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NoSQL vs SQL — Which Database Type is Better For Big Data Applications

BY RICHA BHATIA (HTTPS://ANALYTICSINDIAMAG.COM/AUTHOR/RICHA-BHATIAANALYTICSINDIAMAG-COM/)
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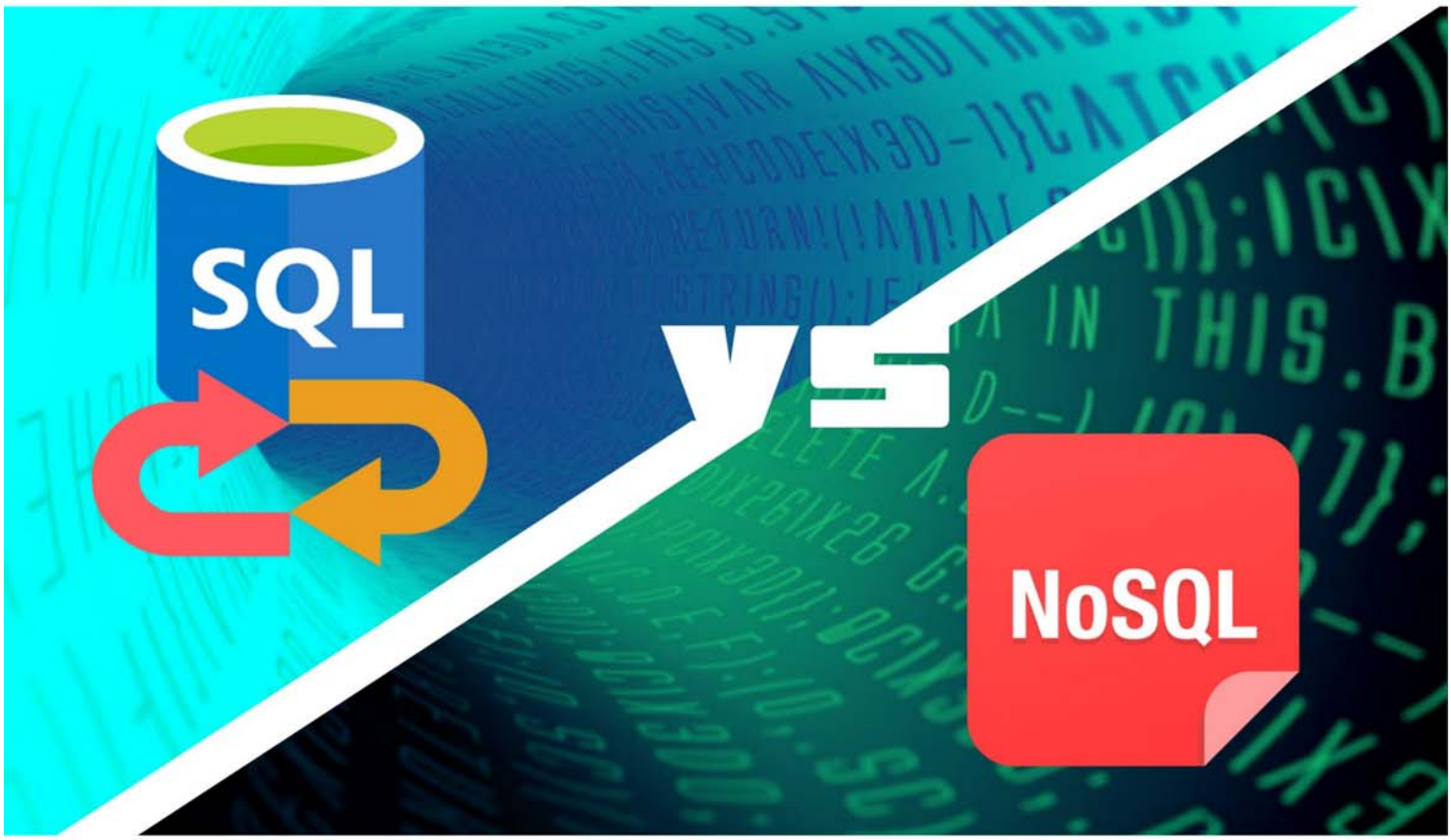

It's a fierce database debate that refuses to settle. NoSQL vs SQL database comes to the fore when picking a storage solution. The growing complexity of big data required companies to use data management tools based on the relational model, such as the classic RDMBS.

In an earlier interview, Aerospike CEO John Dillon revealed how in an increasing number of cases, the use of relational databases leads to problems due to:

- fixed schema, which makes them ill-suited for changing business requirements, as schema changes are problematic and time-consuming,
- insufficient performance (too low) and latency (too high) for the new requirements
- limited ability to scale cost-effectively, if at all

That explains the soaring popularity of NoSQL database systems that sprang up alongside major Internet companies such as Google, Yahoo and Amazon; each had challenges in dealing with huge quantities of data in real-time, something that conventional RDBMS solutions could not cope with.

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NoSQL – The New Darling Of the Big Data World

NoSQL systems are distributed, non-relational databases designed for large-scale data storage and for massively-parallel, high-performance data processing across a large number of commodity servers. They arose out of a need for agility, performance, and scale, and can support a wide set of use cases, including exploratory and predictive analytics in real-time. They arose out of a need for agility, performance, and scale, and can support a wide set of use cases, including exploratory and predictive analytics in real-time. Built by top internet companies to keep pace with the data deluge, NoSQL data base scales horizontally, and is designed to scale to hundreds of millions and even billions of users doing updates as well as reads.

Some of the common applications of NoSQL database are:

Social applications: usually a social application, can scale from a zero to millions of users in few weeks and to better manage this growth, one needs a DB that can manage massive number of users and data, but also that can scale horizontally easily.

Online advertisement/BI: For ads to reach a wide number of potential users, it is important to be able to target specific users. NoSQL database help one develop and deploy the application that should manipulate billions of data (events, content and users using flexible data schema)

Archiving Data: if one wants to archive data and keep them available to the user, NoSQL databases can help you. First of all, one can store and access a huge volume of data when stored in NoSQL. When using document oriented NoSQL Engine such as Couchbase, MongoDB, one can store any type of data (flexible schema/schema-less) allowing you to archive anything.

Is NoSQL Faster Than SQL

Cameron Purdy, a former Oracle executive and a Java evangelist explains what made NoSQL type database fast compared to relational SQL based databases. According to Purdy, for ad hoc queries, joins, updates, relational databases tend to be faster than "NoSQL type databases" for most use cases.

"The reason that NoSQL is useful is that many applications can be built avoiding those particular use cases, and can instead focus on using a very small set of database functionality; for example, applications can perform all data access and modification using primary key-based operations in order to optimize for a NoSQL K/V store," he noted in a post.

Are NoSQL databases scalable vis -a-vis relational SQL based databases? According to Purdy, most of the operations that one can perform on a relational (SQL) database are either impossible or impossibly-slow using a NoSQL database, and tend to get worse as the NoSQL database is scaled out. As in the above example, applications can be optimized to avoid these particular use cases and instead focus on a very small set of functionality that does scale extremely well, by relying on features that enable partitioning, replication, and routing, he stated.

Is NoSQL More Suited For Big Analytic Workloads

According to Dillon, NoSQL is designed for operational needs — real-time applications that often interface with customers or parties external to the organization. It provides the ability to query the data, so users can drill down into the data as it changes. NoSQL allows for high-performance, agile processing of information at massive scale. It stores unstructured data across multiple processing nodes, as well as across multiple servers. As such, the NoSQL distributed database infrastructure has been the solution of choice for some of the largest data warehouses.

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To meet the demand for data management and handle the increasing interdependency and complexity of big data, NoSQL databases were built by internet companies to better manage and analyze datasets.

SQL vs NoSQL: Key Differences

- One of the key differentiator is that NoSQL supported by column oriented databases where RDBMS is row oriented database.
- NoSQL seems to work better on both unstructured and unrelated data. The better solutions are the crossover databases that have elements of both NoSQL and SQL.
- RDBMSs that use SQL are schema–oriented which means the structure of the data should be known in advance to ensure that the data adheres to the schema. For example, predefined schema based applications that use SQL include Payroll Management System, Order Processing and Flight Reservations.
- SQL Databases are vertically scalable – this means that they can only be scaled by enhancing the horse power of the implementation hardware, thereby making it a costly deal for processing large batches of data.
- NoSQL databases give up some features of the traditional databases for speed and horizontal scalability. NoSQL databases on the other hand are perceived to be cheaper, faster and safer to extend a preexisting program to do a new job than to implement something from scratch.
- Even though SQL has its own set of limits, it is also a very mature technology, which is well understood, and has a large pool of developers who understand how to use it well.
- More importantly, data Integrity is a key feature of SQL based databases. This means, ensuring the data is validated across all the tables and there's no duplicate, unrelated or unauthorized data inserted in the system.
- Advantages of SQL databases are that they are typically more performant when dealing with more complex queries. Users cite the relational nature of SQL DBs encourages a well-structured database
- Most banking institutions have a SQL-type database system

So, Is NoSQL Better For Analysis

This depends on a lot of factors, for example the type of data one is analyzing, how much data one has and how quickly you need it. For example, for applications such as user behavior analysis, relational DB is best.

Well, if the data fits into a spreadsheet, then it is better suited for a SQL-type database such as PostGres, BigQuery as relational databases are good at analyzing data in rows and columns. For semi-structured data, think social media, texts or geographical data which requires large amount of text mining or image processing, NoSQL type database such as mongoDB, CouchDB works best. Since running analytics on semi-structured data requires a heavy coding background, analyzing these type of DBs require a data scientist.

When it comes to size of data, PostGres MySQL usually gives a good performance for under 1terabyte of data Amazon Redshift is preferred for petabyte scale. And with smaller teams of engineers focused on building pipelines, relational DBs take less to manage than NoSQL.

On the other hand, relational databases, one can use SQL to query them. SQL as a language is well-known among data analysts and engineers and is also easy to learn than most programming languages.

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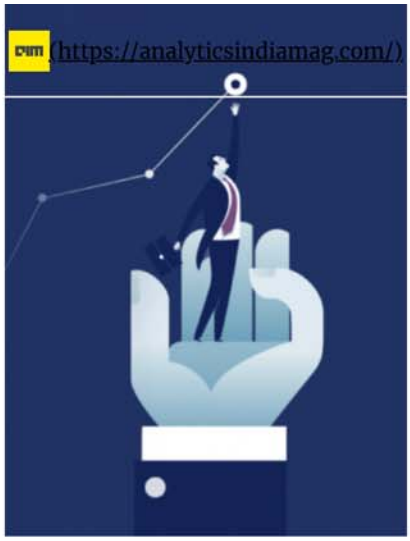

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Chief Digital Officer And Analytics- How Do They Go Hand In Hand

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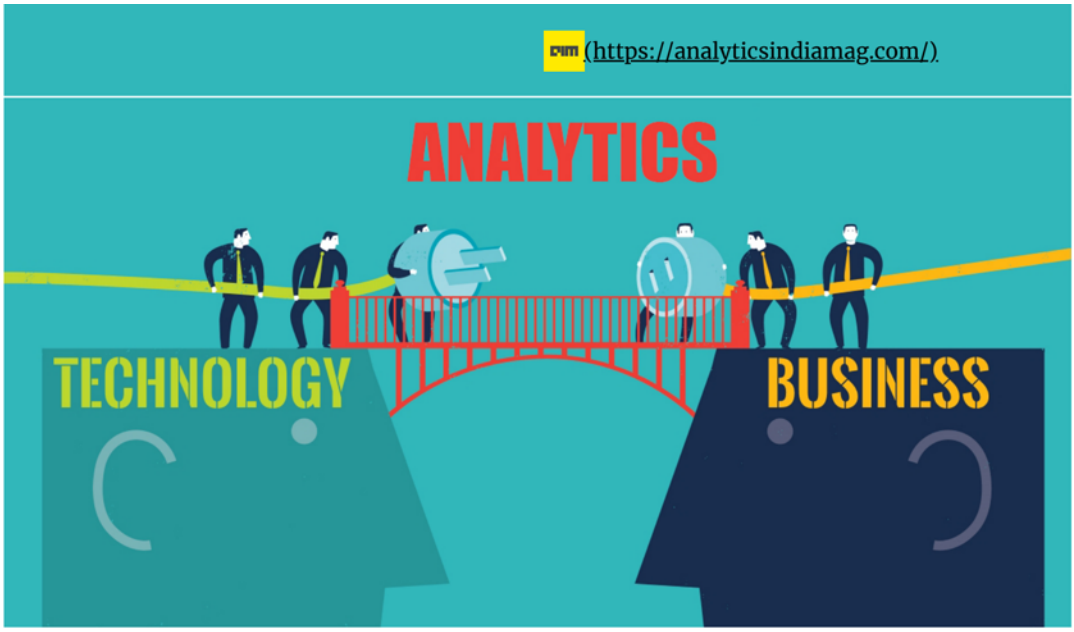

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As businesses are evolving at a rapid pace, digital transformation has taken a centre stage, and so has the role of chief digital officer. While the position isn't very new, their roles and responsibilities have evolved substantially over the time as they are no more responsible just for introducing the basic digital capabilities but transforming the overall processes to get a better sync with the disrupting technologies.

As McKinsey rightly pointed out CDO as "transformer in chief", they are charged with coordinating and managing comprehensive changes—that may include everything from updating how a company works to building entirely new business.

Chief Digital Officer vs. the others

The C-suite today is crowded with attractive titles and companies are carving out new executive roles such as as chief data officer and chief analytics officer, being the popular ones. Though these roles have different functions, they may overlap quite often. While the latter are responsible for overseeing the data in an organisation and carrying out data analysis (https://analyticsindiamag.com/moving-towards-conversational-economy-voice-new-frontier-says-nishikant-nigam-css-corp/), the profile of chief digital officer often goes on and off with analytics. The popular roles and responsibilities that define chief digital officer comprises envisioning a company's digital future—keeping in mind its people, processes, technology and how digital enables all of that.

Though all these titles were created to harness the power of data, each of them approaches the problem in slightly different manner. To give an overview, while the role of chief data officer is to mainly manage data by collecting high quality and meaningful data, creating an infrastructure to store it, chief analytics officer is usually responsible for data analysis and business intelligence, and generating insights out of data. Whereas chief digital officer's role is to change the overall business process.

CDO may come from various backgrounds such as technology, data science, marketing, and play a role in building strategies and overall business ability. As businesses are becoming more data driven, the role of CDOs has become popular than ever.

Roles and responsibilities of chief digital officer

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That being said, what are the major roles and responsibilities that's perceived to be taken by a chief digital officer? They are expected to leverage the technology expertise of an often-marginalised IT department, to begin with. As long as two years ago, a chief digital officer was expected to map the digital capabilities (https://analyticsindiamag.com/top-5-books-on-dawn-of-digital-transformation-every-cxo-should-read/), bring about digital process innovation, develop digital project portfolio or measure new efficiencies, but today, the profile is associated with much more than that—use of analytics being one of them. They work closely with the CEO, CIO, and financial officer to shape up the strategies.

As we mentioned earlier, just being focused on digital experience into a bringing a combination of strategy, innovation, technology and operations, chief digital officer has come a long way.

How chief digital officer can utilise analytics

Since the late 2015, sectors like insurance and banking has seen a tremendous increase in these roles, where they have started bringing advanced technologies in combination with new business models and processes. For instance, Amazon is using deep learning in combination with other technologies like computer vision and sensor fusion", to delight their customers with unique new shopping experiences, amongst many other instances.

The relevance of customers has increased tremendously over the years and companies are looking forward to know and understand their customers better. With technology and customer habits changing so quickly, companies are looking to develop a deep and detailed customer behaviour across all channels. CDO can do the big data (https://analyticsindiamag.com/big-data-turning-wheels-reliance-jio-inside-youngest-mobile-operators-big-data-strategy/) mapping of these paths to explore various opportunities, create clear and visually compelling dashboards on the customer journey etc., which will help the businesses to start thinking about the customer in a more specific way.

"Digital capabilities ultimately provide an important foundation for improving the customer experience. It's up to the CDO to identify those functions where digital is critical: for example, investing in automation capabilities to rapidly respond to customer interactions, developing sophisticated reporting and analytics (https://analyticsindiamag.com/top-6-full-time-analytics-courses-india-ranking-2017/) capabilities to interpret customer needs, building innovative interfaces to gather customer data", wrote McKinsey in its company blog post.

The new chief digital officer is expected to build agility, speed and act upon the data (https://analyticsindiamag.com/predictive-data-preparation-makes-analytics-success/) to build crucial strategies, better capabilities and move on with better plans. If the collected data show a prototype that doesn't work, CDO's role is to decide what's best for the organisation without being biased. Based (https://analyticsindiamag.com/vadodara-based-phonon-communications-acquires-idelivr-home-indias-largest-loan-bot/) on analytics on this data, they also play a role in establishing flexible budgeting processes so that projects that show signs of success can get resources to scale quickly.

Why analytics should be on his agenda as a priority?

The present day CDOs are also being responsible for sorting out their data strategy in an organisation, which includes analytics (https://analyticsindiamag.com/can-big-data-analytics-along-design-thinking-form-core-business-growth/), regulatory compliance and more. It is about creating insights from these data to deliver business growth by overcoming the limitations. As the power of data and analytics is profoundly altering the business landscape, capturing on this avenue has become a mandate. CDO too need to acquire a knowledge on data analytics so that they can understand what's rapidly becoming feasible and to embrace data for greater benefits.

CDO's across organisations have realised the importance of data and analytics, and are constantly adopting these tools to deliver better performance in terms of productivity and capturing customer behaviour. Capturing the potential of data analytics can very well help them establish priorities, plan

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a well defined path and fetch good business results. The creation of powerful data assets along with properly implanted statistical and analytics tools th[illegible]ore is an agenda for most CDOs. It not only underwrites and effective planning but ensures an overall growth.

Any business is always about people, processes and technology, and if digital along with analytics is enabling them, there could be a no better platform to implement it, and CDOs are doing just that.

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