

BIG DATA AND MODERN DATABASE SYSTEMS

Tashkent Hydrometeorology Technical College
Lecturer Of The Department Of Specialized Subjects
Toshboyeva Mahliyo

Abstract

Big Data technologies have become an integral component of modern information systems and play a significant role in data-driven decision-making processes. This article examines the concept of Big Data, its key characteristics, and its relationship with modern database systems. Special attention is paid to the limitations of traditional relational databases when handling large-scale data and the advantages of NoSQL and distributed database technologies. The article also analyzes practical applications of Big Data in various sectors and highlights the importance of efficient data storage, processing, and management. The study demonstrates that the integration of Big Data technologies with modern database systems enhances scalability, performance, and analytical capabilities in contemporary information environments.

Keywords: Big Data, database systems, DBMS, NoSQL, data processing, information systems, digital technologies.

INTRODUCTION

The rapid development of information technologies has led to an unprecedented growth in the volume of data generated from various sources, including digital platforms, sensor networks, social media, and information systems. Traditional data processing approaches and database systems are often unable to efficiently handle such large and complex datasets. As a result, the concept of Big Data has emerged as a response to the challenges associated with managing massive volumes of information. Big Data technologies enable organizations to collect, store, process, and analyze large-scale data in order to extract valuable insights. Modern database systems play a crucial role in supporting Big Data environments by providing flexible data models, high performance, and scalability. Therefore, studying Big Data and its interaction with modern database systems is essential for the development of effective and sustainable information systems.

Concept and Characteristics of Big Data

Big Data refers to extremely large datasets that cannot be efficiently processed using traditional database management systems. The concept of Big Data is commonly described through several key characteristics known as the “V” model:

- **Volume** – the massive size of data generated and stored;
- **Velocity** – the high speed at which data is created and processed;
- **Variety** – the diversity of data formats, including structured, semi-structured, and unstructured data;
- **Veracity** – the reliability and quality of data;
- **Value** – the potential benefits derived from data analysis.

These characteristics require new approaches to data storage and management, leading to the development of advanced database technologies.

Traditional Databases and Their Limitations

Relational database management systems such as MySQL, Oracle, and PostgreSQL have long been used for structured data storage and processing. While these systems are effective for many applications, they face significant limitations in Big Data environments. These include limited scalability, performance constraints when processing large datasets, and difficulties in handling unstructured data.

As data volume and complexity increase, organizations require more flexible and scalable database solutions capable of supporting distributed data processing.

Modern Database Systems for Big Data

To address the challenges of Big Data, modern database systems such as **NoSQL databases** and distributed data platforms have been developed. NoSQL databases provide flexible data models and horizontal scalability, making them suitable for large-scale data processing. Common types of NoSQL databases include:

- document-oriented databases (MongoDB);
- key-value stores (Redis);
- column-oriented databases (Cassandra);
- graph databases (Neo4j).

In addition, Big Data processing frameworks such as Hadoop and Apache Spark are widely used to manage and analyze large datasets efficiently.

Practical Applications of Big Data and Databases

Big Data technologies and modern database systems are widely applied in various sectors, including finance, healthcare, education, telecommunications, and e-commerce. By analyzing large volumes of data, organizations can improve decision-making, optimize operations, and enhance service quality. In the context of the digital economy, Big Data analytics enables predictive analysis, personalized services, and intelligent system development, contributing to innovation and competitiveness.

Conclusion

In conclusion, Big Data and modern database systems play a vital role in the development of contemporary information systems. The limitations of traditional databases have led to the adoption of NoSQL and distributed database technologies capable of handling large-scale and diverse data. The effective integration of Big Data technologies enhances system scalability, performance, and analytical potential. As data continues to grow in importance, Big Data and advanced database systems will remain key drivers of digital transformation and technological progress.

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