

N. Sriram, Dhanusha. C, S. Kanagalakshmi

# Mastering NoSQL with MongoDB



# Mastering NoSQL with MongoDB

## **N. Sriram**

Department of Software Systems and Computer Science  
(PG) in KG College of Arts and Science, Coimbatore

## **Dhanusha. C**

Department of Software Systems, and Computer Science  
[PG], KG College of Arts and Science, Coimbatore

## **S. Kanagalakshmi**

Department of Software Systems in KG College of Arts and  
Science, Coimbatore



**DeepScience**

*Published, marketed, and distributed by:*

Deep Science Publishing, 2025  
USA | UK | India | Turkey  
Reg. No. MH-33-0523625  
www.deepscienceresearch.com  
editor@deepscienceresearch.com  
WhatsApp: +91 7977171947

ISBN: 978-93-7185-375-0

E-ISBN: 978-93-7185-934-9

<https://doi.org/10.70593/978-93-7185-934-9>

Copyright © N. Sriram, Dhanusha, C., S. Kanagalakshmi, 2025.

**Citation:** Sriram, N., Dhanusha, C., Kanagalakshmi, (2025). *Mastering NoSQL with MongoDB*. Deep Science Publishing. <https://doi.org/10.70593/978-93-7185-934-9>

This book is published online under a fully open access program and is licensed under a Creative Commons Attribution-Non-Commercial 4.0 International License (CC BY-NC 4.0). This open access license allows third parties to copy and redistribute the material in any medium or format, provided that proper attribution is given to the author(s) and the published source. The publishers, authors, and editors are not responsible for errors or omissions, or for any consequences arising from the application of the information presented in this book, and make no warranty, express or implied, regarding the content of this publication. Although the publisher, authors, and editors have made every effort to ensure that the content is not misleading or false, they do not represent or warrant that the information-particularly regarding verification by third parties-has been verified. The publisher is neutral with regard to jurisdictional claims in published maps and institutional affiliations. The authors and publishers have made every effort to contact all copyright holders of the material reproduced in this publication and apologize to anyone we may have been unable to reach. If any copyright material has not been acknowledged, please write to us so we can correct it in a future reprint.

## Preface

The fast-paced development of the data-intensive applications has changed the manner, in which organizations store, process, and analyse data. With the continued generation of large amounts of unstructured and semi-structured data in modern systems, relational databases are commonly not required to be flexible, scalable, and provide real-time responses. With this changing trend, the trend has given way to the emergence of NoSQL technologies with MongoDB as one of the most robust as well as popular document-oriented databases. The book has been developed in such a way that it can be used as a great resource by students, teachers, and practitioners who want to be well-grounded in the concepts of MongoDB and NoSQL. Starting with best tenets of NoSQL databases, the text discusses why non-relational databases are important in modern software structure. The chapters are logically structured to present the basic ideas, shed light on the hidden principles, and develop the practical knowledge at a certain pace.

The readers are taken through critical areas such as the data modeling, CRUD operations, indexing, aggregation structures, sharding, replication and performance tuning as factors that are important in building efficient scalable and reliable database-driven applications. Understandings of MongoDB Shell, installation and configuration procedures, and generalized best practices in using the product in real-life situations are also presented in the book. Though the subject matter is quite technical, there are clear explanation of it and it comes with illustration, examples as well as articulated breakdowns. We will do so as we want to make sure that the learners acquire not only theoretical knowledge but also practical knowledge in working with MongoDB in a project, research and industrial setting with a high level of confidence. Hopefully, this book may become a helpful guide that enables a person to become curious, to develop a proper conceptual knowledge, and to become capable of fulfilling the capabilities of MongoDB and the NoSQL technologies. You may be on your way to modern database systems, or you may be expanding your knowledge base, either way, this text is supposed to put you on the right path, with sufficient clarity, accuracy, and intent.

## Table of Content

<b>Chapter No.</b>	<b>Content</b>	<b>Page No.</b>
	1.1 Introduction to NoSQL	1
	1.1.1. Common Use Cases for NoSQL	1
	1.2. Types of NoSQL	2
	1.2.1. Document-Oriented Databases	2
	1.2.2. Key-Value Stores	4
	1.2.3. Column-Family Stores	6
	1.2.4. Graph Databases	8
	1.3. MongoDB	10
I	1.3.1. Why do you need MongoDB technology?	11
	1.3.2. Drawbacks of MongoDB	14
	1.4. Difference Between MongoDB and RDBMS	14
	1.5. CAP Theorem	17
	1.5.1. NoSQL Database Types and CAP Theorem	20
	1.5.2. The CAP Theorem-MongoDB	21
	1.6. JSON	23
	1.7. BSON	27
	1.7.1. JSON Vs BSON	30
	1.8. The MongoDB Document	31
II	2. MongoDB Installation and Data Modeling	37
	2.1. Databases and Collections	37

<b>Chapter No.</b>	<b>Content</b>	<b>Page No.</b>
	2.2. Introduction to MongoDB Shell	40
	2.3. Configuring MongoDB Shell	46
	2.3.1. How to Configure Settings?	52
	2.4. Accessing the MongoDB Shell	55
	2.5. Understanding Data Types	57
	2.6. MongoDB Data Modeling	65
II	2.6.1. Embedded Data Model	65
	2.6.2. Reference Data Model	68
	2.7. Perform Schema Validation	76
	3. CRUD Operations	81
	3.1. Introduction to CRUD Operations	81
	3.2. Creating Databases and Collections	83
	3.3. Insert Operation	92
	3.4. Read Operation	95
III	3.5. Update Operation	98
	3.6. Delete Operation	100
	3.7. MongoDB findOneAndDelete()	113
	3.8. findOneAndReplace() Method	116
	3.9. findOneAndUpdate() Method	120
	3.10. findAndModify() Method	126
	4. Aggregate Operators	131
IV	4.1 Aggregation Operators	131
	4.2 Aggregation Stage Operators	138

<b>Chapter No.</b>	<b>Content</b>	<b>Page No.</b>
	4.3. Expression Arithmetic Operators	143
	4.4. Set Expression Operators	144
	4.5. Array Operators	148
	4.6. Expression Boolean Operators	150
	4.7. Expression Comparison Operators	152
IV	4.8. Expression Date Operators	156
	4.9. Expression String Operators	163
	5. Indexes and Performance Tuning	170
	5.1. Different Types of Indexes	170
	5.2. Index Creation	175
	5.3. Listing the Indexes	180
	5.4. Default_Id Index	183
	5.5. Drop an Index	186
	5.6. Single Field Index	190
V	5.7. Compound Index	194
	5.8. Introduction to Storage and Storage Engine	199
	5.9. WiredTiger Storage Engine	205
	5.10. In-Memory Storage Engine	209
	5.11. Introduction to MongoDB Sharding: Advantages of sharding	213
	5.12. Architecture Overview	214
	5.13. Development, Continuous Deployment and Staging Environments	218
	5.14. Planning ahead on Sharding	220

<b>Chapter No.</b>	<b>Content</b>	<b>Page No.</b>
	5.15. Shard Key	223
	5.16. Choosing a Shard Key	226