Creation of an automated tool for evaluation and selection of NoSQL databases intended for financial services based on predefined criteria.

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***Abstract**: As technology advances every day of our lives and generates vast amounts of data while different systems, sensors etc. are working, it is important to meet their needs and demands. Digitalization is one of the biggest driving forces for developing of databases – relational and non-relational – in every sphere that they are used, and especially the utilization of NoSQL dBs in areas that were once unthinkable. Financial services offered by different institutions usually relied on relational databases only, but with continuously changing technologies new ways for managing data emerged. This paper presents an automated tool for evaluation and selection of NoSQL databases intended for financial services based on predefined criteria.*
***Keywords**: EVALUATION, TOOL, NoSQL, AUTOMATION*

1. Introduction

Technological advancements, digitalization of different processes around us and the immense growth of data that is generated, gathered, used, and analysed, leads to the need of utilization of new methods for working with data. For many decades relational dBs were the only way for storing data in every sphere. With the development of technologies, new ways have emerged, and more particularly NoSQL or non-relational databases. These types of databases can work not only with structured data, but with semi-structured and unstructured data. Nowadays, the latter evokes many challenges to store, work and analyse. Many spheres have only worked with traditional relational databases because the information gathered supposes only this type of storage, for example more specifically in the financial services area. The digitalization, Artificial Intelligence, video calls, chats, etc. are entering the different parts of the financial services, which needs new ways for storing data and this is where NoSQL comes in hand.

Financial services and non-relational databases were two completely contrasting things, but nowadays institutions working with financial services are adopting such types of databases more and more. As SQL databases are becoming slower with the vast amount of data generated and its unpredictable types [1], NoSQL databases are showing their development and advantages, especially in the financial sphere. [2] The main aim of this paper is to present an automated tool for evaluation and selection of non-relational databases intended for financial services based on predefined criteria.

2. Background of NoSQL databases

NoSQL or non-relational databases are comparatively new way for storing data. These databases are specialized for working with semi-structured and unstructured data. NoSQL have some advantages compared to the relational ones and they are as follows [3]:

- Storing and accessing data with the help of key-values
- Do not need predefined schema
- Horizontal scalability
- Offer better performance
- Flexible and dynamic way for storing and retrieving data.

There are four types of NoSQL databases – document-based, key-value stores, column-oriented and graph-based database. Each one of them offers similar characteristics, but also something specific which is different for every type. Document-based databases store information into documents. They are using flexible and not predefined schema and can be scaled horizontally. These are some of the advantages which allow this database to be used in several industries and cases. Some examples of document-based dBs are MongoDB and Couchbase. [4] Key-value pair database use key-value method for storing and retrieving data. These types of dBs are good when there is need for fast in-memory access and for apps that do not need frequent updates or support for frequent queries. Examples of key-value pairs are Amazon Dynamo DB and Redis. [5] The next type of database is the Column-oriented one. The columnar dBs are good for fast retrieval of columns with data, and they are created to scale "out" using distribution on low-cost hardware. Some examples of column-oriented databases are HBase, Cassandra and MariaDB. [6] Graph-based databases store data into nodes and relationships, and not in tables and documents. This type is flexible and again as in the other types of NoSQL there is no need for a predefined model. Examples of Graph-based databases are Orient DB and Neo4j. [7]

3. NoSQL and financial services

In the past few decades, legacy systems have been working only with relational databases, but this is changing fast nowadays because of the high needs and demands of the clients in financial institutions. For the latter to be able to answer these demands, it's important to develop at a fast pace. Even though NoSQL databases were firstly used by Internet giants, nowadays many companies from different spheres are adopting the non-relational databases because of the faster response time, lower cost, better horizontal scalability, etc. NoSQL databases can manage not only structured, but semi-structured and unstructured data, which helps immensely to store unpredictable data, which is possible to derive from modern new applications. [8]

Even though keeping the old legacy systems working with relational databases in financial institutions will be more financially reliable for the short period of time, in the future it will be better to adopt newer systems which are using NoSQL databases. The full-on digital transformation that is happening in the financial services, needs better data management and analysis, which is offered by the non-relational databases. Big Data and NoSQL offer real-time digital validation, crime monitoring, fraud prevention, personalization with real-time data, pre-trade assistance, targeted marketing which are all important for the development of the financial services and the clients which are using them. [9]

4. How to select a NoSQL for financial service?

After briefly discussing what are the different types of NoSQL databases, and how combined with Big Data they can bring advantages to the direct clients, it is important to see how the companies offering different financial services can make the right evaluation and selection for non-relational databases to migrate their systems to or to start to develop all over again on completely new database.

Based on detailed literature review on publications for different financial services, which are using NoSQL databases as a base of their systems, a specific way of evaluation and selection was not found. [10,11,12,13,14,15,16,17,18,19] Founded on this research, a list with financial services was made (the list it is not exhaustive, more services can be added if needed), also criteria for evaluation were derived which is as follows: real-time digital authorization, personalization, security, pre-trade assistance and targeted marketing. [9] For the aim of the research a list with NoSQL databases is made as again it is not exhaustive and more can be added.

For the evaluation of NoSQL dBs two elements are evaluated – if there is a non-relational solution created for financial service: 0 – means no solution, 1 – development, 2 – there is fully working financial service solution and the second one is the criteria defined above as each one of them has its own weight: 1 – Poor, 2 –

Unsatisfactory, 3 – Good, 4 – Very Good and 5 – Excellent. The criteria and evaluation of the NoSQL databases are created as an expert appraisal based on research and literature review.

5. *Automated tool for evaluation and selection of NoSQL database*

For the aims of this paper and the follow-up research work on this topic that will continue, an automated tool for evaluation and selection of NoSQL databases has been created based on the criteria and list of predefined non-relational databases. The list of databases in the tool at the moment includes Couchbase, MongoDB, Amazon Dynamo DB, Redis, MariaDB, HBase, Cassandra, Neo4j, Orient DB – at least two examples of every type of non-relational database. This tool can help companies to decide which is the correct NoSQL database for their particular case and give them suggestions if the selected NoSQL database does not correspond fully to their needs and requirements. The financial services added to the tool until the current moment are as follows: Fraud detection, Mobile wallet, E-payments, Market data, Trade, Core banking system, Personalization, Real-time analytics, Capital markets, Insurance, Authentication/Authorization and Risk Management. The list which is made is based on the already existing publications and solutions of companies on the market. [10,11,13,14,15,16,18,19]

The tool for evaluation and selection of NoSQL database, starts with the choice if the company will migrate an already existing system or it will create absolutely new one, after that the type of system needs to be selected and then a list with all existing financial services in the tool appears and the client needs to select which ones will need for their system. Depending on the choice made on the screen, the criteria predefined in the previous point based on the expert appraisal and the weight of the different criteria, possible solutions for the company are listed based on the calculations made by the tool. On the screen a list of possible solutions is visualized. As in this list the solution with most points based on the criteria is shown at the highest place and less likely solutions are shown below it. The NoSQL databases with less points, can also be made to work for the given criteria, but changes will be needed. The tool gives different options for non-relational databases, because there are cases in which the company already has some software that works with and even that this is not the best solution, the tool gives options and ways to make the already existing one a good choice. There are other cases in which the already used and owned by the company is too expensive to be make it work and in this case a decision should be made according to the results of the tool.

6. *Conclusion*

Digitalization and digital transformation is happening in every possible sphere, which leads to the collection of immense amounts of data that need to be stored in proper way, then analyzed and conclusions to be made from it. The challenges are coming from the different sources of data and types that are gathered, which leads to the need of NoSQL databases, because of their capability of working with unpredictable data types.

In the last years, financial institutions started to adopt new ways for storing data and using NoSQL databases as base of their systems, because the relational ones are becoming slower with the big amounts of data and the inability to store semi-structured and unstructured data. The reason for financial sphere to turn to non-relational databases is because the newest services are generating different types of data and financial institutions are transforming their legacy systems in better ones with more functionalities and data which can not be stored in relational databases anymore. The criteria used for evaluation and selection of NoSQL databases is predefined in the automated tool which was created for helping the companies decide which is the best solution for their case. After calculating the points, the tool will show the possible solutions based on the characteristics and parameters of the given case.

7. *References*

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