CURRENT TRENDS AND INNOVATIONS IN DATABASE TECHNOLOGY

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Abstract: The current state of database technology in 2024 is marked by significant advancements aimed at enhancing performance, accessibility, and security. Key trends include the integration of Artificial Intelligence (AI) to automate maintenance tasks and optimize resource allocation, reducing the workload on database administrators (DBAs). In-memory and all-flash databases are gaining popularity for their ability to provide real-time data access and handle large-scale data-intensive applications

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Most databases fall into one of two categories, relational database management systems (RDBMS) and unstructured/special application databases. RDBMS have been around since the 1970s and consist of related tables made up of rows and columns. They're manipulated using structured query language (SQL), the de-facto standard language for performing create, read, update, and delete (CRUD) functions. This is the dominant database type for enterprise computing. The advent of the cloud saw data processing capabilities scale horizontally like never before. This happened just in time to support the increase in data generated by the internet. But as unstructured data became increasingly common, a need for a new database paradigm led to the creation of NoSQL, a broad category of databases that do not use SQL as their main language. Because NoSQL databases have no set requirements in terms of schemas or structure, they are ideal for software environments based on DevOps toolsets and continuous improvement/continuous delivery (CI/CD) pipelines. Technologies come and go, and databases are no different. Early DBAs cut their teeth on Informix, SQL server, and Oracle database management systems, while the next generation favored the simplicity of open-source MySQL/LAMP stack and PostgreSQL. Current DevOps workflows benefit from the unstructured agility of NoSQL databases like MongoDB and DynamoDB. Where databases go from here will depend upon a number of factors, including technology and market innovations, but the need for them will only continue

to increase. With more data created in the last couple years than in the rest of human history combined, the need to manage, manipulate, and secure it has never been more critical. Databases have evolved to keep pace with the growing need, changing to accommodate new ways of gathering and using information or becoming outdated and going the way of the floppy disk. Their future looks even more turbulent as new technologies and ways of interacting with data come into play. This article outlines five current database trends that explain the booming market for them and offer some idea about what to expect as they continue to evolve with changing technology

1.Old Guard Losing Out To Cloud DBs

Not so long ago, Oracle, IBM, SAP, Teradata, and Software AG were the bigwigs of the database world. They all began life as on-premises systems and all have attempted to transition to the cloud, with varying degrees of success. However, cloud-based databases have largely taken over and cloud-native databases dominate the market. Microsoft is now the leader, with Amazon Web Services (AWS), Google Cloud Platform (GCP), and Alibaba Cloud close behind. Oracle, IBM, and SAP retain a large slice of the market after a painful transition to cloud-based systems, but cloud is king without question As their name implies, on-premises environments have computing resources and systems that are physically located within an organization's premises or facilities. This gives them direct control and ownership over their IT infrastructure, including the physical infrastructure, security measures, and network connectivity. This means they are also responsible for procuring, installing, configuring, and managing all the necessary components as well as ensuring their maintenance, upgrades, backups, and security. In contrast, a cloud-based infrastructure involves the deployment and maintenance of servers, storage devices, networking equipment, and other hardware and software resources in the cloud service provider's data centers. A cloud infrastructure is easier to deploy and manage initially, with no required upfront capital expenditures in hardware. Cost-wise, the cloud uses a metered, pay-per-use model, which—depending on scaling requirements and other factors—can be more cost-effective than on-premises.

A wide range of providers offer these services. For example, 11:11 Systems—which sponsored this article—offers an infrastructure based on VMware technology, and includes built-in security and backup, a unified cloud console, and simple onboarding and deployment. Their cloud is flexible and scalable to meet unique business requirements. Other vendors, like Navisite and Rackspace Technology, offer similar solutions, giving enterprise customers the ability to choose the cloud platform with the features and cost that best meets their needs.

2. Artificial Intelligence In Databases

On average, database administrators (DBAs) spend 90 percent of their time on maintenance tasks, according to Oracle's Cloud Business Group surveys. AI is being

added to database management as a way to greatly lower the maintenance burden. When well-integrated with databases and their underlying infrastructure, AI helps DBAs spot storage and memory bottlenecks and other issues that inhibit database operations

3. In-Memory Databases

Today's mission-critical software solutions require minimal database latency for optimal performance. Unfortunately, traditional database management systems (DBMS) rely on sluggish disk read/write operations for storing data on media (e.g., hard disk drives). For this reason, in-memory databases—databases that store entire datasets in read only memory (RAM)—have become strong alternatives for these critical use cases. Records stored and retrieved directly to and from RAM make faster, more reliable performance possible. Additionally, popular solutions such as Redis—an in-memory data structure store—make it possible for databases to support more data structure types and custom access patterns, allowing for the simplification of software code without data structure conversion or serialization

4. All-Flash Databases

Memory-based databases are great, but can be very expensive. All-flash arrays provide similar performance at a better price, while also providing a lot more capacity. As a result, more databases now run inside all-flash arrays than on in-memory systems. An example of this is JP Morgan Chase, which was seeing a 30 percent increase or more in data storage needs annually. Greg Johnson, executive director of Global Electronic Trading Services, transitioned from disk-based systems to all-flash arrays to provide the capacity and speed his databases need for transactional and other mission-critical systems. "The combination of all-flash and AI has helped us to approve over 200 million credit card transactions that would have otherwise been declined,"

5. Stronger Database Security Layers

With cyber attacks and data breaches continuing to dominate headlines in the technology world, more focus has been placed on securing the data layer of the software application. In turn, more vendors are augmenting their offerings with stronger built-in security features. Oracle now integrates always-on encryption and automated patching at the database level, for example, while Amazon RDS includes a built-in firewall for rules-based database access. Similarly, database users need far more safeguards related to privacy, data residency, sovereignty, and localization, and DBAs must pay attention to where data is stored and where it is going. Vendors are now introducing location-tracking features into their storage arrays and databases to make it possible to verify compliance Big data security is the process of monitoring and protecting a company's important business data with the goal of ensuing safe and compliant ongoing operation.

Big data security is a constant concern because Big Data deployments are valuable targets to would-be intruders. A single ransomware attack might leave a company's big data deployment subject to ransom demands. Even worse, an unauthorized user may gain access to a company's big data to siphon off and sell valuable information. The losses can be severe. A company's IP may be spread everywhere to unauthorized buyers, and it may suffer fines and judgments from regulators.

Conclusion

In conclusion, the evolution of database technology in 2024 is characterized by the integration of AI, the adoption of innovative architectures, and a strong focus on security and accessibility. These advancements are paving the way for more efficient, secure, and scalable data management practices, ensuring that organizations can harness the full potential of their data in an increasingly data-driven world.

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