions.

Combining this CDC capture information from Snowflake with the Qlik Merge function offers a highly performant way to do handle Incremental Loads. The Merge function provides a simple way of automatically "merging" changes into an

in-memory table. You simply pass the function a few parameters and the results of the Snowflake Changes query for the table.

```
// Merge any changes that have been applied since last data load
MERGE (Timestamp_c, latestTimestampVar) on "Hospital_Account_ID" concatenate (Accounts)  LOAD *;
SQL SELECT "METADATA$ACTION", cast(CURRENT_TIMESTAMP() as varchar(100)) as "Timestamp_c",
   "Hospital_Account_ID","Primary_ICD_Diagnosis_Code","Admit_ICD_Diangosis_Code",
    "Primary_ICD_Procedure_Code","Primary_Payor_ID","Total_Account_Balance_$",
    "Total_Account_Adjustment_$","Total_Account_Charge_$","Total_Account_Payment_$","HRRP_Condition"
    FROM "GENERALHOSPITALDB"."dbo"."Accounts" CHANGES(INFORMATION => DEFAULT)
            AT(TIMESTAMP => '$(lastTimestampVar)'::timestamp_tz)  END(TIMESTAMP => CURRENT_TIMESTAMP())
    // don't need DELETE row event generated for Updates,  only Insert treated as Upsert but deletes are needed
    where not("METADATA$ISUPDATE" = TRUE and "METADATA$ACTION" = 'DELETE');
```

This functionality:

1. Speeds up traditional Incremental Load applications.
2. Can be used to handle Incremental Loads for tables without Last Modified Timestamp columns where you may be doing full reloads.
3. Partial Reloads to allow end users to quickly bring the latest and greatest changes very quickly into memory so that they can analyze them.

Time Travel Setup & Qlik Merge Function Details

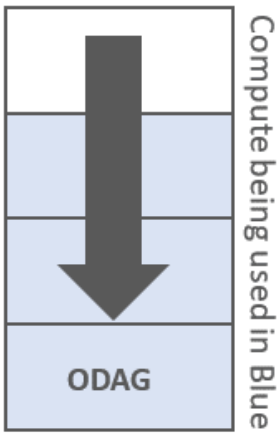
Details about Snowflake Change Tracking can be found here:
https://docs.snowflake.com/en/sql-reference/constructs/changes.html

Details about the Qlik Merge function can be found here:
https://help.qlik.com/en-US/sense/May2022/Subsystems/Hub/Content/Sense_Hub/Scripting/ScriptPrefixes/Merge.htm

On-Demand Options

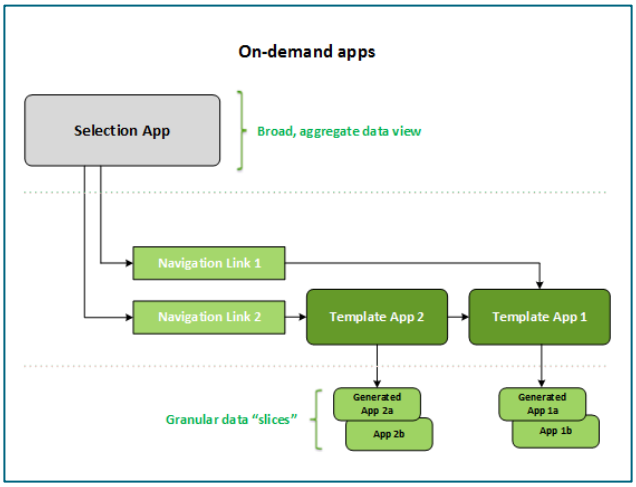
The following sections will discuss in detail the strategies on to leverage real/near time data from Snowflake.

On Demand App Generation (ODAG)



"On Demand App Generation", commonly called ODAG, is about bringing in just the right chunk of data you're interested in to do your analysis. It's a technique commonly used in **big data** scenarios where it's just not possible or efficient to load all of the data into their Qlik app. It's common to see this approach when the fact table exceeds 500-800 million rows (purely estimate, depends on rest of data model).

A simple example might be that user comes in to a "shopping cart app" where they see trends and explore high level aggregated data, then make selections to narrow in on the specific dimension values of interest by using the associativity in the engine. When the user has confirmed that the cohort of data is manageable enough of and has the appropriate parameters chosen, then the user can launch the "analysis app" which has all of the chart objects and layout already defined, or after loading that data it can return a blank sheet if desired.

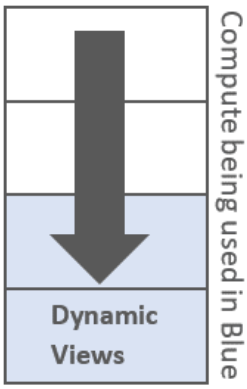


Here is the official help document for creating and managing On Demand Apps:

https://help.qlik.com/en-US/sense/May2022/Subsystems/Hub/Content/Sense_Hub/DataSource/Manage-big-data.htm

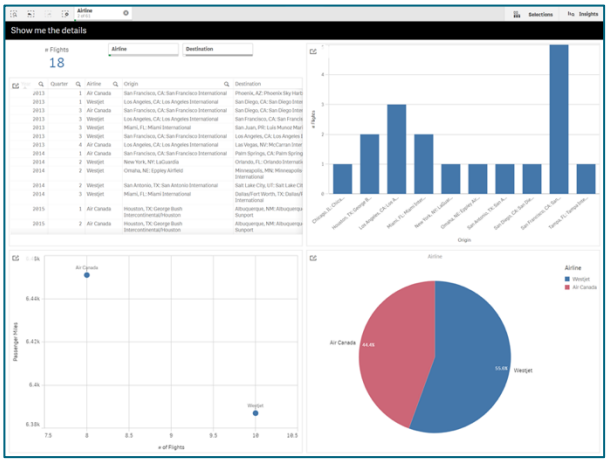
Dynamic Views

Dynamic views enable you to connect a base app to another app. Master visualizations from that app can then be used in the base app. This enables app creators to use master visualizations from the template app as dynamic charts in other apps. There is no limit to the number of dynamic views you can add to your base app. Dynamic views are made from three main components:



- Dynamic views: A mechanism added to base apps that connect to template apps and enable app creators to add master visualizations from the template app to the base app.
- Dynamic view template apps: A Qlik Sense app containing connections to data sources, such as cloud databases.
- Dynamic charts: Master visualizations in the dynamic view template app that can be added to base apps and that can be manually refreshed by users.

The template app and the base app do not need to use the same data. If you have a data set covering customer purchases, you could add a dynamic view to a template app containing weather data to look at any correlations.

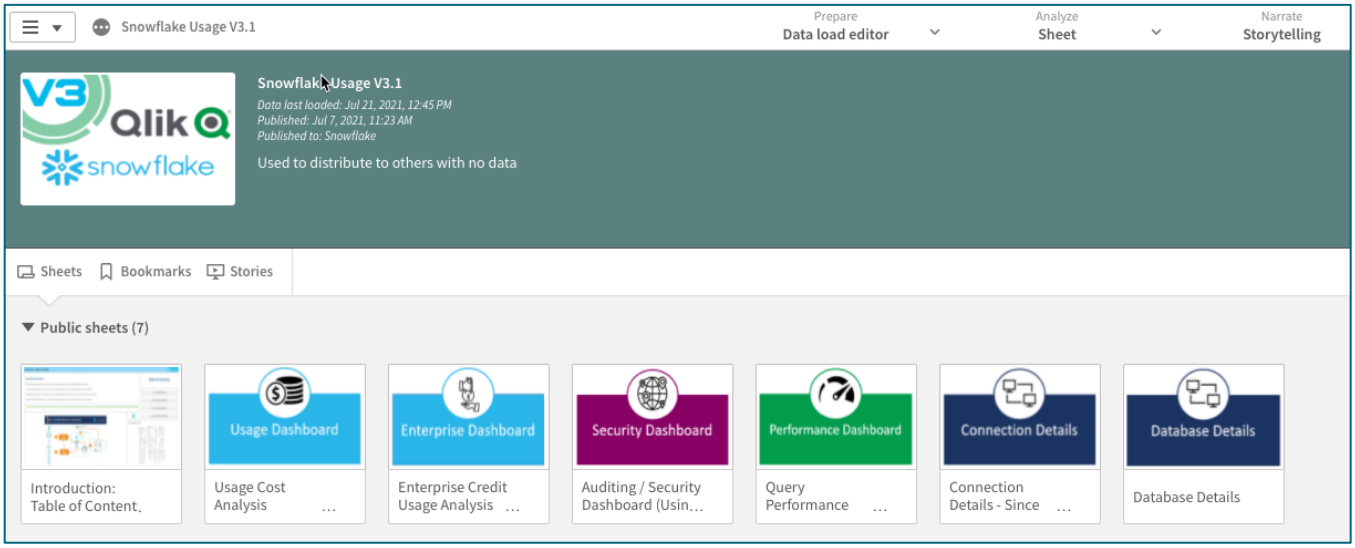


If the data queried from the template app's source can be filtered using values in your base app, you can use binding expressions in the template app's script. This enables the dynamic view to only query a subset of data specifically related to the selections in the base app from the data sources of the template app. For example, you could bind the field SalesDate in the base app to the field DailyTemperatureReadingDate in the template app.

Here is the official help document for creating and managing Dynamic Views: https://help.qlik.com/en-US/sense/May2022/Subsystems/Hub/Content/Sense_Hub/DynamicViews/dynamic-views.htm

Qlik Snowflake Usage Dashboard (V3.1)

This Qlik Sense app combines data from multiple Snowflake usage and metadata tables to create an understanding of six key areas.



- **Usage Cost Analysis**: Analysis by various factors how Snowflake credits/spend are being consumed
- **Enterprise Credit Usage Analysis**: Allows investigation of credit/usage spend against a pre-bought credit pack from Snowflake (Enterprise Customers)
- **Auditing/Security**: Tracks logins and location from IP's that access Snowflake (We are using Qlik GeoAnalytics for IP lookup to location). Failed/Successful logins and type of connection used by version
- **Query Performance Analytics**: Tracks details of query performance, find anomalies and issues quickly, also breaks out usage by Qlik product.
- **Connection Details (NEW)**: Understand which products are contributing to costs and query usage. Understand all the types of connection strings used to access Snowflake.
- **Database Details (NEW)**: Understand the data structures of you Snowflake instance. Columns, Rows, Storage, etc and how all the Databases, Schemas,

Tables, and Columns correlate. Also tracks shared(external) vs internally owned tables.

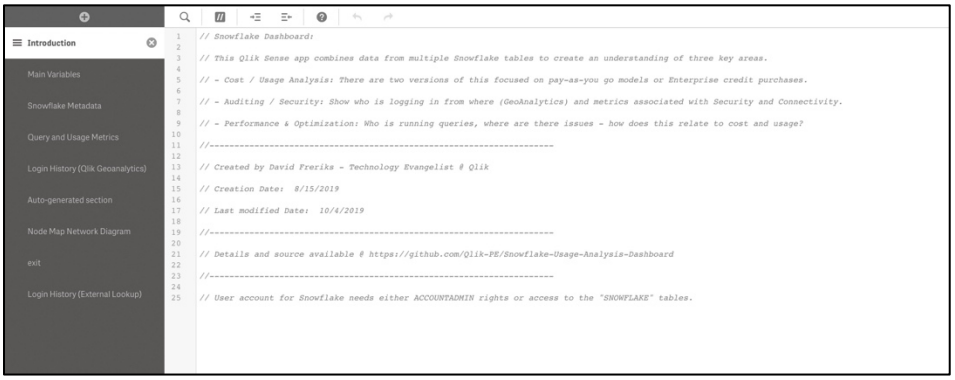
Instructions and descriptions are below. The app can be downloaded from: https://github.com/Qlik-PE/Snowflake-Usage-Analysis-Dashboard

Upload to your Qlik Sense server, Qlik SaaS, or Qlik Sense Desktop. Follow the instructions in the app to add your Snowflake credentials and update the GeoAnalytics connection or modify to use a public IP lookup service. A demo version using the Qlik Partner Engineering account can be accessed Here.

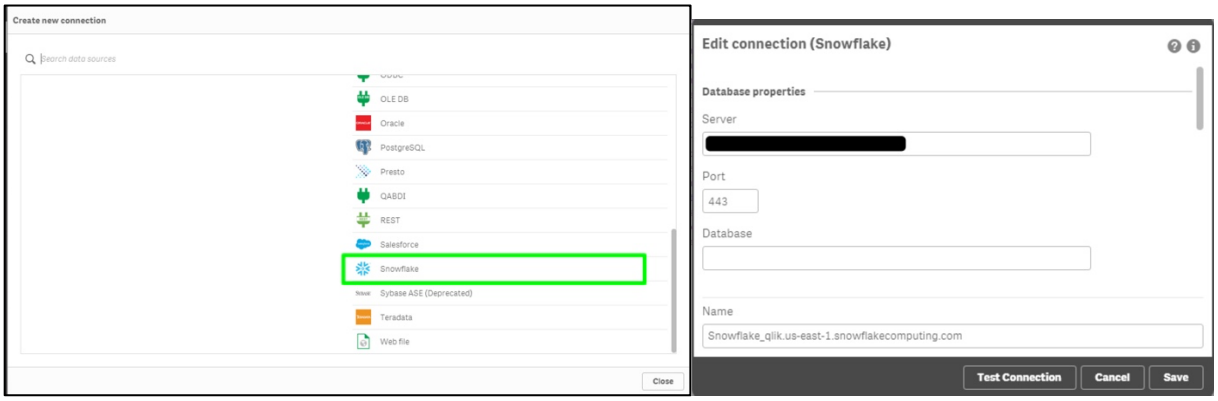
Data Model:

The data is collected from a series of methods and combined in Qlik's in-memory associative engine. Qlik is unique in that unlike other BI/Visualization tools it can handle multi-grain fact scenarios with data at different levels of aggregation and granularity. For this application, we are combining metadata from databases, tables, and columns with query performance data, login information, storage costs, and usage costs. We also perform dynamic IP lookups to get geospatial information about user IP locations.

Data Load Script:



The data is extracted using Qlik load script. The load scripts are how Qlik requests the data from the source tables, SQL functions, and geo-lookups. The model for this application has been broken into logical grouping of similar data by using tabs to help simplify understanding of the data imported. In order to map this application to your instance of Snowflake, you will need to create your own data connection to Snowflake. Starting with the September 2019 release of Qlik Sense Enterprise, there is a built-in connector inside Qlik. Older versions of Qlik Sense will require a download of the ODBC driver from the Snowflake website.

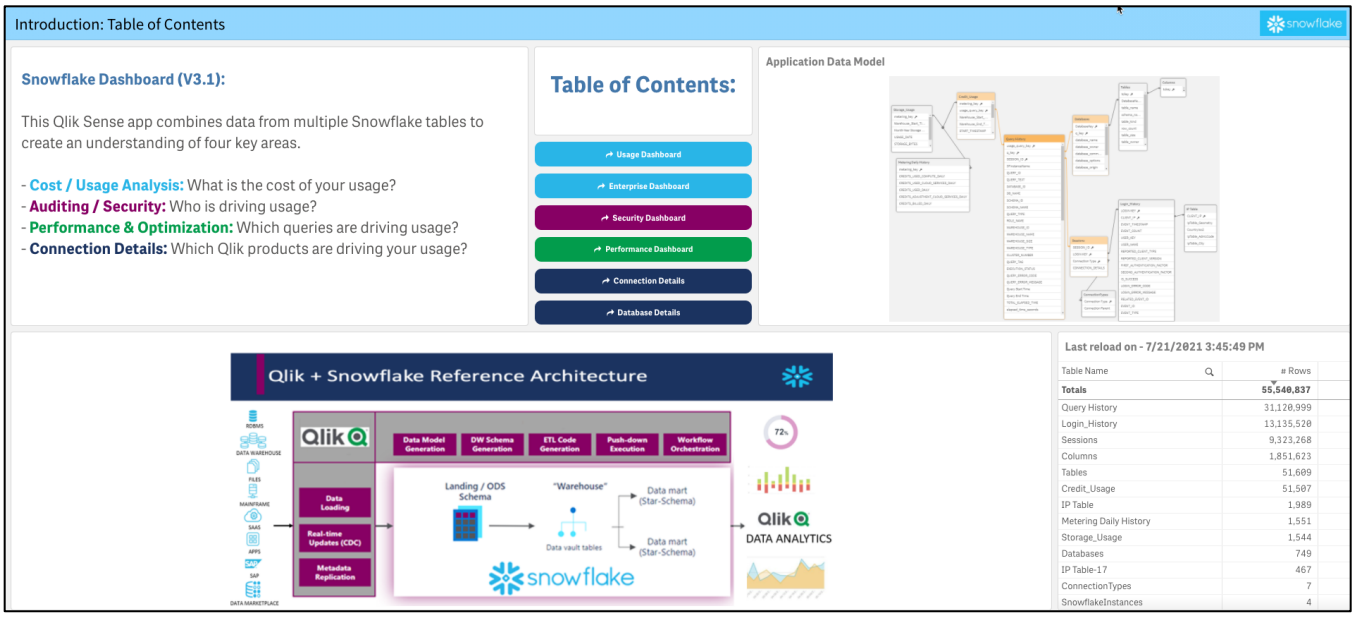


The other element in the load script is the Qlik GeoAnalytics IP lookup. This section of the script takes the unique IP's from the Login History in-memory table and passes them to the GeoAnalytics engine and returns City, State, Country, and Lat/Long values for each IP.

Analysis Details about the Usage Dashboard

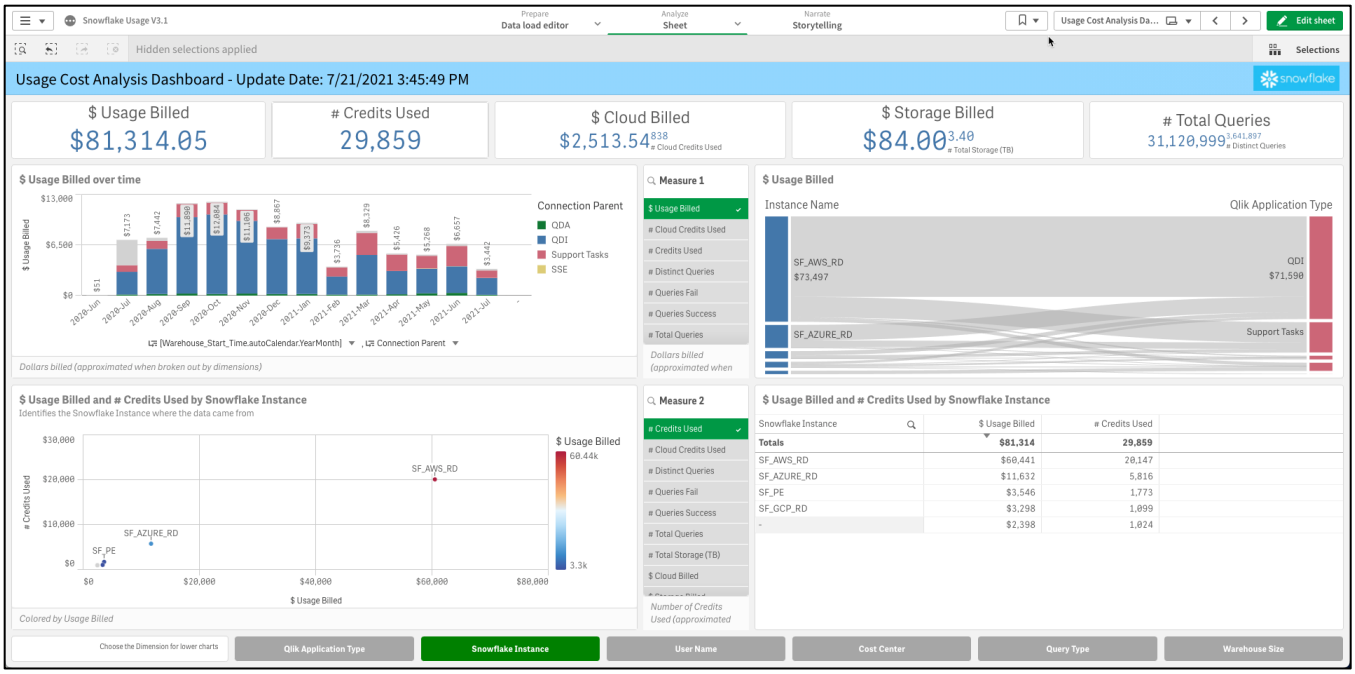
Table of Contents:

This is the basic introduction to the layout and structure of the app.



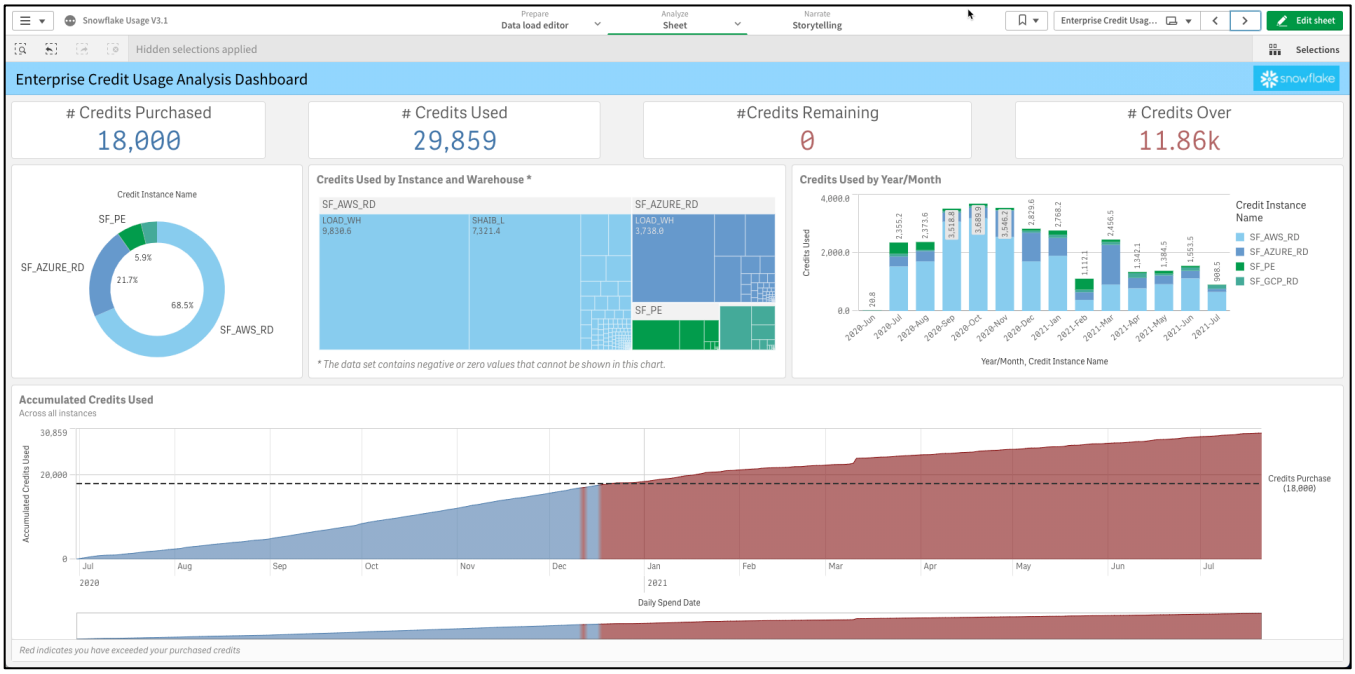
Usage Cost Analysis:

This dashboard shows costs and usage associated with Snowflake usage. Note how Qlik's engine has mapped estimated costs down to a user level. This is a mixed grain fact situation so costs are dynamically allocated and may not be exact – but does give a general estimate on usage/cost comparison. Users can alter their cost per credit and storage costs based on their unique pricing models that may be applicable.



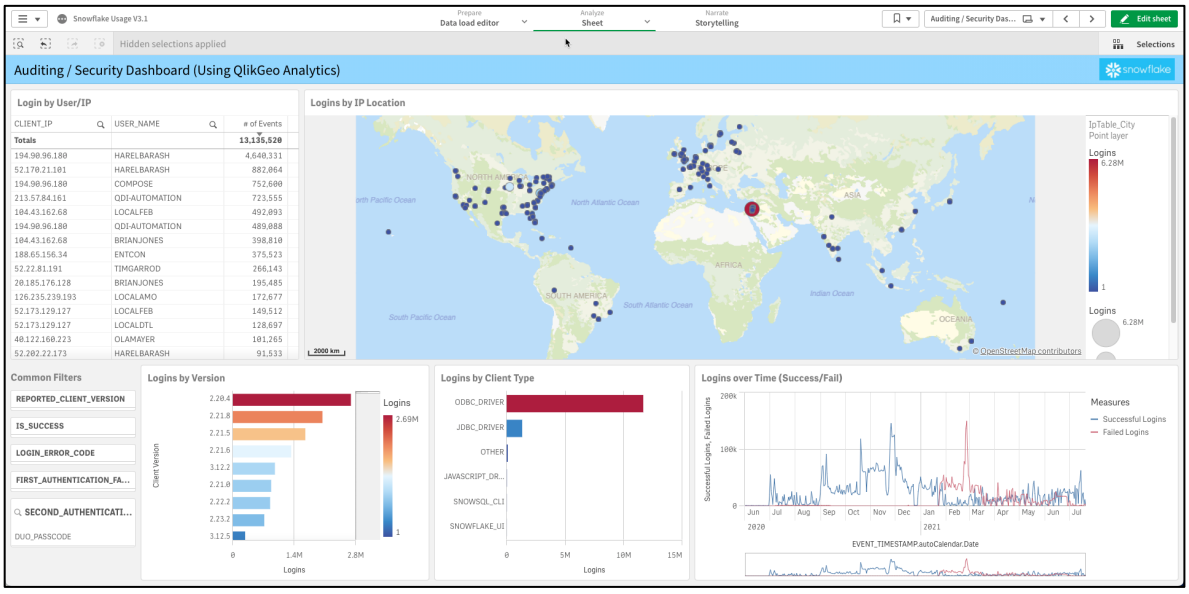
Enterprise Credit Usage:

This dashboard is based on consumption of pre-purchased credits vs usage. The chart shows when purchased credits are running out.



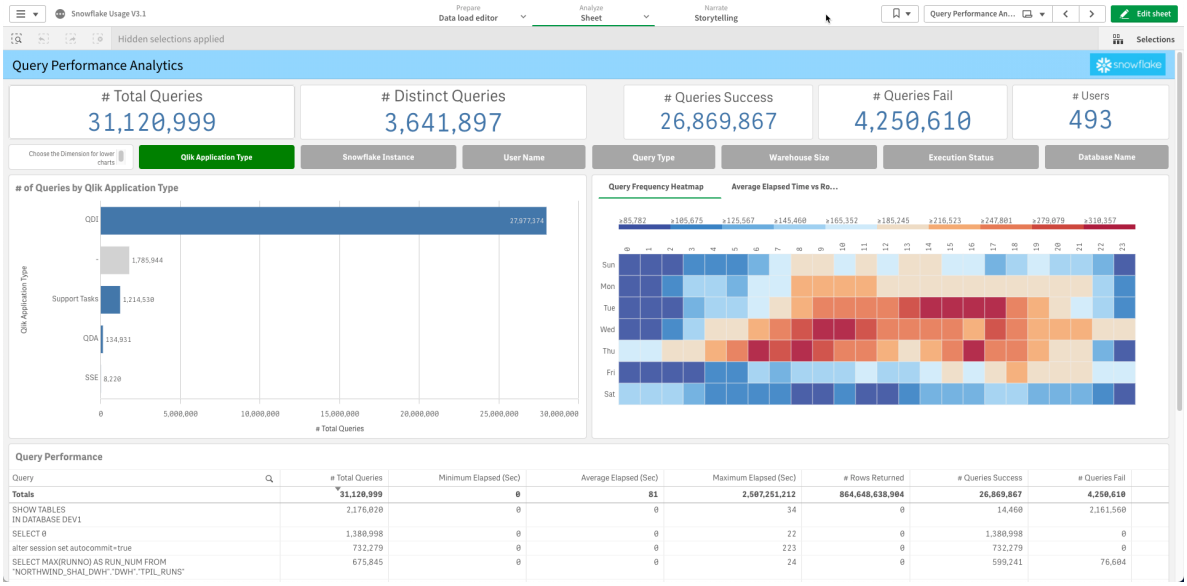
Auditing / Security:

This dashboard uses the GeoAnalytics IPlookup feature to display where users are logging in from around the globe. Also allows for investigation how users are accessing the system, version of drivers used, and when/how often users are accessing the system.



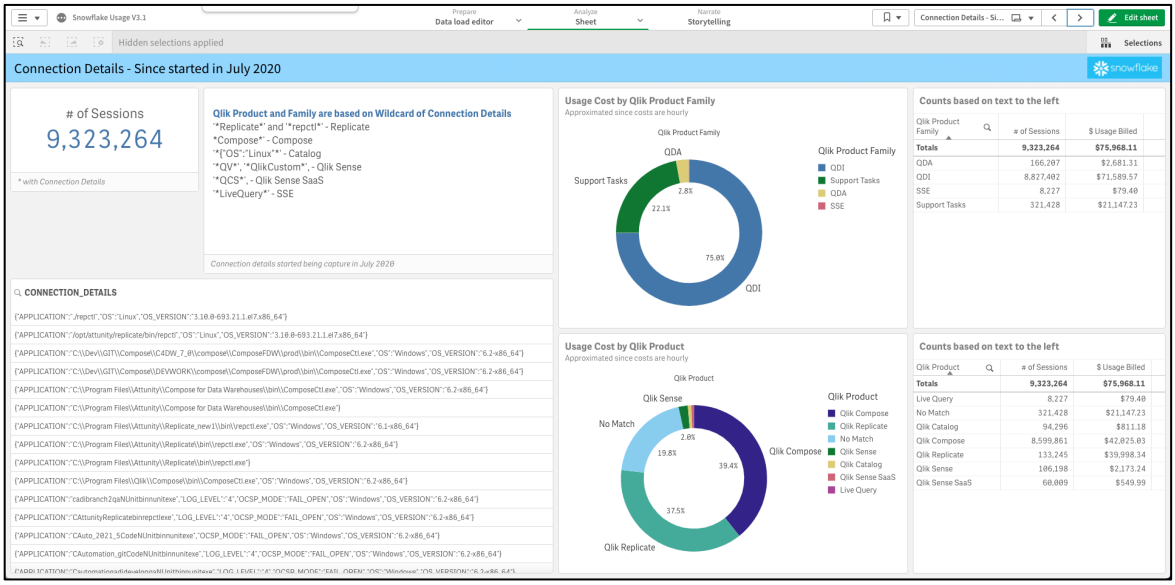
Query Performance:

This dashboard can be used to understand query performance, usage hotspots, query volumes vs runtime, errors, and dive deep into query details.



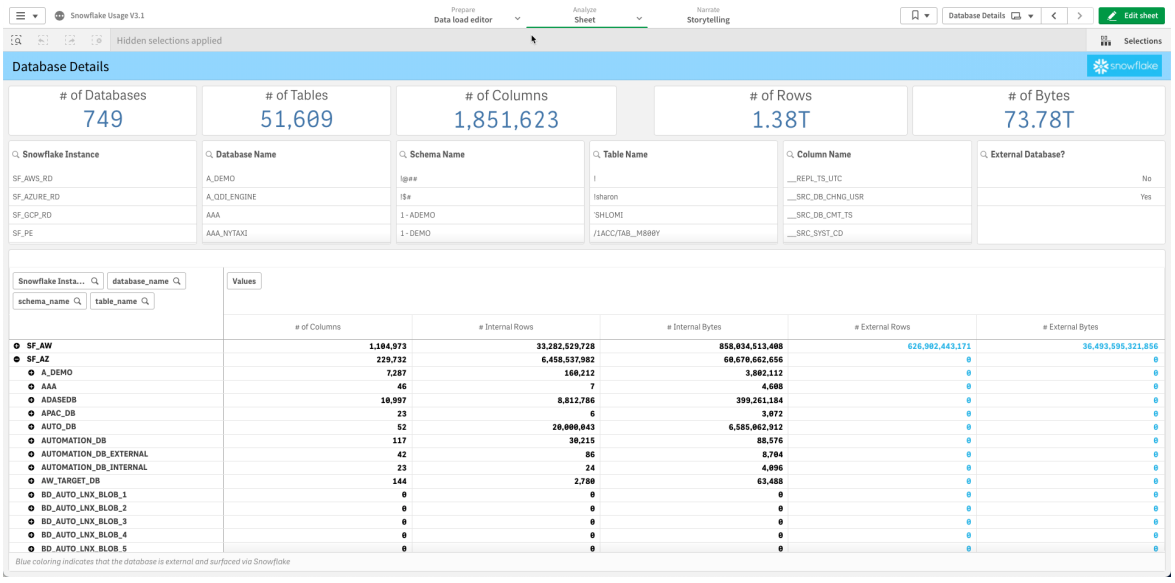
Connection Details

Using the Wildmatch function Qlik can tag all the connections string used in Snowflake and assign them to a particular product. In this dashboard all Qlik products for both QDI and QDA have been mapped to their respective connection string information in order to understand cost by product/family.



Database Details

Metadata browser for all Snowflake Instances, Databases, Schemas, Tables, and Columns by internal or external storage.



Appendix: Connecting Qlik to Snowflake (QSE and Qlik SaaS)

Making Snowflake Connection

- Native connector is available for connecting to Snowflake.
- ODBC Driver from Snowflake can also be installed and used for client managed version when using Qlik Sense Enterprise.

Authentication Methods

- To connect to Snowflake, Qlik Sense currently supports username-password method or OAUTH to authenticate using the native connector.
- OAuth also can be used by Qlik Sense client managed to connect to Snowflake currently with ODBC downloaded driver. This can be accomplished using the Simba provided ODBC driver from Snowflake: https://docs.snowflake.com/en/user-guide/odbc-parameters.html

Some Key Snowflake Feature Support via Native Driver:

- Time Travel feature
- Custom SQL feature
- Reading External tables
- Customizable connection string
- Support for Variants / Nested JSON using dot notation
- Full support for Direct/Live connections

NOTE: It's important to understand any and all SQL written against Snowflake will work in Qlik Sense in the SQL SELECT component of the Qlik LOAD script.

Appendix: ODBC Connection Setup

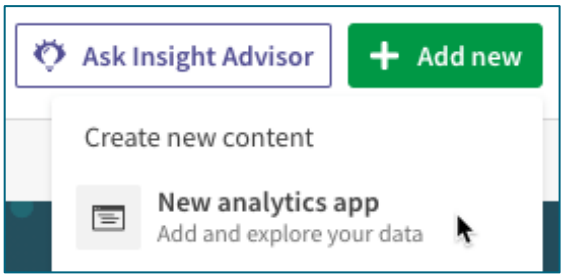
For Qlik Sense Enterprise (Client Managed) Snowflake access there are multiple connectivity options, Native Connection or downloaded and installed ODBC Connection from Snowflake

For Qlik Sense SaaS only Native Connection is available.

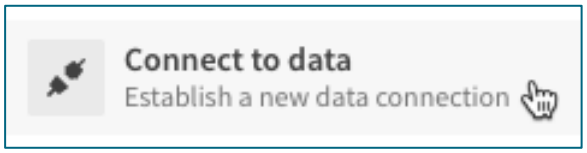
For more details and explanations visit the Qlik Help Site:
https://help.qlik.com/en-US/connectors/Subsystems/ODBC_connector_help/Content/Connectors_ODBC/Snowflake/Snowflake-connector.htm

Native Connection (Qlik Sense Enterprise / Qlik SaaS):

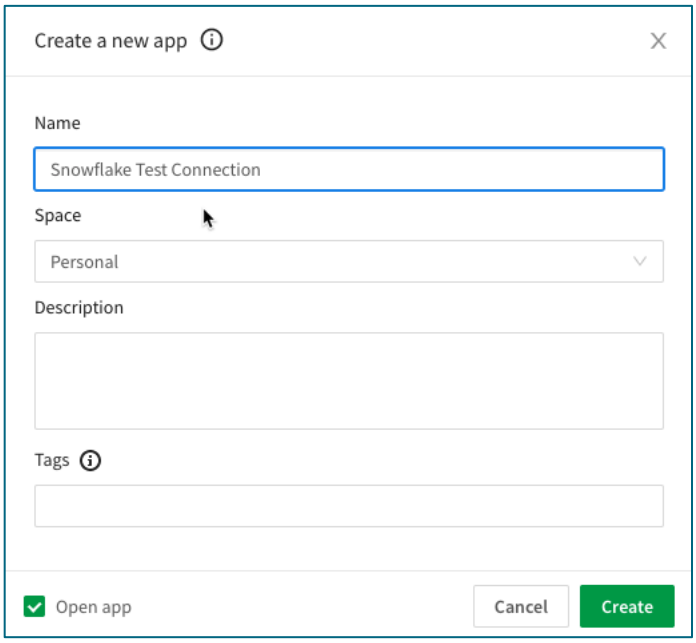
After logging into Qlik (SaaS or Enterprise) – Create a New App or Create a new Data Connection: For this example, I will show using Qlik SaaS.



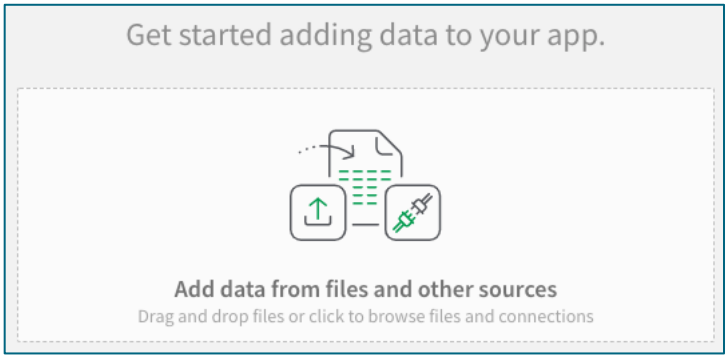
OR



Create a name and Click Create:



Start by Adding Data from Sources:



Choose the Named Snowflake Connector:

Complete the Connection by filling out the details of the Snowflake Connection (there are two options):

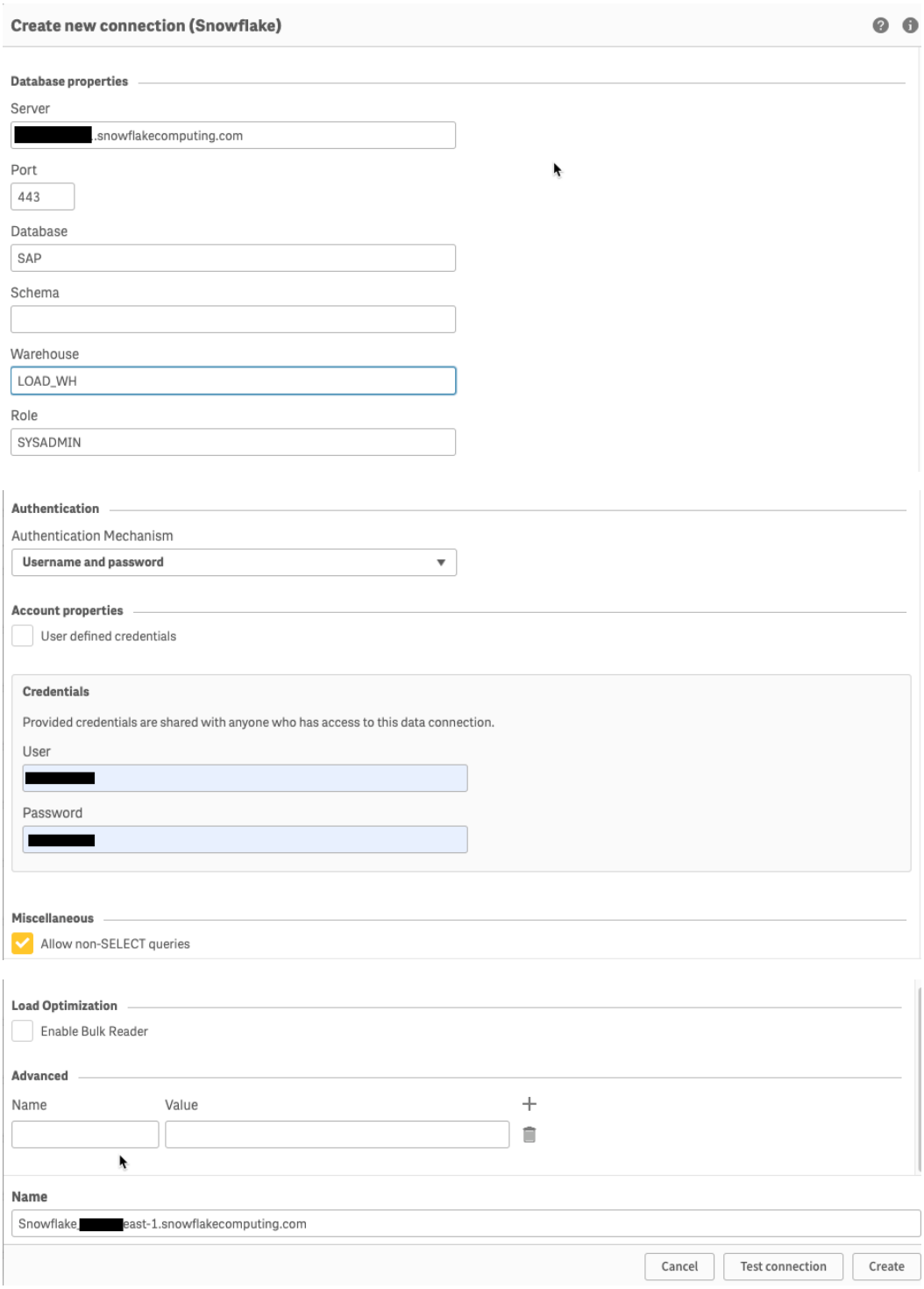
- Username and Password
- OAuth
- Key Pair

Username and Password Option Settings:

- Server (required): Snowflake system name
- Port (required): 443 (SSL)
- Database (optional): If you wish to set a default schema
- Schema (optional): If you wish to set a default schema
- Warehouse (required): Warehouse name (size/compute)
- Role (optional): Will use default role of user unless specified
- Authentication:
    - User Defined Credentials:
        - New credentials: Drop-down menu item that appears if User defined credentials is selected.
        - Existing credentials: Drop-down menu item that appears if User defined credentials is selected.
        - User: User name for the connection.
        - Password: Password for the connection.
        - Credentials name: Name given to a set of user defined credentials.
- Allow Non-SELECT Queries (optional): Allows use of SHOW, USE, DESCRIBE, etc functions…
- Enable Bulk Reader (optional): Speed improvement of Bulk Data load for large datasets

Advanced Settings: Advanced property / custom settings

Fully configured will look like this (username/password option):



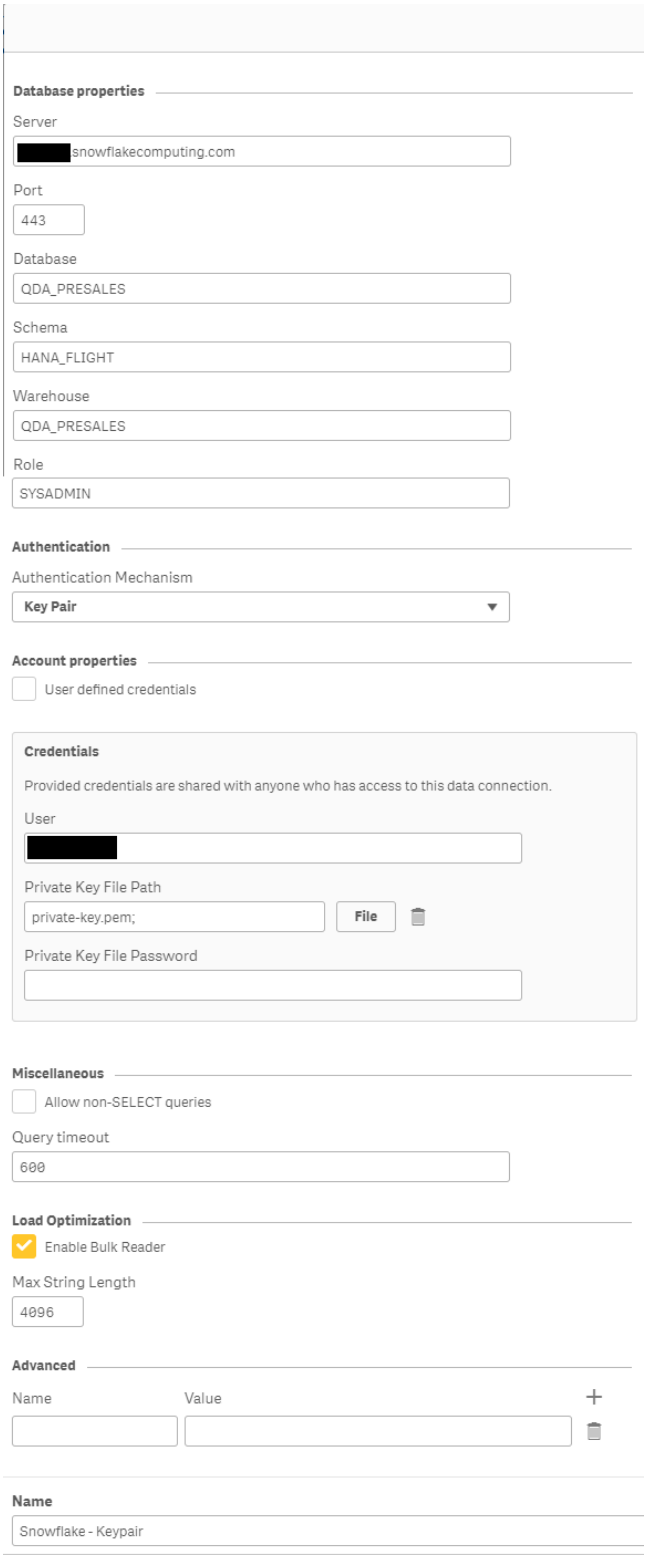
OAUTH Option Settings:

- Server (required): Snowflake system name
- Port (required): 443 (SSL)
- Database (optional): If you wish to set a default schema
- Schema (optional): If you wish to set a default schema
- Warehouse (required): Warehouse name (size/compute)
- Role (optional): Will use default role of user unless specified
- Authentication:
    - OAuth: Select this drop-down option to authenticate via OAuth.
    - OAuth Server (Authorize): URL of the authorization server.
    - OAuth Server (Token) : URL of the token server.
    - Client Id: The client id when configuring the OAuth authorization server.
    - Client Secret: The client secret when configuring the OAuth authorization server. This needs to be inputted every time the connection needs to be re-authenticated.
    - Scope If scope offers offline access, re-authentication is automatic. This property is optional.
- Allow Non-SELECT Queries (optional): Allows use of SHOW, USE, DESCRIBE, etc functions…
- Enable Bulk Reader (optional): Speed improvement of Bulk Data load for large datasets
- Advanced Settings: Advanced property / custom settings

Key Pair Options Setting:

- Server (required): Snowflake system name
- Port (required): 443 (SSL)
- Database (optional): If you wish to set a default schema
- Schema (optional): If you wish to set a default schema
- Warehouse (required): Warehouse name (size/compute)
- Role (optional): Will use default role of user unless specified
- Authentication:
    - Key Pair: Select this drop-down option to authenticate via Key Pair.
    - User : Your user id in Snowflake
    - Private Key File : A copy of the private key used to perform Key Pair authentication
    - Private Key File Password (Optional) : Password for key file if present
- Allow Non-SELECT Queries (optional): Allows use of SHOW, USE, DESCRIBE, etc functions…
- Enable Bulk Reader (optional): Speed improvement of Bulk Data load for large datasets
- Advanced Settings: Advanced property / custom settings

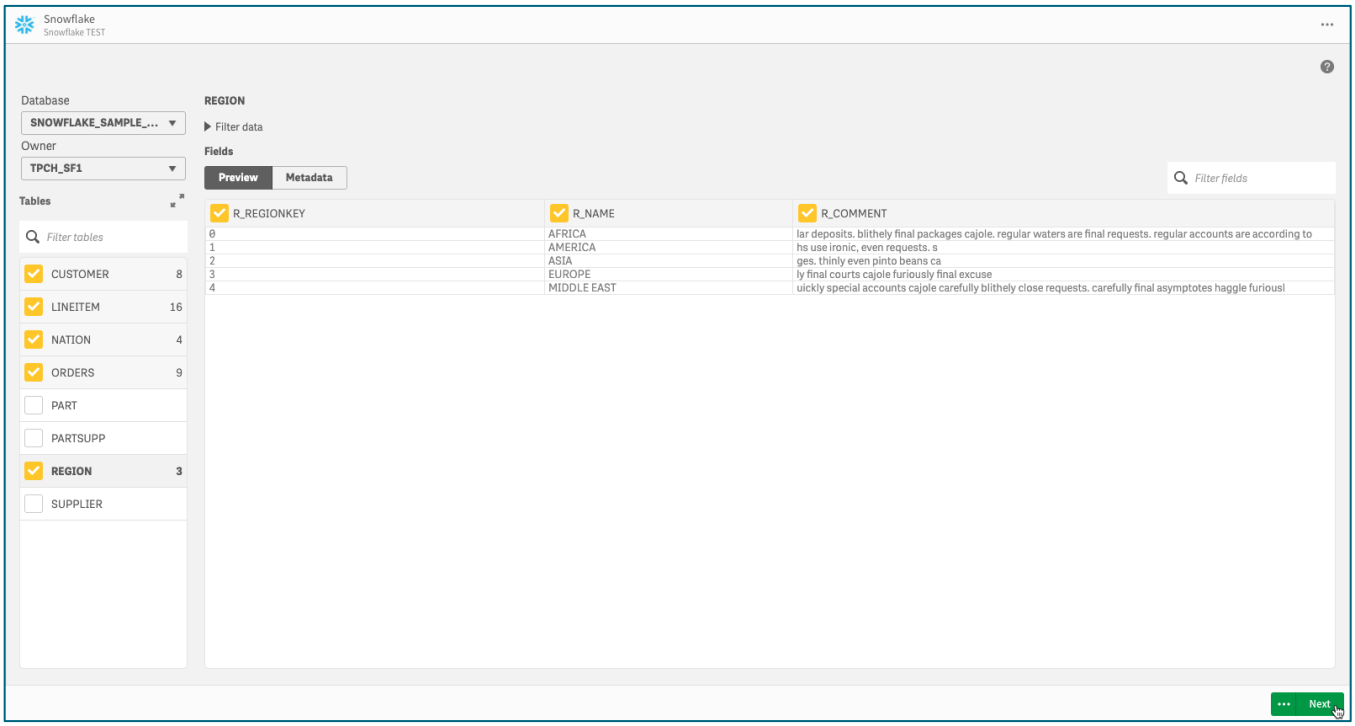
- Configuration Below



If everything is correct, you will get:

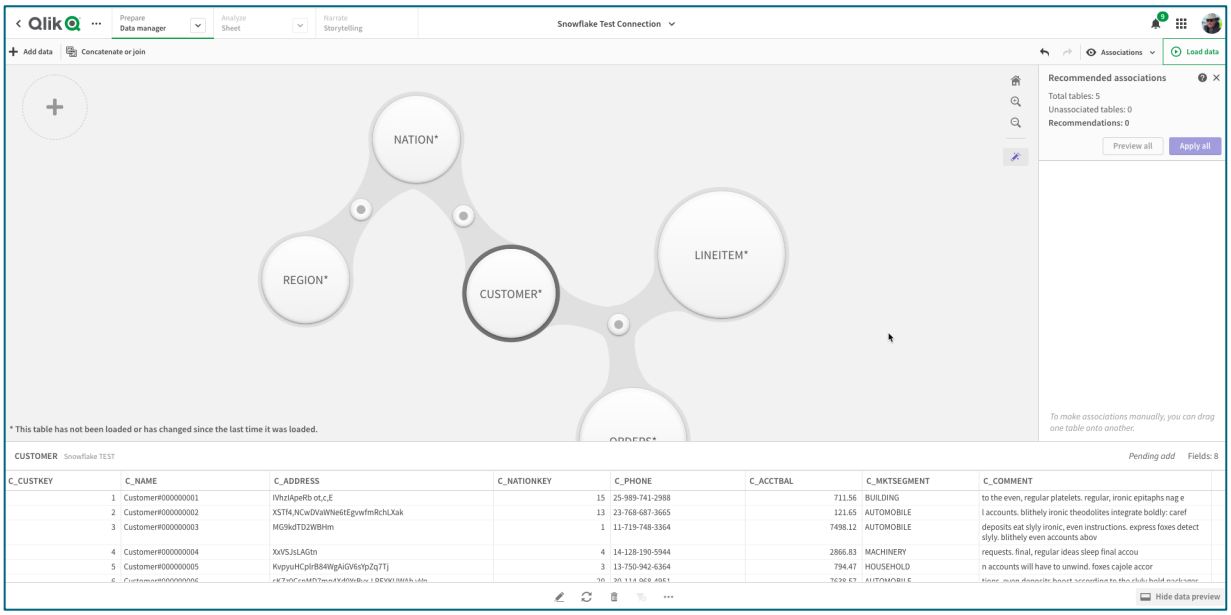
Click CREATE.

Now we will choose the data we want, for this scenario, we will use Snowflake sample data from TPCH_SF1.

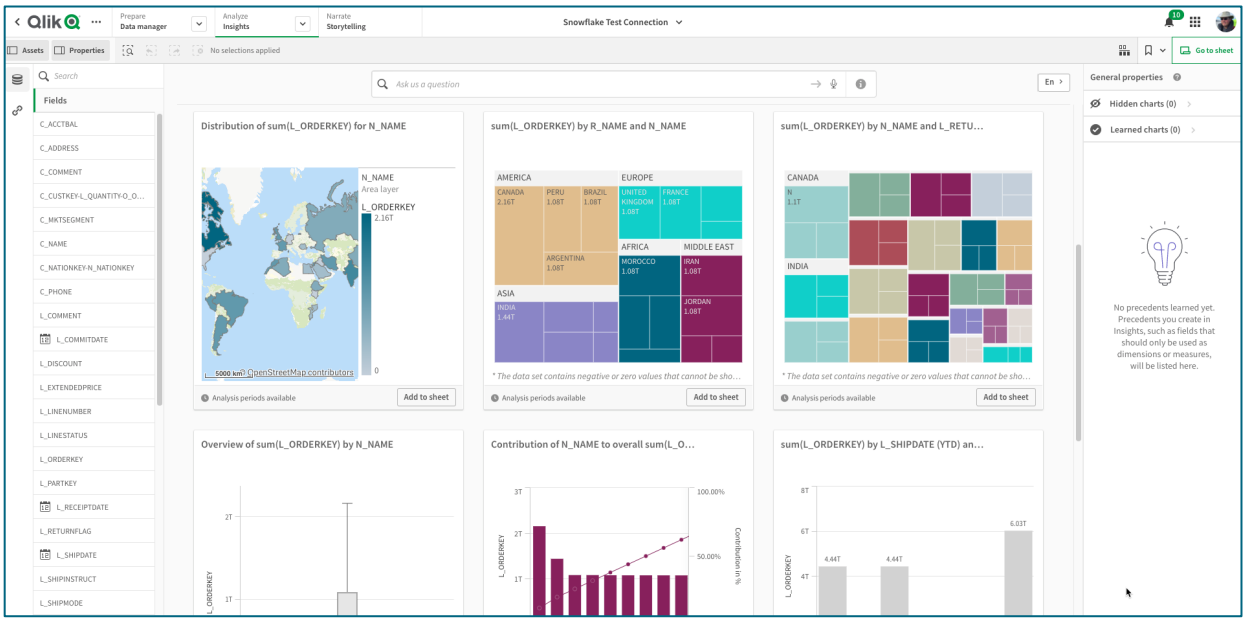


Select NEXT:

The sample data will be loaded and profiled.



One the data is connected in the Associative Model, we can LOAD DATA and test the app using Insights:



The data has successfully loaded!

Appendix: ODBC Connection (Qlik Sense Enterprise)

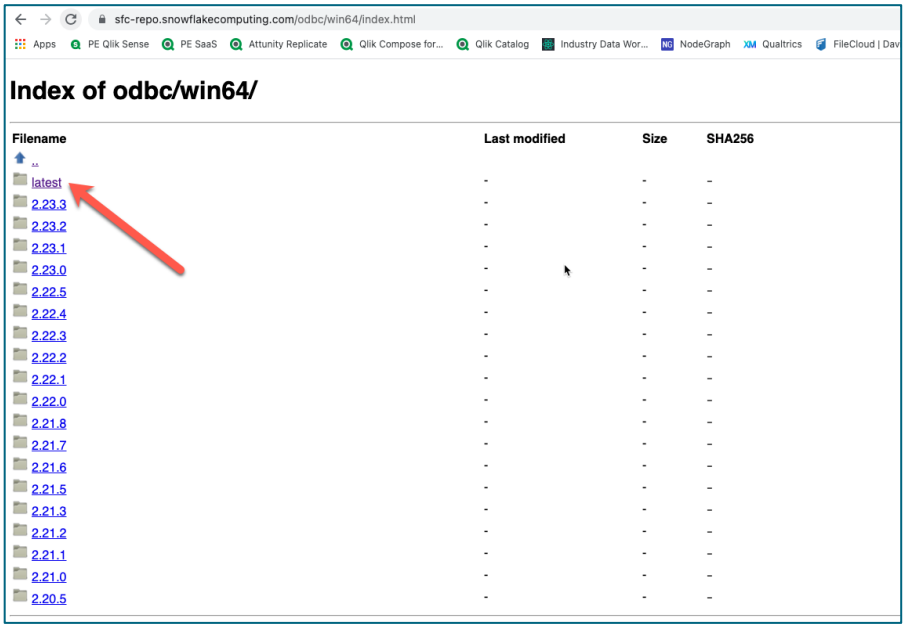
This capability is helpful when new features are released by Snowflake outside of the Qlik upgrade cycle.

Download the ODBC driver

https://docs.snowflake.com/en/user-guide/odbc-download.html

The installer for the Snowflake ODBC driver is distributed through the Snowflake web interface. Before downloading the driver, you may want to first verify the version of the driver you are currently using. To verify your driver version, connect to Snowflake through a client application that uses the driver and check the version. If the application supports executing SQL queries, you can call the CURRENT_CLIENT function.

To download the installer for the latest version of the driver for your platform (example for Windows x64): https://sfc-repo.snowflakecomputing.com/odbc/win64/latest/index.html



Appendix: Installing and configuring the ODBC Driver for Windows

Download can be found at:

https://docs.snowflake.net/manuals/user-guide/odbc-windows.html

Step 1. Double-click on the downloaded .msi file:

snowflake64_odbc-<version>.msi

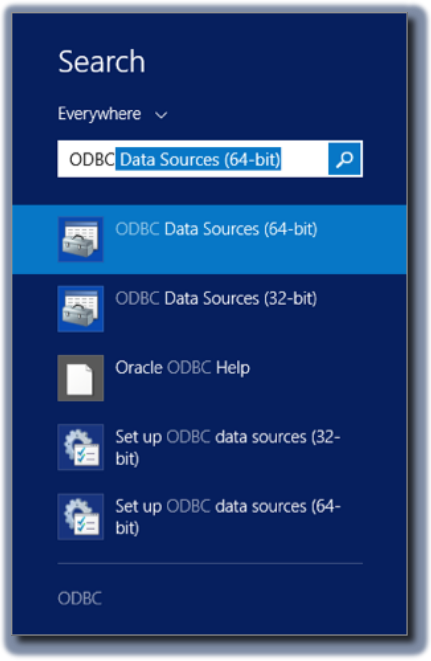
snowflake32_odbc-<version>.msi

Step 2. Configure the ODBC Driver

To configure the ODBC driver in a Windows environment, create a DSN for the driver:

Launch the Windows Data Source Administration Tool:

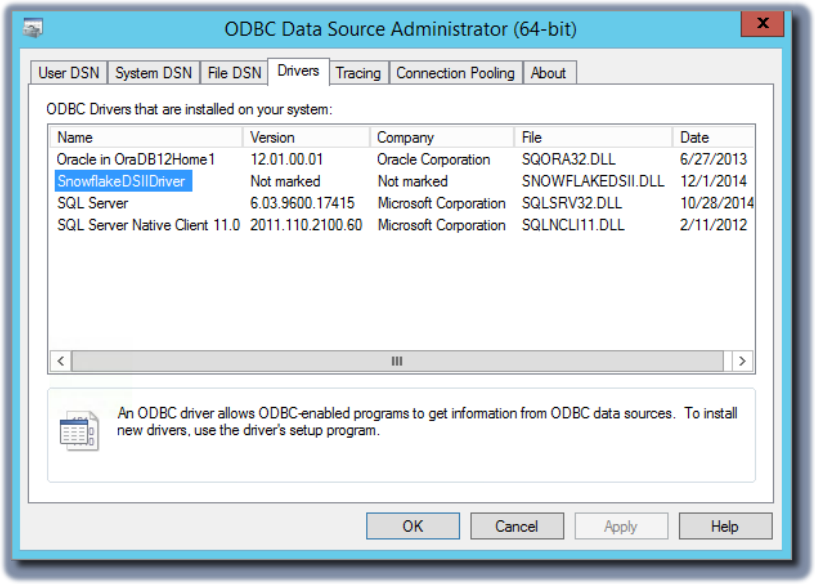
Search on your Windows machine for the launcher for the ODBC Data Source Administration Tool:



Once you find the ODBC administration tool, click on the tool to launch it and display the set-up window.

Verify that the Snowflake ODBC driver is installed:

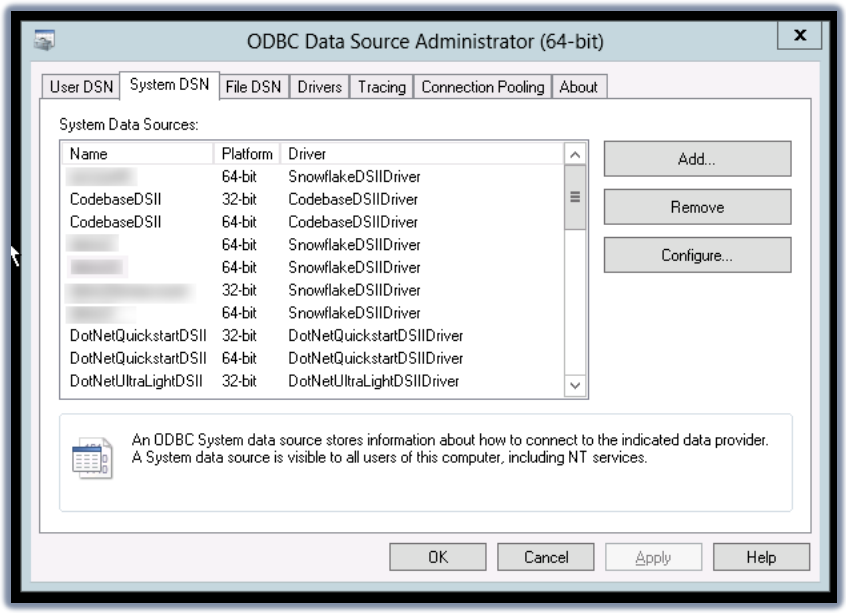
Navigate to the **Drivers** tab in the set-up window and verify that the driver (SnowflakeDSIIDriver) appears:



If you do not see **SnowflakeDSIIDriver**, then the Snowflake ODBC driver installation did not complete successfully and you need to re-install it.

Create a new DSN:

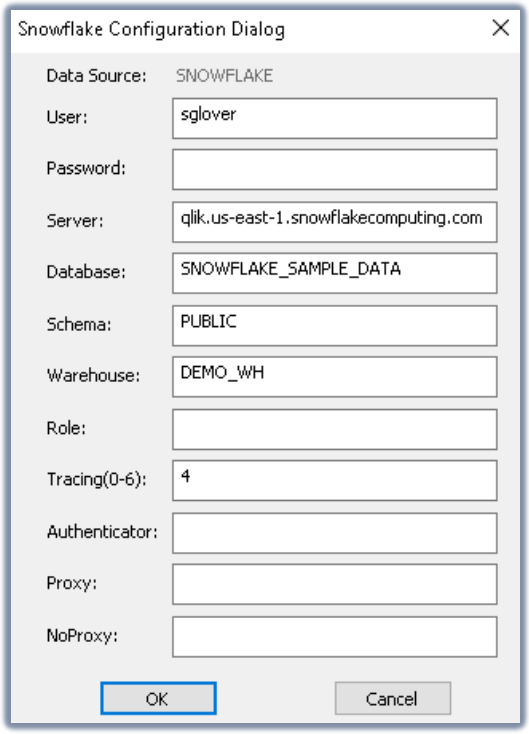
Navigate to the **User DSN** or **System DSN** tab and click the **Add** button:



Select **SnowflakeDSIIDriver** from the list of installed drivers.

Enter the connection parameters for the driver.

In the fields provided in **Snowflake Configuration dialog**, enter the parameters for the DSN:



When entering parameters, note the following:

Data Source, **User** and **Server** are the only parameters required to create a DSN.

The **Password** field accepts a value but does ***not*** store the value. This is a security precaution to ensure passwords are never stored directly in the driver.

All other parameters in the dialog are optional.

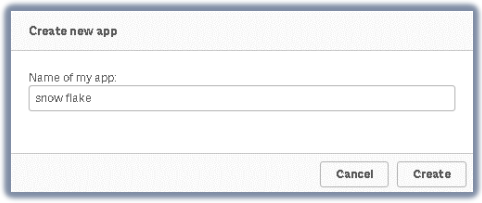
Appendix: Qlik Sense Configuration

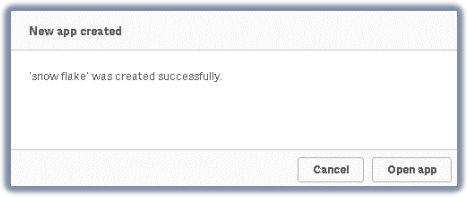
Install & Configure Qlik Sense

This is not covered in this guide, as we pre-assume a running Qlik Sense system. If you need to setup Qlik Sense – download Qlik Sense desktop (Qlik Sense Desktop).

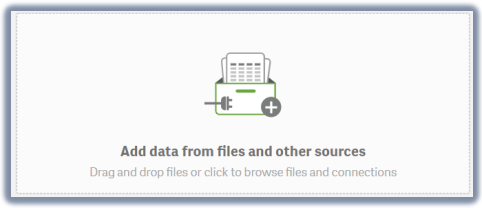
Creating the Qlik Sense App

Step 1. Open Qlik Sense and create a new App



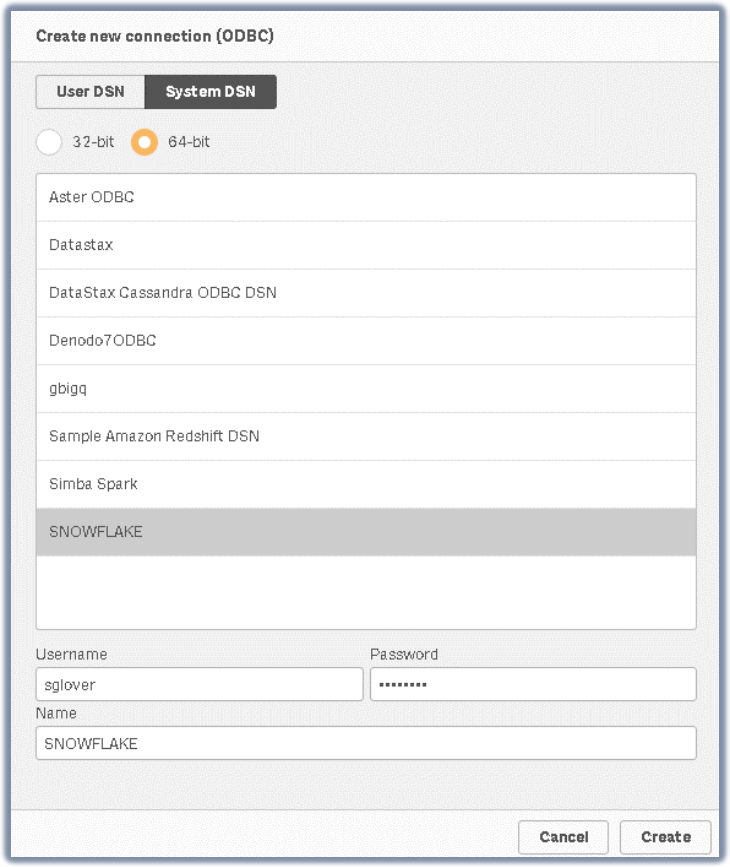


Step 2. Select - Add data from Files and other sources

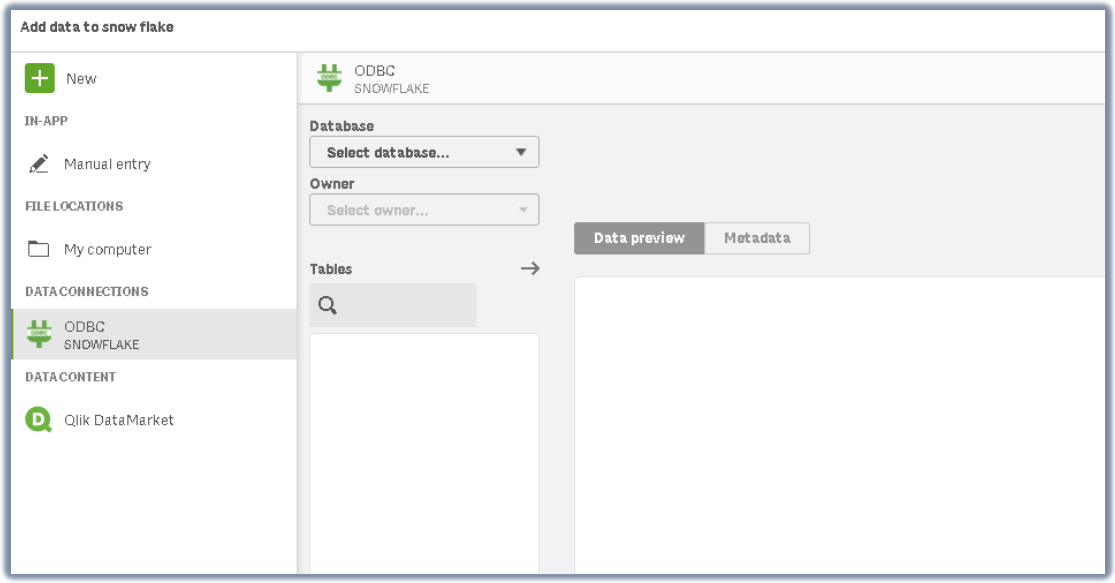


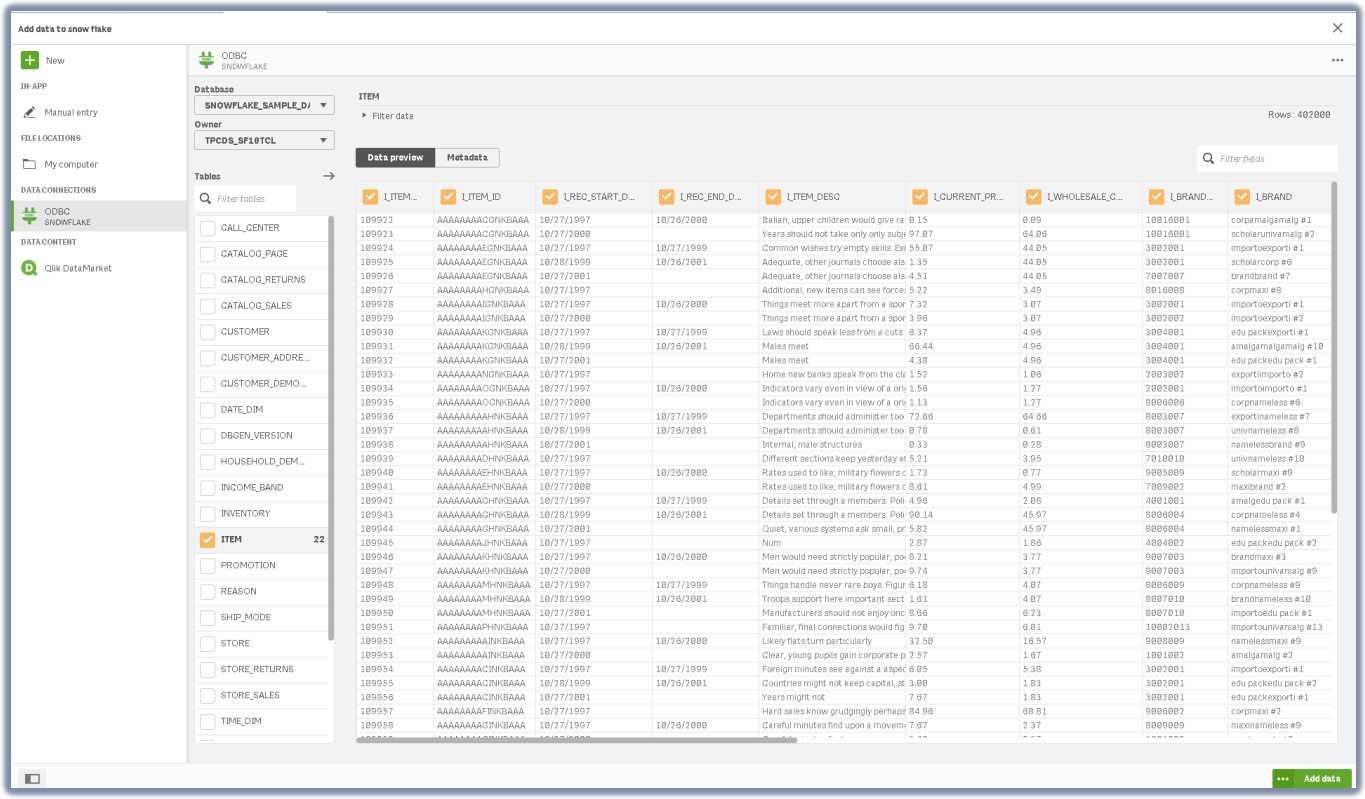
Step 3. Select ODBC

Step 4. Create new connection

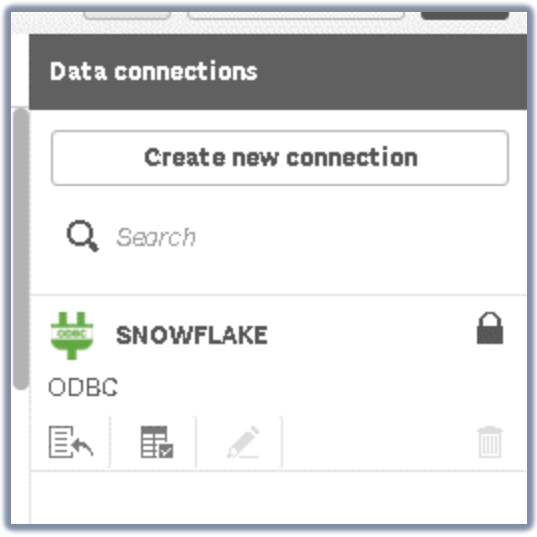


Step 5. Add data to the app

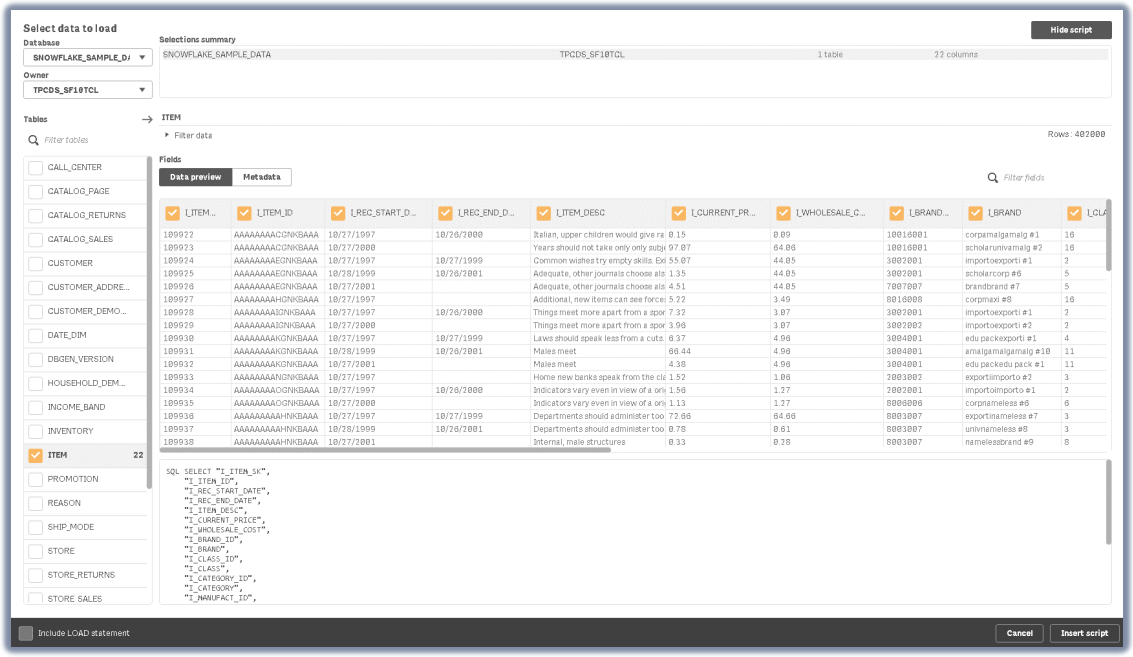




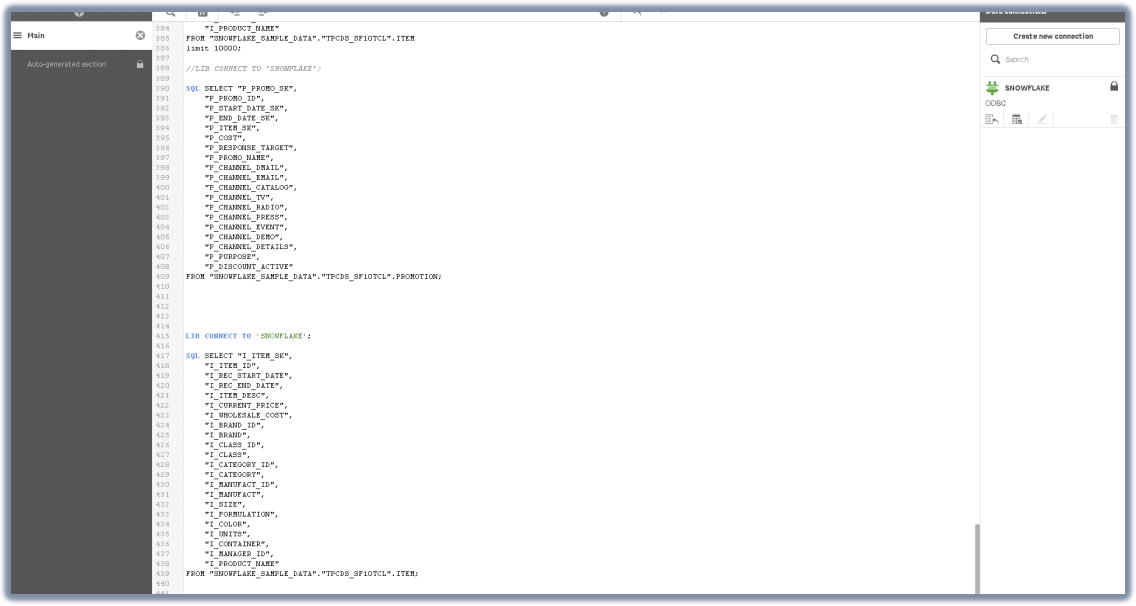
You can also load data by “select data “



Select the “Database” and the “Owner” and click on “Insert Script”

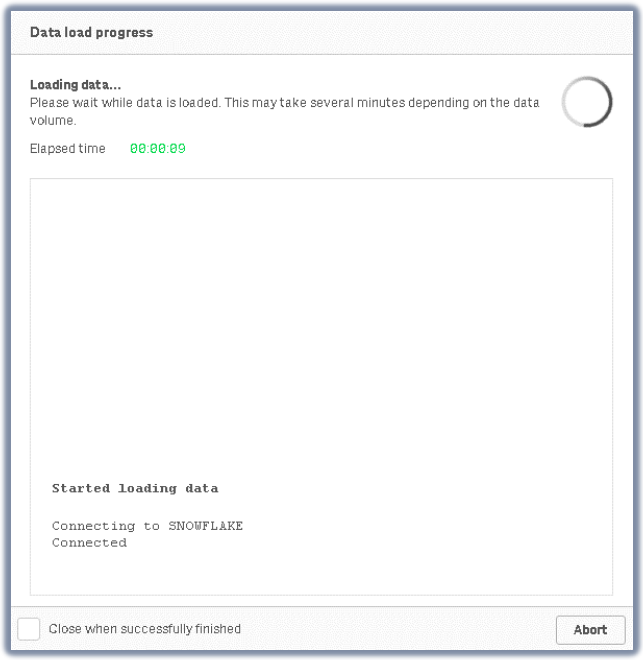


Script inserted in the “Main” section

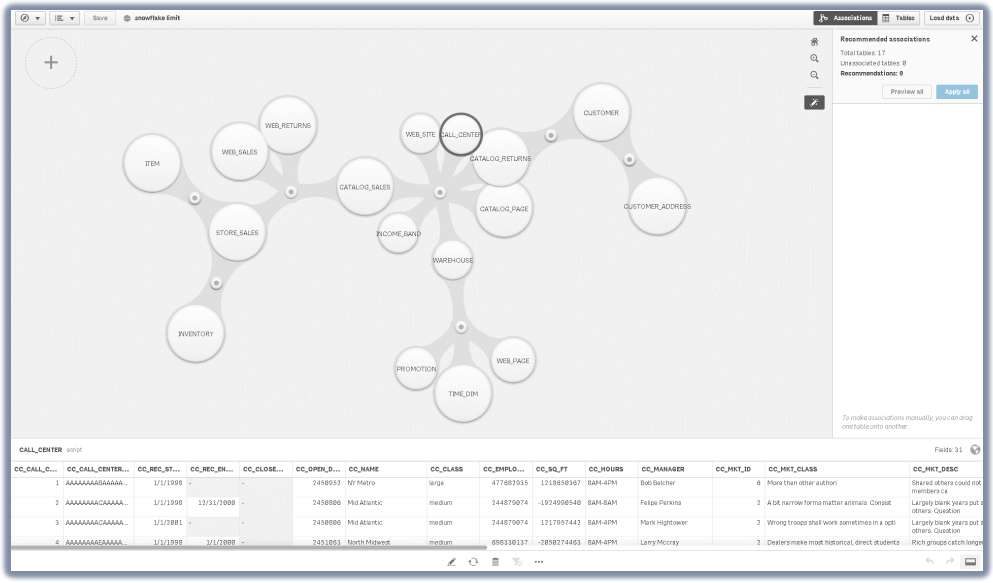


Click on “Load data”

Data load “Progress”



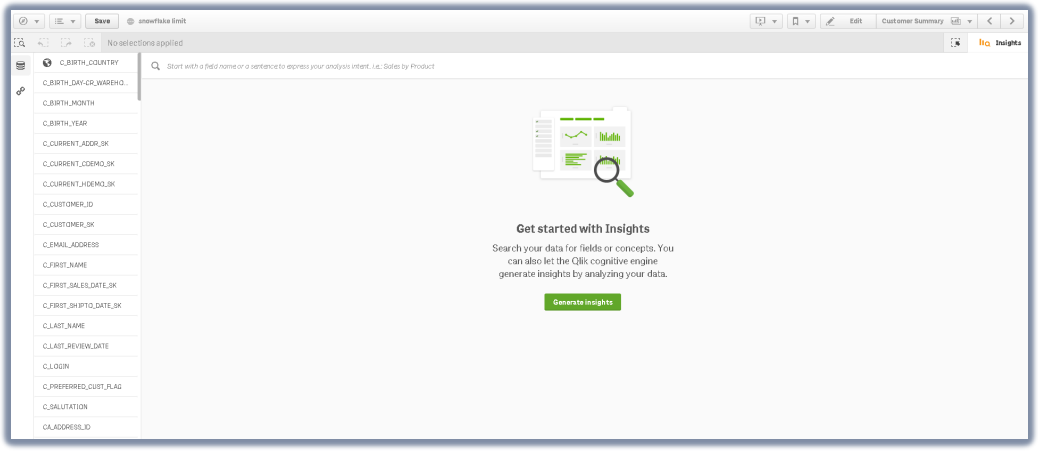
Go to “Data Manager” and build the “Associations”



Click on “Load Data”

Click on “Edit the sheet” and add the charts to the dashboard

Step 6. Generate Insights…



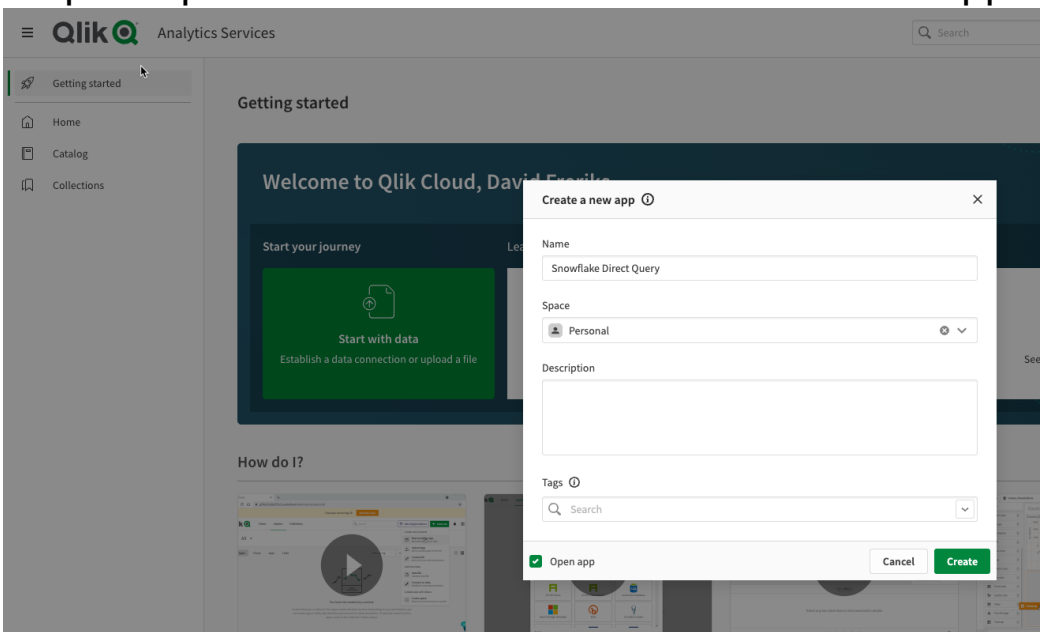
Step 7. Explore!

By either using insights or directly building on the canvas, we can build our app exploring Customer summary.

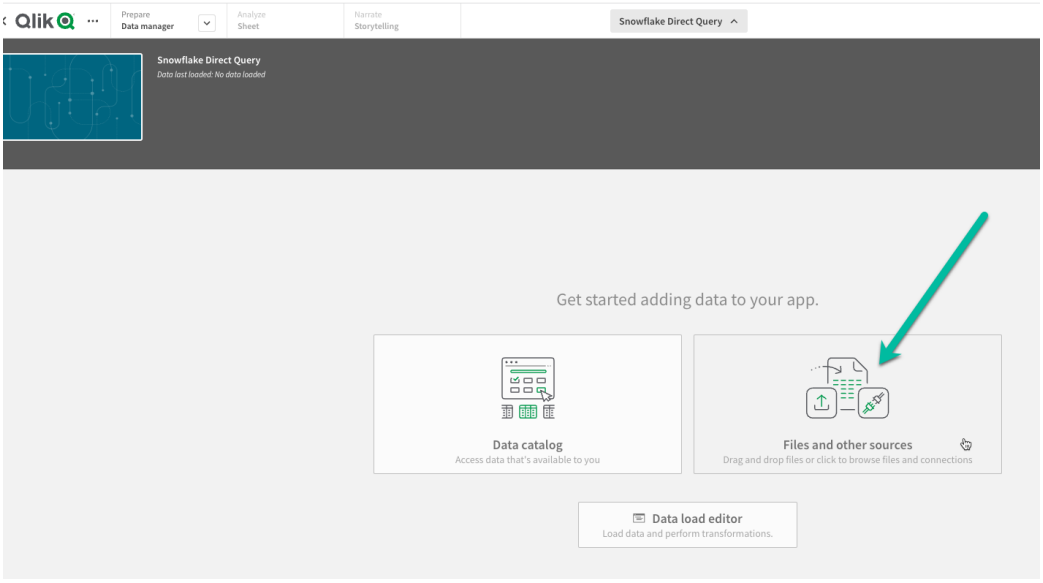
Appendix: Using Qlik Sense SaaS Direct Query

Direct Query as discussed above is a new option to connect to Snowflake with live queries.

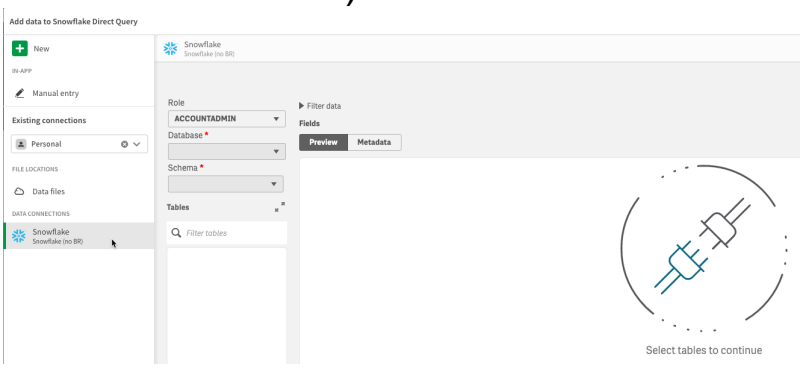
Step 1. Open Qlik Sense SaaS and create a new app



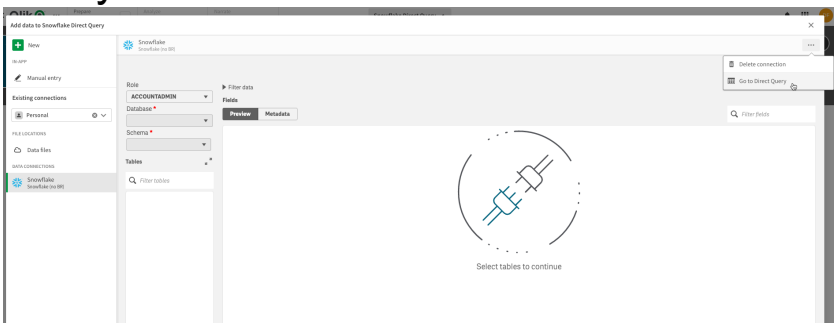
Step 2. Choose Files and other sources



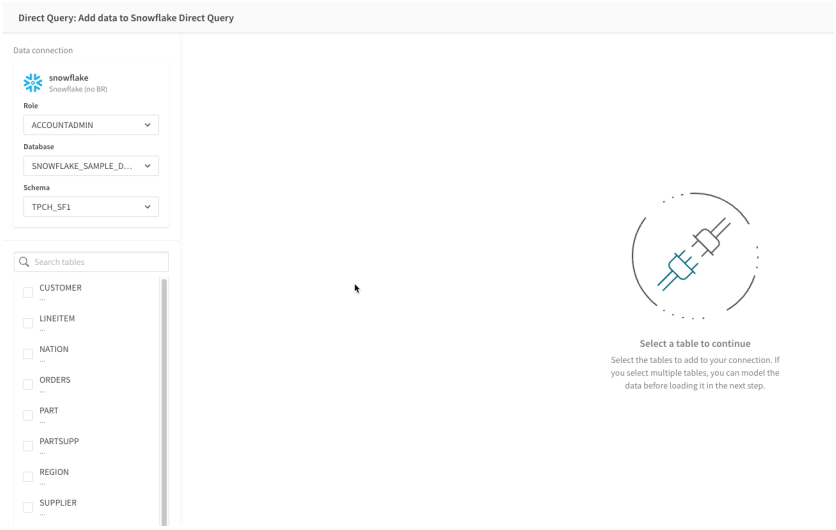
Step 3. Choose existing Snowflake Connection (or create per instructions above).



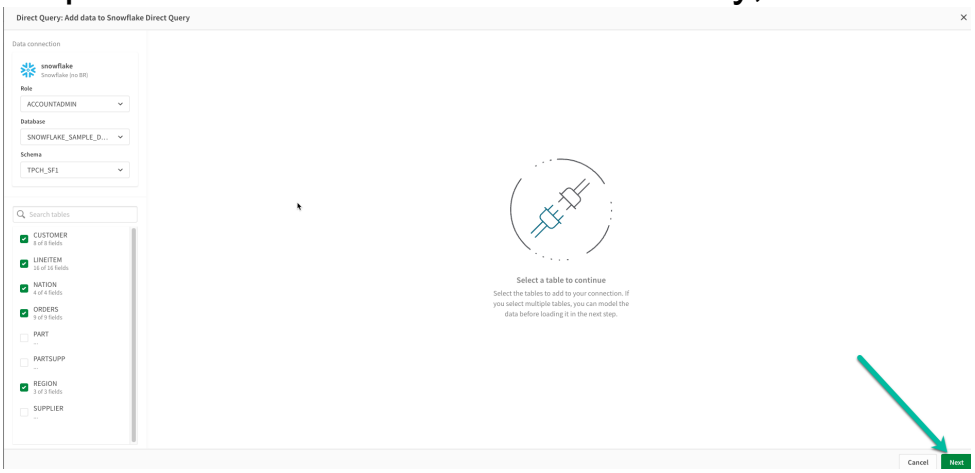
Step 4. When a Snowflake source is selected, a new option will appear in the top right corner, hit the dropdown and select “Go to Direct Query”.



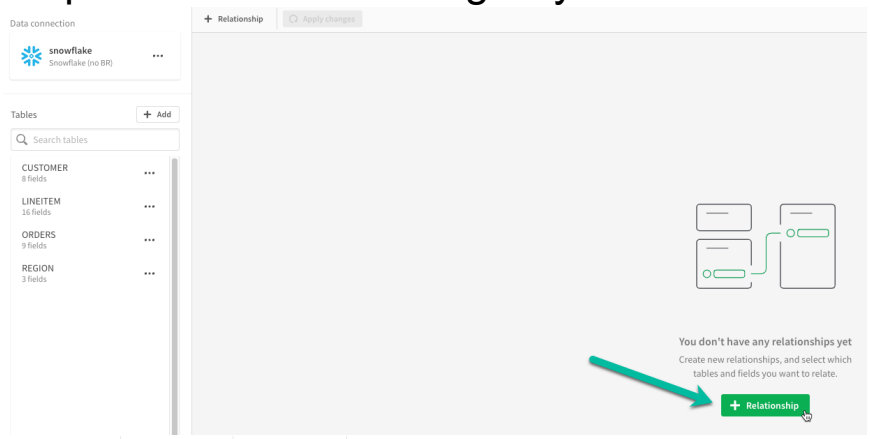
Step 5. A new interface will appear to create the data model for Direct Query (we will use Snowflake TPCH SF1 test data)

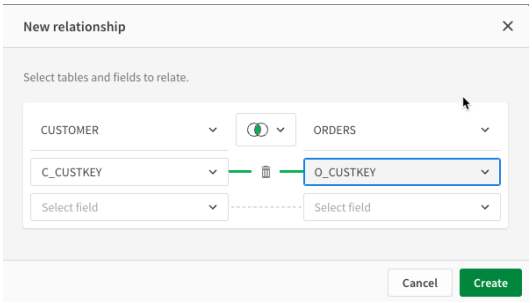


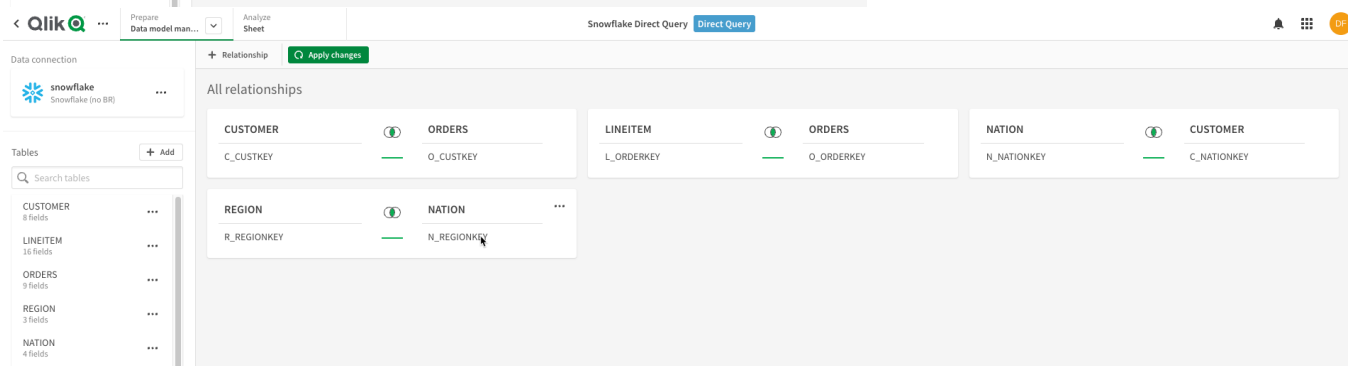
Step 6. Choose the tables for the Query, select Next



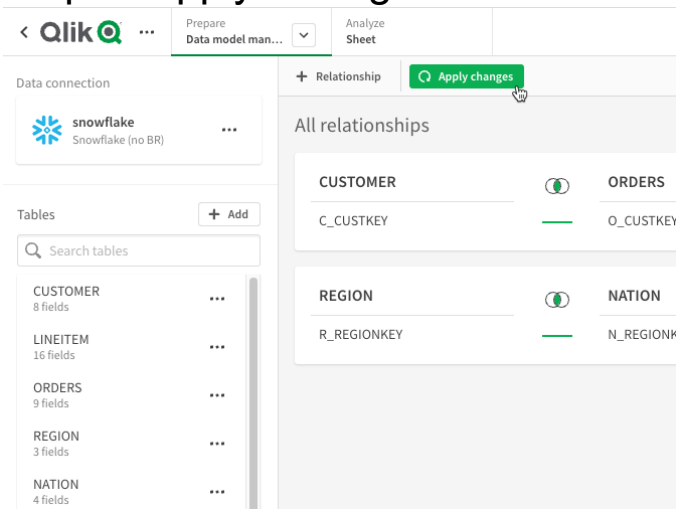
Step 7. Model Joins using Keys with "+ Relationship" button



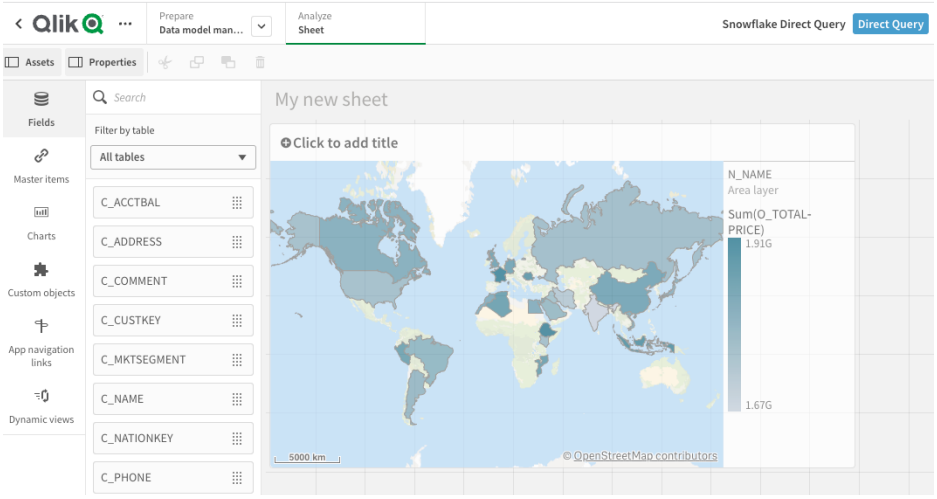




Step 8. Apply Changes



Step 9. Analyze Sheet and build Dashboard!



Conclusions

This document showcased many integration options and best practices for using the Qlik Sense Analytics Platform with the Snowflake Data Cloud. The document discussed high level concepts, practical applications, and most importantly strategies on how to combine Qlik and Snowflake best to optimize analytics at your organization. This document will be updated as new capabilities are added to both the Snowflake engine and Qlik Sense platform.

About Qlik

Qlik's vision is a data-literate world, where everyone can use data and analytics to improve decision-making and solve their most challenging problems. Our cloud-based Qlik Active Intelligence Platform® delivers end-to-end, real-time data integration and analytics cloud solutions to close the gaps between data, insights and action. By transforming data into Active Intelligence, businesses can drive better decisions, improve revenue and profitability, and optimize customer relationships. Qlik does business in more than 100 countries and serves over 38,000 active customers around the world.

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