Unit 1: Introduction to Databases

1.1 Introduction to Databases

- **What is a Database?**
  - A database is a collection of organized data that can be easily accessed, managed, and updated.
  - • Example: Library catalog.

- **Why use a Database?**
  - - Efficient data storage.
  - - Easy retrieval and updates.
  - - Ensures consistency and security.

1.2 Overview of DBMS

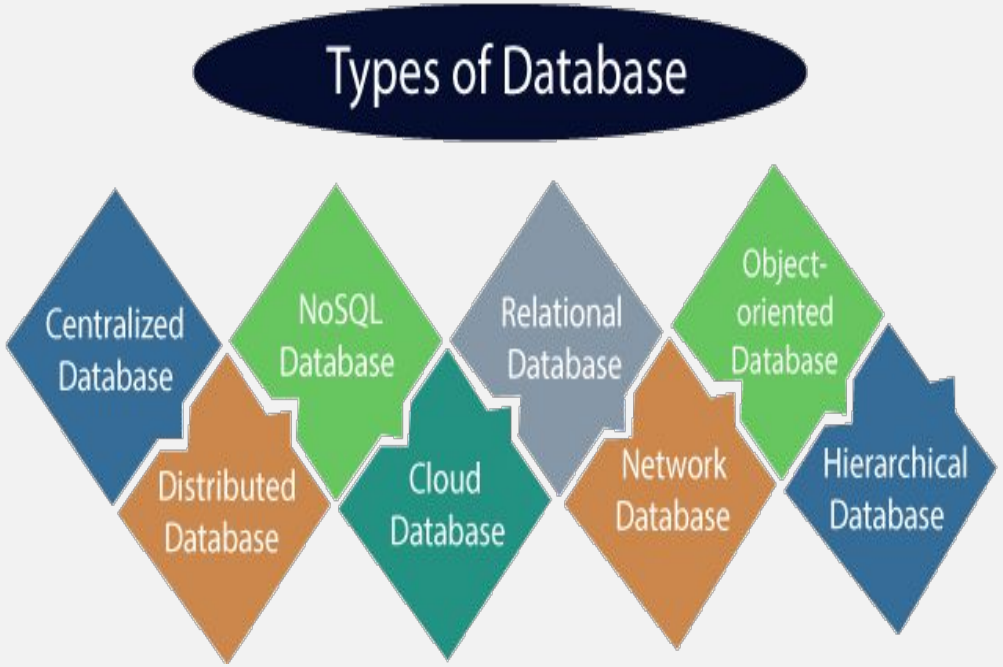
- **What is a DBMS?**
  - Software to create, manage, and use databases.
  - • Examples: MySQL, MongoDB, Oracle DB.

- **Key Functions:**
  - - Store, retrieve, and update data.
  - - Handle multiple users.
  - • Real-life Example: Banking systems for account tracking.

1.3 Types of Databases: RDBMS

- **Relational Databases:**
  - - Data stored in tables (rows and columns).
  - - Use SQL (Structured Query Language).
- Example: MySQL, PostgreSQL.

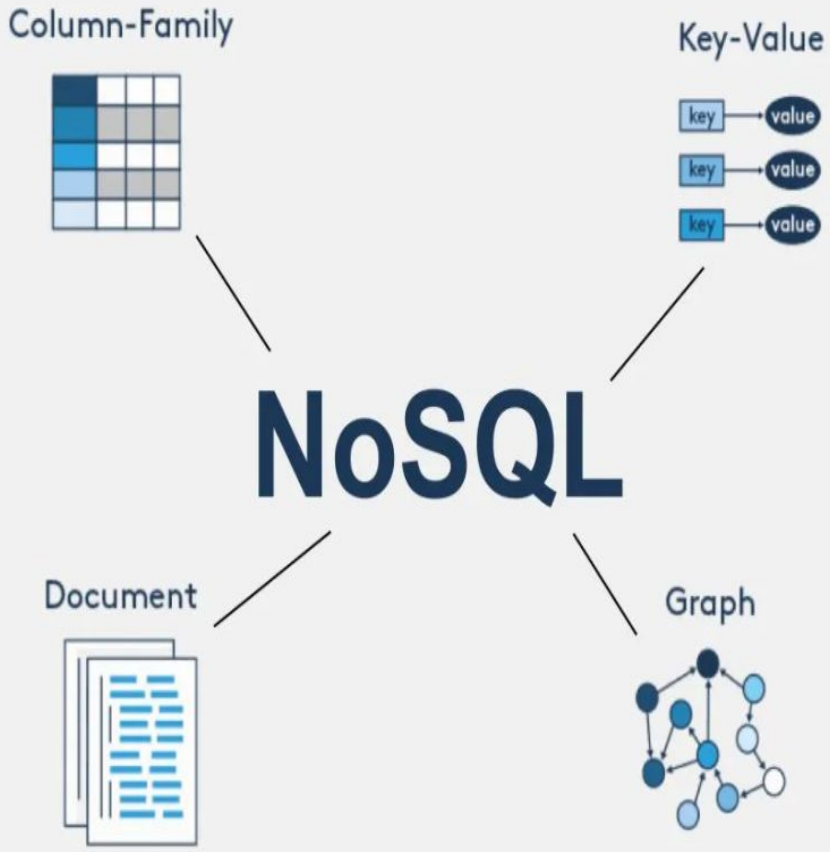
- **Simple Example:**
  - | ID | Name | Age |
  - |----|-------|-----|
  - | 1 | Alice | 20 |
  - | 2 | Bob | 22 |



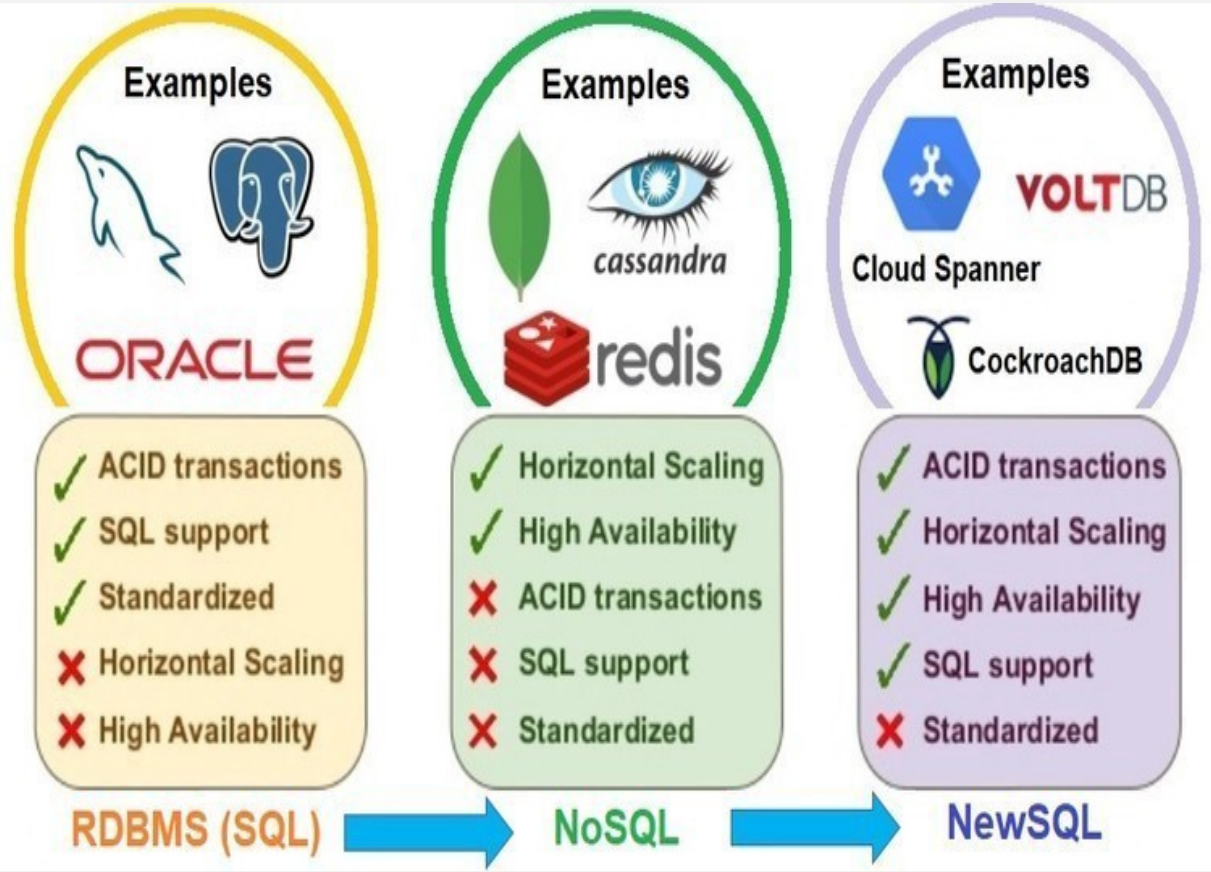
1.4 NoSQL Databases

- • Handles unstructured/semi-structured data.
- • Types: Key-value, document, graph.

- • **Example (MongoDB Document):**
- {
- "ID": 1,
- "Name": "Alice",
- "Age": 20
- }



1.5 NewSQL Databases

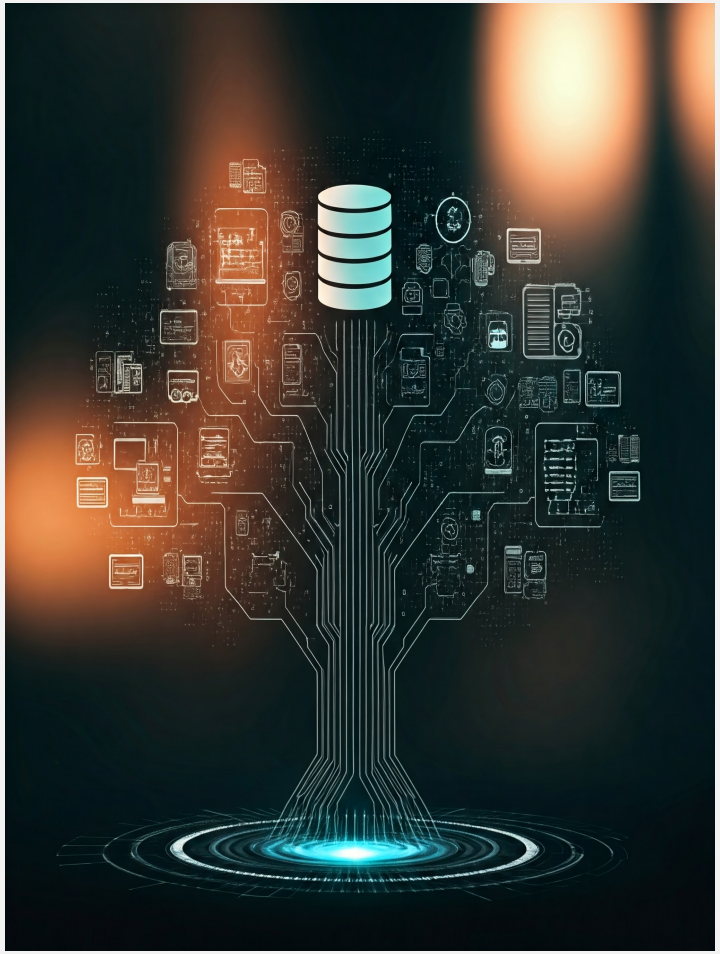


- Combines RDBMS and NoSQL features.
- Scalable and consistent.
- Example: CockroachDB.

2.1 Evolution and Trends

- • **Evolution:**
- - 1970s: Relational databases emerged.
- - 2000s: NoSQL for Big Data.
- - 2010s: NewSQL introduced.

- • **Trends:**
- - Cloud-based databases.
- - AI and ML for optimization.
- - Multi-model databases.



3.1 Foundations of MongoDB

- A NoSQL database storing JSON-like documents.
- Flexible and scalable.

- **Key Features:**
  - Schema-less (no fixed structure).
  - Handles unstructured data.

- **Example:**

```
{
 "Name": "Alice",
  "Email": "alice@example.com",
  "Interests": ["Reading", "Travel"]
}
```

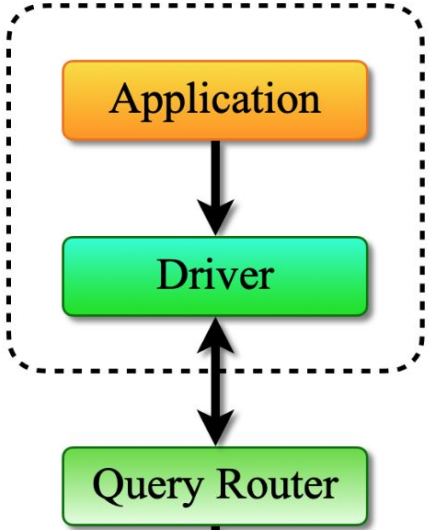
3.1 MongoDB Architecture and Components

- • Database > Collections > Documents.
- • Example:
- Database: School
- Collection: Students
- Document: { "Name": "Alice", "Age": 20 }

- • Replication: Multiple copies for high availability.
- • Sharding: Distributes data across servers.

2. Native language drivers

```
db.customer.insert({…})
db.customer.find({
      name: "Raj Kumar"})
```



1. Dynamic Document Schema

```
{ name: "Raj Kumar",
  date: "2011-07-18",
  address: "2nd Floor.",
  phone: [
     { home: 1234567890},
     { mobile: 1234567890} ]
}
```

3. High availability

- Replica sets

4. High Performance

- Data locality
- Rich Indexes
- RAM

5. Horizontal Scalability

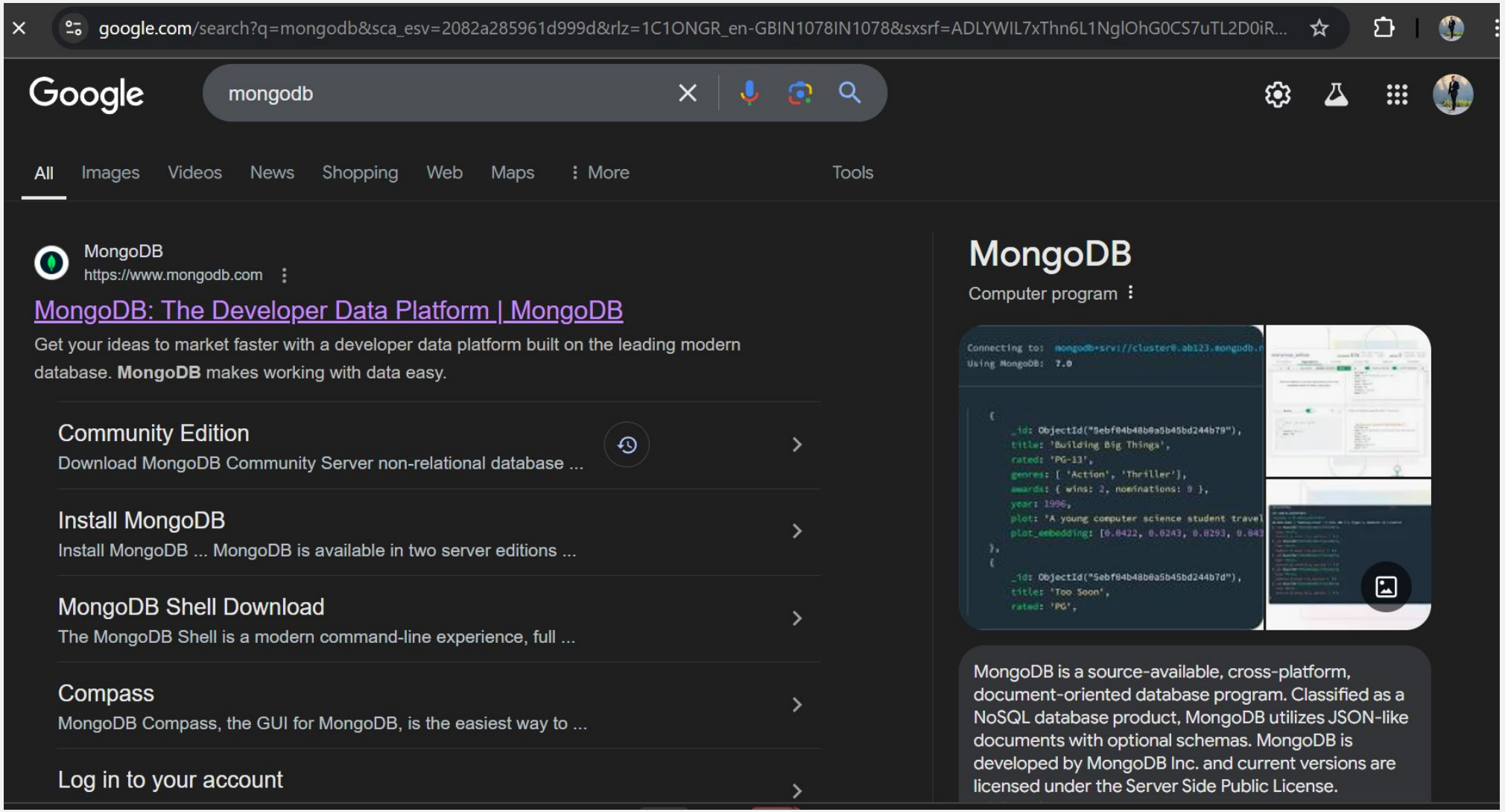
- Sharding

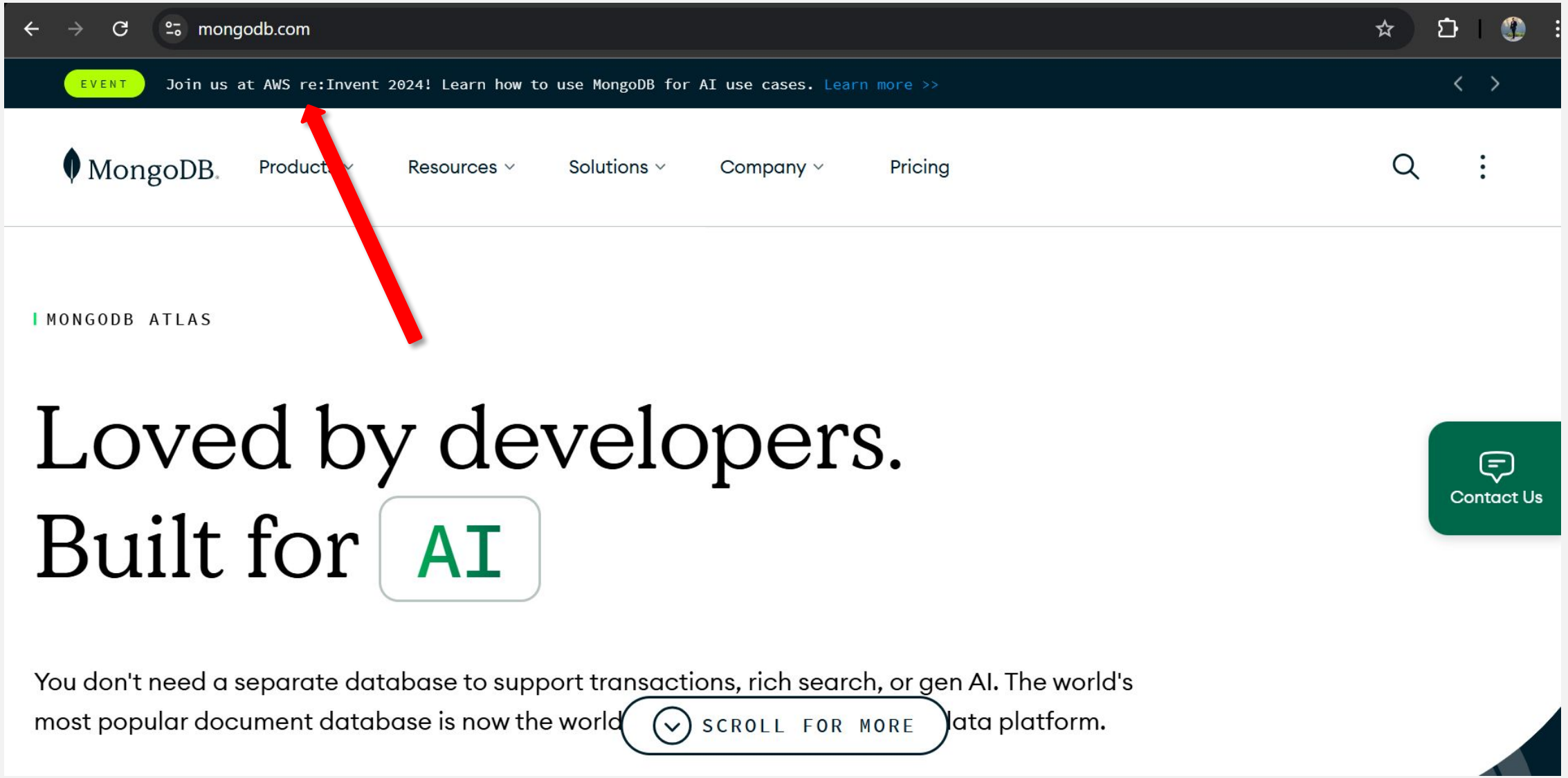
4.1 Installation and Setup of MongoDB

- • **Steps:**
- 1. Download MongoDB.
- 2. Install the package.
- 3. Start server: `mongod`.
- 4. Use shell: `mongo`.

- • **Example Commands:**
- - Start server: `mongod`
- - Insert data: db.students.insert({...})
- - Retrieve data: db.students.find()

4.1 Installation and Setup of MongoDB

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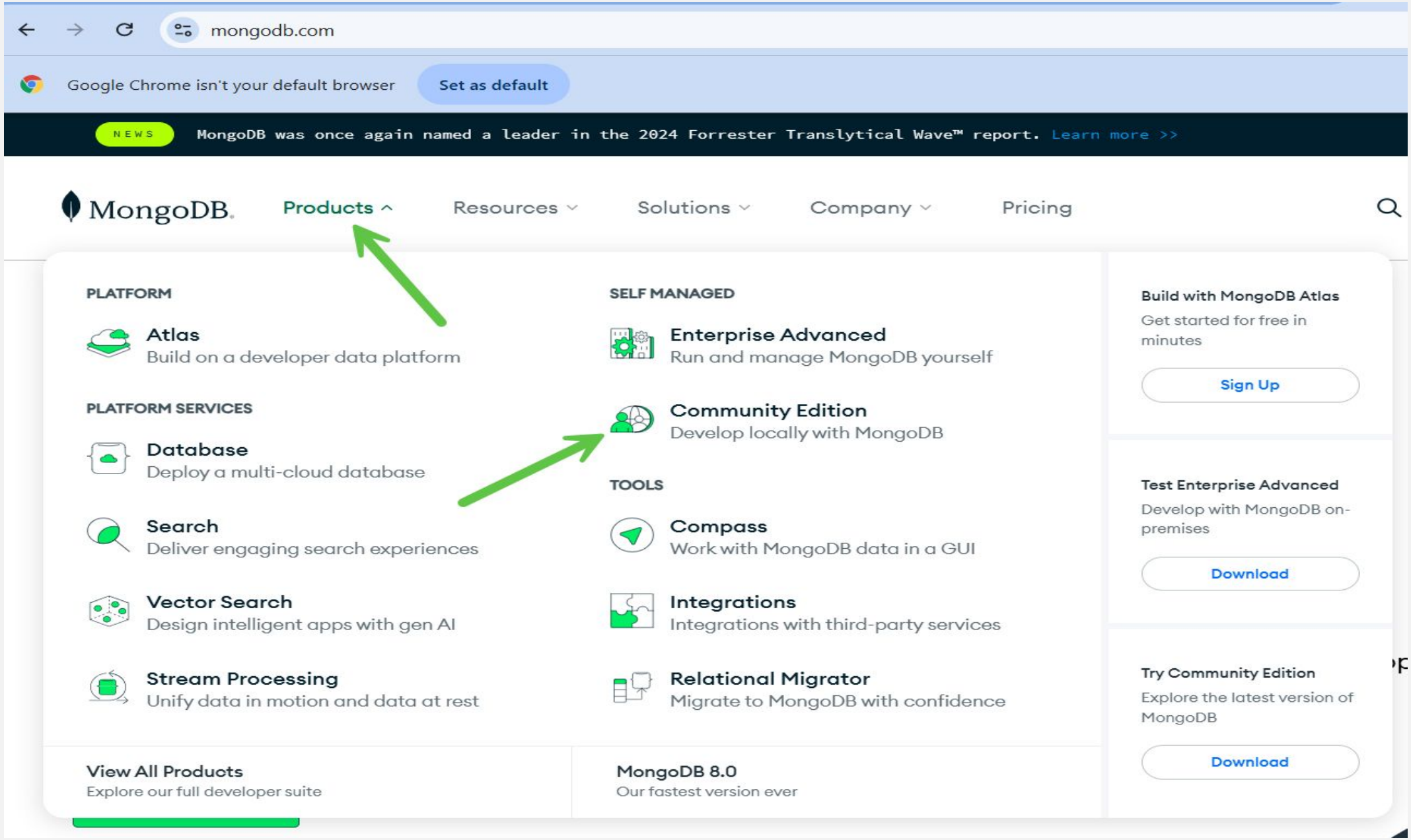
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Set as default
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Pricing
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Atlas
Build on a developer data platform
PLATFORM SERVICES
Database
Deploy a multi-cloud database
Search
Deliver engaging search experiences
Vector Search
Design intelligent apps with gen AI
Stream Processing
Unify data in motion and data at rest
SELF MANAGED
Enterprise Advanced
Run and manage MongoDB yourself
Community Edition
Develop locally with MongoDB
TOOLS
Compass
Work with MongoDB data in a GUI
Integrations
Integrations with third-party services
Relational Migrator
Migrate to MongoDB with confidence
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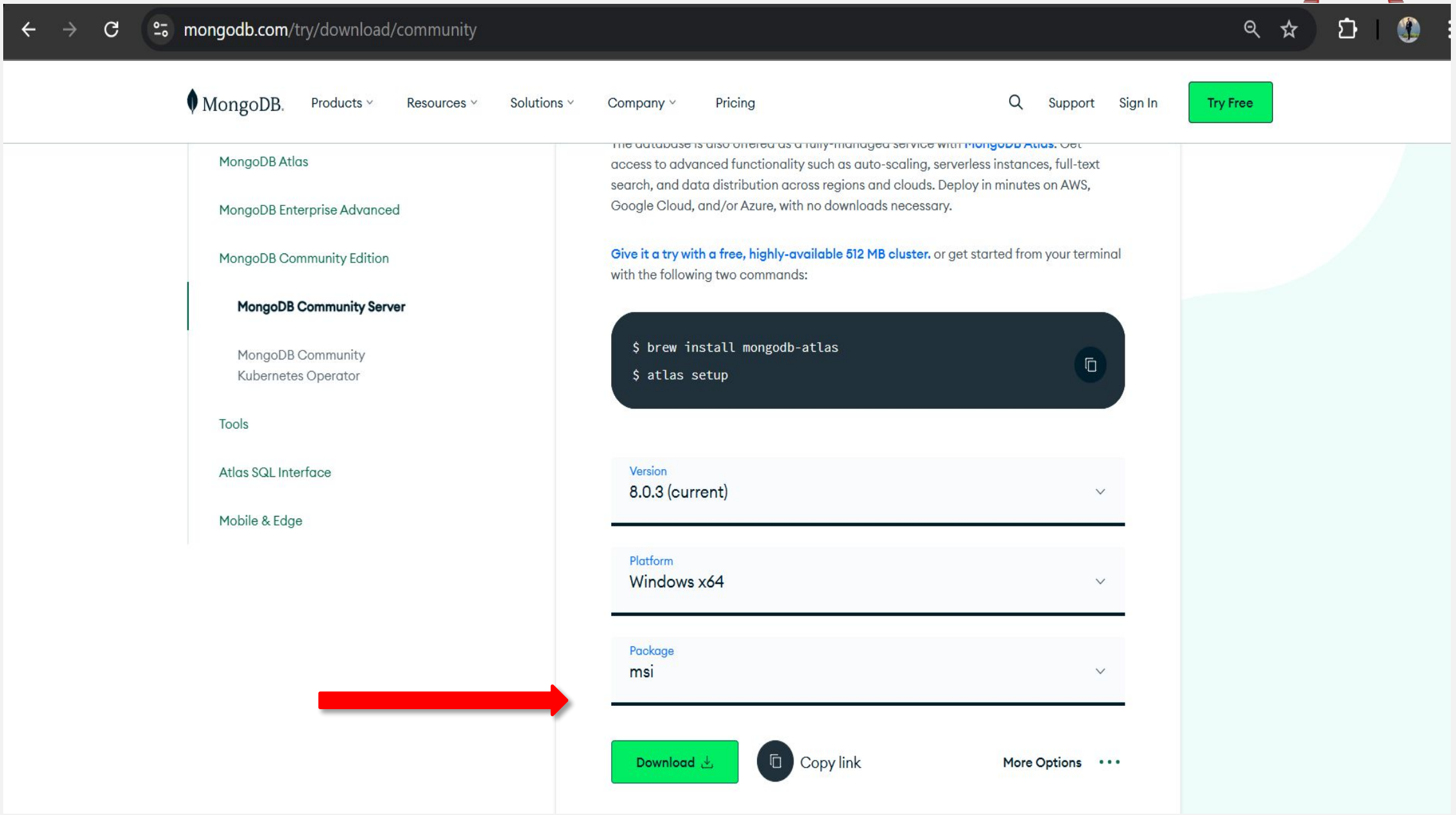
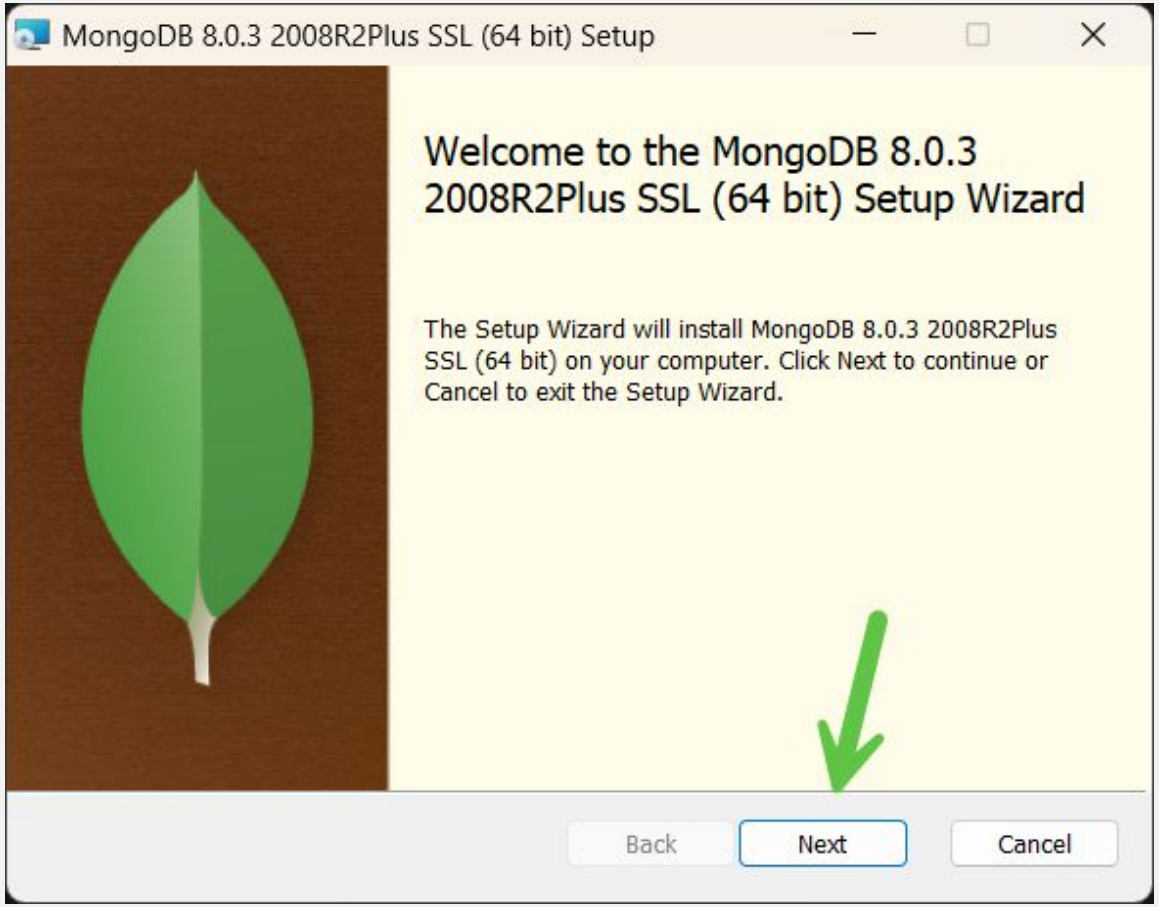
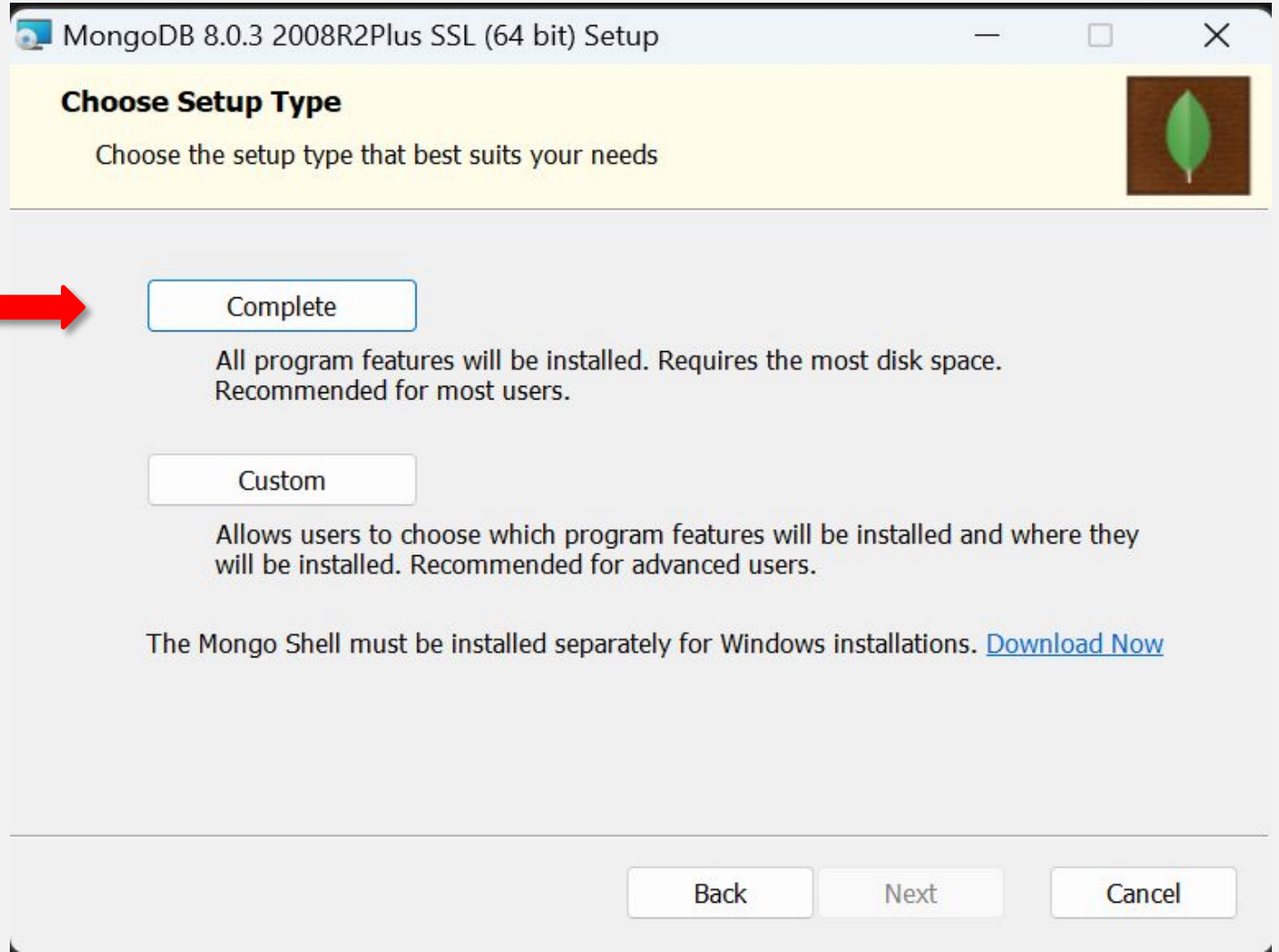


Downloaded

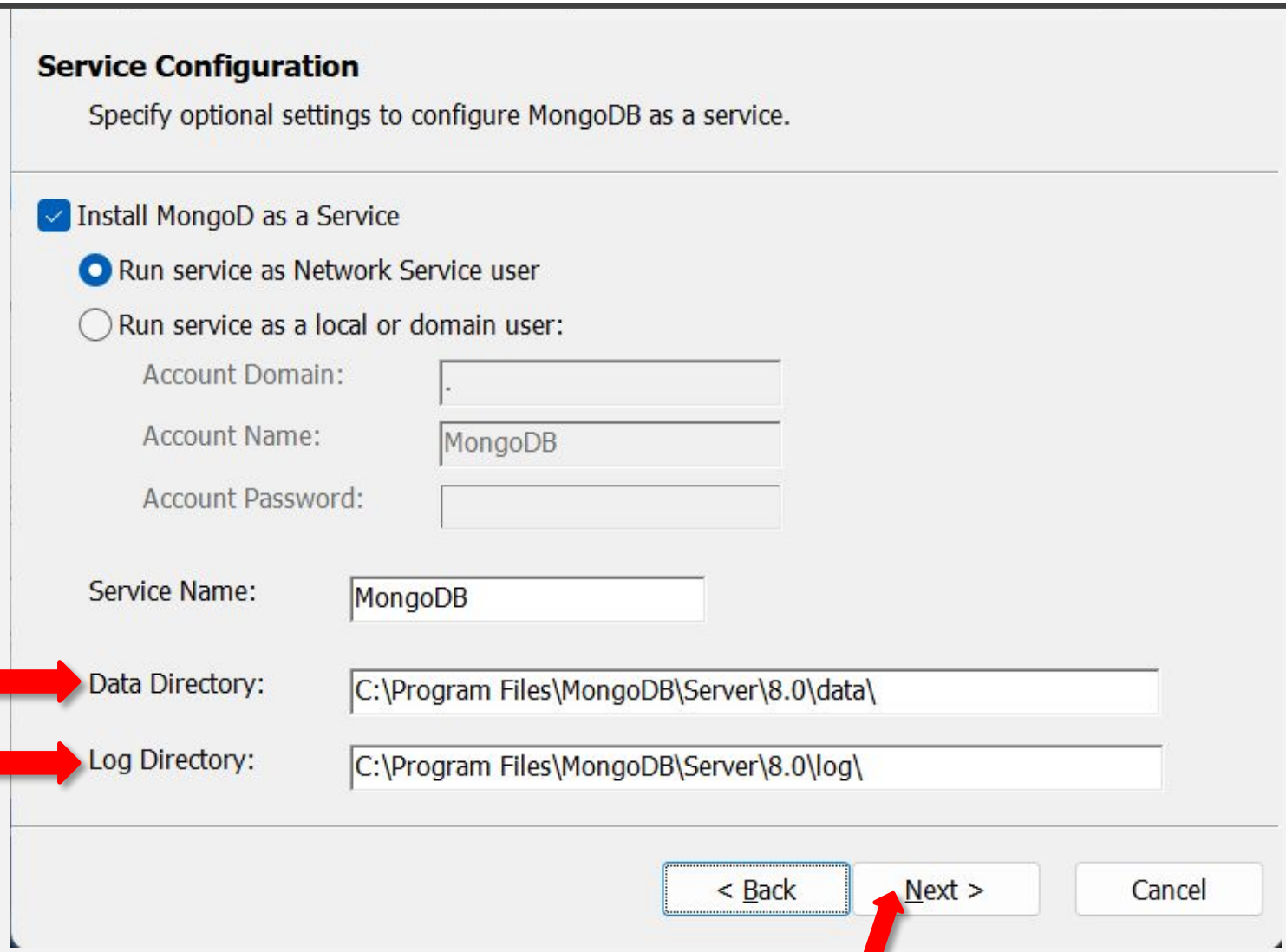

Today
mongodb-windows-x86_64-8.0.3-signed


MongoDB 8.0.3 2008R2Plus SSL (64 bit) Setup
Welcome to the MongoDB 8.0.3 2008R2Plus SSL (64 bit) Setup Wizard
The Setup Wizard will install MongoDB 8.0.3 2008R2Plus SSL (64 bit) on your computer. Click Next to continue or Cancel to exit the Setup Wizard.
Back
Next
Cancel

Let's Install MongoDB

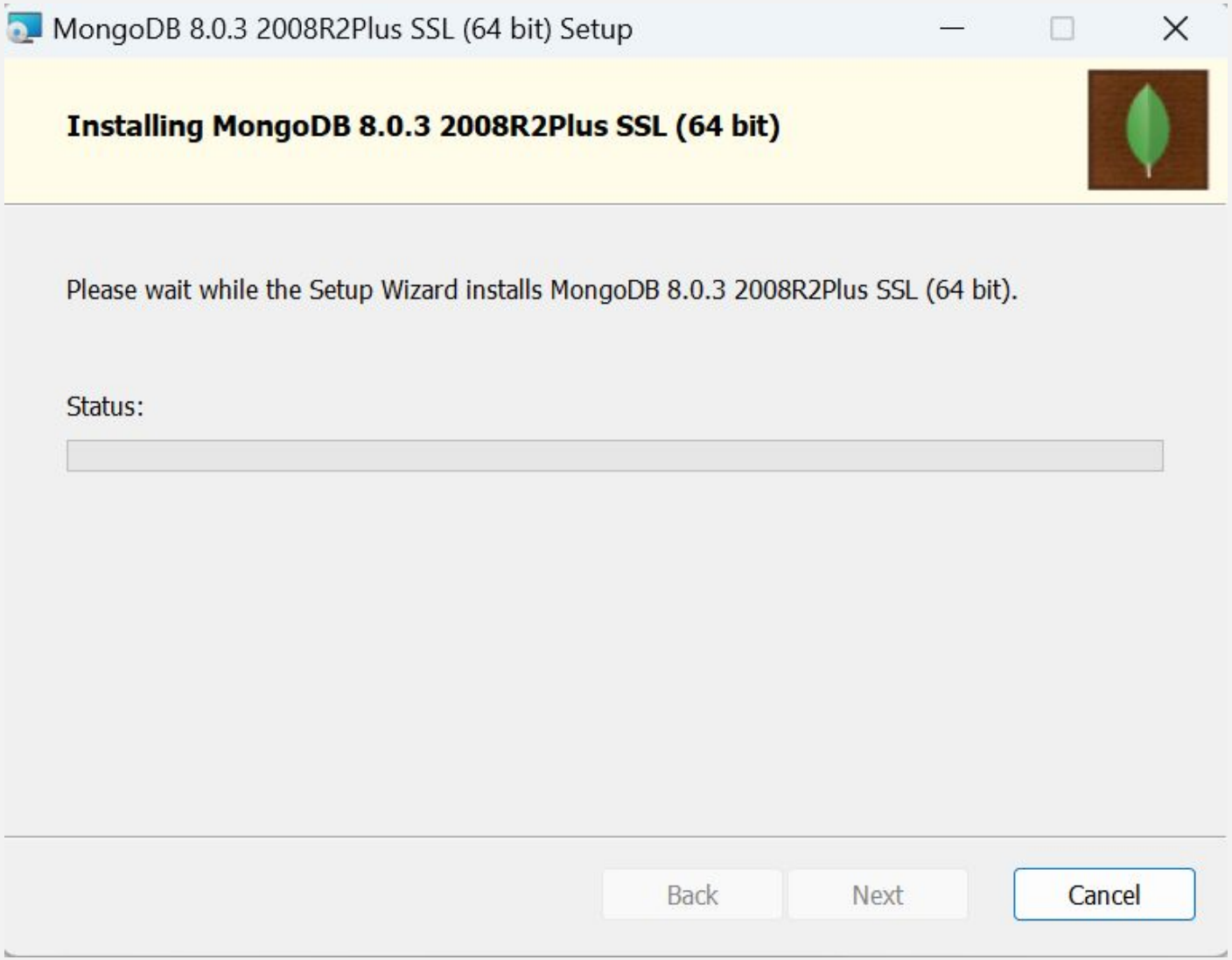


Let's Install MongoDB

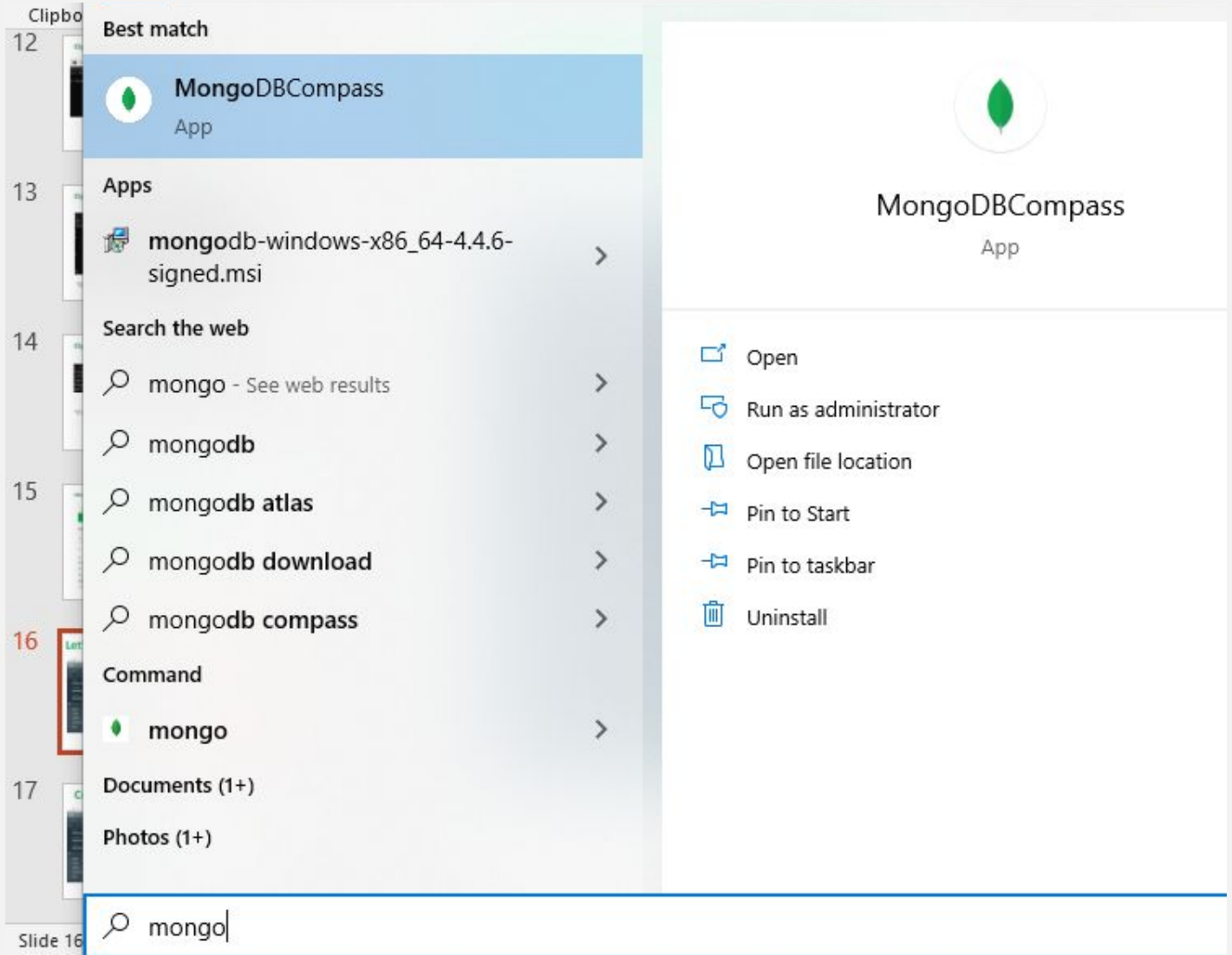


Check Path

Click next and then install


MongoDB 8.0.3 2008R2Plus SSL (64 bit) Setup
Installing MongoDB 8.0.3 2008R2Plus SSL (64 bit)
Please wait while the Setup Wizard installs MongoDB 8.0.3 2008R2Plus SSL (64 bit).
Status:
Back
Next
Cancel

Let's open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Slide 16
Best match
MongoDBCompass
App
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Search the web
mongo - See web results
mongodb
mongodb atlas
mongodb download
mongodb compass
Command
mongo
Documents (1+)
Photos (1+)
MongoDBCompass
App
Open
Run as administrator
Open file location
Pin to Start
Pin to taskbar
Uninstall
mongo

MongoDB Compass

Connections Edit View Help

Compass

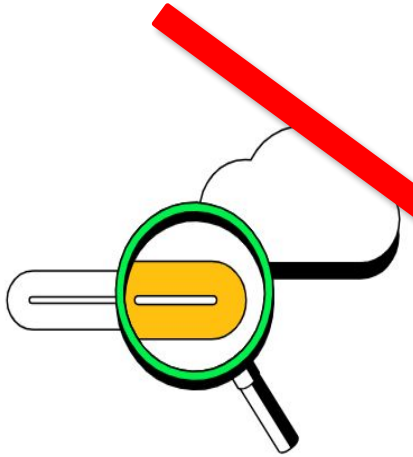
My Queries

CONNECTIONS

You have not connected to any deployments.

+ Add new connection

Welcome



Welcome to MongoDB Compass

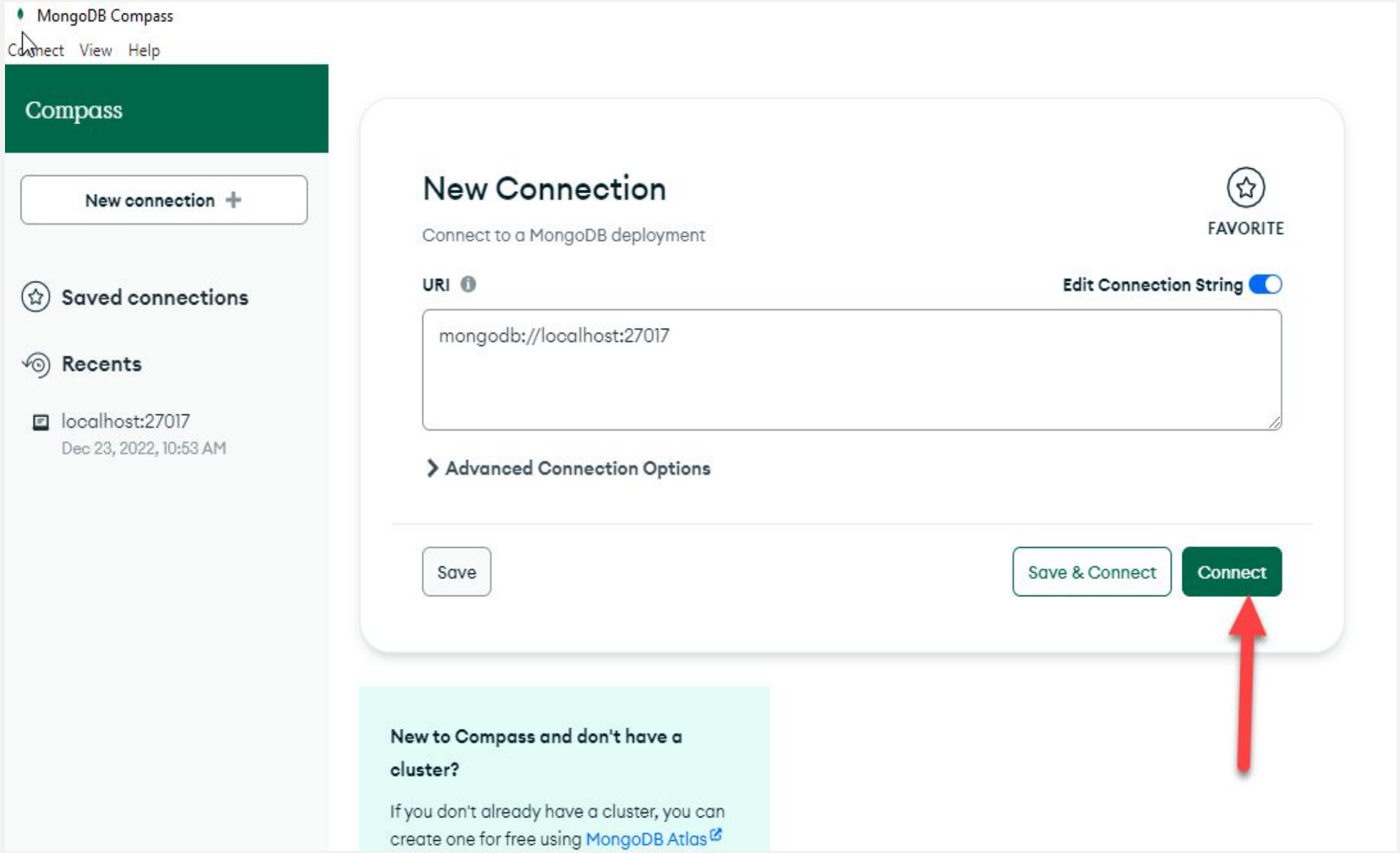
To get started, connect to an existing server or

+ Add new connection

New to Compass and don't have a cluster?

If you don't already have a cluster, you can create one for free using MongoDB Atlas

CREATE FREE CLUSTER


MongoDB Compass
Connect View Help
Compass
New connection +
Saved connections
Recents
localhost:27017
Dec 23, 2022, 10:53 AM
New Connection
Connect to a MongoDB deployment
FAVORITE
URI
Edit Connection String
mongodb://localhost:27017
Advanced Connection Options
Save
Save & Connect
Connect
New to Compass and don't have a cluster?
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MongoDB Compass

Connections Edit View Help

Compass

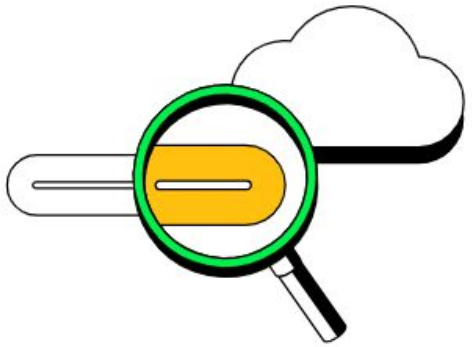
{} My Queries

CONNECTIONS (1)

Search connections

- myconn
  - admin
  - config
  - local

Welcome



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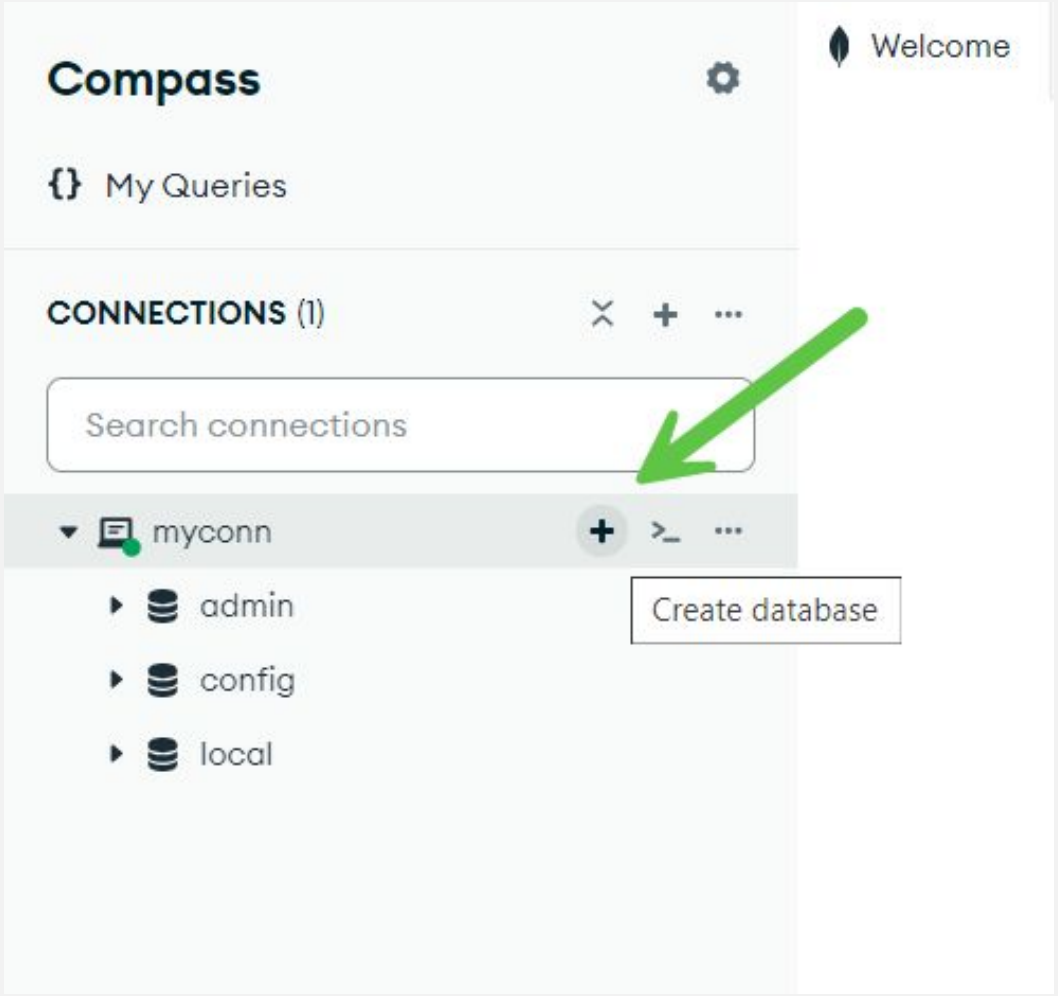
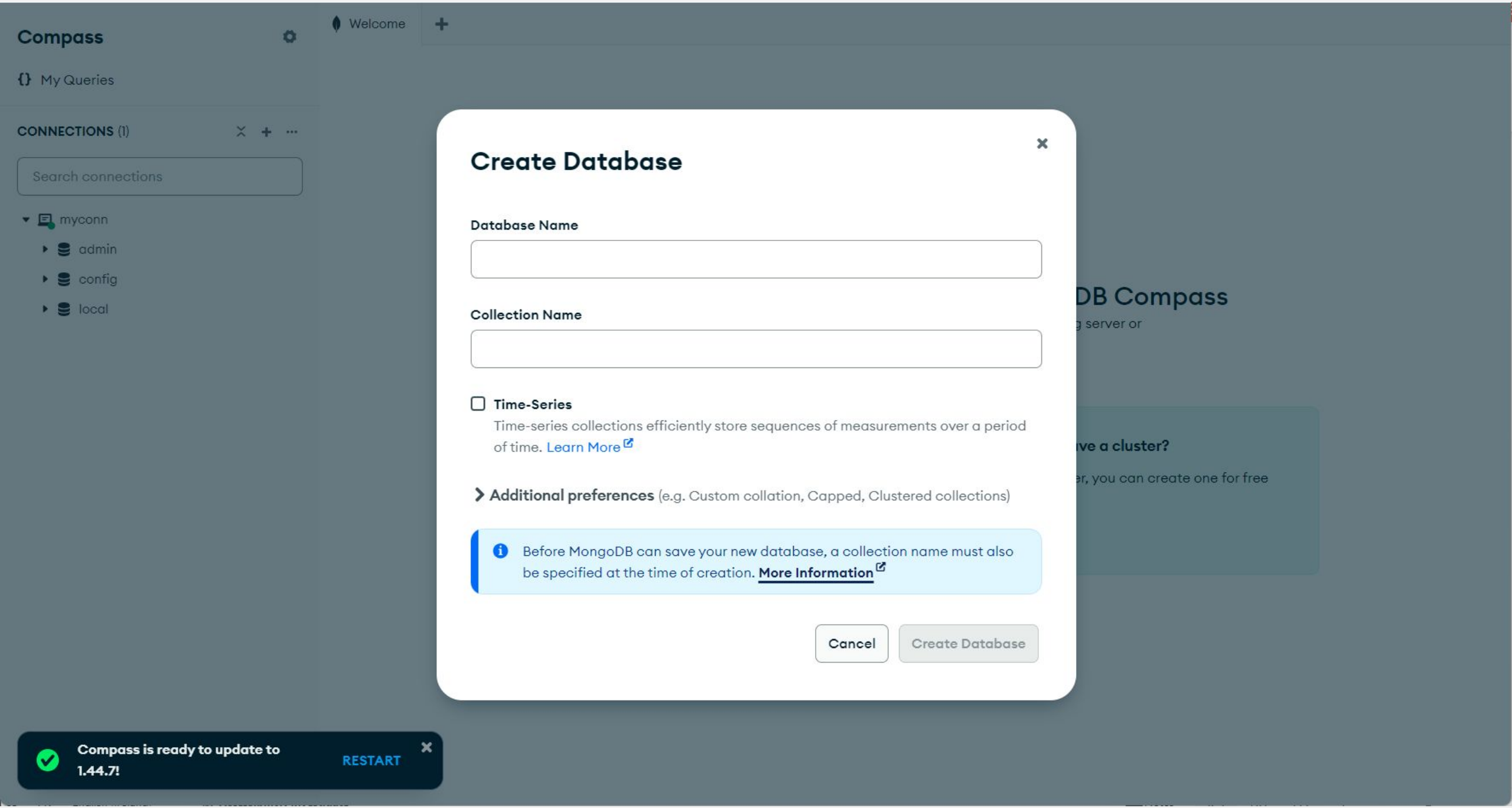
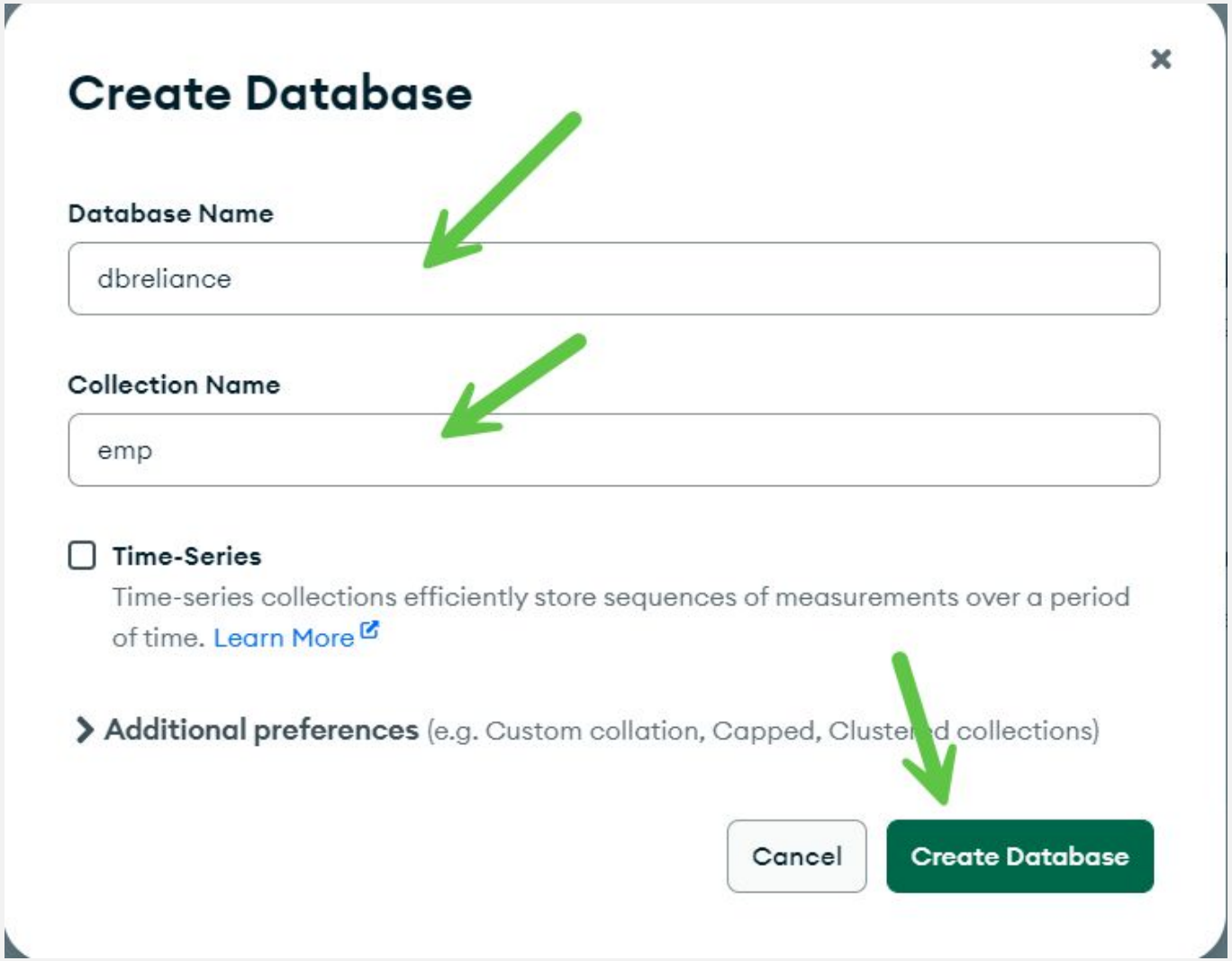
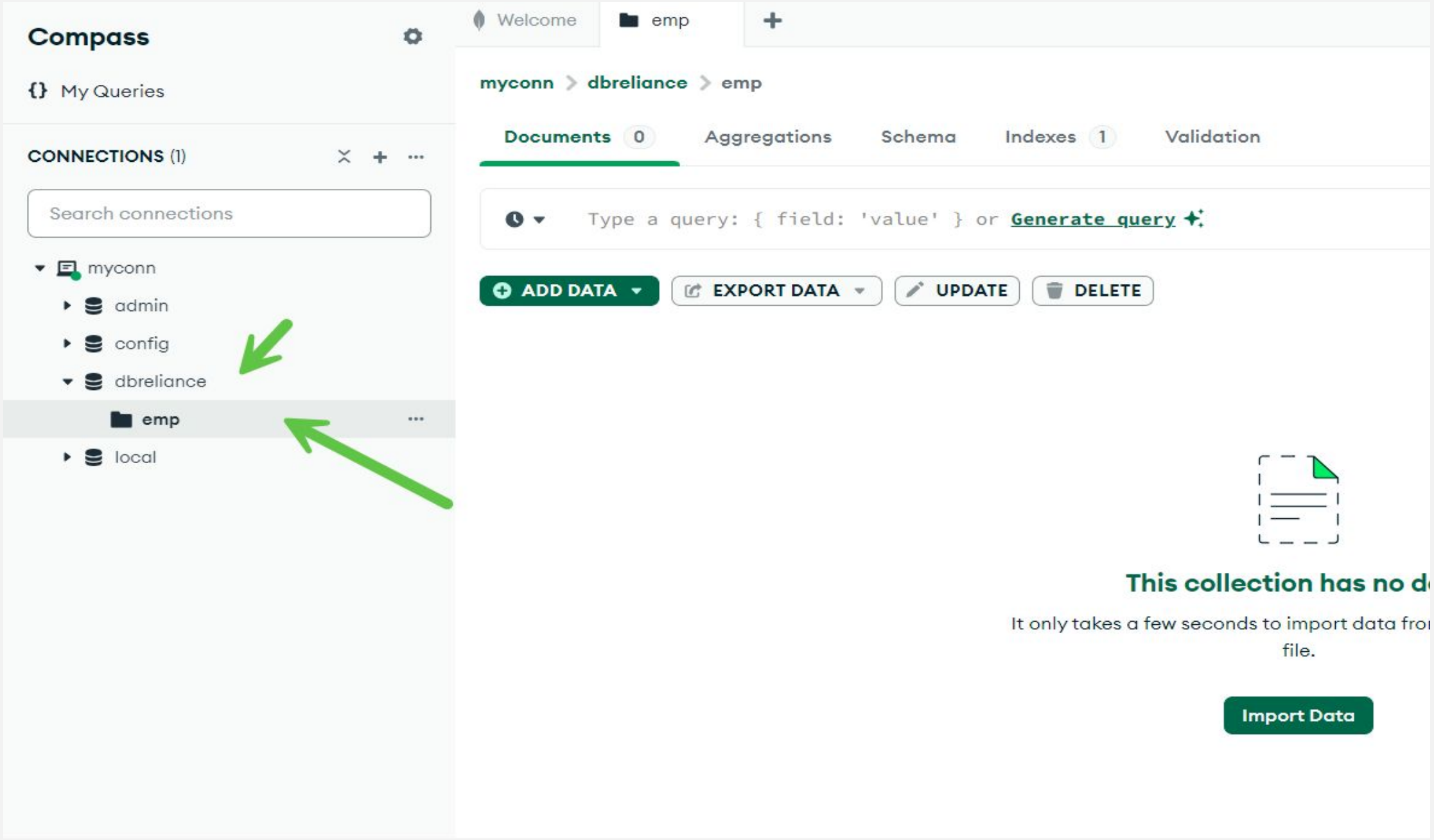

Compass
Welcome
My Queries
CONNECTIONS (1)
Search connections
myconn
admin
config
local
Create database


Compass
My Queries
CONNECTIONS (1)
Search connections
myconn
admin
config
local
Welcome
Create Database
Database Name
Collection Name
Time-Series
Time-series collections efficiently store sequences of measurements over a period of time. Learn More
Additional preferences (e.g. Custom collation, Capped, Clustered collections)
Before MongoDB can save your new database, a collection name must also be specified at the time of creation. More Information
Cancel
Create Database
DB Compass
g server or
ve a cluster?
er, you can create one for free
Compass is ready to update to 1.44.7!
RESTART


Create Database
Database Name
dbreliance
Collection Name
emp
Time-Series
Time-series collections efficiently store sequences of measurements over a period of time. Learn More
Additional preferences (e.g. Custom collation, Capped, Clustered collections)
Cancel
Create Database


Compass
My Queries
CONNECTIONS (1)
Search connections
myconn
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config
dbreliance
emp
local
Welcome
emp
myconn > dbreliance > emp
Documents 0
Aggregations
Schema
Indexes 1
Validation
Type a query: { field: 'value' } or Generate query
ADD DATA
EXPORT DATA
UPDATE
DELETE
This collection has no d
It only takes a few seconds to import data fro
file.
Import Data

References

- • https://www.cloudduggu.com/mongodb/introduction/
- • https://www.geeksforgeeks.org/mongodb-architecture/
- • https://www.w3schools.com/mongodb/
- •https://www.techtarget.com/searchdatamanagement/definition/MongoDB