FULL STACK WEB DEVELOPER PART XVI

NoSQL Databases

intro to MongoDB

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Full Stack Web Developer Part XVI: NoSQL Databases - MongoDB

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Full Stack Web Developer - Part XVI - No SQL Databases

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by Panos M. for Tech Career Booster (https://www.techcareerbooster.com)

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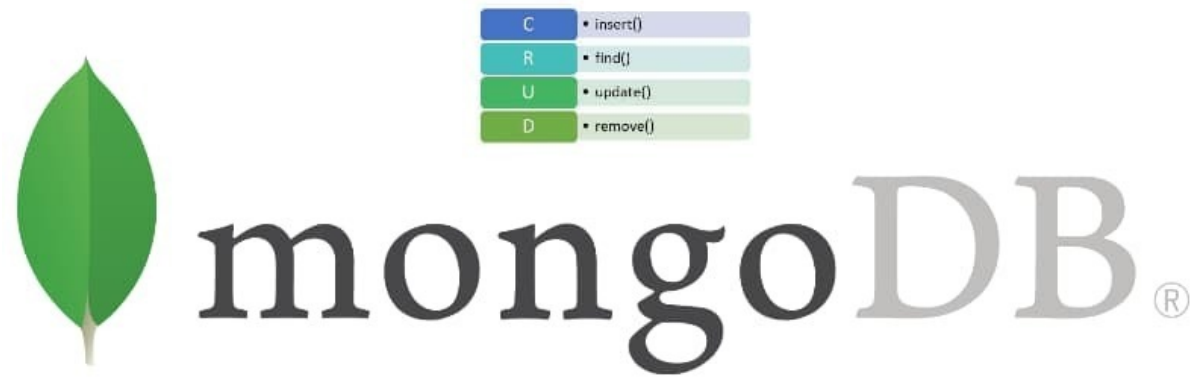
NoSQL Databases

This book is about MongoDB. It is a very popular example of a NoSQL database. NoSQL databases have become very popular and you will definitely meet them in your software engineering life sooner rather than later. Hence, this introduction is very important so that you will able to catch up quickly with this new technology.

1 - Mongo DB

Summary



MongoDB - Summary

MongoDB is a very popular document database management system. This chapter gives you enough knowledge to understand what MongoDB is and to be able to start a Web application that is backed up by a MongoDB server for persistency. You will also understand what are the differences to RDBMS systems. We consider this a very important chapter because of the increased popularty of NoSQL databases and MongoDB per se.

Learning Goals

1. Learn what type of database is MongoDB.
2. Learn how to install MongoDB.
3. Learn how to configure MongoDB server.
4. Learn how to check whether MongoDB server is running or not.
5. Learn how to start an interactive MongoDB console.
6. Learn how to display the current database.
7. Learn how to display the non-empty databases.
8. Learn how to switch your current database.
9. Learn how to create a new database.
10. Learn how to create new collections.
11. Learn how to create new documents.
12. Learn how you can list all the documents of a collection.
13. Learn how to create many documents with one command.
14. Learn how to retrieve documents using various criteria.
15. Learn how to use a projection to limit the number of fields returned.
16. Learn how you can limit the number of results returned.
17. Learn how to use special query operators.
18. Learn how to update one or more documents.
19. Learn how to replace one document.
20. Learn about embedded documents.

21. Learn how to query based on fields in embedded documents.
22. Learn about Array values.
23. Learn how to query documents on fields that have Array values.
24. Learn how to iterate over the results using a cursor.
25. Learn how to define indexes on your documents.
26. Learn about the query execution plan.
27. Learn how to list all indexes.
28. Learn how to remove an index.
29. Learn how to create unique indexes.
30. Learn how to create compound indexes.
31. Learn about the way you can integrate Ruby application with MongoDB server.
32. Learn about the way you can integrate Ruby on Rails Web application with MongoDB server.
33. Learn how to use Object to Document mapping gem and create associations between objects.
34. Learn how to add validations to your documents.

Introduction

MongoDB is a *document* database. In other words, in MongoDB a record is a document that resembles JSON objects. For example:

```
{
  first_name: "John",
  last_name: "Papas",
  identity_number: "12345678"
  salary: 3600
}
```

(the above code snippet online)

Documents then are characterized by field - value pairs. For example, in the previous document, you can see the field `first_name` with value `"John"`.

Note that the documents can contain other documents. In that case, the document that is contained inside the other is called an embedded document.

Installing MongoDB

You can find installation instructions for MongoDB here. If you have Mac OS X, the instructions are here.

Update your Homebrew

```
brew update
```

(the above code snippet online)

Install MongoDB

```
brew install mongodb
```

(the above code snippet online)

Add MongoDB Bin Folder To PATH

MongoDB installs shortcuts to its executables inside `/usr/local/bin`. So, if this path is inside your PATH environment variable, then you are good to go. Otherwise, you will have to add it.

Configuration

When MongoDB server is running it is given a path to a configuration file. Usually this is `/usr/local/etc/mongod.conf`. In this file, you specify also the path to the data folder, i.e. the folder in which the documents are going to be saved.

These are the contents of my file:

```
systemLog:
  destination: file
  path: /usr/local/var/log/mongodb/mongo.log
  logAppend: true
storage:
  dbPath: /usr/local/var/mongodb
net:
  bindIp: 127.0.0.1
```

(the above code snippet online)

As you can read from above, my data folder is `/usr/local/var/mongodb`.

MongoDB Running Process

You can always check whether MongoDB is running using the following command:

```
ps -ef | grep 'mongo'
  501   834     1   0 12:23PM ??         0:32.64 /usr/local/opt/mongodb/bin/mongo\
d --config /usr/local/etc/mongod.conf
```

(the above code snippet online)

The `/usr/local/opt/mongodb/bin/mongod` is the executable that is used to start MongoDB server.

MongoDB is always running and it is a process that listens for client connections. Like MySQL database server. The default port MongoDB server is listening to, is port number `27017`.

Mongo Client and Mongo Shell

You can connect to MongoDB server by executing `mongo`. The `mongo` command starts what we call the Mongo shell. It is a JavaScript shell that allows you to execute queries and commands in your MongoDB database. The commands are being sent over to MongoDB server which executes them and returns the results back to the client.

```
$ mongo
MongoDB shell version v3.4.2
connecting to: mongodb://127.0.0.1:27017
MongoDB server version: 3.4.2
Server has startup warnings:
2017-08-08T12:23:05.168+0300 I CONTROL  [initandlisten]
2017-08-08T12:23:05.168+0300 I CONTROL  [initandlisten] ** WARNING: Access contro\
l is not enabled for the database.
2017-08-08T12:23:05.168+0300 I CONTROL  [initandlisten] **          Read and writ\
e access to data and configuration is unrestricted.
2017-08-08T12:23:05.168+0300 I CONTROL  [initandlisten]
>
```

(the above code snippet online)

The `>` is the mongo shell prompt. Now you can use JavaScript commands, including MongoDB-specific JavaScript commands.

> *Hint:* If you want to exit the mongo shell, then give the command `quit()`. Or hit <kbd>Ctrl + C</kbd>.

Display Current Database

Being in a mongo shell session, let's type some commands. The following displays the current database:

```
> db
test
>
```

(the above code snippet online)

As you can see the default database is the one with name `test`.

Display All Non-Empty Databases

```
> show dbs
blog_development  0.000GB
local             0.000GB
>
```

(the above code snippet online)

Note that the output of this command, `show dbs`, includes all the non-empty databases. That is why it does not list the `test` database. `test` database is empty.

Note also that the above output will be different to yours.

Switching Current Database

In order to switch to a database, you have to use the helper `use <name_of_database>`. See the following interaction:

```
> use local
switched to db local
> db
local
>
```

(the above code snippet online)

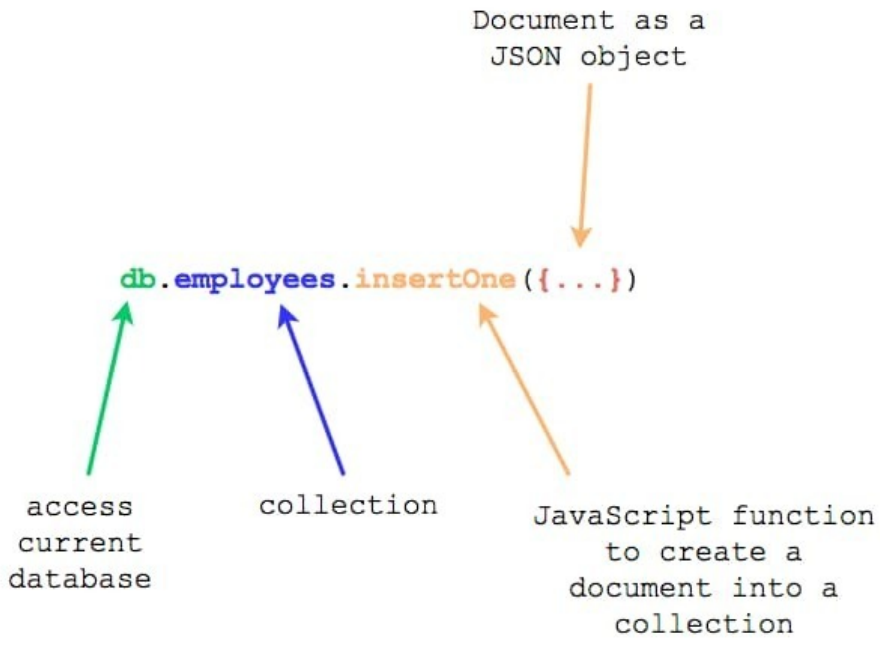
Create a New Database

In order to create a new database, you have first to `use` it. Then you need to create the first document. Note that documents need to be created inside a collection. Here is an example:

```
> use accounting
switched to db accounting
> db.employees.insertOne({first_name: "John", last_name: "Papas", identity_number\
: "12345678", salary: 3600})
{
        "acknowledged" : true,
        "insertedId" : ObjectId("598a10b21631fe0993ee7974")
}
> show dbs
accounting        0.000GB
blog_development  0.000GB
local             0.000GB
>
```

(the above code snippet online)

1. Line 1 switches to a new database.
2. Line 3 creates a **new document** within a **new collection** within a **new database**
3. Line 8 proves now that `accounting` database is one of the non-empty databases.



How to Create Database alongside the First Collection and the First Document

In other words, in order to create a new database, you need to create a new collection and a new document inside that new collection. MongoDB will receive the command `db.<collection>.insertOne(<docume` and will create the collection and the database if they don't exist, before actually creating the document itself.

List All Documents

You can list the documents of a collection as follows:

```
1  > db.employees.find();
2  { "_id" : ObjectId("598a9d09c0317e30b80c33a5"), "first_name" : "John", "last_name\
3  " : "Papas", "identity_number" : "12345678", "salary" : 3600 }
4  >
```

(the above code snippet online)

The above will return all the documents of the collection in groups of 20. Do you see the `"_id"` property? This is automatically assigned by MongoDB in order to make the documents unique. It works like the primary key of the document.

Another way to list all documents is using the `.pretty()` function:

```
> db.employees.find().pretty();
{
        "_id" : ObjectId("598a9d09c0317e30b80c33a5"),
        "first_name" : "John",
        "last_name" : "Papas",
        "identity_number" : "12345678",
        "salary" : 3600
}
>
```

(the above code snippet online)

CRUD Operations

Let's see some basics with regards to CRUD (Create, Retrieve, Update, Delete) using mongo shell.

Create

In order to create a new document you need to use either `insertOne()` or `insertMany()` methods on the collection reference.

Let's create some documents inside the `employees` collection (in our `accounting` db).

```
> db.employees.insertOne({first_name: "Mary", last_name: "Foo", identity_number: \
"87654321", "salary": 2800});
{
      "acknowledged" : true,
      "insertedId" : ObjectId("598ab700c0317e30b80c33a6")
}
>
```

(the above code snippet online)

The above creates a new document. Let's create more than one:

```
> db.employees.insertMany([
... {first_name: "Paul", last_name: "Bar", identity_number: "37281493", salary: 3\
500},
... {first_name: "Peter", last_name: "Pan", identity_number: "38589242123", salar\
y: 1500}
... ]);
{
        "acknowledged" : true,
        "insertedIds" : [
                ObjectId("598ab79ec0317e30b80c33a7"),
                ObjectId("598ab79ec0317e30b80c33a8")
        ]
}
>
```

(the above code snippet online)

The `insertMany()` above creates two documents to the employees collection. Let's now get the list of all the documents in the collection:

```
> db.employees.find()
{ "_id" : ObjectId("598a9d09c0317e30b80c33a5"), "first_name" : "John", "last_name\
" : "Papas", "identity_number" : "12345678", "salary" : 3600 }
{ "_id" : ObjectId("598ab700c0317e30b80c33a6"), "first_name" : "Mary", "last_name\
" : "Foo", "identity_number" : "87654321", "salary" : 2800 }
{ "_id" : ObjectId("598ab79ec0317e30b80c33a7"), "first_name" : "Paul", "last_name\
" : "Bar", "identity_number" : "37281493", "salary" : 3500 }
{ "_id" : ObjectId("598ab79ec0317e30b80c33a8"), "first_name" : "Peter", "last_nam\
e" : "Pan", "identity_number" : "38589242123", "salary" : 1500 }
>
```

(the above code snippet online)

Retrieve Documents

The `find()` is the main method that is used to retrieve documents from the database.

If you don't give any arguments it will return all the documents. Otherwise, the first argument is the filtering/where clause.

```
> db.employees.find({first_name: "Paul"})
{ "_id" : ObjectId("598ab79ec0317e30b80c33a7"), "first_name" : "Paul", "last_name\
" : "Bar", "identity_number" : "37281493", "salary" : 3500 }
>
```

(the above code snippet online)

The above query brings all the employees that have `first_name` equal to `"Paul"`.

You can also give a second argument to the `find()` method. The second argument works like a projection/fields selection argument.

```
> db.employees.find({first_name: "Paul"}, {first_name: 1, identity_number: 1})
{ "_id" : ObjectId("598ab79ec0317e30b80c33a7"), "first_name" : "Paul", "identity_\
number" : "37281493" }
>
```

(the above code snippet online)

The above projection selects the properties `first_name` and `identity_number`. Please, note that the `_id` property is always returned.

```
> db.employees.find({first_name: "Paul"}, {first_name: 0})
{ "_id" : ObjectId("598ab79ec0317e30b80c33a7"), "last_name" : "Bar", "identity_nu\
mber" : "37281493", "salary" : 3500 }
>
```

(the above code snippet online)

The `{first_name: 0}`, on the other hand, specifies which property should **not** be returned.

Note that the result of the `find()` is a *cursor*. It is the mongo shell that uses the cursor to iterate and scan through the results.

You can also modify the cursor, by specifying things like the `limit`, for example:

```
> db.employees.find().limit(2)
{ "_id" : ObjectId("598a9d09c0317e30b80c33a5"), "first_name" : "John", "last_name\
" : "Papas", "identity_number" : "12345678", "salary" : 3600 }
{ "_id" : ObjectId("598ab700c0317e30b80c33a6"), "first_name" : "Mary", "last_name\
" : "Foo", "identity_number" : "87654321", "salary" : 2800 }
>
```

(the above code snippet online)

The above limits the cursor results to the first 2 records located.

Your filter may contain query operators. For example:

```
> db.employees.find({salary: {$gt: 2500}})
{ "_id" : ObjectId("598a9d09c0317e30b80c33a5"), "first_name" : "Nick", "last_name\
" : "Papas", "identity_number" : "12345678", "salary" : 3600 }
{ "_id" : ObjectId("598ab700c0317e30b80c33a6"), "first_name" : "Mary", "last_name\
" : "Foo", "identity_number" : "87654321", "salary" : 2800 }
>
```

(the above code snippet online)

The `{salary: {$gt: 2500}}` filter is using the query operator `$gt`, i.e. greater than. There are other query operators that you can use. You can read more about them here.

Another more complicated example is this one:

```
> db.employees.find({$or: [{salary: {$gt: 2900}}, {first_name: "Peter"}]});
{ "_id" : ObjectId("598a9d09c0317e30b80c33a5"), "first_name" : "Nick", "last_name\
" : "Papas", "identity_number" : "12345678", "salary" : 3600 }
{ "_id" : ObjectId("598ab79ec0317e30b80c33a8"), "first_name" : "Peter", "last_nam\
e" : "Pan", "identity_number" : "38589242123", "salary" : 1500 }
>
```

(the above code snippet online)

The `{$or: [{salary: {$gt: 2900}}, {first_name: "Peter"}]}` is using the `$or` operator. The value of `$or` is an array of conditions that will be ORed. If any of the conditions matches, then document will be included in the result returned.

The MongoDB documentation page on querying documents is a very good reference to visit every time you want to create a query and you have doubts about.

Querying using JavaScript becomes more complicated when the document has a more complicated structure.

We will see more advanced queries later on.

Update Documents

The methods to use to update existing documents are `updateOne()`, `updateMany()` and `replaceOne()`.

Let's suppose that we want to change the name of the employee with `first_name "John"` to be `"Nick"`:

```
> db.employees.find()
{ "_id" : ObjectId("598a9d09c0317e30b80c33a5"), "first_name" : "John", "last_name\
" : "Papas", "identity_number" : "12345678", "salary" : 3600 }
{ "_id" : ObjectId("598ab700c0317e30b80c33a6"), "first_name" : "Mary", "last_name\
" : "Foo", "identity_number" : "87654321", "salary" : 2800 }
{ "_id" : ObjectId("598ab79ec0317e30b80c33a7"), "first_name" : "Paul", "last_name\
" : "Bar", "identity_number" : "37281493", "salary" : 3500 }
{ "_id" : ObjectId("598ab79ec0317e30b80c33a8"), "first_name" : "Peter", "last_nam\
e" : "Pan", "identity_number" : "38589242123", "salary" : 1500 }
> db.employees.updateOne({first_name: "John"}, {$set: {first_name: "Nick"}});
{ "acknowledged" : true, "matchedCount" : 1, "modifiedCount" : 1 }
> db.employees.find()
{ "_id" : ObjectId("598a9d09c0317e30b80c33a5"), "first_name" : "Nick", "last_name\
" : "Papas", "identity_number" : "12345678", "salary" : 3600 }
{ "_id" : ObjectId("598ab700c0317e30b80c33a6"), "first_name" : "Mary", "last_name\
" : "Foo", "identity_number" : "87654321", "salary" : 2800 }
{ "_id" : ObjectId("598ab79ec0317e30b80c33a7"), "first_name" : "Paul", "last_name\
" : "Bar", "identity_number" : "37281493", "salary" : 3500 }
{ "_id" : ObjectId("598ab79ec0317e30b80c33a8"), "first_name" : "Peter", "last_nam\
e" : "Pan", "identity_number" : "38589242123", "salary" : 1500 }
>
```

(the above code snippet online)

What happens above? We first display all the employees. Then we use `updateOne()` to specify which document to update and how.

The `updateOne()` takes as first argument the *filter/where* object. It tells which document is going to be updated. In the above example we specify that the document to be updated is the one with `first_name` equal to `"John"`. The second argument to `updateOne()` is the update action. We use `$set` to tell that we want to set specific fields. In the example above we update the `first_name`.

The `updateMany()` is similar to `updateOne()` with regards to its syntax. But the `updateMany()` is updating all the matching documents, whereas the `updateOne()` updates only one document even if more that one might match the filter.

The `replaceOne()` method is used to replace a document with another one:

```
> db.employees.replaceOne({first_name: "Paul"}, {first_name: "Keith", last_name: \
"Reilly", identity_number: "3728817", salary: 2900})
{ "acknowledged" : true, "matchedCount" : 1, "modifiedCount" : 1 }
> db.employees.find()
{ "_id" : ObjectId("598a9d09c0317e30b80c33a5"), "first_name" : "Nick", "last_name\
" : "Papas", "identity_number" : "12345678", "salary" : 3600 }
{ "_id" : ObjectId("598ab700c0317e30b80c33a6"), "first_name" : "Mary", "last_name\
" : "Foo", "identity_number" : "87654321", "salary" : 2800 }
{ "_id" : ObjectId("598ab79ec0317e30b80c33a7"), "first_name" : "Keith", "last_nam\
e" : "Reilly", "identity_number" : "3728817", "salary" : 2900 }
{ "_id" : ObjectId("598ab79ec0317e30b80c33a8"), "first_name" : "Peter", "last_nam\
e" : "Pan", "identity_number" : "38589242123", "salary" : 1500 }
>
```

(the above code snippet online)

The above command replaces the document that has `first_name` equal to `"Paul"`, with a completely new document. Note, however, that the command does not replace the id of the document. Hence, the new document has the same id as the previous one.

Delete Documents

The methods to delete documents from a collection are `deleteOne()` and `deleteMany()`.

The first one, matches a single document using its first argument as a filter/where clause. The second one will match many documents.

```
> db.employees.deleteOne({first_name: "Keith"})
{ "acknowledged" : true, "deletedCount" : 1 }
> db.employees.find()
{ "_id" : ObjectId("598a9d09c0317e30b80c33a5"), "first_name" : "Nick", "last_name\
" : "Papas", "identity_number" : "12345678", "salary" : 3600 }
{ "_id" : ObjectId("598ab700c0317e30b80c33a6"), "first_name" : "Mary", "last_name\
" : "Foo", "identity_number" : "87654321", "salary" : 2800 }
{ "_id" : ObjectId("598ab79ec0317e30b80c33a8"), "first_name" : "Peter", "last_nam\
e" : "Pan", "identity_number" : "38589242123", "salary" : 1500 }
>
```

(the above code snippet online)

Embedded/Nested Documents

Let's create some more complicated documents. Assume that we want to add `contact_details` on each one of our employees:

```
> db.employees.find()
{ "_id" : ObjectId("598a9d09c0317e30b80c33a5"), "first_name" : "Nick", "last_name\
" : "Papas", "identity_number" : "12345678", "salary" : 3600 }
{ "_id" : ObjectId("598ab700c0317e30b80c33a6"), "first_name" : "Mary", "last_name\
" : "Foo", "identity_number" : "87654321", "salary" : 2800 }
{ "_id" : ObjectId("598ab79ec0317e30b80c33a8"), "first_name" : "Peter", "last_nam\
e" : "Pan", "identity_number" : "38589242123", "salary" : 1500 }
> db.employees.updateOne({first_name: "Nick"}, {$set: {contact_details: {address:\
 "1A Meyrick Park Cres", city: "Bournemouth", zip_code: "BH3 7AG", country: "UK"}\
}})
{ "acknowledged" : true, "matchedCount" : 1, "modifiedCount" : 1 }
> db.employees.updateOne({first_name: "Mary"}, {$set: {contact_details: {address:\
 "6 Coronach Way", city: "New Rossington", zip_code: "DN11 0RN", country: "UK"}}}\
)
{ "acknowledged" : true, "matchedCount" : 1, "modifiedCount" : 1 }
> db.employees.updateOne({first_name: "Peter"}, {$set: {contact_details: {address\
: "38 Coleraine Rd", city: "London", zip_code: "N8 0QL", country: "UK"}}})
{ "acknowledged" : true, "matchedCount" : 1, "modifiedCount" : 1 }
> db.employees.find()
{ "_id" : ObjectId("598a9d09c0317e30b80c33a5"), "first_name" : "Nick", "last_name\
" : "Papas", "identity_number" : "12345678", "salary" : 3600, "contact_details" :\
 { "address" : "1A Meyrick Park Cres", "city" : "Bournemouth", "zip_code" : "BH3 \
7AG", "country" : "UK" } }
{ "_id" : ObjectId("598ab700c0317e30b80c33a6"), "first_name" : "Mary", "last_name\
" : "Foo", "identity_number" : "87654321", "salary" : 2800, "contact_details" : {\
 "address" : "6 Coronach Way", "city" : "New Rossington", "zip_code" : "DN11 0RN"\
, "country" : "UK" } }
{ "_id" : ObjectId("598ab79ec0317e30b80c33a8"), "first_name" : "Peter", "last_nam\
```

```
e" : "Pan", "identity_number" : "38589242123", "salary" : 1500, "contact_details"\
 : { "address" : "38 Coleraine Rd", "city" : "London", "zip_code" : "N8 0QL", "co\
untry" : "UK" } }
>
```

(the above code snippet online)

We have used the `updateOne()` method to add an embedded/nested document inside each one of the existing documents. Now all the employees have a nested document as value of their `contact_details` property.

You can use the `dot notation` to refer to fields in the embedded documents. For example:

```
> db.employees.find({"contact_details.city": "London"})
{ "_id" : ObjectId("598ab79ec0317e30b80c33a8"), "first_name" : "Peter", "last_nam\
e" : "Pan", "identity_number" : "38589242123", "salary" : 1500, "contact_details"\
 : { "address" : "38 Coleraine Rd", "city" : "London", "zip_code" : "N8 0QL", "co\
untry" : "UK" } }
>
```

(the above code snippet online)

The above query returns all the employees that have contact details city equal to `"London"`.

Array Values

Another case that it is interesting, is the case in which some of the document properties have as value an Array.

Let's do an example. We are going to use another database, named `book_store`. The following commands create the collection `books`.

```
> use book_store;
switched to db book_store
> db.books.insertOne({title: "Of Mice And Men", author: "John Steinbeck", tags: [\
"novel", "classic"]});
{
        "acknowledged" : true,
        "insertedId" : ObjectId("598b5ee4c0317e30b80c33a9")
}
> db.books.insertOne({title: "The Idiot", author: "Fyodor Dostoyevsky", tags: ["n\
ovel", "classic"]});
{
        "acknowledged" : true,
        "insertedId" : ObjectId("598b5f20c0317e30b80c33aa")
}
> db.books.insertOne({title: "Life of Pi", author: "Yann Martel", tags: ["novel",\
 "modern"]});
```

```
{
        "acknowledged" : true,
        "insertedId" : ObjectId("598b5f5bc0317e30b80c33ab")
}
> db.books.insertOne({title: "Protable Cosmos", author: "Jones Alexander", tags: \
["history", "modern"]});
{
        "acknowledged" : true,
        "insertedId" : ObjectId("598b5fa5c0317e30b80c33ac")
}
> db.books.find()
{ "_id" : ObjectId("598b5ee4c0317e30b80c33a9"), "title" : "Of Mice And Men", "aut\
hor" : "John Steinbeck", "tags" : [ "novel", "classic" ] }
{ "_id" : ObjectId("598b5f20c0317e30b80c33aa"), "title" : "The Idiot", "author" :\
 "Fyodor Dostoyevsky", "tags" : [ "novel", "classic" ] }
{ "_id" : ObjectId("598b5f5bc0317e30b80c33ab"), "title" : "Life of Pi", "author" \
: "Yann Martel", "tags" : [ "novel", "modern" ] }
{ "_id" : ObjectId("598b5fa5c0317e30b80c33ac"), "title" : "Protable Cosmos", "aut\
hor" : "Jones Alexander", "tags" : [ "history", "modern" ] }
>
```

(the above code snippet online)

Each document has a property named `tags` which has an Array value. Let's do some queries:

```
> db.books.find({tags: ["history", "modern"]});
{ "_id" : ObjectId("598b5fa5c0317e30b80c33ac"), "title" : "Protable Cosmos", "aut\
hor" : "Jones Alexander", "tags" : [ "history", "modern" ] }
>
```

(the above code snippet online)

The filter `{tags: ["history", "modern"]}` tells MongoDB to return books that they have `tags` property equal to `["history", "modern"]`.

```
> db.books.find({tags: ["modern", "history"]});
>
```

(the above code snippet online)

Note the above. If you try the same tag but with different order of the Array values, the document will not match. It is a different query. The match of the Array values needs to be exact and with the same order.

If you don't care about the order of the values, then you need to use the `$all` query operator:

```
> db.books.find({tags: {$all: ["modern", "history"]}});
{ "_id" : ObjectId("598b5fa5c0317e30b80c33ac"), "title" : "Protable Cosmos", "aut\
hor" : "Jones Alexander", "tags" : [ "history", "modern" ] }
>
```

(the above code snippet online)

If you want to find documents that have a specific value into their `tags` Array, the query becomes much simpler:

```
> db.books.find({tags: "novel"})
{ "_id" : ObjectId("598b5ee4c0317e30b80c33a9"), "title" : "Of Mice And Men", "aut\
hor" : "John Steinbeck", "tags" : [ "novel", "classic" ] }
{ "_id" : ObjectId("598b5f20c0317e30b80c33aa"), "title" : "The Idiot", "author" :\
 "Fyodor Dostoyevsky", "tags" : [ "novel", "classic" ] }
{ "_id" : ObjectId("598b5f5bc0317e30b80c33ab"), "title" : "Life of Pi", "author" \
: "Yann Martel", "tags" : [ "novel", "modern" ] }
>
```

(the above code snippet online)

The following query brings the books that have one of the tags `"classic"` or `"history"`:

```
> db.books.find({$or: [{tags: "classic"}, {tags: "history"}]})
{ "_id" : ObjectId("598b5ee4c0317e30b80c33a9"), "title" : "Of Mice And Men", "aut\
hor" : "John Steinbeck", "tags" : [ "novel", "classic" ] }
{ "_id" : ObjectId("598b5f20c0317e30b80c33aa"), "title" : "The Idiot", "author" :\
 "Fyodor Dostoyevsky", "tags" : [ "novel", "classic" ] }
{ "_id" : ObjectId("598b5fa5c0317e30b80c33ac"), "title" : "Protable Cosmos", "aut\
hor" : "Jones Alexander", "tags" : [ "history", "modern" ] }
>
```

(the above code snippet online)

Iterating Using a Cursor

You can save the query cursor into a variable and then iterate over the results one by one:

```
> var books = db.books.find()
> while (books.hasNext()) {
... print(tojson(books.next()));
... }
{
        "_id" : ObjectId("598b5ee4c0317e30b80c33a9"),
        "title" : "Of Mice And Men",
        "author" : "John Steinbeck",
        "tags" : [
                "novel",
                "classic"
        ]
}
{
        "_id" : ObjectId("598b5f20c0317e30b80c33aa"),
        "title" : "The Idiot",
        "author" : "Fyodor Dostoyevsky",
        "tags" : [
                "novel",
                "classic"
        ]
}
{
        "_id" : ObjectId("598b5f5bc0317e30b80c33ab"),
        "title" : "Life of Pi",
        "author" : "Yann Martel",
        "tags" : [
                "novel",
                "modern"
        ]
}
{
        "_id" : ObjectId("598b5fa5c0317e30b80c33ac"),
        "title" : "Protable Cosmos",
        "author" : "Jones Alexander",
        "tags" : [
                "history",
                "modern"
        ]
}
>
```

(the above code snippet online)

The method `hasNext()` returns `true` if there are more data to fetch. And the `next()` returns the actual document. Note that we use the `print()` and `tojson()` helpers to print out to the console.

Indexes

Indexes help you find documents quickly, like the indexes we use in RDBMS databases.

Unique Index on `_id` field

As we said earlier, the `_id` field is present in all documents. And it is the primary key. Uniquely identifies a document and two documents cannot have the same id within the same collection.

```
> db.books.find()
{ "_id" : ObjectId("598b5ee4c0317e30b80c33a9"), "title" : "Of Mice And Men", "aut\
hor" : "John Steinbeck", "tags" : [ "novel", "classic" ] }
{ "_id" : ObjectId("598b5f20c0317e30b80c33aa"), "title" : "The Idiot", "author" :\
 "Fyodor Dostoyevsky", "tags" : [ "novel", "classic" ] }
{ "_id" : ObjectId("598b5f5bc0317e30b80c33ab"), "title" : "Life of Pi", "author" \
: "Yann Martel", "tags" : [ "novel", "modern" ] }
{ "_id" : ObjectId("598b5fa5c0317e30b80c33ac"), "title" : "Protable Cosmos", "aut\
hor" : "Jones Alexander", "tags" : [ "history", "modern" ] }
>
> db.books.insertOne({"_id" : ObjectId("598b5fa5c0317e30b80c33ac"), "title": "dum\
my", "author" : "dummy", "tags" : []})
2017-08-10T08:02:03.603+0300 E QUERY    [thread1] WriteError: E11000 duplicate ke\
y error collection: book_store.books index: _id_ dup key: { : ObjectId('598b5fa5c\
0317e30b80c33ac') } :
WriteError({
        "index" : 0,
        "code" : 11000,
        "errmsg" : "E11000 duplicate key error collection: book_store.books index\
: _id_ dup key: { : ObjectId('598b5fa5c0317e30b80c33ac') }",
        "op" : {
                "_id" : ObjectId("598b5fa5c0317e30b80c33ac"),
                "title" : "dummy",
                "author" : "dummy",
                "tags" : [ ]
        }
})
WriteError@src/mongo/shell/bulk_api.js:469:48
Bulk/mergeBatchResults@src/mongo/shell/bulk_api.js:836:49
Bulk/executeBatch@src/mongo/shell/bulk_api.js:906:13
Bulk/this.execute@src/mongo/shell/bulk_api.js:1150:21
DBCollection.prototype.insertOne@src/mongo/shell/crud_api.js:242:9
@(shell):1:1
>
```

(the above code snippet online)

The `db.books.insertOne()` command above, failed because we tried to create a new document in the `book` collection using an `_id` value that already exists for another document. Do you see the error thrown? `E11000 duplicate key error`

Create Index

We can create an index on a single document field. These are called single field indexes. Look at the following example:

```
> db.books.createIndex({title: 1})
{
        "createdCollectionAutomatically" : false,
        "numIndexesBefore" : 1,
        "numIndexesAfter" : 2,
        "ok" : 1
}
>
```

(the above code snippet online)

We have created an index on the field `title` of the `books` collection. The `1` given as a value to the `title` field index specification means that we want the index to be sorting elements in ascending order. If we gave `-1` instead, then we would have specified the index to have the elements ordered in descending order. However, for single field indexes, this is irrelevant, because MongoDB can traverse the index in both directions with the same performance.

Here is a query that uses the `title` as a filter:

```
> db.books.find({title: "Life of Pi"})
{ "_id" : ObjectId("598b5f5bc0317e30b80c33ab"), "title" : "Life of Pi", "author" \
: "Yann Martel", "tags" : [ "novel", "modern" ] }
>
```

(the above code snippet online)

Execution Plan

The above query, with the `title` index in place, uses the index to quickly fetch the document requested and does not do full collection scan. You can confirm that by asking the execution plan of the query:

```
> db.books.find({title: "Life of Pi"}).explain("executionStats")
{
        "queryPlanner" : {
                "plannerVersion" : 1,
                "namespace" : "book_store.books",
                "indexFilterSet" : false,
                "parsedQuery" : {
                        "title" : {
                                "$eq" : "Life of Pi"
                        }
                },
                "winningPlan" : {
                        "stage" : "FETCH",
                        "inputStage" : {
                                "stage" : "IXSCAN",
                                "keyPattern" : {
                                        "title" : 1
                                },
                                "indexName" : "title_1",
                                "isMultiKey" : false,
                                "multiKeyPaths" : {
                                        "title" : [ ]
                                },
                                "isUnique" : false,
                                "isSparse" : false,
                                "isPartial" : false,
                                "indexVersion" : 1,
                                "direction" : "forward",
                                "indexBounds" : {
                                        "title" : [
                                                "[\"Life of Pi\", \"Life of Pi\"]"
                                        ]
                                }
                        }
                },
                "rejectedPlans" : [ ]
        },
        "executionStats" : {
                "executionSuccess" : true,
                "nReturned" : 1,
                "executionTimeMillis" : 24,
                "totalKeysExamined" : 1,
                "totalDocsExamined" : 1,
                "executionStages" : {
                        "stage" : "FETCH",
                        "nReturned" : 1,
```

```
                        "executionTimeMillisEstimate" : 0,
                        "works" : 2,
                        "advanced" : 1,
                        "needTime" : 0,
                        "needYield" : 0,
                        "saveState" : 1,
                        "restoreState" : 1,
                        "isEOF" : 1,
                        "invalidates" : 0,
                        "docsExamined" : 1,
                        "alreadyHasObj" : 0,
                        "inputStage" : {
                                "stage" : "IXSCAN",
                                "nReturned" : 1,
                                "executionTimeMillisEstimate" : 0,
                                "works" : 2,
                                "advanced" : 1,
                                "needTime" : 0,
                                "needYield" : 0,
                                "saveState" : 1,
                                "restoreState" : 1,
                                "isEOF" : 1,
                                "invalidates" : 0,
                                "keyPattern" : {
                                        "title" : 1
                                },
                                "indexName" : "title_1",
                                "isMultiKey" : false,
                                "multiKeyPaths" : {
                                        "title" : [ ]
                                },
                                "isUnique" : false,
                                "isSparse" : false,
                                "isPartial" : false,
                                "indexVersion" : 1,
                                "direction" : "forward",
                                "indexBounds" : {
                                        "title" : [
                                                "[\"Life of Pi\", \"Life of Pi\"]"
                                        ]
                                },
                                "keysExamined" : 1,
                                "seeks" : 1,
                                "dupsTested" : 0,
                                "dupsDropped" : 0,
                                "seenInvalidated" : 0
```

```
                        }
                }
        },
        "serverInfo" : {
                "host" : "Panayotiss-MacBook-Pro.local",
                "port" : 27017,
                "version" : "3.4.6",
                "gitVersion" : "c55eb86ef46ee7aede3b1e2a5d184a7df4bfb5b5"
        },
        "ok" : 1
}
>
```

(the above code snippet online)

The `.explain("executionStats")` method returns back information about the method used to fetch the document, execute the query. In the example above, you can see that it returned `IXSCAN` for the `inputStage.stage` value, which means it used the index. You can also see that the `totalDocsExamined` value is `1`, even if the documents / books are `4`.

On the other hand, if you try searching by `author` that does not have an index, you will see a full collection scan query explanation:

```
> db.books.find({author: "Yann Martel"}).explain("executionStats")
{
        "queryPlanner" : {
                "plannerVersion" : 1,
                "namespace" : "book_store.books",
                "indexFilterSet" : false,
                "parsedQuery" : {
                        "author" : {
                                "$eq" : "Yann Martel"
                        }
                },
                "winningPlan" : {
                        "stage" : "COLLSCAN",
                        "filter" : {
                                "author" : {
                                        "$eq" : "Yann Martel"
                                }
                        },
                        "direction" : "forward"
                },
                "rejectedPlans" : [ ]
        },
        "executionStats" : {
                "executionSuccess" : true,
```

```
                "nReturned" : 1,
                "executionTimeMillis" : 0,
                "totalKeysExamined" : 0,
                "totalDocsExamined" : 4,
                "executionStages" : {
                        "stage" : "COLLSCAN",
                        "filter" : {
                                "author" : {
                                        "$eq" : "Yann Martel"
                                }
                        },
                        "nReturned" : 1,
                        "executionTimeMillisEstimate" : 0,
                        "works" : 6,
                        "advanced" : 1,
                        "needTime" : 4,
                        "needYield" : 0,
                        "saveState" : 0,
                        "restoreState" : 0,
                        "isEOF" : 1,
                        "invalidates" : 0,
                        "direction" : "forward",
                        "docsExamined" : 4
                }
        },
        "serverInfo" : {
                "host" : "Panayotiss-MacBook-Pro.local",
                "port" : 27017,
                "version" : "3.4.6",
                "gitVersion" : "c55eb86ef46ee7aede3b1e2a5d184a7df4bfb5b5"
        },
        "ok" : 1
}
>
```

(the above code snippet online)

Do you see the `inputStage.stage` that has the value `COLSCAN`? Also do you see the `totalDocsExamined`? It has the value `4`. These are indicators that we had a full scan collection and no index has been used.

List All Indexes

You can list all indexes of a collection with the method call `.getIndexes()`:

```
> db.books.getIndexes()
[
        {
                "v" : 1,
                "key" : {
                        "_id" : 1
                },
                "name" : "_id_",
                "ns" : "book_store.books"
        },
        {
                "v" : 1,
                "key" : {
                        "title" : 1
                },
                "name" : "title_1",
                "ns" : "book_store.books"
        }
]
>
```

(the above code snippet online)

As you can see above, we have 2 indexes in the `books` collection. One on `_id` field and another one on `title` field:

Drop Index

In order to remove an index, you have to use the `dropIndex()` method. Let's remove the `title` index:

```
> db.books.dropIndex({title: 1})
{ "nIndexesWas" : 2, "ok" : 1 }
> db.books.getIndexes()
[
        {
                "v" : 1,
                "key" : {
                        "_id" : 1
                },
                "name" : "_id_",
                "ns" : "book_store.books"
        }
]
>
```

(the above code snippet online)

The above removed the `{title: 1}` index. As you can see, then call to `getIndexes()` now returns one index only.

Unique Index

Like in RDBM systems, you can create a *unique index* that will protect you from adding documents having the same value on a particular field.

Let's create a unique index on the `title` field:

```
> db.books.createIndex({title: 1}, {unique: true})
{
        "createdCollectionAutomatically" : false,
        "numIndexesBefore" : 1,
        "numIndexesAfter" : 2,
        "ok" : 1
}
>
```

(the above code snippet online)

Now if you try to create a document that has a `title` equal to the `title` of an existing document, then your operation will fail.

```
> db.books.find()
{ "_id" : ObjectId("598b5ee4c0317e30b80c33a9"), "title" : "Of Mice And Men", "aut\
hor" : "John Steinbeck", "tags" : [ "novel", "classic" ] }
{ "_id" : ObjectId("598b5f20c0317e30b80c33aa"), "title" : "The Idiot", "author" :\
 "Fyodor Dostoyevsky", "tags" : [ "novel", "classic" ] }
{ "_id" : ObjectId("598b5f5bc0317e30b80c33ab"), "title" : "Life of Pi", "author" \
: "Yann Martel", "tags" : [ "novel", "modern" ] }
{ "_id" : ObjectId("598b5fa5c0317e30b80c33ac"), "title" : "Protable Cosmos", "aut\
hor" : "Jones Alexander", "tags" : [ "history", "modern" ] }
>
> db.books.insertOne({title: "Life of Pi", "author": "Unknown", "tags": []})
2017-08-10T16:29:06.021+0300 E QUERY    [thread1] WriteError: E11000 duplicate ke\
y error collection: book_store.books index: title_1 dup key: { : "Life of Pi" } :
WriteError({
        "index" : 0,
        "code" : 11000,
        "errmsg" : "E11000 duplicate key error collection: book_store.books index\
: title_1 dup key: { : \"Life of Pi\" }",
        "op" : {
                "_id" : ObjectId("598c5fa2c0317e30b80c33ad"),
                "title" : "Life of Pi",
                "author" : "Unknown",
                "tags" : [ ]
```

```
        }
})
WriteError@src/mongo/shell/bulk_api.js:469:48
Bulk/mergeBatchResults@src/mongo/shell/bulk_api.js:836:49
Bulk/executeBatch@src/mongo/shell/bulk_api.js:906:13
Bulk/this.execute@src/mongo/shell/bulk_api.js:1150:21
DBCollection.prototype.insertOne@src/mongo/shell/crud_api.js:242:9
@(shell):1:1
>
```

(the above code snippet online)

Do you see the error `E11000 duplicate key error collection` when we try to create another book instance with the title `Life Of Pi`? This error is raised thanks to the unique index on the `title` field.

Compound Index

Besides the single field indexes, one can create compound indexes, i.e. indexes that index the combined values of two or more fields of the collection.

Let's switch to our `accounting` database and create a unique compound index on the `employees` collection as follows:

```
> use accounting
switched to db accounting
>
> db.employees.find()
{ "_id" : ObjectId("598a9d09c0317e30b80c33a5"), "first_name" : "Nick", "last_name\
" : "Papas", "identity_number" : "12345678", "salary" : 3600, "contact_details" :\
 { "address" : "1A Meyrick Park Cres", "city" : "Bournemouth", "zip_code" : "BH3 \
7AG", "country" : "UK" } }
{ "_id" : ObjectId("598ab700c0317e30b80c33a6"), "first_name" : "Mary", "last_name\
" : "Foo", "identity_number" : "87654321", "salary" : 2800, "contact_details" : {\
 "address" : "6 Coronach Way", "city" : "New Rossington", "zip_code" : "DN11 0RN"\
, "country" : "UK" } }
{ "_id" : ObjectId("598ab79ec0317e30b80c33a8"), "first_name" : "Peter", "last_nam\
e" : "Pan", "identity_number" : "38589242123", "salary" : 1500, "contact_details"\
 : { "address" : "38 Coleraine Rd", "city" : "London", "zip_code" : "N8 0QL", "co\
untry" : "UK" } }
>
> db.employees.createIndex({first_name: 1, last_name: 1}, {unique: true})
{
        "createdCollectionAutomatically" : false,
        "numIndexesBefore" : 1,
        "numIndexesAfter" : 2,
        "ok" : 1
```

```
}
>
> db.employees.getIndexes()
[
        {
                "v" : 1,
                "key" : {
                        "_id" : 1
                },
                "name" : "_id_",
                "ns" : "accounting.employees"
        },
        {
                "v" : 1,
                "unique" : true,
                "key" : {
                        "first_name" : 1,
                        "last_name" : 1
                },
                "name" : "first_name_1_last_name_1",
                "ns" : "accounting.employees"
        }
]
>
```

(the above code snippet online)

The call `db.employees.createIndex({first_name: 1, last_name: 1}, {unique: true})` creates a unique index on the combination of `first_name` and `last_name`.

This allows us to create a document with `first_name` equal to `Peter` like the following:

```
> db.employees.insertOne({first_name: "Peter", last_name: "Gorilla", identity_num\
ber: "37281923", salary: 3500, contact_details: {}})
{
        "acknowledged" : true,
        "insertedId" : ObjectId("598c6151c0317e30b80c33ae")
}
>
```

(the above code snippet online) because there is no `"Peter Gorilla"` combination in the database. However, it does not allow the following creation:

```
> db.employees.insertOne({first_name: "Peter", last_name: "Pan", identity_number:\
 "37281923", salary: 3500, contact_details: {}})
2017-08-10T16:37:00.601+0300 E QUERY    [thread1] WriteError: E11000 duplicate ke\
y error collection: accounting.employees index: first_name_1_last_name_1 dup key:\
 { : "Peter", : "Pan" } :
WriteError({
        "index" : 0,
        "code" : 11000,
        "errmsg" : "E11000 duplicate key error collection: accounting.employees i\
ndex: first_name_1_last_name_1 dup key: { : \"Peter\", : \"Pan\" }",
        "op" : {
                "_id" : ObjectId("598c617cc0317e30b80c33af"),
                "first_name" : "Peter",
                "last_name" : "Pan",
                "identity_number" : "37281923",
                "salary" : 3500,
                "contact_details" : {

                }
        }
})
WriteError@src/mongo/shell/bulk_api.js:469:48
Bulk/mergeBatchResults@src/mongo/shell/bulk_api.js:836:49
Bulk/executeBatch@src/mongo/shell/bulk_api.js:906:13
Bulk/this.execute@src/mongo/shell/bulk_api.js:1150:21
DBCollection.prototype.insertOne@src/mongo/shell/crud_api.js:242:9
@(shell):1:1
>
```

(the above code snippet online)

Because there is already a `"Peter Pan"` in the database.

Closing Note On Indexes

Building and managing the correct indexes is very important aspect of your MongoDB database design. You might want to read all the details that are given in the official MongoDB documentation about the indexes

Ruby Integration

So far so good. We have worked with mongo shell, but how can we integrate our Ruby application with MongoDB? Can we build Ruby applications that save data in MongoDB?

We can definitely do. And the answer is Mongo Ruby Driver.

A Ruby MongoDB Application

Let's implement, very quickly, a Ruby MongoDB Application. A simple bookstore. The application is going to be a command line application.

Here is a short demo of this application running:

Mongo Ruby Integration - Command Line App Demo

The text that follows explains all the necessary steps to implement this small application

Project Root Folder

Create the folder that is going to host the source code of your application. Let's name it `bookstore-mongo-ruby-driver`.

```
$ mkdir bookstore-mongo-ruby-driver
$ cd bookstore-mongo-ruby-driver
bookstore-mongo-ruby-driver $
```

(the above code snippet online)

Rvm Integration

Make sure you create the necessary `.ruby-version` and `.ruby-gemset` files so that you integrate your project with Rvm. The `rvm current` command should be returning back that you work with a Ruby 2.X version in a gemset dedicated to your new project.

Something like this:

```
bookstore-mongo-ruby-driver $ rvm current
ruby-2.2.3@bookstore-mongo-ruby-driver
bookstore-mongo-ruby-driver $
```

(the above code snippet online)

Gemfile

Let's go ahead and create our `Gemfile` that will reference the gem necessary to integrate Ruby with MongoDB:

```
# File: Gemfile
#
source 'https://rubygems.org'

gem 'mongo'
```

(the above code snippet online)

Then run the `bundle` command to bring all the necessary gems for your Ruby / Mongo app to work.

The Main Commands

Before we go into the implementation of the application, let's list very quickly the main Ruby methods that we will use:

1. `require 'mongo'`: This is necessary to bring the Ruby MongoDB integration API.
2. `Mongo::Client.new()`: It will be used to get an instance to a MongoDB client object.
3. `<client_reference>[<collection_name>]`: It will give us access to a specific collection.
4. `<collection_reference>.insert_one()`: It will be used to insert one new document.
5. `<collection_reference>.find()`: It will be used to query a collection.
6. `<collection_reference>.delete_one()`: It will be used to delete a document from a collection.
7. `<collection_reference>.update_one()`: It will be used to update a document.

The `main.rb` Program

Having said the above, this is the code that we have written in order to implement the application:

```
1  require 'mongo'
2
3  $mongo_client = Mongo::Client.new(['127.0.0.1:27017'], database: 'book_store')
4
5  def print_commands
6    print '(l)ist books, (i)nsert one, (d)delete, (u)pdate, (q)uit: '
7  end
8
9  def print_book_list
10   $mongo_client[:books].find.each do |book|
11     puts book.inspect
12   end
13 end
14
15 def insert_one
16   print 'Give the title: '
17   title = gets.chomp
18   if title.empty?
19     puts 'Title cannot be empty'
20     return
21   end
22
23   print 'Give the author: '
24   author = gets.chomp
25   if author.empty?
26     puts 'Author cannot be empty'
27     return
28   end
```

```ruby

  print 'Give the tags in comma separated list: '
  tags = gets.chomp.split(',').map(&:strip)

  book = {title: title, author: author, tags: tags}
  result = $mongo_client[:books].insert_one(book)
  puts "Insertion result: #{result.inspect}"
end

def delete_one
  print 'Give me the title of book to delete: '
  title = gets.chomp
  book = $mongo_client[:books].find({title: title}).first
  unless book
    puts 'Book not found'
    return
  end
  result = $mongo_client[:books].delete_one({title: title})
  puts "Deletion result: #{result.inspect}"
end

def update_one
  print 'Give me the title of the book you want to update: '
  old_title = gets.chomp
  book = $mongo_client[:books].find(title: old_title).first
  unless book
    puts 'Book not found'
    return
  end

  book = {}

  print "Give the new title. Leave empty if you don't want to update: "
  title = gets.chomp
  book.merge!({title: title}) unless title.empty?

  print "Give the new author. Leave empty if you don't want to update: "
  author = gets.chomp
  book.merge!({author: author}) unless author.empty?

  print "Give the tags in comma separated list. Leave empty if you don't want to \
udpate: "
  tags = gets.chomp.split(',').map(&:strip)
  book.merge!({tags: tags}) unless tags.empty?

  result = $mongo_client[:books].update_one({title: old_title}, {"$set" => book})
```

```
75    puts "Update result: #{result.inspect}"
76  end
77
78  print_commands
79
80  while (answer = gets.chomp) != 'q'
81    case
82      when answer == 'l'
83        print_book_list
84      when answer == 'i'
85        insert_one
86      when answer == 'd'
87        delete_one
88      when answer == 'u'
89        update_one
90      when answer == 'q'
91        puts 'Bye!'
92        exit
93      else
94        puts "Wrong Choice! Try again."
95    end
96
97    print_commands
98  end
```

(the above code snippet online)

Let's see the important lines of this program one-by-one:

1. On line 1, we require the `mongo` library file.
2. On line 3, we create a MongoDB client object, using the `Mongo::Client.new()` initiliazer. This method takes as first argument an array with the MongoDB server IPS & Ports. You may have a cluster of MongoDB server that is why you are requested to give the IP & Port of your server inside an Array. If you have only one server, the Array should only have one entry. Since we are connecting to the local MongoDB server, we give as IP `127.0.0.1` and as Port `27017`. Then we give a hash of options, the minimum of which should be the database we want to connect to. It is our `book_store` database.
3. The method `print_book_list` shows how we can access the `books` collection of our database. We give the name of the collection as a symbol to the client reference using the square brackets operator. `$mongo_client[:books]`.
4. Whenever we have access to the collection we are interested in, then we can execute MongoDB calls, like on line 10, where we call `.find` and we get back an iterator that we can use to go from one result to the next.
5. On line 34, we use `$mongo_client[:books].insert_one({...})` method to create a new book inside the `books` collection. Here, we just give the Hash object like we did with the `insertOne()` when we used the mongo shell JavaScript API.

6. On line 41, we locate a specific document with the help of `.find()` call on the collection reference. Also, we call `.first` in order to get the first element in the collection.
7. Whereas on line 46, we call `$mongo_client[:books].delete_one({title: title})` that will delete the book that has the provided `title`. The `delete_one()` method call takes same arguments as the corresponding `deleteOne()` JavaScript call that we learned in the mongo shell API.
8. On line 73, we call `$mongo_client[:books].update_one({title: old_title}, {"$set" => book})`. This is a call to `update_one()` method which takes the same arguments as the `updateOne()` of the JavaScript API.

That's it. That was a short demo of the MongoDB Ruby driver API. Mostly, it resembles the JavaScript API that we use in the mongo shell.

Ruby on Rails Integration

Before we finish our MongoDB encounter, we will have a look on the MongoDB Ruby on Rails integration.

Obviously, one can use the `mongo` gem, i.e. the MongoDB Ruby driver to integrate with Ruby on Rails, but, there is another gem that has been built on top of that and it provides an `ActiveRecord`-like interface that proves to be very useful to map the Ruby object world to the document world. This gem is called mongoid.

Create a New Rvm Gemset

Let's start by creating and using new rvm gemset. For example:

```
1 $ rvm use 2.4.0@bookstore-mongoid --create
```

(the above code snippet online)

Install `bundler` and `rails`

On this gemset, install `bundler` and then `rails`:

```
1 $ gem install bundler --no-ri --no-rdoc
2 ...
3 $ gem install rails --no-ri --no-rdoc
4 ...
5 $
```

(the above code snippet online)

Initialize The Application

Let's initialize a new bookstore application using `rails`:

```
$ rails new bookstore --skip-active-record
...
$
```

(the above code snippet online)

The above will make sure that your Ruby on Rails application is initialized without ActiveRecord support. We don't want ActiveRecord because we will be using `mongoid` instead.

Change directory to the newly created folder `bookstore`.

Rvm setup

Make sure that you create the `.ruby-version` and `.ruby-gemset` files in order to freeze the Ruby version and gemset for Rvm.

Reference `haml-rails` Gem

Let's integrate with `HAML` by adding the `haml-rails` gem into our Gemfile. Then, run `bundle` to bring all the dependencies in.

Convert Existing ERB files to HAML

Now, let's convert existing ERB files to HAML:

```
bookstore $ bin/rake haml:erb2haml
------------------------------------------------------------------------------
Generating HAML for app/views/layouts/application.html.erb...
Generating HAML for app/views/layouts/mailer.html.erb...
Generating HAML for app/views/layouts/mailer.text.erb...
------------------------------------------------------------------------------
HAML generated for the following files:
        app/views/layouts/application.html.erb
        app/views/layouts/mailer.html.erb
        app/views/layouts/mailer.text.erb
------------------------------------------------------------------------------
Would you like to delete the original .erb files? (This is not recommended unless\
 you are under version control.) (y/n)
y
Deleting original .erb files.
------------------------------------------------------------------------------
Task complete!
No .erb files found. Task will now exit.
bookstore $
```

(the above code snippet online)

Reference `mongoid` Gem

You need to edit your `Gemfile` to reference the `mongoid` gem:

Then run `bundle` to bring `mongoid` in. This will also bring in `mongo` gem, since `mongoid` relies on it.

Mongoid Configuration File

Let's now generate the Mongoid configuration file:

```
bookstore $ rails generate mongoid:config
      create  config/mongoid.yml
bookstore $
```

(the above code snippet online)

This is what has been generated by default:

```
# File: config/mongoid.yml
#
development:
  # Configure available database clients. (required)
  clients:
    # Defines the default client. (required)
    default:
      # Defines the name of the default database that Mongoid can connect to.
      # (required).
      database: book_store
      # Provides the hosts the default client can connect to. Must be an array
      # of host:port pairs. (required)
      hosts:
        - localhost:27017
      options:
        # Change the default write concern. (default = { w: 1 })
        # write:
        #   w: 1

        # Change the default read preference. Valid options for mode are: :second\
ary,
        # :secondary_preferred, :primary, :primary_preferred, :nearest
        # (default: primary)
        # read:
        #   mode: :secondary_preferred
        #   tag_sets:
        #     - use: web

```

```
29          # The name of the user for authentication.
30          # user: 'user'
31
32          # The password of the user for authentication.
33          # password: 'password'
34
35          # The user's database roles.
36          # roles:
37          #   - 'dbOwner'
38
39          # Change the default authentication mechanism. Valid options are: :scram,
40          # :mongodb_cr, :mongodb_x509, and :plain. Note that all authentication
41          # mechanisms require username and password, with the exception of :mongod\
42 b_x509.
43          # Default on mongoDB 3.0 is :scram, default on 2.4 and 2.6 is :plain.
44          # auth_mech: :scram
45
46          # The database or source to authenticate the user against.
47          # (default: the database specified above or admin)
48          # auth_source: admin
49
50          # Force a the driver cluster to behave in a certain manner instead of aut\
51 o-
52          # discovering. Can be one of: :direct, :replica_set, :sharded. Set to :di\
53 rect
54          # when connecting to hidden members of a replica set.
55          # connect: :direct
56
57          # Changes the default time in seconds the server monitors refresh their s\
58 tatus
59          # via ismaster commands. (default: 10)
60          # heartbeat_frequency: 10
61
62          # The time in seconds for selecting servers for a near read preference. (\
63 default: 0.015)
64          # local_threshold: 0.015
65
66          # The timeout in seconds for selecting a server for an operation. (defaul\
67 t: 30)
68          # server_selection_timeout: 30
69
70          # The maximum number of connections in the connection pool. (default: 5)
71          # max_pool_size: 5
72
73          # The minimum number of connections in the connection pool. (default: 1)
74          # min_pool_size: 1
```

```
75
76          # The time to wait, in seconds, in the connection pool for a connection
77          # to be checked in before timing out. (default: 5)
78          # wait_queue_timeout: 5
79
80          # The time to wait to establish a connection before timing out, in second\
81  s.
82          # (default: 5)
83          # connect_timeout: 5
84
85          # The timeout to wait to execute operations on a socket before raising an\
86   error.
87          # (default: 5)
88          # socket_timeout: 5
89
90          # The name of the replica set to connect to. Servers provided as seeds th\
91  at do
92          # not belong to this replica set will be ignored.
93          # replica_set: name
94
95          # Whether to connect to the servers via ssl. (default: false)
96          # ssl: true
97
98          # The certificate file used to identify the connection against MongoDB.
99          # ssl_cert: /path/to/my.cert
100
101         # The private keyfile used to identify the connection against MongoDB.
102         # Note that even if the key is stored in the same file as the certificate,
103         # both need to be explicitly specified.
104         # ssl_key: /path/to/my.key
105
106         # A passphrase for the private key.
107         # ssl_key_pass_phrase: password
108
109         # Whether or not to do peer certification validation. (default: true)
110         # ssl_verify: true
111
112         # The file containing a set of concatenated certification authority certi\
113 fications
114         # used to validate certs passed from the other end of the connection.
115         # ssl_ca_cert: /path/to/ca.cert
116
117
118   # Configure Mongoid specific options. (optional)
119   options:
120     # Includes the root model name in json serialization. (default: false)
```

```
    # include_root_in_json: false

    # Include the _type field in serialization. (default: false)
    # include_type_for_serialization: false

    # Preload all models in development, needed when models use
    # inheritance. (default: false)
    # preload_models: false

    # Raise an error when performing a #find and the document is not found.
    # (default: true)
    # raise_not_found_error: true

    # Raise an error when defining a scope with the same name as an
    # existing method. (default: false)
    # scope_overwrite_exception: false

    # Raise an error when defining a field with the same name as an
    # existing method. (default: false)
    # duplicate_fields_exception: false

    # Use Active Support's time zone in conversions. (default: true)
    # use_activesupport_time_zone: true

    # Ensure all times are UTC in the app side. (default: false)
    # use_utc: false

    # Set the Mongoid and Ruby driver log levels when not in a Rails
    # environment. The Mongoid logger will be set to the Rails logger
    # otherwise.(default: :info)
    # log_level: :info

    # Control whether `belongs_to` association is required. By default
    # `belongs_to` will trigger a validation error if the association
    # is not present. (default: true)
    # belongs_to_required_by_default: true

    # Application name that is printed to the mongodb logs upon establishing a
    # connection in server versions >= 3.4. Note that the name cannot exceed 128 \
bytes.
    # app_name: MyApplicationName
test:
  clients:
    default:
      database: bookstore_test
      hosts:
```

```
167         - localhost:27017
168       options:
169         read:
170           mode: :primary
171         max_pool_size: 1
```

(the above code snippet online)

This is a long configuration file, but most of its lines are commented out. But, it is ready to be used as is. Only make sure that you set the correct name for your development database, on line 10. I have now set it to `book_store` in order to match the database we worked with earlier in this chapter.

Otherwise, the development and test environment have the correct default values for you to start doing development. When you go to production, you will have to create the corresponding section or rely on your hosting platform settings.

> *Information:* On Heroku, you can integrate with MongoDB via Mongoid if you add the correct add-on. For example, look here and [here]https://devcenter.heroku.com/articles/mongolab).

Book Model

Let's now implement our `Book` model and integrate it with MongoDB:

```
1  # File: app/models/book.rb
2  #
3  class Book
4    include Mongoid::Document
5
6    field :title
7    field :author
8    field :tags, type: Array
9
10   def tags_joined
11     tags.join(',') rescue ''
12   end
13
14   def tags=(value)
15     write_attribute(:tags, value.split(',').map(&:strip))
16   end
17 end
```

(the above code snippet online)

These are the things that you need to be aware of from the above code:

1. All the models that persist in our MongoDB database as documents in collection, need to include the module `Mongoid::Document`. Line 4.

2. Then we define the fields that constitute the document so that we can have an API to read and write the particular document. Lines 6 - 8.
3. I have defined the method `tags_joined` in order to get the tags into a comma separated list. Lines 10 - 12.
4. I have overridden tags assignment so that it can get a comma separated list and write the attribute to the database after splitting it. LInes 14 - 16.

Rails Console Interaction

Let' confirm the integration of our application with the MongoDB server, by starting a Rails console and fetching some books:

```
1  bookstore $ bin/rails c
2  2.4.0 :001 > Book.count
3   => 6
```

(the above code snippet online)

The `Book.count` will count all the book documents in our database.

On the other hand, the `Book.all` will open an iterator for us to browse all the books:

```
1  2.4.0 :004 > Book.all.each { |b| puts b.inspect }
2  #<Book _id: 598b5ee4c0317e30b80c33a9, title: "Of Mice And Men", author: "John Ste\
3  inbeck", tags: ["novel", "classic"]>
4  #<Book _id: 598b5f20c0317e30b80c33aa, title: "The Idiot", author: "Fyodor Dostoye\
5  vsky", tags: ["novel", "classic"]>
6  #<Book _id: 598b5f5bc0317e30b80c33ab, title: "Life of Pi", author: "Yann Martel",\
7   tags: ["novel", "modern"]>
8  #<Book _id: 598b5fa5c0317e30b80c33ac, title: "Portable Cosmos", author: "Jones Al\
9  exander", tags: ["history", "modern"]>
10 #<Book _id: 598d44ae0ad9864bb54453e9, title: "1984", author: "George Orwell", tag\
11 s: ["novel"]>
12 #<Book _id: 598d44c50ad9864bb54453ea, title: "MongoDB Server", author: "Panayotis\
13  Matsinopoulos", tags: ["it", "databases"]>
14  => #<Mongoid::Contextual::Mongo:0x007f9a849e59c8 @cache=nil, @klass=Book, @crite\
15 ria=#<Mongoid::Criteria
16   selector: {}
17   options:  {}
18   class:    Book
19   embedded: false>
20 , @collection=#<Mongo::Collection:0x70150813329340 namespace=book_store.books>, @\
21 view=#<Mongo::Collection::View:0x70150813329280 namespace='book_store.books' @fil\
22 ter={} @options={}>, @cache_loaded=true>
```

(the above code snippet online)

Rails CRUD for Books

Let's now implement the book management part of our bookstore application.

The Routes

We first add the routes for the book resource:

```
# File: config/routes.rb
#
Rails.application.routes.draw do
  # For details on the DSL available within this file, see http://guides.rubyonra\
ils.org/routing.html
  resources :books
end
```

(the above code snippet online)

You can then print the routes as follows:

```
bookstore $ bin/rake routes
   Prefix Verb   URI Pattern                Controller#Action
    books GET    /books(.:format)           books#index
          POST   /books(.:format)           books#create
 new_book GET    /books/new(.:format)       books#new
edit_book GET    /books/:id/edit(.:format) books#edit
     book GET    /books/:id(.:format)       books#show
          PATCH  /books/:id(.:format)       books#update
          PUT    /books/:id(.:format)       books#update
          DELETE /books/:id(.:format)       books#destroy
bookstore
```

(the above code snippet online)

The Controller Actions

This is the `books_controller.rb`:

```ruby
# File: app/controllers/books_controller.rb
#
class BooksController < ApplicationController
  before_action :find_book, only: [:edit, :update, :show, :destroy]

  def new
    @book = Book.new
  end

  def create
    @book = Book.new(book_params)
    if @book.save
      redirect_to edit_book_url(@book)
    else
      render :new
    end
  end

  def update
    if @book.update(book_params)
      redirect_to edit_book_url(@book)
    else
      render :edit
    end
  end

  def index
    @books = Book.all.sort({title: 1})
  end

  def show
    redirect_to edit_book_url(@book)
  end

  def destroy
    @book.destroy
    redirect_to books_url
  end

  private

  def find_book
    @book = Book.find(params[:id])
  end

  def book_params
```

```
47      result = params.require(:book).permit(:title, :author, :tags_joined)
48      tags_joined = result.delete(:tags_joined)
49      result.merge({ tags: tags_joined })
50    end
51  end
```

(the above code snippet online)

I don't believe there is something that you don't already know here. Look how we use the class `Book` in order to build and save instances.

1. On line 11, the `Book.new(book_params)` instantiates a new `Book` instance.
2. On line 20, the `@book.update(book_params)` is used to update a specific book.
3. On line 27, the `Book.all.sort({title: 1})` is used to fetch books in ascending sorted order.
4. On line 36, the `@book.destroy` deletes a book from the collection.
5. On line 43, the `Book.find(params[:id])` finds the book given its id.

Again, you will find a lot of similarity between `Mongoid` and `ActiveRecord`.

However, you need to take into account that `Mongoid` maps Objects to Documents, whereas `ActiveRecord` maps Objects to Relations/Tables. Also, `ActiveRecord` assumes an RDBMS which offers referential integrity and transactions. MongoDB does not offer that.

The Views

The views to support the CRUD actions for books are pretty much standard:

`new` View

```
1  -# File: app/views/books/new.html.haml
2  -#
3  %h1 Create a New Book
4
5  = render partial: 'books/form'
```

(the above code snippet online)

`edit` View

```
1  -# File: app/views/books/edit.html.haml
2  -#
3  %h1 Edit Book Details
4
5  = render partial: 'books/form'
```

(the above code snippet online)

`_form` Partial

Both `new` and `edit` view use the `_form` partial:

```
-# File: app/views/books/_form.html.haml
-#
= form_for @book do |f|
  = f.label :title
  = f.text_field :title, placeholder: 'book title'
  %br
  = f.label :author
  = f.text_field :author, placeholder: 'author of book'
  %br
  = f.label :tags
  = f.text_field :tags_joined, placeholder: 'comma separated list of tags'
  %br
  = f.submit
```

(the above code snippet online)

`index` View

And finally, the `index` view:

```
-# File: app/views/books/index.html.haml
-#
%h1 List Of Books
- unless @books.empty?
  %table
    %thead
      %tr
        %th Title
        %th Author
        %th Tags
        %th
    %tbody
      - @books.each do |book|
        %tr
          %td= book.title
          %td= book.author
          %td= book.tags_joined
          %td
            = link_to 'Edit', edit_book_url(book)
             
            = link_to 'Delete', book_url(book), method: :delete, data: {confirm: \
'Are you sure?'}
```

(the above code snippet online)

Associations

Like `ActiveRecord` does, `Mongoid` offers the ability to define associations between documents, and, definitely, this is a big addition to what the simple `mongo` gem can do.

The associations that `Mongoid` lets you define are:

1. `embeds_one`
2. `embeds_many`
3. `has_one`
4. `has_many`
5. `has_and_belongs_to_many`
6. `belongs_to`

The first two are used to define nested documents. Either a single nested document (`embeds_one`) or an array of documents.

Example of `embeds_many`

Let's suppose that we want to support `comments` for each book. We are going to support it as an embedded document.

`Comment` Model

First, let's create the `Comment` model:

```
1  # File: app/models/comment.rb
2  #
3  class Comment
4    include Mongoid::Document
5    include Mongoid::Timestamps::Created
6
7    field :text
8
9    embedded_in :book
10 end
```

(the above code snippet online)

Things that you need to be aware of:

1. The model needs to include the module `Mongoid::Document`, even if it is an embedded document.
2. The model of an embedded document is a class that has a reference back to its hosting document. See line 9. We have used the `embedded_in :book` to tell that the document is to be embedded inside a `Book` document.
3. The `Comment` model has the field `text` and a `created_at` timestamp which is created with the inclusion of the `Mongoid::Timestamps::Created` module. If you want both `created_at` and `updated_at` you can use the module `Mongoid::Timestamps` instead. The `created_at` timestamp will be set automatically upon creation.

`Book` Model

The `Book` Model needs to be enhanced in order to indicate that it embeds many comments:

```
1  # File: app/models/book.rb
2  #
3  class Book
4    include Mongoid::Document
5  ...
6    field :tags, type: Array
7    embeds_many :comments
8
9    def tags_joined
10 ...
11 end
```

(the above code snippet online)

The only difference is line 9, `embeds_many :comments`.

Rails Console Demo

With the above in place, let's try to use this association from the rails console first:

```
1  bookstore $ bin/rails c
2  2.4.0 :001 > b = Book.last
3   => #<Book _id: 598f0e090ad986e2b60082b9, title: "C from theory to practice", aut\
4  hor: "George S. Tselikis; Nikolaos D. Tselikas", tags: ["c", "programming"]>
5  2.4.0 :002 > b.comments << Comment.new({text: 'very useful book, even a little bi\
6  t advanced for me'})
7   => [#<Comment _id: 598fd9ef0ad986fa92abf393, created_at: 2017-08-13 04:47:43 UTC\
8  , text: "very useful book, even a little bit advanced for me">]
9  2.4.0 :003 >
```

(the above code snippet online)

The `002` command above added an embedded document for a new `Comment` for the `Book` at hand.

And this is how this book looks like if we fetch it from the database using `mongo` shell:

```
> use book_store
switched to db book_store
> db.books.find({title: "C from theory to practice"})
{ "_id" : ObjectId("598f0e090ad986e2b60082b9"), "title" : "C from theory to pract\
ice", "author" : "George S. Tselikis; Nikolaos D. Tselikas", "tags" : [ "c", "pro\
gramming" ], "comments" : [ { "_id" : ObjectId("598fd9ef0ad986fa92abf393"), "text\
" : "very useful book, even a little bit advanced for me", "created_at" : ISODate\
("2017-08-13T04:47:43.643Z") } ] }
>
```

(the above code snippet online)

Do you see the array of embedded `comments`? It has one element inside. Do you also see the timestamp `created_at`. This has been automatically set.

Comments in our Rails Application

Can we integrate this new feature at the UI level in our bookstore application?

Display Comments

We now introduce the `show` view as follows:

```
-# File: app/views/show.html.haml
-#
%h1 Book: #{@book.title}
%p
  Author: #{@book.author}
%p
  Tags: #{@book.tags_joined}
%h2 Comments
%ul#comments-list
  - @book.comments.sort { |a, b| b.created_at <=> a.created_at }.each do |comment|
    = render partial: 'books/comment', locals: {comment: comment}
```

(the above code snippet online)

This displays the details of a book and its comments at the bottom. But it relies on the `books/_comment.html.haml` partial which is this:

```
-# File: app/views/books/_comment.html.haml
-#
%li
  = comment.text
  = "(#{comment.created_at})"
```

(the above code snippet online)

In order to make this page accessible, you will have to do

1. a change in your `books_controller.rb` so that the `show` action renders the `show` view.
2. a change in your `app/views/books/index.html.haml` so that the title of a book is displayed as a link to corresponding show page.

The above two changes are left to you as an exercise.

Create a Comment

On the show page, we are going to add something more so that the user is able to add a new comment.

<u>New Route</u>

First, we will need to set the correct endpoint. This is the change that we have to do inside our `config/routes.rb` file:

```
# File: config/routes.rb
#
Rails.application.routes.draw do
  # For details on the DSL available within this file, see http://guides.rubyonra\
ils.org/routing.html
  resources :books do
    member do
      post '/comments', to: 'comments#create'
    end
  end
end
```

(the above code snippet online)

Above, we have added a nested resource. The comments inside the books. In fact, we have limited the nested comments routes only for specific books. This is what the `member do` block does. Let's see the routes generated:

```
bookstore $ bin/rake routes
       Prefix Verb   URI Pattern                    Controller#Action
comments_book POST   /books/:id/comments(.:format) comments#create
        books GET    /books(.:format)               books#index
              POST   /books(.:format)               books#create
     new_book GET    /books/new(.:format)           books#new
    edit_book GET    /books/:id/edit(.:format)      books#edit
         book GET    /books/:id(.:format)           books#show
              PATCH  /books/:id(.:format)           books#update
              PUT    /books/:id(.:format)           books#update
              DELETE /books/:id(.:format)           books#destroy
bookstore $
```

(the above code snippet online)

Do you see the `comments_book` entry? This is the new entry that has been added. The URI Pattern is `/books/:id/comments` and the controller that will handle this is `CommentsController`, on its action `#create`.

Form To Submit New Comment

Let's enhance the `app/views/books/show.html.haml` to have a form for new comment submission:

```
1  -# File: app/views/show.html.haml
2  -#
3  %h1 Book: #{@book.title}
4  %p
5    Author: #{@book.author}
6  %p
7    Tags: #{@book.tags_joined}
8  %h2 Comments
9  %ul#comments-list
10   - @book.comments.sort { |a, b| b.created_at <=> a.created_at }.each do |comment|
11     = render partial: 'books/comment', locals: {comment: comment}
12
13 %h3 New Comment
14 = form_tag comments_book_path(@book), id: 'new_comment_form' do
15   = text_field_tag :new_comment
16   = submit_tag 'Submit'
```

(the above code snippet online)

The new lines that we have added are lines 13 to 16. Although this form can submit to `comments#create` action synchronously, we will do an AJAX call instead. For that reason:

Integrate jQuery

You need to add `jquery-rails` in your Gemfile and then `bundle`. This will bring in `jQuery` libraries.

Also, amend your `app/assets/javascript/application.js` so that it requires `jQuery`:

```
1  // This is a manifest file that'll be compiled into application.js, which will in\
2  clude all the files
3  // listed below.
4  //
5  // Any JavaScript/Coffee file within this directory, lib/assets/javascripts, or a\
6  ny plugin's
7  // vendor/assets/javascripts directory can be referenced here using a relative pa\
8  th.
9  //
10 // It's not advisable to add code directly here, but if you do, it'll appear at t\
```

```
he bottom of the
// compiled file. JavaScript code in this file should be added after the last req\
uire_* statement.
//
// Read Sprockets README (https://github.com/rails/sprockets#sprockets-directives\
) for details
// about supported directives.
//
//= require 'jquery'
//= require rails-ujs
//= require_tree .
```

(the above code snippet online)

Submit Form With AJAX Request

Now, let's create the file `app/assets/javascript/new_comment.js` that will submit the form with AJAX request.

```
// File: app/assets/javascripts/new_comment.js
//
$(document).ready(function () {
    var $newCommentForm = $('#new_comment_form');

    $newCommentForm.find('input[type=submit]').on('click', function (e) {
        e.preventDefault();

        var $newComment = $newCommentForm.find('#new_comment');
        var $list = $('#comments-list');

        $.ajax({
            url: $newCommentForm.attr('action'),

            method: 'POST',

            headers: {'X-CSRF-Token': $('meta[name="csrf-token"]').attr('content'\
)},

            data: {new_comment: $newComment.val().trim() },

            success: function(data, textStatus, jqXHR) {
                $list.prepend(data);
            }
        })
    });
});
```

(the above code snippet online)

We have already used the above technique in the `JavaScript with Rails Applications` chapter. You may want to pay attention to the `success` handler. The `data` variable is going to contain whatever the server will return back to the browser. We take it and we put it as first child in the list of comments.

Doing so, we assume that the controller is going to return back some HTML fragment (a `li` to be more specific) that will be added to the existing list of comments.

Controller and Action

Let's create the controller and the action:

```
1  # File: app/controllers/comments_controller.rb
2  #
3  class CommentsController < ApplicationController
4    def create
5      @book = Book.find(params[:id])
6      new_comment_text = params[:new_comment]
7      if new_comment_text.blank?
8        head :unprocessable_entity
9      else
10       @comment = Comment.new(text: new_comment_text)
11       @book.comments << @comment
12       render layout: false
13     end
14   end
15 end
```

(the above code snippet online)

The implementation of the `create` action is pretty simple. Please note:

1. `params[:id]` returns the book the comment is going to be attached to.
2. `params[:new_comment]` returns the comment text to be set for the new comment.
3. If the new comment given is blank, then we don't do anything but we return status code `422`, i.e. `Unprocessable Entity`.
4. Otherwise, we add the comment and we render the `app/views/comments/create.html.haml` view without layout. We do that because this is an AJAX request and we only return back the necessary HTML part that will be appended to the existing DOM/page.

This is the `app/views/comments/create.html.haml`:

```
1  -# File: app/views/comments/create.html.haml
2  -#
3  = render partial: 'books/comment', locals: {comment: @comment}
```

(the above code snippet online)

So, the response is going to be the content of the file `app/views/books/_comment.html.haml` dynamically built for the `@comment` that we have just added.

Ready for Demo

Everything is in place. Restart your server, if you have not done that. This will make sure that you have jQuery in place.

This is a video that demonstrates the usage of AJAX.

Adding Comment to A Book

Example of `has_one`/`has_many`/`belongs_to`

On the other hand, the `has_one`/`has_many`/`belongs_to` association is used to reference another external document. We are going to create the model `Publisher` and then associate book to a Publisher via the `has_many` association.

`Publisher` Model

Let's suppose that we have the `Publisher` model as follows:

```
1  # File: app/models/publisher.rb
2  #
3  class Publisher
4    include Mongoid::Document
5
6    field :name
7
8    has_many :books
9  end
```

(the above code snippet online)

The document `Publisher` is now associated to a collection of books.

`Book` Model

Let's now amend the `Book` model accordingly?

```ruby
# File: app/models/book.rb
#
class Book
  include Mongoid::Document

  field :title
  field :author
  field :tags, type: Array
  embeds_many :comments
  belongs_to :publisher

  def tags_joined
    tags.join(',') rescue ''
  end

  def tags=(value)
    write_attribute(:tags, value.split(',').map(&:strip))
  end
end
```

(the above code snippet online)

The new line here is the `belongs_to :publisher`.

Rails Console Demo

The following is a rails console session that demonstrates the use of the newly created association:

```
2.4.0 :008 > b = Book.where({title: "1984"}).first
 => #<Book _id: 598d44ae0ad9864bb54453e9, title: "1984", author: "George Orwell", \
 tags: ["novel", "classic"], publisher_id: nil>
2.4.0 :009 > b.publisher
 => nil
2.4.0 :010 > p = Publisher.create({name: 'Harvill Secker'})
 => #<Publisher _id: 599056fe0ad986042ad001a5, name: "Harvill Secker">
2.4.0 :011 > b.publisher = p
 => #<Publisher _id: 599056fe0ad986042ad001a5, name: "Harvill Secker">
2.4.0 :012 > b.save!
 => true
2.4.0 :013 > b.reload
 => #<Book _id: 598d44ae0ad9864bb54453e9, title: "1984", author: "George Orwell", \
 tags: ["novel", "classic"], publisher_id: BSON::ObjectId('599056fe0ad986042ad001\
a5')>
2.4.0 :014 > b.publisher
 => #<Publisher _id: 599056fe0ad986042ad001a5, name: "Harvill Secker">
2.4.0 :015 > p.reload
 => #<Publisher _id: 599056fe0ad986042ad001a5, name: "Harvill Secker">
```

```
2.4.0 :016 > p.books
 => [#<Book _id: 598d44ae0ad9864bb54453e9, title: "1984", author: "George Orwell"\
, tags: ["novel", "classic"], publisher_id: BSON::ObjectId('599056fe0ad986042ad00\
1a5')>]
2.4.0 :017 >
```

(the above code snippet online)

1. On command `008` we locate a book. We use the `where()` method and then we take the `first` that matches.
2. On command `009`, we see that this book does not have a Publisher.
3. On command `010`, we create a new `Publisher`.
4. On command `011`, we associate the new `Publisher` to the book and then on command `012` we commit the update to the database.
5. On commands `013` and `014`, we make sure that the book has the `Publisher` as expected.
6. On commands `015` and `016`, we see the list of books that this `Publisher` owns.

`mongo` Shell Output

Let's see also how the book with title `1984`, which belongs to a `Publisher`, is now displayed when fetched as JSON object from database using JavaScript API:

```
> db.books.find({title: "1984"})
{ "_id" : ObjectId("598d44ae0ad9864bb54453e9"), "title" : "1984", "author" : "Geo\
rge Orwell", "tags" : [ "novel", "classic" ], "publisher_id" : ObjectId("599056fe\
0ad986042ad001a5") }
>
```

(the above code snippet online)

Do you see the `publisher_id` property? This is there because of the `belongs_to :publisher` association that we have inserted in the `Book` model.

And this is the `Publisher` associated:

```
> db.publishers.find("599056fe0ad986042ad001a5")
{ "_id" : ObjectId("599056fe0ad986042ad001a5"), "name" : "Harvill Secker" }
>
```

(the above code snippet online)

Rails App UI

And let's see how we can enhance our `bookstore` app to support the setting of a Publisher, while creating or editing a `Book`.

First change: We have to enhance the `show` view to display the Publisher of a book:

```
1  -# File: app/views/show.html.haml
2  -#
3  %h1 Book: #{@book.title}
4  ...
5  %p
6    Publisher: #{@book.publisher.try(:name)}
7  %p
8  ...
9    = submit_tag 'Submit'
```

(the above code snippet online)

We have added lines 6 and 7. We display the `Publisher` name.

Then we have to enhance the form that allows creation and update of a `Book`:

```
1  -# File: app/views/books/_form.html.haml
2  -#
3  ...
4    %br
5    = f.label :publisher
6    = f.collection_select :publisher_id, Publisher.all, :id, :name, prompt: 'Publis\
7  her?'
8  ...
9    = f.submit
```

(the above code snippet online)

We have added the label and the select box to select the Publisher.

Finally, we have to update the `books_controller.rb` so that it allows the `publisher_id` attribute.

```
1  # File: app/controllers/books_controller.rb
2  #
3  class BooksController < ApplicationController
4  ...
5    def book_params
6      result = params.require(:book).permit(:title, :author, :tags_joined, :publish\
7  er_id)
8  ...
9  end
```

(the above code snippet online)

We have added the `:publisher_id` in the list of permitted attributes.

Now, everything is ready. You can set the `Publisher` of a book:

> *Note:* You need to create the `Publisher` CRUD (Create, Retrieve, Update, Delete) part of the app as an exercise.

Mongoid - Setting Book Publisher

Validations

Mongoid allows us to add validations to our models. This is because it includes the `ActiveModel::Validations` module.

We leave this to you as an exercise:

1. `Book` validations:
    1. Make `title` mandatory and unique
    2. Make `author` mandatory
    3. Make `publisher` mandatory
2. `Publisher` validations:
    1. Make `name` mandatory and unique

Closing The MongoDB Chapter

MongoDB is used in many production applications. It is definitely a knowledge that will be proven useful in the job. In order to master it, you need to study very well the MongoDB documentation itself and then the Ruby driver and Mongoid gems documentations.

Tasks and Quizzes

> **Before you continue, you may want to know that**: You can sign up to Tech Career Booster and have a mentor evaluate your tasks, your quizzes and, generally, your progress in becoming a Web Developer. Or you can sign up and get access to Tech Career Booster Slack channel. In that channel, there are a lot of people that can answer your questions and give you valuable feedback.

Quiz

The quiz for this chapter can be found here

Task Details

You need to make sure that you carry out whatever the chapter content teaches you. Such as:

1. Using Mongo Ruby driver implement the simple bookstore command line interface application.
2. Using `mongoid` implement the Rails application that has
    1. All basic CRUD operations for books
    2. Each book should embed many Comments
    3. You need to make sure that the books index page can take you to the show page of a book
    4. You need to make sure that the controller `show` action renders the `show` view.
    5. You need to implement the addition of a comment using AJAX.

6. You need to create all the CRUD pages for the `Publisher` model.
7. You need to make sure that we can assign a Publisher to a Book
8. You need to implement the validations on Book and Publisher as the chapter enlists them.

Important: Your work needs to be uploaded on your Github account. Also, you need to deploy your application on Heroku and set up integration with production Mongo.