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Original Article

Enhancing Business User Experience: By Leveraging SQL Automation through Snowflake Tasks for BI Tools and Dashboards

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Abstract: *In the era of data-driven decision-making, business intelligence (BI) tools play a crucial role in enabling organizations to derive actionable insights from their data. However, the complexity of data queries and the manual nature of report generation often hinder user experience. This article explores how SQL automation can enhance the business user experience by streamlining data access, improving report generation speed, and increasing overall usability within BI tools and dashboards. By automating repetitive SQL tasks, organizations can empower business users to engage with data more effectively, ultimately leading to better decision-making and strategic outcomes. Another direct use case of data preparation automation in diagnostic analytics, where an analysis is performed and then business users need to see it refreshed every next cycle when source data is refreshed*

Keywords: *SQL Automation, Business Intelligence, User Experience, BI Tools, Data Analytics, Dashboards, Data-Driven Decision Making, Stores procedures, Snowflake Task.*

I. INTRODUCTION

In today's age of making decisions based on data driven insights and strategies, in business operations and analytics have made it necessary for companies to incorporate SQL automation into their Business Intelligence tools and dashboards to improve their prowess and operational effectiveness significantly. SQL (Structured Query Language) the accepted language, for managing and querying databases in the industry can greatly simplify data operations when automated (Chaudhuri et al., 2011). By utilizing automated SQL queries, in their operations organizations can save time that would otherwise be spent on data manipulation and reporting. This empowers analysts and decision makers to concentrate on extracting insights from the data of being overwhelmed by technical intricacies (Helfert 2006). This transition does not improve user accessibility. Also democratizes data analysis by allowing non experts to interact directly with data, through user friendly interfaces offered by contemporary BI tools (Gartner 2020). Moreover incorporating automated SQL procedures, into BI dashboards enables the retrieval of data and the creation of reports both essential for making timely decisions in today's fast paced business world (Bertot et al., 2016). As businesses deal with growing data amounts and intricacy automating SQL queries is a tactic, for promoting a culture centered around data and staying competitive in the market.

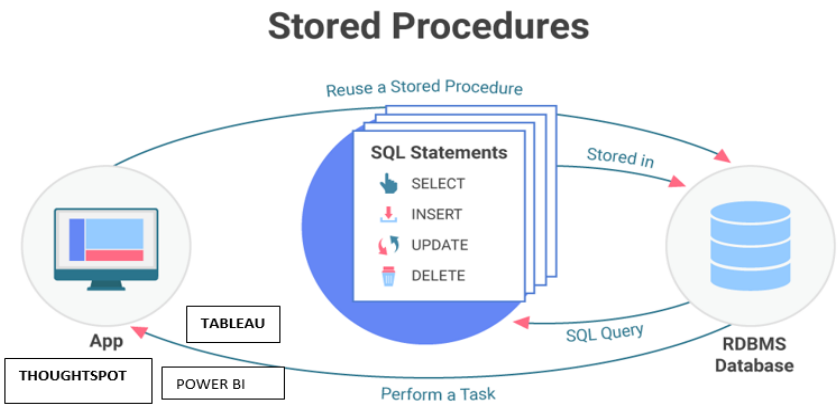

Figure 1: Architecture SQL automation

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Table 1: Comparison of automation by Stored procedures vs Tasks automation

Features	Snowflake Task Automation	SQL Server Stored Procedures
Architecture	Cloud-based data warehousing	On-premise and cloud-based RDBMS
Scheduling	Time-based and event-driven scheduling	Manual execution or triggered by events
Concurrency	Handles multiple tasks concurrently	Can handle multiple requests but may require resource management
Ease of Use	User-friendly, SQL-based definition	Requires more design and testing effort
Performance	Optimized for high concurrency	Precompiled, can offer faster execution for complex queries
Integration	Seamlessly integrates with Snowflake features (streams, warehouses)	Integrates well with Microsoft ecosystem and applications
Modularity	Tasks are simpler and less modular	Highly modular, supports complex logic

A. Problem Statement

In today's business landscape where organizations deal with a growing amount of data sets and data analysis requirements have become more demanding, than before; extracting valuable insights can be quite challenging when depending on conventional manual SQL queries methods. Numerous companies encounter inefficiencies due to the time-consuming nature of data extraction procedures that typically require repetitive SQL coding tasks susceptible to errors resulting in inconsistent outcomes and delayed decision-making processes. Moreover, the dependence, on data teams for creating reports restricts tech users' access to important information which hampers the organizations agility and responsiveness to market fluctuations. It may cause delays, for business stakeholders in obtaining insights which could inhibit innovation and quick responses. Likewise the absence of automation may create a knowledge void where business users feel detached from data leading to a culture that doesn't prioritize data driven decision making. This situation highlights the requirement for companies to integrate SQL automation into their business intelligence tools and dashboards to enable data access, in real time and enhance teamwork, between technical and non tech teams while ultimately achieving better business results by making informed decisions promptly.

B. Solution

Here are ten key points on the solution of leveraging SQL automation in BI tools and dashboards:

- Enhanced User Accessibility: Automated SQL processes provide intuitive interfaces that allow non-technical users to generate reports and insights without needing deep SQL knowledge, fostering a culture of data-driven decision-making across the organization.
- Time Efficiency: By automating repetitive SQL query generation and execution, organizations can significantly reduce the time spent on data retrieval, allowing analysts and decision-makers to focus on interpreting results rather than coding.
- Real-Time Data Access: Automation enables real-time data querying and reporting, ensuring that stakeholders have access to the most current information, which is critical for timely decision-making and responsiveness to market changes.
- Scalability: As data volumes grow, automated SQL solutions can scale effortlessly, managing increasing complexity without a proportional increase in manual effort, making it easier for organizations to adapt to changing business needs.
- Dynamic Reporting: SQL automation allows for the creation of dynamic dashboards that can automatically update and reflect changes in underlying data, providing users with up-to-date insights at a glance.
- Scheduled Reporting: Organizations can set up automated reporting schedules, ensuring that key stakeholders receive regular updates without having to request them, thus maintaining a continuous flow of information.
- Improved Collaboration: By democratizing data access through automated SQL, teams across the organization can collaborate more effectively, sharing insights and fostering a unified approach to data analysis.
- Integration with Advanced Analytics: Automated SQL can seamlessly integrate with advanced analytics tools and machine learning models, allowing organizations to derive deeper insights and predictive analytics from their data.

C. Uses

Here are ten key uses of leveraging SQL automation in BI tools and dashboards:

- Automated Reporting: SQL automation enables the generation of routine reports, allowing stakeholders to receive timely insights without manual intervention, enhancing productivity across teams.

- Real-Time Data Analysis: Users can quickly execute SQL queries to pull up-to-date data, facilitating real-time analysis that supports agile decision-making in fast-paced business environments.
- Self-Service Analytics: Empowering non-technical users to create their own queries and reports through automated SQL interfaces promotes a self-service analytics culture, reducing reliance on IT teams.
- Data Transformation: SQL automation can streamline data transformation processes, allowing users to easily manipulate and prepare data for analysis without complex coding.
- Interactive Dashboards: Automated SQL queries feed data into interactive dashboards, enabling users to explore data visually and gain insights through dynamic filtering and slicing options.
- Data Quality Monitoring: Automated SQL scripts can be used to regularly check data quality and integrity, alerting users to discrepancies or issues that may arise in the data pipeline.
- Trend Analysis: SQL automation allows for the easy identification of trends over time by automating the retrieval and visualization of historical data, supporting strategic planning and forecasting.
- Personalized Insights: Users can create customized reports tailored to their specific needs, leveraging SQL automation to quickly access and analyze data relevant to their roles.
- Integration with Other Tools: SQL automation can be integrated with other BI tools and data sources, enhancing the data ecosystem and providing a comprehensive view of organizational performance.
- Performance Optimization: Automated SQL processes can optimize query performance, ensuring that data retrieval is efficient and does not place unnecessary strain on database resources, thereby enhancing overall system performance.

D. Impact

Utilizing automated SQL processes, within Business Intelligence (BI) software and dashboards greatly boosts productivity and decision-making effectiveness while bolstering data strategy impact. By simplifying data retrieval and reporting tasks through SQL automation tools substantially decreases the effort and time needed for handling data. This shift enables teams to concentrate on analysis and strategic projects rather than routine duties. Improved efficiency does not speed up insight generation. Also elevates decision making quality by providing stakeholders with prompt access, to trustworthy data sources. Furthermore, the accessibility of data has increased due, to easy to use automated interfaces that allow non experts to work with data directly. This encourages a culture within the organization that values making decisions based on data. Improved teamwork between nonspecialized teams is facilitated as everyone can interact with and comprehend the data easily resulting in more coherent plans and projects. Furthermore, automating SQL procedures assists, in preserving the accuracy of data reducing mistakes made by humans and guaranteeing data quality. Organizations that can expand their operations without needing resources quickly adjust to changes, in the market landscape. SQL automation does not boost efficiency but also helps organizations discover valuable insights that fuel innovation and enhance performance measures to stay competitive in a data driven world for long term success.

E. Scope

The scope of leveraging SQL automation in Business Intelligence (BI) tools and dashboards is expansive, encompassing various dimensions that enhance data management, analysis, and reporting capabilities across organizations. At its core, SQL automation facilitates the efficient extraction, transformation, and loading (ETL) of data from multiple sources, enabling seamless integration into BI platforms. This integration allows organizations to create dynamic, interactive dashboards that respond in real-time to user queries, thus providing up-to-date insights that are critical for informed decision-making. Furthermore, the scope includes the development of user-friendly interfaces that empower non-technical users to generate their own reports and analyses, thereby democratizing data access and fostering a culture of data-driven decision-making throughout the organization. Beyond reporting, SQL automation can extend to data quality monitoring, where automated scripts regularly assess data integrity and consistency, alerting stakeholders to any discrepancies. Additionally, the scope encompasses the ability to schedule automated tasks, such as routine reporting and data updates, which ensures that insights are refreshed and readily available without manual intervention. As organizations increasingly adopt advanced analytics and machine learning techniques, SQL automation plays a crucial role in preparing and transforming data for these applications, further broadening its impact. Ultimately, the scope of SQL automation in BI tools and dashboards is not only about optimizing current processes but also about enabling organizations to harness the full potential of their data assets, driving innovation, strategic initiatives, and competitive advantage in a rapidly evolving market landscape.

Multiple real time case study was executed on same topic where the business problem was to get final business insights from raw data sources, below are few of the data sources available:

- IRI data
- Neilson data
- Numerator promotion data
- Sequoya promotion data
- Foot traffic data
- Season AAN /FAN data allergy incidences, flu incidences
- Customer buying patter

Need was to join all these sources and create business insights, maintain it every week with new data Solution approach provided was to first identify these tables as Dimension and FACT table into join these data tables through complex SQL logic and then automate those queries to run every Monday morning when new data arrives. all these SQL queries were optimized and scheduled by snowflake tasks scheduler, further to continue, first all these raw data sources need to be ingested into data lake and then need to be joined through SQL joins to provide final table that provides business insights through data visualizations

Raw data was ingested into snowflake data lake and then data preparation for business intelligence purpose was done by first creating SQL statements and then automating SQL queries through Snowflake tasks, business help achieved form this process is to append new data whenever new data arrives every Monday / weekly
This is how a task is scheduled in Snowflake

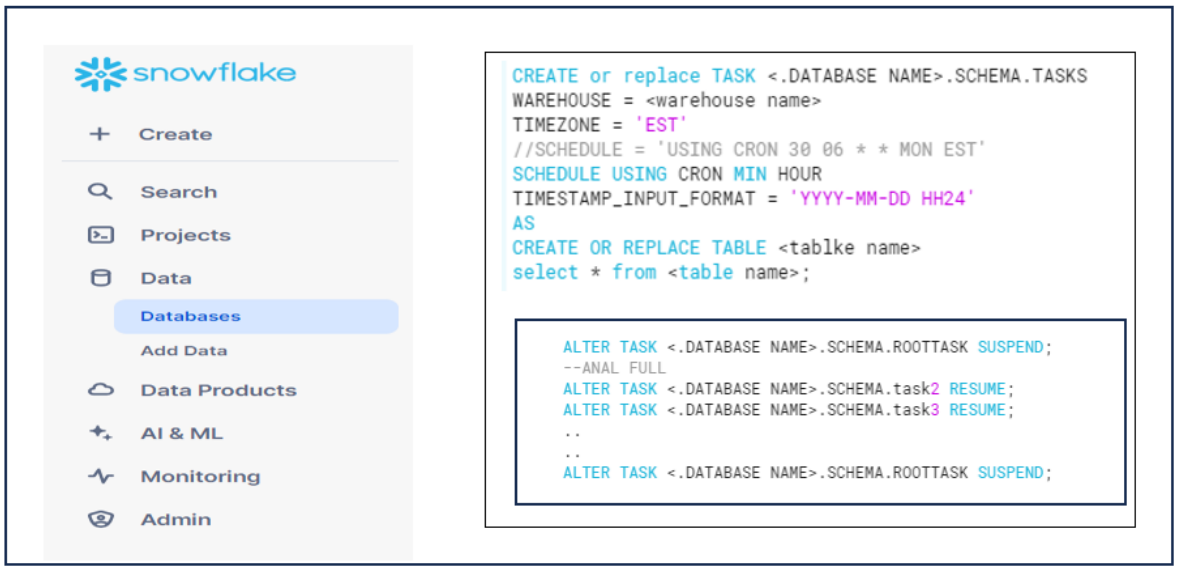

Figure 2: Snowflake schedule code

We can have multiple schedules, adjust refresh time based on any time zone , tasks can be scheduled for any weekday, exact hours and minutes . Mainly there is a root task that first needs to be suspended and then all dependent tasks are resumed and then finally root tasks is also resumed , root task will execute based on the time given in the scheduler . for the example shown above as commented code , it tells that tasks is scheduled at 6 hours and 30 mins EST tie on every Monday , these timezones could be changed to UTC or CST, PST etc.
More useful features are shown below,

- **Task status:** To check current status , the time it ran last time , what is the current status suspended or started , we can also see execute status of every task like that to make sure all tasks completed successfully
- **Run History** Provide details when it ran last time , we could full history of how many times it ran in last 7 days or any other time period, if task has not started then also it will show when will it start next

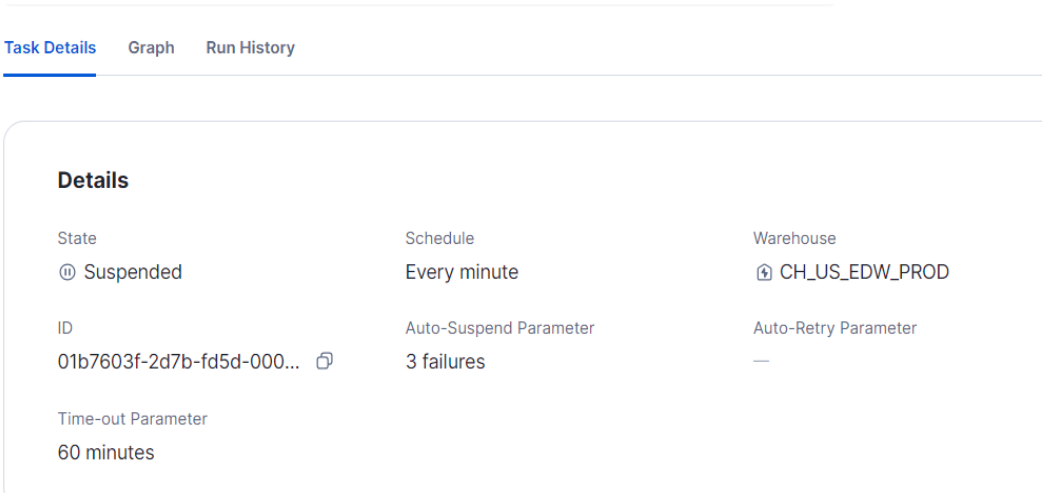

Figure 3 Snowflake Task Status Details

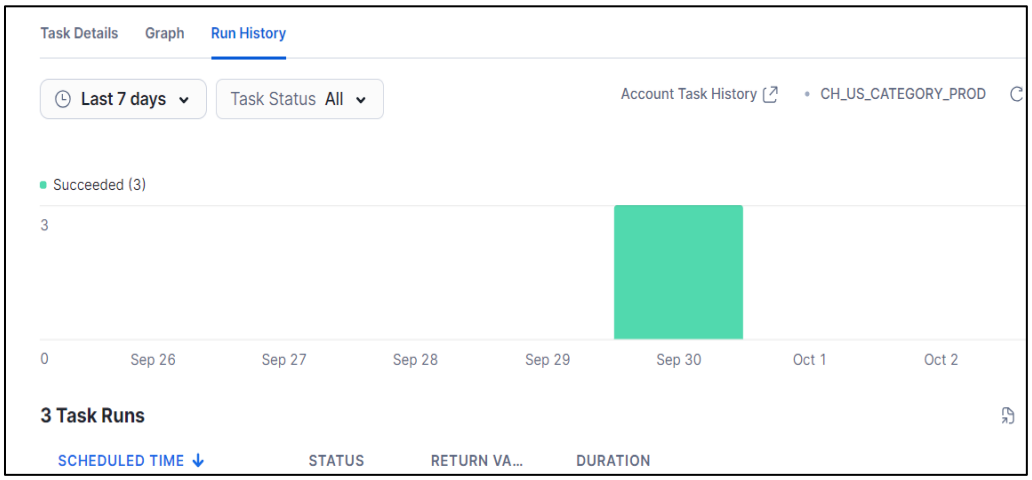

Figure 4: Snowflake Task History

Benefit was that a final table has all the data which is refreshable every Monday morning and business got latest updated insights. whole process was streamlined and fully automated, It avoids all cumbersome process where business to handle all these files individually which was very error prone and complicated. Another benefit was time saving for business, this automated process has a fixed time to get completed and data refreshed done.

II. CONCLUSION

SQL automation presents a transformative opportunity for enhancing the business user experience within BI tools and dashboards. By streamlining data access, automating report generation, and enabling self-service analytics, organizations can empower users to engage with data more effectively. As the analytics landscape evolves, embracing SQL automation will be critical for organizations seeking to improve decision-making processes and drive strategic outcomes. Further studies on SQL automation in Business Intelligence (BI) tools and dashboards should focus on several key areas of improvement to maximize its effectiveness and address potential challenges. Firstly, research could delve into optimizing automation algorithms to enhance performance and reduce latency in data retrieval, particularly for large datasets, ensuring that users receive timely insights without sacrificing accuracy. Additionally, there is a need to investigate the impact of SQL automation on data governance frameworks, specifically how automated processes can maintain data integrity, security, and compliance with regulations like GDPR or CCPA. Another critical area is user experience; understanding how varying levels of technical expertise among users affect their interaction with automated systems can inform the design of more intuitive BI tools. Moreover, studies should explore the integration of advanced analytics, such as machine learning and natural language processing, with SQL automation

to improve decision-making capabilities and predictive modeling in BI applications. Finally, examining the training and development needs of BI professionals in an increasingly automated landscape is essential, as organizations must ensure their teams possess the necessary skills to leverage these technologies effectively. By addressing these areas, future research can provide a comprehensive framework for enhancing SQL automation in BI tools and dashboards, ultimately leading to more effective data-driven decision-making.

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