e-PGPathshala

Subject : Computer Science

Paper: Data Analytics

Module No 32: CS/DA/32 – MongoDB-I

Quadrant 1 – e-text

1.1 Introduction

This chapter gives an overview of the basics of MongoDB and setting up the Mongo environment.

1.2 Learning Outcomes

- To know the basics of MongoDB
- To understand the need for MongoDB as a data store
- To learn setting up the Mongo environment
- To understand basic Mongo's query languages

1.3 An Overview of MongoDB and its advantages

MongoDB is a cross-platform, document oriented database that provides, high performance, high availability, and easy scalability. MongoDB works on concept of collection and document.

- **Database**

  Database is a physical container for collections. Each database gets its own set of files on the file system. A single MongoDB server typically has multiple databases.

- **Collection**

  Collection is a group of MongoDB documents. It is the equivalent of an RDBMS table. A collection exists within a single database. Collections do not enforce a schema. Documents within a collection can have different fields. Typically, all documents in a collection are of similar or related purpose.

- **Document**

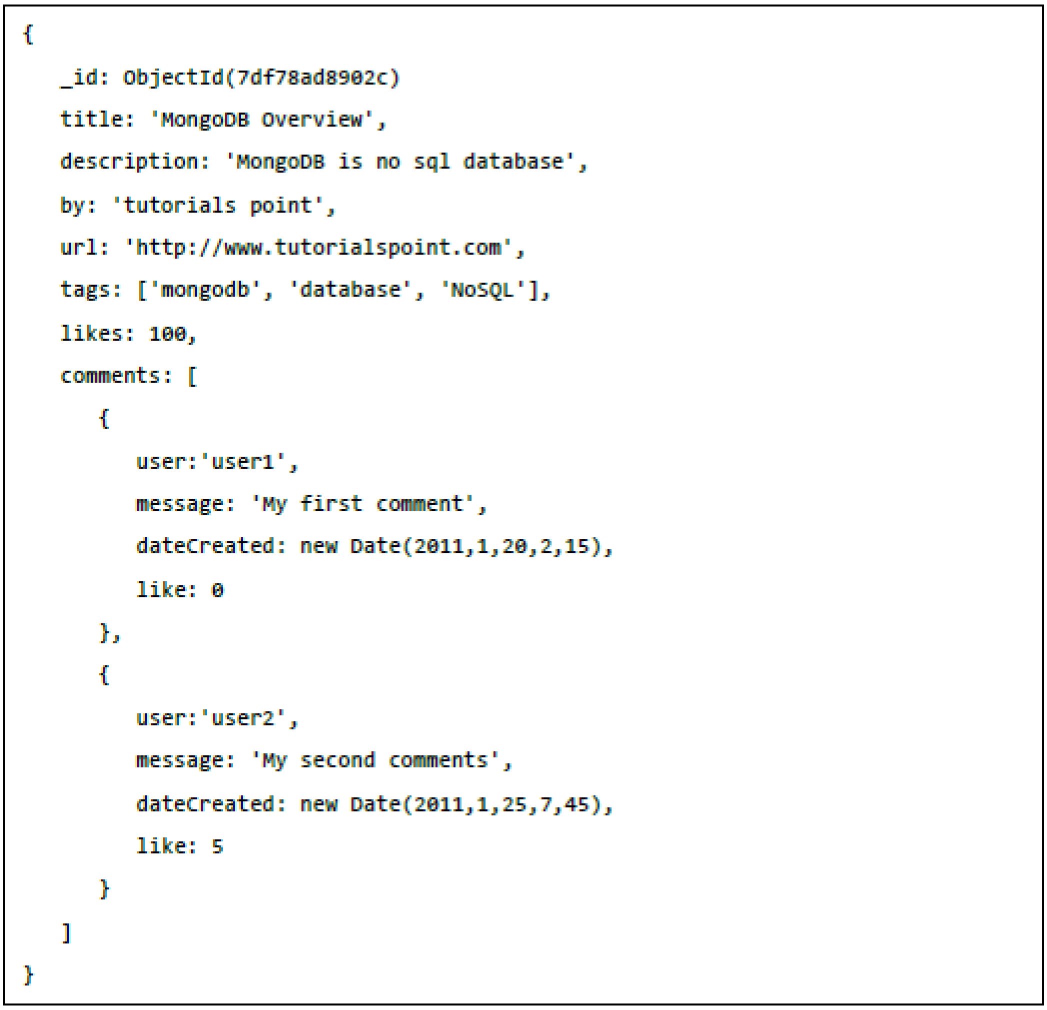
A document is a set of key-value pairs. Documents have dynamic schema. Dynamic schema means that documents in the same collection do not need to have the same set of fields or structure, and common fields in a collection's documents may hold different types of data.

The following table shows the relationship of RDBMS terminology with MongoDB.

RDBMS	**MongoDB**
Database	Database
Table	Collection
Tuple/Row	Document
column	Field
Table Join	Embedded Documents
Primary Key	Primary Key (Default key _id provided by mongodb itself)
Database Server and Client	
Mysqld/Oracle	mongod
mysql/sqlplus	mongo

Sample Document

Following example shows the document structure of a blog site, which is simply a comma separated key value pair.



```
{
   _id: ObjectId(7df78ad8902c)
   title: 'MongoDB Overview',
   description: 'MongoDB is no sql database',
   by: 'tutorials point',
   url: 'http://www.tutorialspoint.com',
   tags: ['mongodb', 'database', 'NoSQL'],
   likes: 100,
   comments: [
      {
         user:'user1',
         message: 'My first comment',
         dateCreated: new Date(2011,1,20,2,15),
         like: 0
      },
      {
         user:'user2',
         message: 'My second comments',
         dateCreated: new Date(2011,1,25,7,45),
         like: 5
      }
   ]
}
```

_id is a 12 bytes hexadecimal number which assures the uniqueness of every document. You can provide _id while inserting the document. If you don't provide then MongoDB provides a unique id for every document. These 12 bytes first 4 bytes for the current timestamp, next 3 bytes for machine id, next 2 bytes for process id of MongoDB server and remaining 3 bytes are simple incremental VALUE.

Advantages of MongoDB over RDBMS

- **Schema less**: MongoDB is a document database in which one collection holds different documents. Number of fields, content and size of the document can differ from one document to another.
- Structure of a single object is clear.
- No complex joins.
- Deep query-ability. MongoDB supports dynamic queries on documents using a document-based query language that's nearly as powerful as SQL.
- Tuning.

- Ease of scale-out: MongoDB is easy to scale.
- Conversion/mapping of application objects to database objects not needed.
- Uses internal memory for storing the (windowed) working set, enabling faster access of data.

Why Use MongoDB?

- Document Oriented Storage: Data is stored in the form of JSON style documents.
- Index on any attribute
- Replication and high availability
- Auto-sharding
- Rich queries
- Fast in-place updates
- Professional support by MongoDB

Where to Use MongoDB?

- Big Data
- Content Management and Delivery
- Mobile and Social Infrastructure
- User Data Management
- Data Hub

1.4 MongoDB Environment

(i) Install MongoDB on Windows

Step1: Download the latest release of MongoDB from http://www.mongodb.org/downloads. Make sure you get correct version of MongoDB depending upon your Windows version. To get your Windows version, open command prompt and execute the following command.

```
C:\>wmic os get osarchitecture

OSArchitecture

64-bit
```

```
C :\>
```

32-bit versions of MongoDB only support databases smaller than 2GB and suitable only for testing and evaluation purposes.

Step2: Now extract your downloaded file to c:\ drive or any other location. Make sure the name of the extracted folder is mongodb-win32-i386-[version] or mongodb-win32-x86_64-[version]. Here [version] is the version of MongoDB download.

Step3: Next, open the command prompt and run the following command.

```
C:\>move mongodb-win64-* mongodb

1 dir(s) moved.

C :\>
```

In case you have extracted the MongoDB at different location, then go to that path by using command **cd FOOLDER/DIR** and now run the above given process.

MongoDB requires a data folder to store its files. The default location for the MongoDB data directory is c:\data\db. So you need to create this folder using the Command Prompt. Execute the following command sequence.

```
C:\>md data

C:\md data\db
```

If you have to install the MongoDB at a different location, then you need to specify an alternate path for **\data\db** by setting the path **dbpath** in **mongod.exe**. For the same, issue the following commands.

Step4: In the command prompt, navigate to the bin directory present in the MongoDB installation folder. Suppose my installation folder is **D:\set up\mongodb**

```
C:\Users\XYZ>d:

D:\>cd "set up"

D:\set up>cd mongodb

D:\set up\mongodb>cd bin

D:\set up\mongodb\bin>mongod.exe --dbpath "d:\set up\mongodb\data"
```

This will show **waiting for connections** message on the console output, which indicates that the mongod.exe process is running successfully.

Step5: Now to run the MongoDB, you need to open another command prompt and issue the following command.

```
D:\set up\mongodb\bin>mongo.exe

MongoDB shell version: 2.4.6

Connecting to: test

>db.test.save( { a: 1 } )

>db.test.find()

{“_id”: ObjectId(5879b0f65a56a454), "a" : 1 }

>
```

This will show that MongoDB is installed and run successfully. Next time when you run MongoDB, you need to issue only commands.

```
D:\set up\mongodb\bin>mongod.exe --dbpath "d:\set up\mongodb\data"

D:\set up\mongodb\bin>mongo.exe
```

(ii) Install MongoDB on Ubuntu

Step1: Run the following command to import the MongoDB public GPG key –

```
sudo apt-key adv --keyserver hkp://keyserver.ubuntu.com:80 --recv 7F0CEB10
```

Step2: Create a /etc/apt/sources.list.d/mongodb.list file using the following command.

```
echo 'deb http://downloads-distro.mongodb.org/repo/ubuntu-upstart dist 10gen'

| sudo tee /etc/apt/sources.list.d/mongodb.list
```

Step3: Now issue the following command to update the repository –

```
sudo apt-get update
```

Step4: Next install the MongoDB by using the following command –

```
apt-get install mongodb-10gen=2.2.3
```

In the above installation, 2.2.3 is currently released MongoDB version. Make sure to install the latest version always. Now MongoDB is installed successfully.

Start MongoDB

```
sudo service mongodb start
```

Stop MongoDB

```
sudo service mongodb stop
```

Restart MongoDB

```
sudo service mongodb restart
```

To use MongoDB run the following command.

```
mongo
```

This will connect you to running MongoDB instance.

1.5 MongoDB - Data Modelling

Data in MongoDB has a flexible schema.documents, in the same collection. They do not need to have the same set of fields or structure, and common fields in a collection’s documents may hold different types of data.

<u>Some considerations while designing Schema in MongoDB</u>

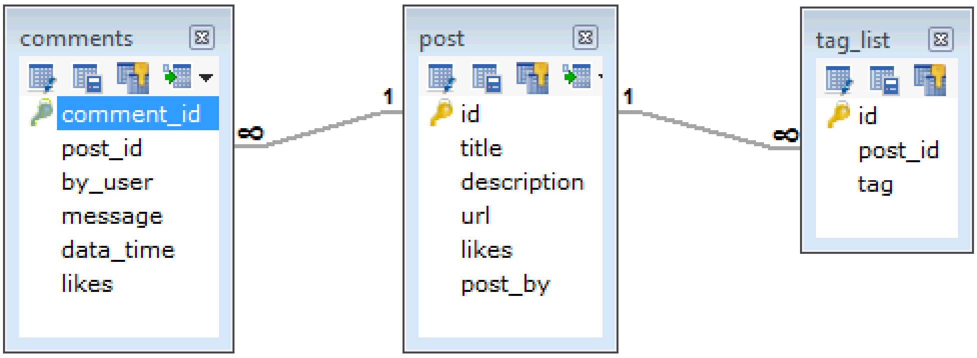
- Design your schema according to user requirements.
- Combine objects into one document if you will use them together. Otherwise separate them (but make sure there should not be need of joins).
- Duplicate the data (but limited) because disk space is cheap as compare to compute time.
- Do joins while write, not on read.
- Optimize your schema for most frequent use cases.
- Do complex aggregation in the schema.

Example

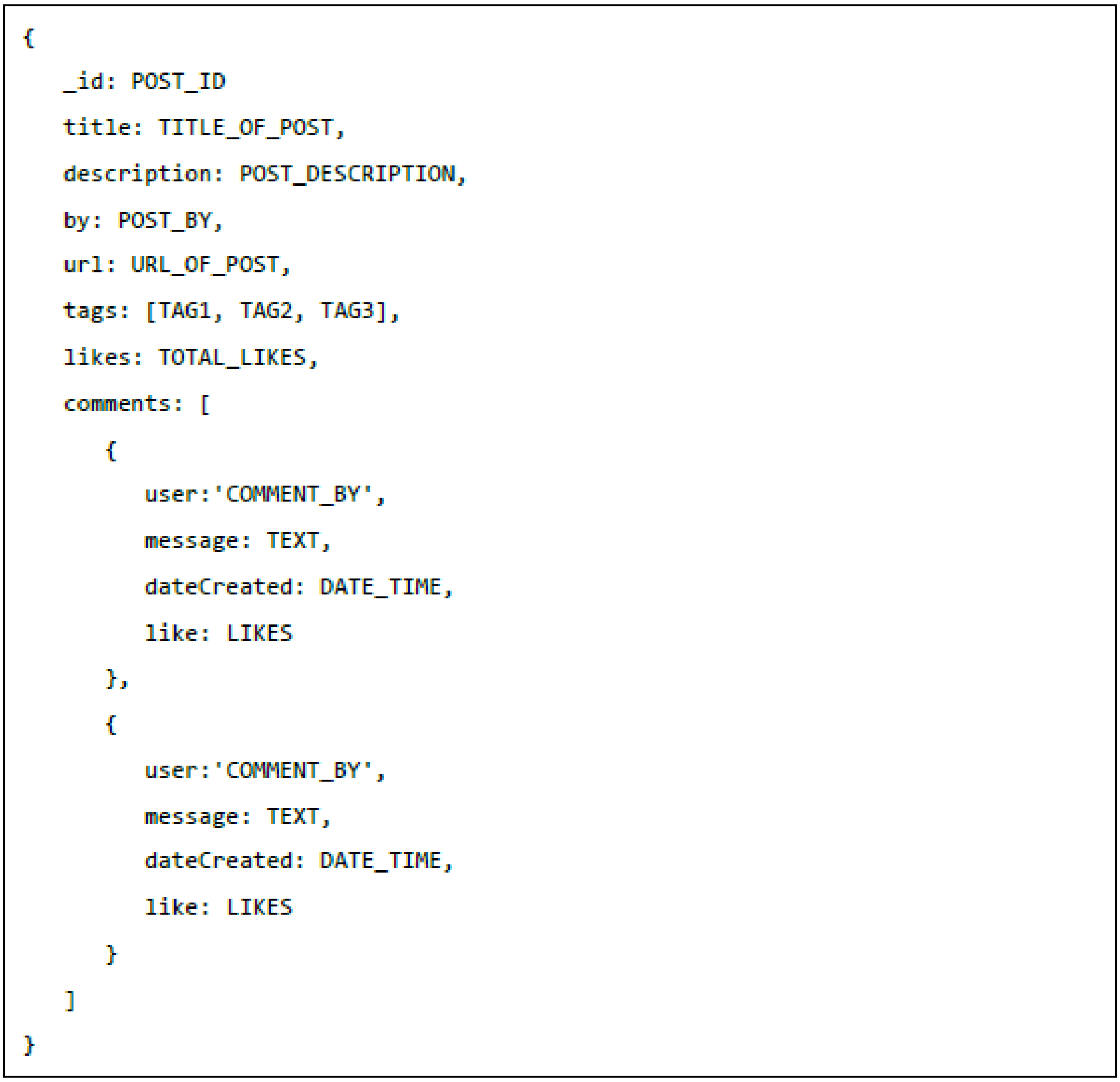
- Suppose a client needs a database design for his blog/website and see the differences between RDBMS and MongoDB schema design. Website has the following requirements.
- Every post has the unique title, description and url.
- Every post can have one or more tags.
- Every post has the name of its publisher and total number of likes.

- Every post has comments given by users along with their name, message, data-time and likes.
- On each post, there can be zero or more comments.

In RDBMS schema, design for above requirements will have minimum three tables.



While in MongoDB schema, design will have one collection post and the following structure:



```
{
   _id: POST_ID
   title: TITLE_OF_POST,
   description: POST_DESCRIPTION,
   by: POST_BY,
   url: URL_OF_POST,
   tags: [TAG1, TAG2, TAG3],
   likes: TOTAL_LIKES,
   comments: [
      {
         user:'COMMENT_BY',
         message: TEXT,
         dateCreated: DATE_TIME,
         like: LIKES
      },
      {
         user:'COMMENT_BY',
         message: TEXT,
         dateCreated: DATE_TIME,
         like: LIKES
      }
   ]
}
```

So while showing the data, in RDBMS you need to join three tables and in MongoDB, data will be shown from one collection only.

1.6 MongoDB - Create Database and Drop Database

(i) The use Command

MongoDB **use DATABASE_NAME** is used to create database. The command will create a new database if it doesn't exist, otherwise it will return the existing database.

Syntax

Basic syntax of **use DATABASE** statement is as follows: use DATABASE_NAME

Example

If you want to create a database with name **<mydb>**, then **use DATABASE** statement would be as follows:

```
>use mydb
```

Switch to db mydb

To check your currently selected database, use the command **db**

```
>db
mydb
```

If you want to check your databases list, use the command **show dbs**.

```
>show dbs
local 0.78125GB
test 0.23012GB
```

Your created database (mydb) is not present in list. To display database, you need to insert at least one document into it.

```
>db.movie.insert({"name":"tutorials point"})
>show dbs
local 0.78125GB
mydb 0.23012GB
test 0.23012GB
```

In MongoDB default database is test. If you didn't create any database, then collections will be stored in test database.

(ii) The dropDatabase() Method

MongoDB **db.dropDatabase()** command is used to drop a existing database.

Syntax

Basic syntax of **dropDatabase()** command is as follows: `db.dropDatabase()`

This will delete the selected database. If you have not selected any database, then it will delete default 'test' database.

Example

First, check the list of available databases by using the command, **show dbs**.

```
>show dbs
local 0.78125GB
```

```
mydb 0.23012GB

test 0.23012GB
```

If you want to delete new database **<mydb>**, then **dropDatabase()** command would be as follows:

```
>use mydb

switched to db mydb

>db.dropDatabase()

>{ "dropped" : "mydb", "ok" : 1 }
```

Now check list of databases.

```
>show dbs

local 0.78125GB

test 0.23012GB
```

1.7 MongoDB - Create Collection and Drop Collection

(i) The createCollection() Method

MongoDB **db.createCollection(name, options)** is used to create collection.

Syntax

Basic syntax of **createCollection()** command is as follows: `db.createCollection(name, options)`

In the command, **name** is name of collection to be created. **Options: -** a document and is used to specify configuration of collection.

Parameter	**Type**	**Description**
Name	String	Name of the collection to be created
Options	Document	(Optional) Specify options about memory size and indexing

Options parameter is optional, so you need to specify only the name of the collection. Following is the list of options you can use:

Field	**Type**	**Description**

capped	Boolean	(Optional) If true, enables a capped collection. Capped collection is a fixed size collection that automatically overwrites its oldest entries when it reaches its maximum size. **If you specify true, you need to specify size parameter also.**
autoIndexID	Boolean	(Optional) If true, automatically create index on _id field. Default value is false.
size	number	(Optional) Specifies a maximum size in bytes for a capped collection. If capped is true, then you need to specify this field also.
max	number	(Optional) Specifies the maximum number of documents allowed in the capped collection.

While inserting the document, MongoDB first checks size field of capped collection, then it checks max field.

Examples

Basic syntax of **createCollection()** method without options is as follows:

```
>use test
Switch to db test
>db.createCollection("mycollection")
{“ok”: 1}
>
```

You can check the created collection by using the command **show collections**.

```
>show collections
mycollection
system.indexes
```

The following example shows the syntax of **createCollection()** method with few important options:

```
>db.createCollection("mycol", { capped : true, autoIndexID : true, size : 6142800, max : 10000 } )
```

```
{“ok”: 1}
```

In MongoDB, you don't need to create collection. MongoDB creates collection automatically, when you insert some document.

```
>db.tutorialspoint.insert({"name" : "tutorialspoint"})
>show collections
mycol
mycollection
system.indexes
tutorialspoint
>
```

(ii) MongoDB - Drop Collection

The drop() Method

MongoDB's **db.collection.drop()** is used to drop a collection from the database.

Syntax

Basic syntax of **drop()** command is as follows: db.COLLECTION_NAME.drop()

Example

First, check the available collections into your database **mydb**.

```
>use mydb
Switch to db mydb
>show collections
mycol
mycollection
system.indexes
tutorialspoint>
```

Now drop the collection with the name **mycollection**.

```
>db.mycollection.drop()
true
```

Again check the list of collections into database.

```
>show collections

mycol

system.indexes

tutorialspoint
```

drop() method will return true, if the selected collection is dropped successfully, otherwise it will return false.

SUMMARY

- Paradigm shift in databases is happening
- MongoDB is extremely attractive to modern application development: complex data structures, huge volume
- For DBAs, some things are different, some things stay the same: no schemas, but many servers