

# MongoDB® for enterprise data management

Understanding MongoDB's key features, benefits and use cases for modern data management



## Executive summary

In the data and artificial intelligence era, database systems have become the backbone of many industries. Aside from collecting and managing large quantities of data, these database systems can have analytics, geospatial database management systems, time series, search capabilities and more. MongoDB® is one of the most widely used database management programmes. It is a document-oriented database application known for its flexibility, scalability, ease of administration and a range of features that make it suitable for a variety of use cases.

This guide explores MongoDB and multiple enterprise applications for this database. The paper delves into the core of MongoDB, detailing its key features, advantages, and the circumstances in which it proves most effective. Using concrete examples from different industries, we underscore the database's versatility, robustness, and readiness to handle diverse use cases. Specifically, this guide aims to:

- Provide readers with a deep understanding of MongoDB's capabilities.
- Demonstrate how the document database fits into industry use cases.
- Highlight how MongoDB addresses business and technical challenges within the financial, telecommunications, and automotive industries.

This guide can be used by decision-makers, IT professionals, and stakeholders in these industries to understand the benefits of MongoDB and how they can use it to drive innovation and business growth.

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# Introduction

MongoDB has emerged as a transformative force in enterprise data management. Offering a flexible and scalable approach to data storage, MongoDB has empowered organisations to break free from the constraints of traditional relational databases and adapt to the dynamic and complex nature of modern data. With its document-oriented architecture, distributed database capabilities, and powerful query language, MongoDB has become a cornerstone technology for businesses across various industries.

It is suited for expanding projects and applications in multiple use cases such as content management systems, mobile applications, Internet of Things (IoT) and real-time analytics. Although MongoDB can be applied in virtually any industry, it is particularly well-suited to the needs of the rapidly changing financial, telco and automotive sectors.

In the financial sector, banks, insurance companies, and investment firms face massive data volumes, high transaction rates, and strict regulations. Traditional relational databases, such as Structured Query Language (SQL), are poorly equipped to handle the diversity, volume, and speed of data generated in this industry. Using traditional SQL databases can result in operational inefficiencies and missed insights. MongoDB and other document databases offer solutions to these challenges with their adaptable Javascript Object Orientation (JSON)-like structures and horizontal scalability. MongoDB's capabilities have significantly benefited financial institutions by reducing costs, enhancing user experiences, and ensuring compliance with stringent data-sharing regulations.

The telecommunications industry also faces challenges in managing vast amounts of data from client interactions, service usage, and billing specifics. This enormous data volume, often overwhelming for traditional databases, can lead to system slowdowns and customer dissatisfaction. With its flexible and scalable data format, MongoDB offers an effective solution. This database handles extensive volumes of structured and unstructured data, streamlining data storage and analysis processes. In the telecommunications sector, MongoDB's implementation empowers efficient management of customer data, call logs, and service usage information. This provides valuable insights into client behaviour and facilitates the delivery of personalised services.

The automotive industry is a critical economic sector. With the increasing relevance of technologies like artificial intelligence, machine learning, and big data analytics, the industry grapples with managing the substantial volumes of data generated by modern automobiles. MongoDB provides a robust and scalable solution. MongoDB's flexibility, schema adaptability, and capacity to handle semi-structured and unstructured data make it ideal for managing diverse automotive data. Using MongoDB's developer data platform facilitates efficient operations and minimises downtime.

Throughout this guide, we will expand on these enterprise use cases and explain how you can use MongoDB to streamline operations, enhance customer experiences and drive innovation.

# Understanding MongoDB

## What is MongoDB?

MongoDB is a document-oriented database management application founded in 2007 by [MongoDB Inc.](#) It is designed for high-volume data storage and can handle diverse data types, such as structured, semi-structured, and unstructured data.

In MongoDB, the data is stored in documents using a JSON-like structure to represent and interact with data. These collections of documents are then stored in a database. The document-based data model makes it possible to model the data without using the complicated multi-table joins imposed by relational databases.

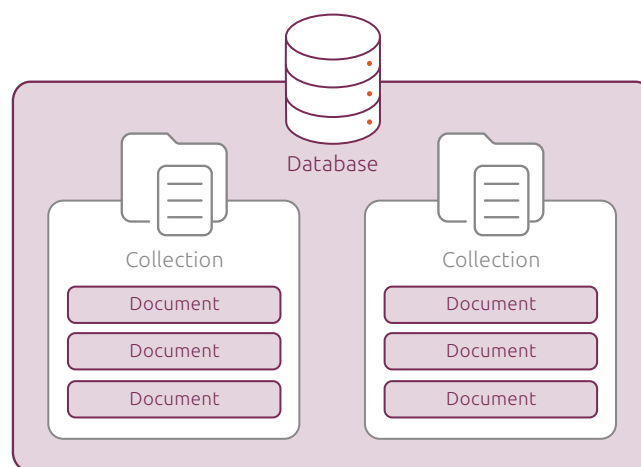
Moreover, MongoDB supports a rich query language allowing full CRUD (Create, Read, Update, Delete) operations, indexing, and real-time aggregation. This means that MongoDB can be used for numerous types of applications. It's particularly well-suited for evolving projects that need flexibility and applications that require a highly scalable environment.

## Key features and benefits

MongoDB is one of the most popular NoSQL databases. In addition, MongoDB is a highly versatile data management solution that provides robust scaling, consistency, fault tolerance, agility, and flexibility capabilities to facilitate rapid development and low operational downtime. This section discusses the most prominent MongoDB features and benefits.

### Data format and transactionality

MongoDB is known for its flexible data store and JSON-like document format. MongoDB stores records as documents, specifically as Binary Javascript Object Notation (BSON) documents gathered in collections.



MongoDB data structure

Given that a document-based data model can represent rich, hierarchical data structures, it's often possible to model data without the complicated multi-table joins imposed by relational databases. For example, suppose you're modelling products for an e-commerce web application. Product information might consist of multiple tables if you use a fully normalised relational data model. You must write a complicated SQL query full of joins to get a product representation from the database shell. Consequently, the database setup can be complex, slowing development time and the end application.

By contrast, with a document database, your product's information can be modelled within a single document. Furthermore, the JSON-like structure describes an understandable representation of the products with a hierarchy. MongoDB's query capabilities are specifically designed to manipulate both structured documents and unstructured data, making it easy for people to use.

## Indexing and aggregation

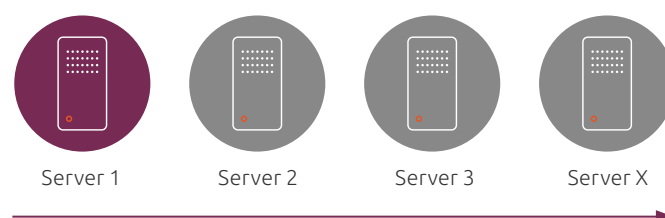
MongoDB efficiently searches data with text, geospatial, or time-series dimensions. In addition, it includes features to analyse data, including support for multiple concurrent queries, indexing, and aggregation. Recent versions of MongoDB also include support for distributed, multi-document, multi-collection, multi-database, and multi-shard transactions with a high data integrity guarantee.

Each document element in a MongoDB document is indexed with primary and secondary indices. This minimises the time needed to search the database. Instead of scanning through each document one at a time for a particular entry, the database engine can use the index to filter out information. Given how quickly queries can be answered, MongoDB's indexing capability is among its most valuable features.

Performing actions on the grouped data in MongoDB also enables you to obtain a single or computed result. It offers three aggregations: a map-reduce function, an aggregation pipeline, and special-purpose aggregation techniques.

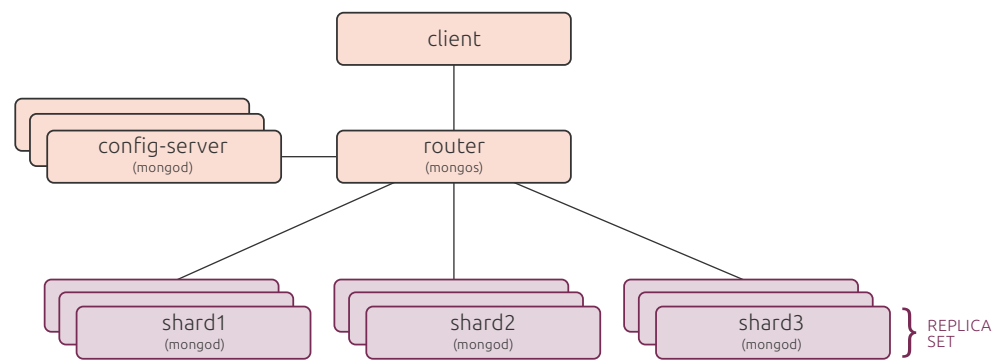
## Scalability and high availability

Popular web applications can experience high web traffic because of user engagement in the content at a given time. During this time, it is essential to ensure that the databases backing them are scalable to adjust to user demands. MongoDB is built on a horizontal scale-out architecture, this means adding more servers to distribute the load across multiple nodes.



MongoDB horizontal scaling

A MongoDB database can be scaled horizontally through the 'sharding' and 'replica set features'. These scalability features also have benefits for fault tolerance in a MongoDB database deployment. The figure below shows the sharding model.



#### MongoDB replication and sharding

Sharding is a method for distributing data across multiple machines. There are various components in a sharded cluster:

- **client** – this component is an application server that uses drivers such as python, javascript, C#, C++ and more to integrate with the MongoDB router.
- **router (mongos)** – this is a mangos operator that acts as an interface between client applications and the sharded cluster.
- **config-server (mongod)** – stores metadata and configuration settings for the cluster.
- **multiple shards (mongod)** – contain a subset of the sharded data, wherein each shard can be deployed as a replica set. The multiple shards represent a horizontal scale-out architecture since shards are deployed in multiple servers.

A replica set is a group of mongod processes that maintain the same data set in a shard or config-server. Replica sets provide redundancy and high availability and are the basis for all production deployments.

Scalability and high availability ensure consistent response times, simplify system maintenance, and decrease operational costs. In addition, applications should handle increasing numbers of users who use the applications concurrently. These requirements in terms of scalability are features that MongoDB can support with its horizontal scale-out architecture. Implementing them in web applications and other use cases can bring numerous advantages for businesses.

Learn more on how to secure and support your MongoDB.

[Whitepaper: A guide to MongoDB® security and support](#)

#### MongoDB security and support

When running a database in a production environment, there are other database considerations: database security and support.

Database security is essential for safeguarding information and ensuring data integrity and availability. While many new database systems struggle to create security guidelines, MongoDB has robust security features. It is known for its security implementations and practices that help protect data and ensure the integrity of the database. For example, users can easily implement benchmarking guidelines such as those published by the Center for Internet Security (CIS).

Users can complement these security capabilities with a dedicated support team. A support team is essential when dealing with critical and complex infrastructure systems, operating systems and applications such as databases. The support organisation provides specialised resources and expertise to ensure the overall technology stack functions optimally, securely and smoothly.

## Use cases

This section provides an overview of the application of MongoDB in various industries, focusing on the financial, telecommunications, and automotive sectors. The use cases discussed here demonstrate MongoDB's adaptability and durability as a solution for tackling complicated data management issues in various operational scenarios.

## Financial sector

Financial institutions handle vast amounts of sensitive and confidential data, including customer information, transaction details, and regulatory compliance records. A trusted database ensures the security and privacy of this sensitive information, protecting it from unauthorised access, breaches, or cyber threats.

MongoDB is one of the most widely used databases in this sector. It provides a sturdy, adaptable and trustworthy foundation. It also can safeguard sensitive customer data while facilitating swift responses to rapidly evolving situations.

Here are the key use cases for MongoDB in the financial sector.

### Customer Data Management

Within financial services, MongoDB is often used as the database for customer data management. MongoDB can store and manage customer profiles, account information and transaction histories. Its flexibility allows for handling diverse data types related to customer records, and it can easily accommodate changes in customer data structures as regulations and business requirements evolve. Its document-oriented model allows for flexible and dynamic schemas, adapting to diverse customer information.

### Online Banking

Another area where MongoDB offers a robust database platform is online banking – which covers any web or mobile banking apps. These applications often need to store and retrieve customer account information, transaction history, and payment data as fast as possible. MongoDB can provide the back-end data storage for these applications, supporting fast and secure access. Its scalability ensures a seamless user experience, and its flexible data model accommodates the evolving requirements of digital banking platforms.

### Fraud detection

The financial sector is particularly susceptible to fraudulent activities due to factors that make it an attractive target for malicious actors. Some key reasons include high-stake transactions, insider threats, data breaches, and more. The financial sector must have a database that can be used for fraud detection systems. MongoDB can store transaction data, user behaviour patterns, and other information that is essential for fraud detection. In addition, it can handle high volumes of data and perform real-time analytics, making it valuable in identifying fraudulent activities.



### Canonical services for the financial sector

Canonical offers comprehensive financial services (FinServ) open source solutions and expertise. From hybrid multi-cloud strategy to Kubernetes, we can help you accelerate innovation, drive business agility and reduce costs.

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## Telecommunications sector

A trusted database is fundamental to the smooth and secure operation of telecommunications services, supporting various aspects of network management, customer services, compliance, and fraud prevention. This section highlights the most critical use cases for MongoDB within the telco industry.

### Subscribers and billing

The telco sector has several technology challenges, including storing and processing large amounts of data collected from multiple sources. Operators collect data on how clients utilise their services, engage with various businesses, and the specifics of the billing and charging applied to the services they receive. The difficulty comes from sorting through this vast amount of data to find insightful information, deduce customer behaviour and usage trends, and then generate reliable predictions on service demand, data volume, and resource consumption. The data size and speed at which data must be processed in telecommunications are too challenging for traditional relational databases to handle. If database operations are not agile and reliable, it leads to system slowdown and low service quality – this makes MongoDB the best database fit across multiple use cases.

### Internet of Things (IoT)

Communication networks increasingly carry data from IoT devices. MongoDB is a powerful database technology that can be used for data storage, retrieval and aggregation, and real-time processing of IoT data, such as alerts and sensor events. It is an ideal choice for managing the diverse data generated by connected devices and sensors because of its indexing, aggregation, format and scaling capabilities.

### Network and inventory management

A suitable database is integral to telco network management because it provides a structured and efficient way to store, manage, and analyse the diverse and vast amounts of data generated and used in telecommunications networks. MongoDB can store network performance data, including equipment status, network logs, and real-time telemetry data. It allows for monitoring and analysing network performance, troubleshooting, and proactive maintenance as it can provide near real-time data feed.

Telco companies often manage extensive inventories of network equipment and service resources. This is why use cases such as service provisioning and inventory management can be streamlined with a database technology like MongoDB. It can help track the allocation and availability of these resources through its storage, retrieval and scaling capabilities.



### Canonical open source solutions for telco

Canonical open source solutions are building blocks that provide a unified approach to meet any current or future use cases in telco using multiple database, AI, cloud and edge technologies.

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## Automotive sector

The automotive industry is a vast and complex sector. It includes all those companies and activities involved in manufacturing vehicles, including most components, such as engines, electronic control units (ECUs) and bodies. The automotive sector is undergoing a technological revolution due to the growing importance of new technologies like artificial intelligence, machine learning, and big data analytics.

Managing and utilising the enormous amounts of data that modern automobiles create is a critical challenge the automotive industry faces. Innovators are tasked with producing great user experiences and need to make effective use of data to deliver value.

MongoDB is trusted by many enterprises in the automotive sector. These organisations value it for its flexibility, scalability, and real-time capabilities. Here are some notable use cases.

### Supply chain management

The first use case is supply chain management, wherein a database stores data on automotive parts and components through the supply chain. Manufacturers use databases to manage inventory, order parts, and ensure efficient production processes. MongoDB can be used to store and collect data related to the inventory of automotive parts and components and can be leveraged for data analytics and reporting. This includes details on the types and quantities of parts, storage locations and order history. Its flexibility allows for easy adaptation to changes in the types of parts and inventory requirements. MongoDB can also be used in demand forecasting and supplier management.

### Fleet management

Another use case is fleet management, wherein systems use databases to track vehicle locations, maintenance schedules and driver behaviour. Fleet operators rely on databases to optimise vehicle use, reduce costs and ensure safety. MongoDB can play a considerable role in real-time vehicle tracking as it can store and manage real-time location data. In addition, it can maintain logs and reports such as maintenance reports and schedules.

### Predictive analytics

Finally, MongoDB can be a valuable database for implementing automotive predictive maintenance systems. Predictive maintenance aims to prevent equipment failures and reduce downtime by predicting when maintenance is needed based on the condition of the equipment and historical data. MongoDB's flexibility, scalability, and real-time data processing capabilities make it well-suited for this application. In addition, it can process real-time data scales and can be integrated with different machine-learning applications.



### Canonical open source solutions for automotive

Trusted by major automotive companies, Canonical delivers a full suite of open-source solutions and services that help you provide security, safety and innovation for digital transformation in automotive.

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## Conclusion

MongoDB is a versatile NoSQL database management system that has transformed how vast amounts of data are stored and accessed. MongoDB is a schema-less database, which means it can represent rich, enormous and hierarchical data structures. It is scalable due to its architecture and sharding capability. It has an indexing capability and is efficient in data search and multiple data dimensions. In addition, it is a well-established database that showcases stability, supportability and security standards.

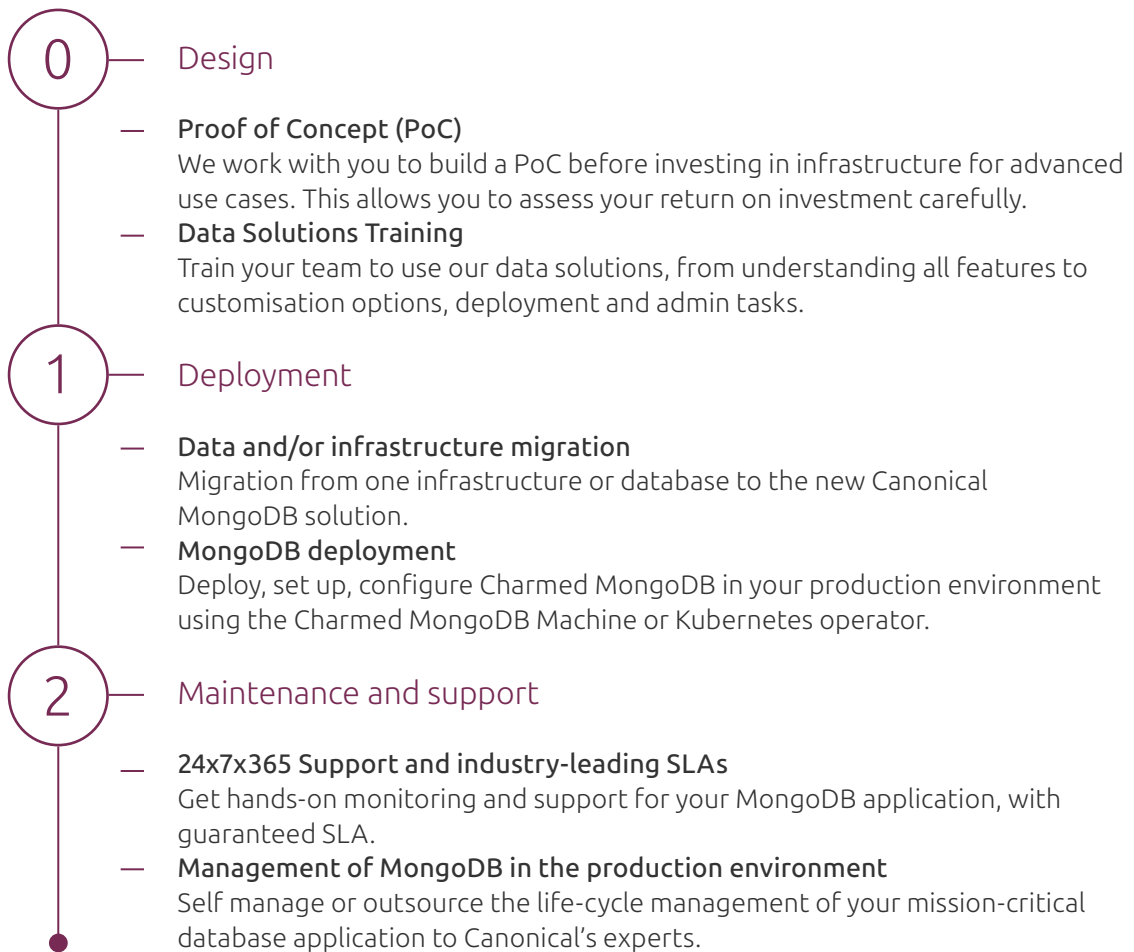
The use of MongoDB depends on your specific project requirements. Despite its scalability, flexibility, and ability to handle unstructured data, there may be better choices for some scenarios. MongoDB can outperform traditional relational databases in complex queries and high data volumes.

MongoDB's use cases in the financial, telecommunications, and automotive industries highlight its adaptability and effectiveness in managing and analysing massive amounts of data. Its use cases demonstrate its adaptability to the ever-evolving challenges of data management and analysis in different industries.

If you need help deciding between MongoDB and other databases, Canonical is here to help. Canonical offers security patching, support, advisory and managed services for databases like MongoDB so you can seamlessly deploy and run your database on any cloud. [Contact us](#) to learn more.

# Canonical for your MongoDB journey

Canonical can support you at every stage of your MongoDB journey (from Day 0 to Day 2):



**Note:** Canonical also offers other data and AI/ML solutions such as Kafka, Spark, OpenSearch, MySQL, PostgreSQL, Kubeflow, MLFlow

Our data products are constantly expanding and improving. [Contact us](#) about your unique requirements. We are happy to assist you.

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