**PROG8410-23S-Section 2 – NoSQL Database Implementation**

**LAB 3 Assignment**

1. **Disadvantages of Column store databases:**

* Databases that use column store architecture are optimized for read-intensive tasks, and may not provide the same level of write speed as other database types.
* Advanced functionalities like full-text search or geospatial indexing may not be available in certain column store databases.
* Representing complex data structures or relationships with column store databases can be challenging due to their limited data modelling capabilities.
* Just like the previous bulletin complex queries or joins can be challenging in column store databases due to their limited querying capabilities.
* It may be difficult to ensure data consistency as certain column store databases have limited support for ACID, meaning Atomicity, Consistency, Isolation, and Durability.

**Citation -** [**https://databasetown.com/column-store-database/**](https://databasetown.com/column-store-database/)

1. **Examples of Column store databased:**

* **Amazon Redshift**

If deployments are hosted on AWS or use other AWS services then Amazon Redshift is widely used. It has great integration with other AWS products for example Amazon Kinesis, etc. Moreover, it takes care of all the system work and provides dynamic scaling.

* **Postgre SQL**

The most known row-based database has an option for column storage too. Postgre SQL may be very useful for people familiar with this platform and using it in production environments. It is an open-source solution; as the source code can be altered, the database can be fully tuned.

* **ClickHouse**

This is an open-source database made by Yandex. ClickHouse is mainly used for column-based storage. It also has a DBaaS offering. Moreover, this database is best at its performance.

* **SQream**

This database is a DbaaS solution that is suitable for extremely large workloads. It has great integration as it has machine learning data sets to produce reliable machine models according to a large amount of data.

* **MariaDB**

This is another well-known open-source database supporting both row and column-based storage. It is very compatible with MySQL, being able to use the huge tooling ecosystem

**Citation -** [**https://www.sentinelone.com/blog/column-oriented-database-examples/**](https://www.sentinelone.com/blog/column-oriented-database-examples/)

1. **Disadvantages of Document store database:**

* Document databases may not be as query-friendly as relational databases, especially when it comes to conducting complex multi-table joins.
* It may be difficult to guarantee data consistency and integrity in some document databases since these databases may not have built-in capability for data validation.
* Just like the above bulletin data consistency and integrity may be difficult in a schema-less model.
* The procedure of backup and recovery could be trickier than with conventional relational databases.
* The ACID (Atomicity, Consistency, Isolation, Durability) transaction capability of some document databases may make it challenging to guarantee data consistency in some circumstances.

**Citation -** [**https://databasetown.com/what-is-document-database/**](https://databasetown.com/what-is-document-database/)

**4) Examples of Document store database:**

* **MongoDB**

MongoDB is a document database that is popular for its user-friendly interface, scalability, and efficient performance.

* **Couchbase**

This database system offers the ability to query using both SQL and NoSQL, with an added caching layer to enhance performance.

* **CouchDB**

A database that operates on a document-based data model and supports ACID semantics, as well as map-reduce and incremental replication, is available as an open-source option.

* **Amazon Document DB**

Amazon Web Services offers a document database service which is managed, supports MongoDB, and enables simple scaling and replication of data.

**Citation -** [**https://databasetown.com/what-is-document-database/**](https://databasetown.com/what-is-document-database/)

**5) Disadvantages of Key-Value store databases:**

* Key-value stores lack complexity, which also means they lack refinement. Querying the database with anything other than the key is not possible due to the absence of a language or straightforward means.
* Without a unified query language to use, queries from one database may not be transportable into a different key-value database.
* The database views values as blobs, making it difficult to understand their contents. Retrieving information requires returning entire values rather than specific pieces, and updating values necessitate updating the entire value.

**Citation -** <https://www.techtarget.com/searchdatamanagement/tip/NoSQL-database-types-explained-Key-value-store>

**6) Examples of Key-Value store databases:**

* **Amazon Dynamo DB**

 DynamoDB has earned the trust of numerous large-scale and general users as a dependable database. With its built-in backup and security options, it is a fully managed and reliable solution. Moreover, it is capable of handling high loads and processing trillions of requests on a daily basis. These outstanding features are among the reasons why DynamoDB is highly regarded in the industry.

* **Aerospike**

This platform enables billions of real-time transactions while decreasing server usage by 80% and enhancing the performance of real-time applications.

* **Redis**

Redis, a data structure server, is a type of open-source key-value database that stores keys containing lists, hashes, strings and sets.

* **Berkeley DB**

This is a high-performance database storage library available as an open-source option, although it is fairly simple in its capabilities.

**Citation -** [**https://www.techtarget.com/searchdatamanagement/tip/NoSQL-database-types-explained-Key-value-store**](https://www.techtarget.com/searchdatamanagement/tip/NoSQL-database-types-explained-Key-value-store)

[**https://www.kdnuggets.com/2021/04/nosql-explained-understanding-key-value-databases.html**](https://www.kdnuggets.com/2021/04/nosql-explained-understanding-key-value-databases.html)

**7) Disadvantages of Graph-type databases:**

* One of the challenges with the architecture of this system is that it was designed as a one-tier infrastructure, which can make it difficult to scale effectively. This can lead to a number of issues, such as slow response times, poor performance, and difficulty accommodating increased user traffic or data loads.
* When it comes to querying, there is no one-size-fits-all approach. There is no standardized language for querying, which means that developers and analysts must be familiar with a variety of query languages depending on the system they are working with. This can make the process of querying more complex and time-consuming.
* When it comes to apps that involve transactions, graphs may not be the most optimal choice. They tend to be less efficient when handling large amounts of transactional data and may struggle with queries that encompass the entire database.
* Optimizing, maintaining, and scaling a graph database can be challenging due to the smaller user base compared to traditional relational databases, making it harder to find the necessary support.

**Citation -** [**https://www.ionos.ca/digitalguide/hosting/technical-matters/graph-database/**](https://www.ionos.ca/digitalguide/hosting/technical-matters/graph-database/)

[**https://www.influxdata.com/graph-database/**](https://www.influxdata.com/graph-database/)

**8) Examples of Graph-type databases:**

* **Neo4J**

The most popular graph database available today is Neo4J, which is open source and boasts excellent performance. Its Cypher query language is highly productive and makes working with your data simple. Neo4J offers both cloud and self-hosted enterprise versions of their database in addition to their open-source product. They also offer a data science platform that is tightly integrated with the ecosystem and provides 65 pre-built algorithms and models to help you gain insights into your data or build custom models.

* **TigerGraph**

The company TigerGraph offers a graph database with integrated visualization tools and features for data science tasks. The database utilizes its own query language called GSQL to access data and boasts impressive performance capabilities, supporting queries that can traverse 10 or more hops and scale to trillions of edges.

* **AWS Neptune**

Amazon Web Services offers AWS Neptune, which is a graph database that comes with support for both property and RDF graph data models. It also provides features such as automatic read replicas, backups, and replication across data centres. Neptune supports querying via Gremlin and SPARQL.

**Citation -** [**https://www.influxdata.com/graph-database/**](https://www.influxdata.com/graph-database/)

**9) Compare Column Stored Database vs Document Stored Database:**

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|  | **Column Stored Database** | **Document Stored Database** |
| **Meaning** | Type of NoSQL database storing data in columns like a traditional relational database | Type of NoSQL database storing data in the form of documents instead of tables with columns and rows |
| **Use Cases - IoT** | Column store databases are well suited for storing and processing IoT data because they can handle a large volume of writes and reads | Sensor data and other information produced by IoT devices can be stored in document databases |
| **Advantages** | Fast query performance | Fast read-write performance |
| **Disadvantages** | Advanced functionalities may not be available | Difficult to guarantee data consistency and integrity |
| **Examples** | Amazon Redshift | Amazon Document DB |

**Citation -** [**https://databasetown.com/what-is-document-database/**](https://databasetown.com/what-is-document-database/)

[**https://databasetown.com/column-store-database/#column-store-database-use-cases**](https://databasetown.com/column-store-database/#column-store-database-use-cases)

**10) Compare Key-Value Store Database Vs Graph-type Database:**

|  |  |  |
| --- | --- | --- |
|  | **Key-Value Store Database** | **Graph-type Database** |
| **Meaning** | A specialised NoSQL database type that employs the key-value technique and contains a large number of key-value pairs. | A specialised NoSQL designed for storing and querying data that is connected via defined relationships. |
| **Use Cases** | Key-value databases are often utilized to store session information for applications that necessitate user logins. | There are cases where multiple individuals are linked to a single email address, which is identified through account differentiation using graph type database. |
| **Advantages** | Key value databases can respond rapidly when the surrounding environment is constructed and optimized properly due to their simplicity. | You can use a tool to analyze data relationships and assess their quality compared to other information in your database making graph-type databases flexible |
| **Disadvantages** | Key Value Store Databases are simple which means that they are not refined | Graph type database has a smaller user base |
| **Examples** | Amazon Dynamo DB | AWS Neptune |

**Citation -** [**https://www.influxdata.com/graph-database/**](https://www.influxdata.com/graph-database/)

[**https://www.techtarget.com/searchdatamanagement/tip/NoSQL-database-types-explained-Key-value-store**](https://www.techtarget.com/searchdatamanagement/tip/NoSQL-database-types-explained-Key-value-store)

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**Thank you!**