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A Comparative Analysis of Cloud Data Warehouses and their Performance on Different Parameters

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Abstract: ***Data warehouses are a critical component of any modern enterprise. They provide a centralized repository for data from a variety of sources, which can then be used to gain insights into business operations. However, there are a number of different data warehouse platforms available, and each platform has its own strengths and weaknesses. This paper compares the performance of different data warehouse platforms on a variety of parameters, including performance, cost, scalability, ease of use, security, data types, joins, queries, OLAP, reporting, dashboards, analytics, integration, and support. The results of the study show that there is no single data warehouse platform that is best for all organizations. The best data warehouse platform for an organization will depend on the specific needs and requirements of that organization.***

Keywords: Data warehouse, Comparison of Data Warehouses, Performance.

1. Introduction

A data warehouse is a centralized repository of data that is designed for analysis. It is a subject-oriented, integrated, time-variant, and non-volatile collection of data.

Data warehouses are used to support decision-making by providing historical and current information about business operations. They can be used to identify trends, spot problems, and make predictions. [1] [7]

Data warehouses are typically implemented using relational database management systems (RDBMS). However, columnar database management systems (CDMS) are becoming increasingly popular for data warehouses because they are better suited for OLAP (online analytical processing) workloads.[2]

There are a number of different data warehouse platforms available, including commercial and open source platforms. The best data warehouse platform for an organization will depend on the specific needs and requirements of that organization.
Here are some of the benefits of using a data warehouse:

Improved decision-making: Data warehouses can help organizations to make better decisions by providing them with access to historical and current information about their business operations.

Increased efficiency: Data warehouses can help organizations to improve their efficiency by streamlining their business processes and reducing the amount of time it takes to access and analyze data.

Improved customer service: Data warehouses can help organizations to improve their customer service by providing them with a better understanding of their customers' needs and preferences.

Increased profitability: Data warehouses can help organizations to increase their profitability by helping them to identify new opportunities for growth, improve their marketing campaigns, and reduce costs.[3][8]

2. Data Warehouses

There are many data warehouses available in the market but for this particular research the researcher has taken into account these five data warehouses :

Oracle: It is a commercial database software company that has been around for over 40 years. Oracle offers a wide range of data warehouse products, including on-premises and cloud-based solutions. Oracle's data warehouses are known for their scalability, performance, and security.[4]

Microsoft SQL Server: It is a database management system developed by Microsoft. SQL Server is a popular choice for both on-premises and cloud-based data warehouses. SQL Server is known for its ease of use, flexibility, and integration with other Microsoft products.

Amazon Red shift: It is a fully managed, petabyte-scale data warehouse service in the cloud from Amazon Web Services (AWS). Redshift is based on the open source PostgreSQL database engine and uses columnar storage to improve performance. Red shift is a good choice for businesses that need to process large amounts of data quickly.

Google BigQuery: It is a server less, highly scalable, and cost-effective cloud data warehouse service from Google Cloud Platform (GCP). BigQuery uses the Google File System (GFS) for storage and the BigQuery Query Engine for querying data. BigQuery is a good choice for businesses that need to analyze large amounts of data quickly and easily.[5]

Snow flake: It is a cloud-based data warehouse that is designed to be highly scalable, secure, and easy to use.

Snowflake uses a unique architecture that separates storage from compute, which allows it to scale horizontally and provide high performance. Snowflake is a good choice for businesses that need to analyze large amounts of data quickly and easily.[6][9]

3. Parameters

The following parameters were used to compare the performance of different data warehouse platforms:

Performance: This parameter measures the speed and efficiency of the data warehouse platform.

Cost and Pricing: This parameter measures the initial cost of the data warehouse platform, as well as the ongoing costs of maintenance and support.

Scalability: This parameter measures the ability of the data warehouse platform to handle increasing volumes of data.

Ease of use: This parameter measures the ease with which users can interact with the data warehouse platform.

Security: This parameter measures the security features of the data warehouse platform.

Data types: This parameter measures the types of data that can be stored in the data warehouse platform.

Joins: This parameter measures the performance of joins on the data warehouse platform.

Queries: This parameter measures the performance of queries on the data warehouse platform.

OLAP: This parameter measures the performance of OLAP operations on the data warehouse platform.

Reporting: This parameter measures the ability of the data warehouse platform to generate reports.

Dashboards: This parameter measures the ability of the data warehouse platform to create dashboards.

Analytics: This parameter measures the ability of the data warehouse platform to perform analytics.

Integration: This parameter measures the ability of the data warehouse platform to integrate with other systems.

Support: This parameter measures the level of support that is available for the data warehouse platform.

The comparison on these parameters have been done by the researcher and been compiled in the following Table 1.

Table 1: Comparison of different Data Warehouses

Feature	Oracle	Microsoft SQL Server	Amazon Redshift	Google BigQuery	Snowflake
Performance	High performance for large-scale data processing	Good performance for a wide range of workloads	High performance for OLAP workloads	Excellent performance for large-scale data processing	Excellent performance for a wide range of workloads
Cost	Expensive	Moderate	Inexpensive	Inexpensive	Expensive
Pricing	Pay-per-use, with discounts for long-term commitments	Pay-per-use, with discounts for high - volume usage	Pay-per-use, with discounts for provisioned capacity	Pay-per-query	Pay-per-use, with discounts for provisioned capacity
Scalability	Highly scalable, with the ability to handle petabytes of data	Scalable to meet the needs of most businesses	Highly scalable, with the ability to handle petabytes of data	Highly scalable, with the ability to handle exabytes of data	Highly scalable, with the ability to handle exabytes of data
Ease of use	Easy to use for experienced database administrators	Easy to use for experienced database administrators	Easy to use for experienced database administrators	Easy to use for data analysts and engineers	Easy to use for data analysts and engineers
Security	Excellent	Excellent	Good	Good	Excellent
Data types	Supports all data types	Supports all data types	Supports all data types	Supports all data types	Supports all data types
Joins	Supports all types of joins	Supports all types of joins	Supports all types of joins	Supports all types of joins	Supports all types of joins
Queries	Supports all types of queries	Supports all types of queries	Supports all types of queries	Supports all types of queries	Supports all types of queries
OLAP	Supports OLAP	Supports OLAP	Supports OLAP	Supports OLAP	Supports OLAP
Reporting	Supports reporting	Supports reporting	Supports reporting	Supports reporting	Supports reporting
Dashboards	Supports dashboards	Supports dashboards	Supports dashboards	Supports dashboards	Supports dashboards
Analytics	Supports analytics	Supports analytics	Supports analytics	Supports analytics	Supports analytics
Integration	Supports integration with other systems	Supports integration with other systems	Supports integration with other systems	Supports integration with other systems	Supports integration with other systems
Support	Provides 24/7 support	Provides 24/7 support	Provides 24/7 support	Provides 24/7 support	Provides 24/7 support

4. Findings

The following findings are based on the results of the study:

- Organizations should carefully consider their needs and requirements before choosing a data warehouse platform.
- Organizations should consider the cost, performance, scalability, ease of use, security, data types, joins, queries, OLAP, reporting, dashboards, analytics, integration, and support when choosing a data warehouse platform.

- Organizations should consider using a hybrid data warehouse platform that combines the strengths of relational and columnar data warehouse platforms.
- Organizations should consider using an open source data warehouse platform if cost is a major concern.

5. Conclusion

In conclusion, there are a number of data warehouses available on the market, each with its own strengths and weaknesses. The best data warehouse for your business will depend on your specific needs and requirements.

When choosing a data warehouse, it is important to consider your budget, your data needs, your technical expertise, and your business requirements. Once you have considered all of these factors, you can start to narrow down your choices and choose the data warehouse that is right for your business.

Here is a summary of the key points from the comparison:

Oracle is a good choice for businesses that need a scalable, secure, and enterprise-grade data warehouse.

Microsoft SQL Server is a good choice for businesses that need a cost-effective, easy-to-use, and integrated data warehouse solution.

Amazon Redshift is a good choice for businesses that need a high-performance, petabyte-scale data warehouse.

Google BigQuery is a good choice for businesses that need a serverless, cost-effective, and easy-to-use data warehouse.

Snowflake is a good choice for businesses that need a highly scalable, secure, and easy-to-use data warehouse.

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