Seneca
SCHOOL OF INFORMATION AND COMMUNICATIONS TECHNOLOGY

WEB322

Web Programming Tools and Frameworks

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WEB322 Week 8 Notes

Week 8 - MongoDB

Introduction to MongoDB

What is MongoDB?

MongoDB is an open source database that stores its data in JSON like format (technically it's stored as BSON data but you will interact with its data in JSON format). MongoDB is classified as a NoSQL database. NoSQL is quickly becoming a popular alternative to traditional Relational Databases (RDBMS). The term NoSQL comes from "Not only SQL" and is intended to mean that it is a type of database system that can store data in non traditional tabular and relational format. This is why MongoDB is considered a NoSQL database. It stores its data using object notation.

How does it relate (no pun intended) to Traditional SQL systems?

When you think of how a traditional relational database system works you have tables and records, primary and foreign keys, and joins between tables when writing queries.

MongoDB has similar functionality with a few major differences.

Let's look at a comparison table of features so we can become familiar with the terminology of the MongoDB world and NoSQL databases.

RDBMS term	MongoDB term
Table	Collection
Record	Document
Column	Field
Joins	Embed data or link to another collection

This page compares MySQL to MongoDB and explains when it makes sense to use one or the other or both!

Queries are still queries, and primary/foreign keys can still be called the same but are implemented via schema and indexes. (more on that part later)

Installing MongoDB locally

Lets get MongoDB installed locally. It should take about 5-10 minutes.

OSX

- Download the latest version of MongoDB for OSX. Get the 64 bit community version with SSL support.
- Extract the .tgz file
- Copy the extracted folder (mongodb-osx-x86_64-x.x.x) into your Applications folder
- Create a .bash_profile file (note: the version of mongoDB maybe different (ie: change x86_64-x.x.x to whatever version you are using):

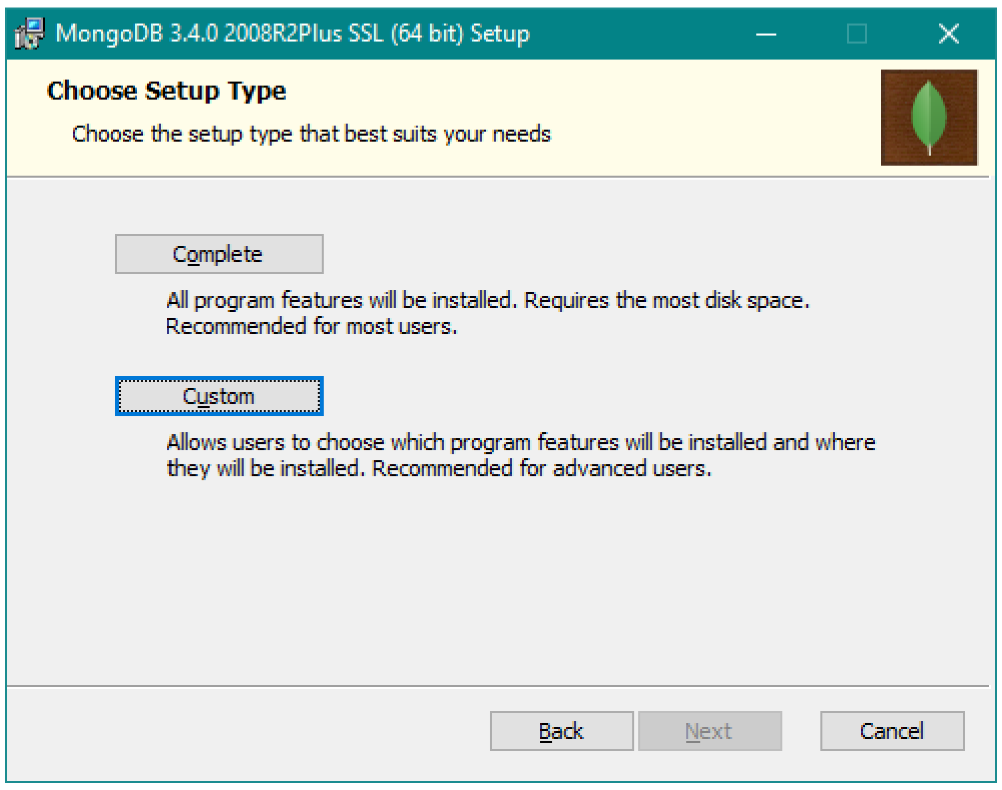
```
$ cd ~
$ pwd
/Users/userName
$ touch .bash_profile
$ open -a TextEdit .bash_profile

export PATH="/Applications/mongodb-osx-x86_64-x.x.x/bin:$PATH"

##restart terminal

$ mongo -version
MongoDB shell version: x.x.x
```

MongoDB should now be installed!

Windows

Download the latest version of MongoDB for Windows. Get the 64 bit community version with SSL support.

- Run the installer
- Agree to the terms and click next
- Choose 'Custom' for the setup type


MongoDB 3.4.0 2008R2Plus SSL (64 bit) Setup

Choose Setup Type

Choose the setup type that best suits your needs

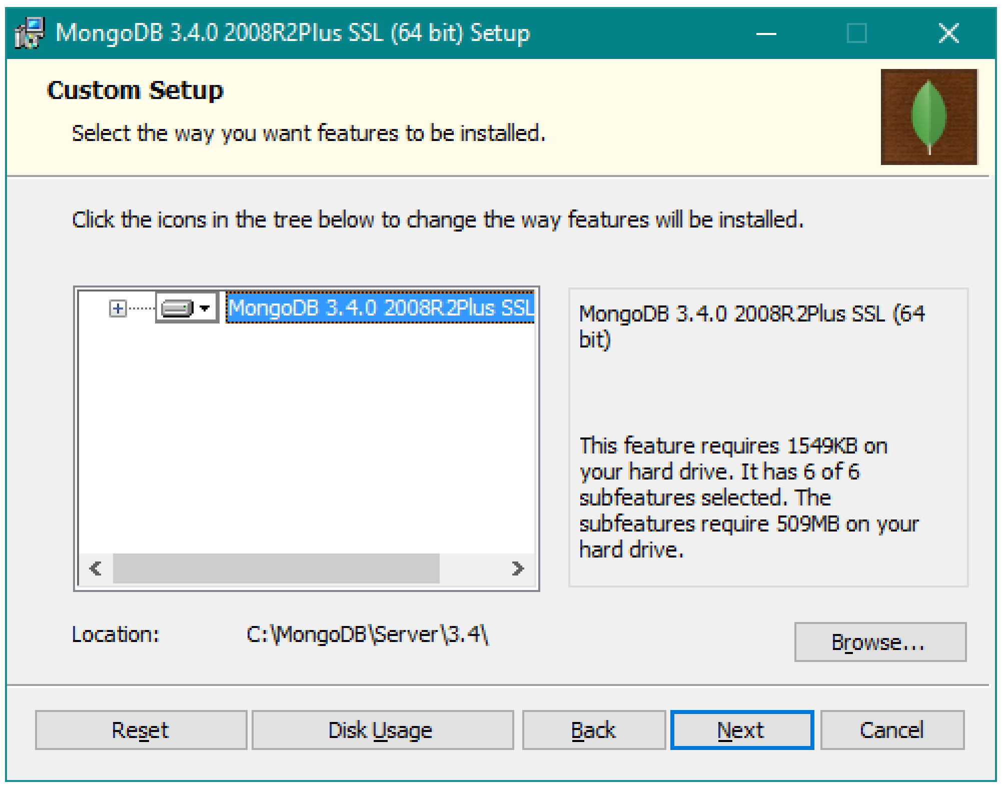
Complete

All program features will be installed. Requires the most disk space. Recommended for most users.

Custom

Allows users to choose which program features will be installed and where they will be installed. Recommended for advanced users.

- Change the install path for windows to C:\MongoDB\Server\3.4 (or whatever version you are installing, ie C:\MongoDB\Server\x.x



MongoDB 3.4.0 2008R2Plus SSL (64 bit) Setup

Custom Setup

Select the way you want features to be installed.

Click the icons in the tree below to change the way features will be installed.

MongoDB 3.4.0 2008R2Plus SSL

MongoDB 3.4.0 2008R2Plus SSL (64 bit)

This feature requires 1549KB on your hard drive. It has 6 of 6 subfeatures selected. The subfeatures require 509MB on your hard drive.

Location: C:\MongoDB\Server\3.4\

- You can install MongoDB in the default directory but we recommend installing it in the path mentioned above if on windows.
- **Lastly, ensure that the \bin directory (ie: C:\MongoDB\Server\x.x\bin [where x.x is the version installed] is added to your PATH**

MongoDB should now be installed!

Running the MongoDB Server

Now we want to try running the server and issuing commands in the shell.

- Create a new directory for your mongoDB database (called db) - this can be anywhere: why don't we use the Desktop?
- Open a terminal window and enter the command:

  ```
  mongod --dbpath ~/Desktop/db
  ```

  (or if you're on Windows, provide the absolute path (ie: **mongod –dbpath C:\users\username\Desktop\db)**
- This will get the "mongoDB" database engine running

Connecting to the MongoDB shell

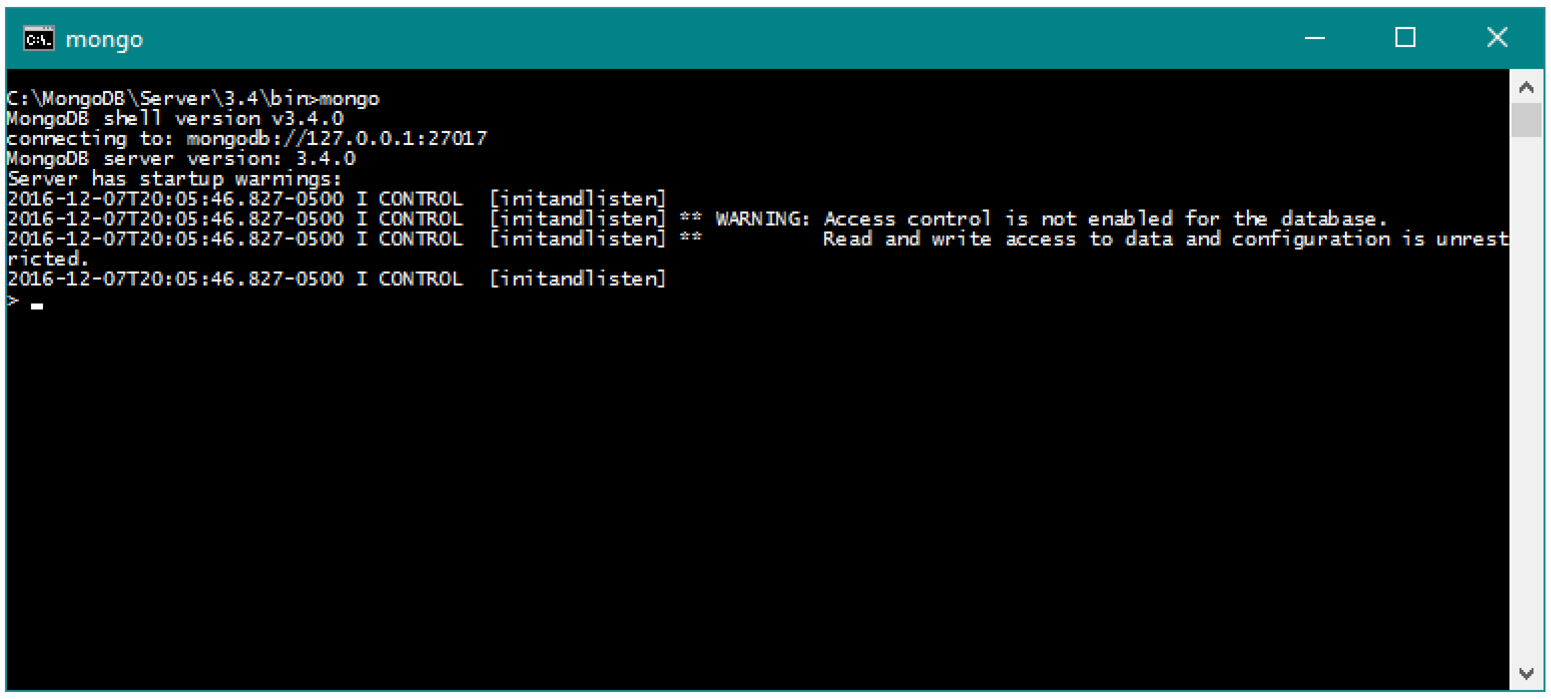
Now that we know how to run MongoDB at anytime, we will learn how to connect to the db through the shell and see how we can issue commands. We will create a web322 database, add a collection for companies, and insert one company into the collection.

With mongod running, we will now run "mongo" to connect to the running server process.

Open a new terminal and execute the command:

```
mongo
```

Once connected to the db with the shell, your window will look like this:



```
C:\MongoDB\Server\3.4\bin>mongo
MongoDB shell version v3.4.0
connecting to: mongodb://127.0.0.1:27017
MongoDB server version: 3.4.0
Server has startup warnings:
2016-12-07T20:05:46.827-0500 I CONTROL  [initandlisten]
2016-12-07T20:05:46.827-0500 I CONTROL  [initandlisten] ** WARNING: Access control is not enabled for the database.
2016-12-07T20:05:46.827-0500 I CONTROL  [initandlisten] **          Read and write access to data and configuration is unrest
ricted.
2016-12-07T20:05:46.827-0500 I CONTROL  [initandlisten]
> 
```

Databases, Collections, and Documents

Now that we are connected to the shell, we can start working with some commands and data. For this example you will see in the shell console that it says:

```
WARNING: Access control is not enabled for the database.
```

This is letting you know you have not setup any user credentials to log in to the db with. This is OK for now, your database server is running locally on your computer. No one will be able to connect to your database outside your computer yet. In a real production or development environment, we would enable authentication to the database. This is outside the scope of this course.

Now it’s time to try out some commands.

Let’s show the databases currently on the server

```
show dbs
```

We can see that there are 2 databases built in and available from a fresh install: admin and local. We won’t be using either of these databases in this course.

When we want to create a new database we just have to simply tell the shell we want to use that database and it will automatically create it if it doesn’t exist. Try this command out.

```
use web322
```

Now we can run show dbs again and you will see it still doesn’t exist. This is because mongodb will only actually create the db and any collections required once you start inserting data. So let’s insert a company to a web322_companies collection!

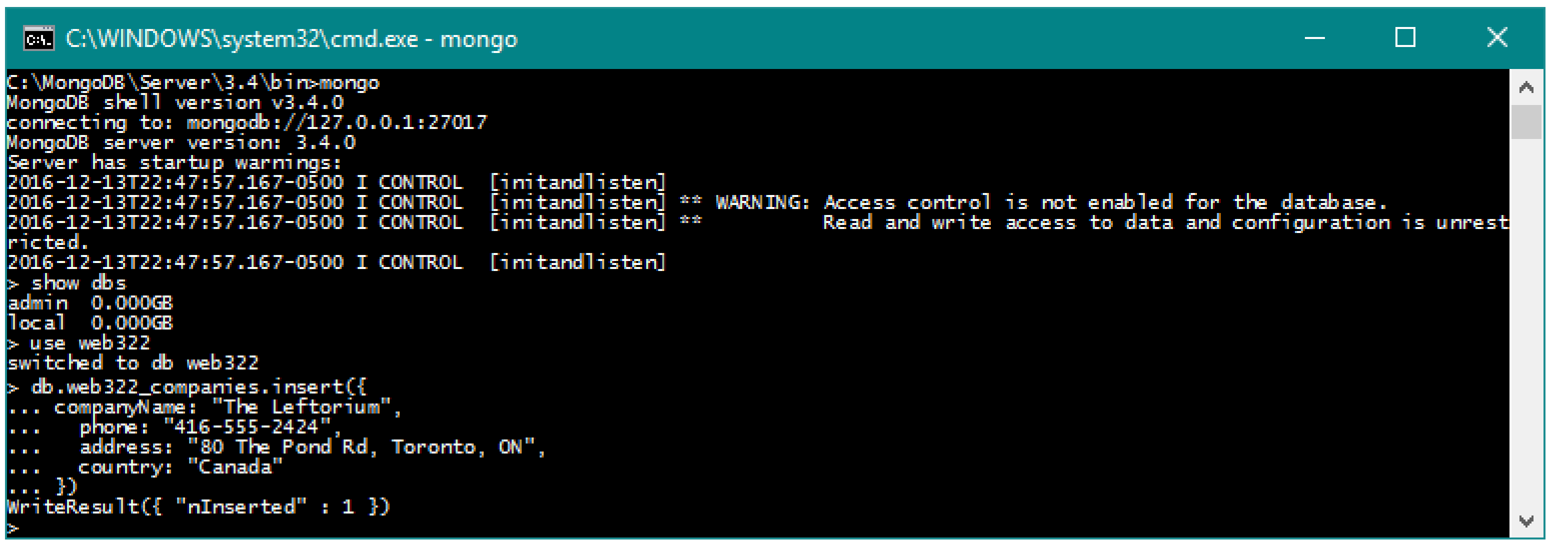
Let’s decide on what a company JSON object would look like to decide what fields we want for the document we are about to insert. Some obvious ones we might want are a company name, phone number, address, and country. Let’s start with that.

```
{
  companyName: "The Leftorium",
  phone: "416-555-2424",
  address: "80 The Pond Rd, Toronto, ON",
  country: "Canada"
}
```

Ok, we’ve decided on what a company record will look like for now. Let’s go ahead and insert this company into the web322_companies collection…

```
db.web322_companies.insert({
    companyName: "The Leftorium",
    phone: "416-555-2424",
    address: "80 The Pond Rd, Toronto, ON",
    country: "Canada"
  })
```

You should get a result like the following:


C:\WINDOWS\system32\cmd.exe - mongo

```
C:\MongoDB\Server\3.4\bin>mongo
MongoDB shell version v3.4.0
connecting to: mongodb://127.0.0.1:27017
MongoDB server version: 3.4.0
Server has startup warnings:
2016-12-13T22:47:57.167-0500 I CONTROL  [initandlisten]
2016-12-13T22:47:57.167-0500 I CONTROL  [initandlisten] ** WARNING: Access control is not enabled for the database.
2016-12-13T22:47:57.167-0500 I CONTROL  [initandlisten] **          Read and write access to data and configuration is unrest
ricted.
2016-12-13T22:47:57.167-0500 I CONTROL  [initandlisten]
> show dbs
admin  0.000GB
local  0.000GB
> use web322
switched to db web322
> db.web322_companies.insert({
... companyName: "The Leftorium",
...   phone: "416-555-2424",
...   address: "80 The Pond Rd, Toronto, ON",
...   country: "Canada"
... })
WriteResult({ "nInserted" : 1 })
>
```

You should see the result WriteResult({ “nInserted” : 1 }). This means a write succeeded and the number of documents inserted (nInserted) was 1.

We can do a quick query to look at the record from the shell with the following command:

```
db.web322_companies.find()
```

You’ll get a result like:

```
{ "_id" : ObjectId("5850c358dbf675a87f27a456"), "companyName" : "The Leftorium", "phone" : "416-5
```

You’ll notice it’s the same as the document you inserted with the added field of “_id”. Every document in MongoDB gets an _id property by default. These are **globally unique** to the entire database and probably even the world! So no need to worry about _id conflicts anytime you do a find by the _id!

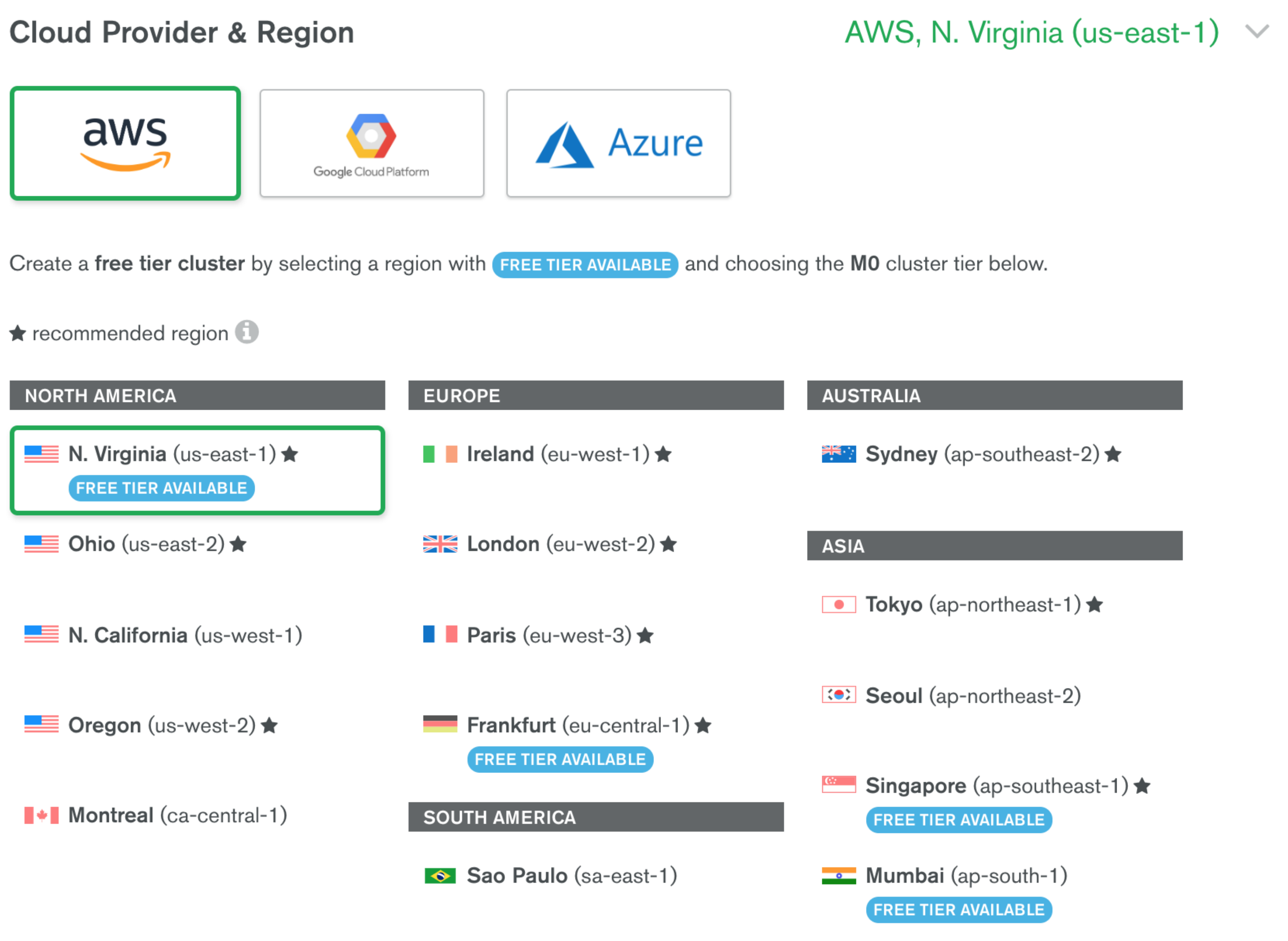
Now let’s setup an online account with MongoDB Atlas and create our own mongodb in the cloud for use with Heroku.

Setting up a MongoDB Atlas account

MongoDB Atlas is an online service that hosts MongoDB in the cloud. You can sign up for a free account to use in this course with your Heroku account.

To get started signup for an account at https://www.mongodb.com/cloud/atlas and click the “Start free” button.

Once your account is setup, you will be taken to the start screen with a modal window suggesting you “Build my first cluster”. You can close this modal window, as we will not be creating a cluster just yet. First, we want to ensure that we have selected all the free options, ie:


Cloud Provider & Region

AWS, N. Virginia (us-east-1)

Create a **free tier cluster** by selecting a region with FREE TIER AVAILABLE and choosing the **M0** cluster tier below.

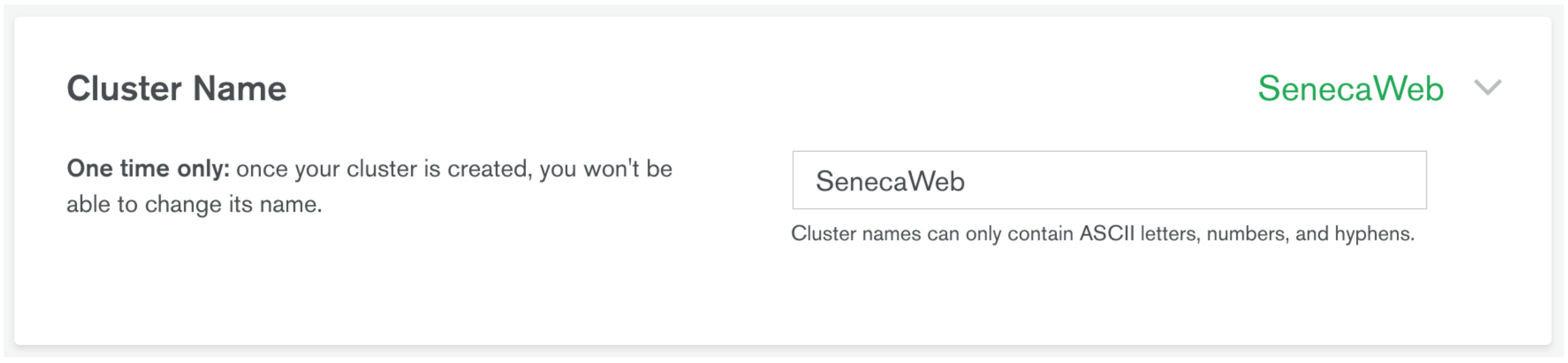
★ recommended region

NORTH AMERICA	EUROPE	AUSTRALIA
N. Virginia (us-east-1) ★ FREE TIER AVAILABLE	**Ireland** (eu-west-1) ★	**Sydney** (ap-southeast-2) ★
Ohio (us-east-2) ★	**London** (eu-west-2) ★	
N. California (us-west-1)	**Paris** (eu-west-3) ★	
Oregon (us-west-2) ★	**Frankfurt** (eu-central-1) ★ FREE TIER AVAILABLE	
Montreal (ca-central-1)		

SOUTH AMERICA
Sao Paulo (sa-east-1)

ASIA
Tokyo (ap-northeast-1) ★
Seoul (ap-northeast-2)
Singapore (ap-southeast-1) ★ FREE TIER AVAILABLE
Mumbai (ap-south-1) FREE TIER AVAILABLE

Next, we must change the cluster name from "Cluster0" to something more recognizable, ie "SenecaWeb".


Cluster Name

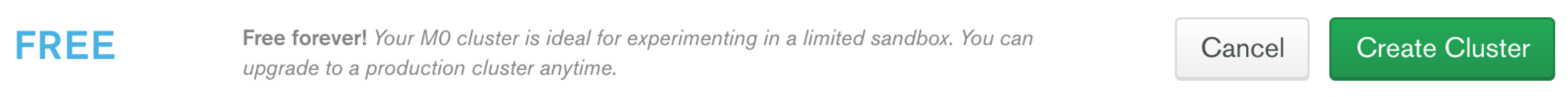
SenecaWeb

One time only: once your cluster is created, you won't be able to change its name.

SenecaWeb

Cluster names can only contain ASCII letters, numbers, and hyphens.

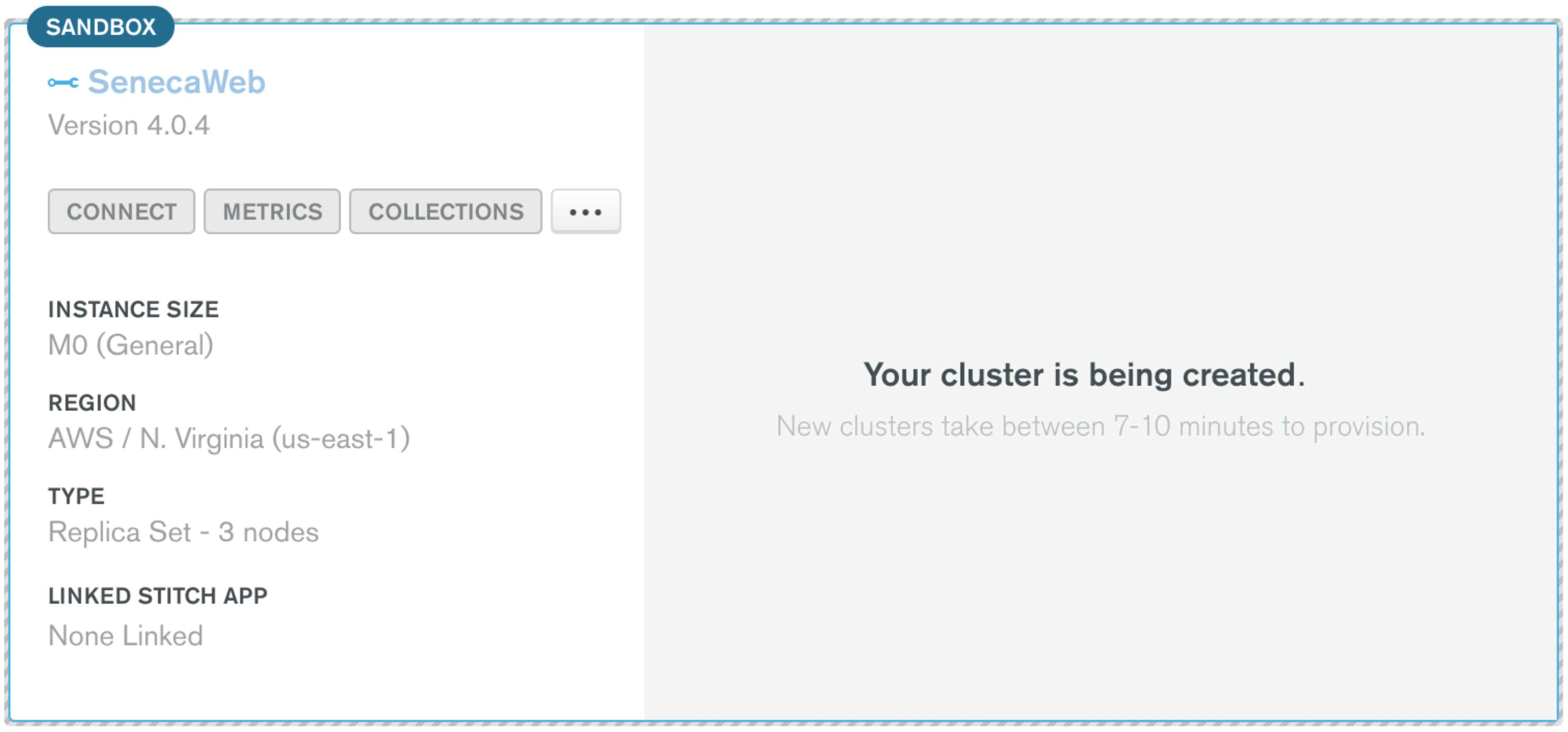
Once this is complete, we can go ahead and "Create Cluster"


FREE

Free forever! *Your M0 cluster is ideal for experimenting in a limited sandbox. You can upgrade to a production cluster anytime.*

Once you pass the Capcha test (proving you're human), you will be redirected to the main page for managing your clusters in MongoDB Atlas (Note: Feel free to close the "Get Started" checklist on the bottom left corner of the screen)

Here, you should see a "Your cluster is being created." message. Before we proceed, we must wait for this to finish (it could be between 7-10 minutes).

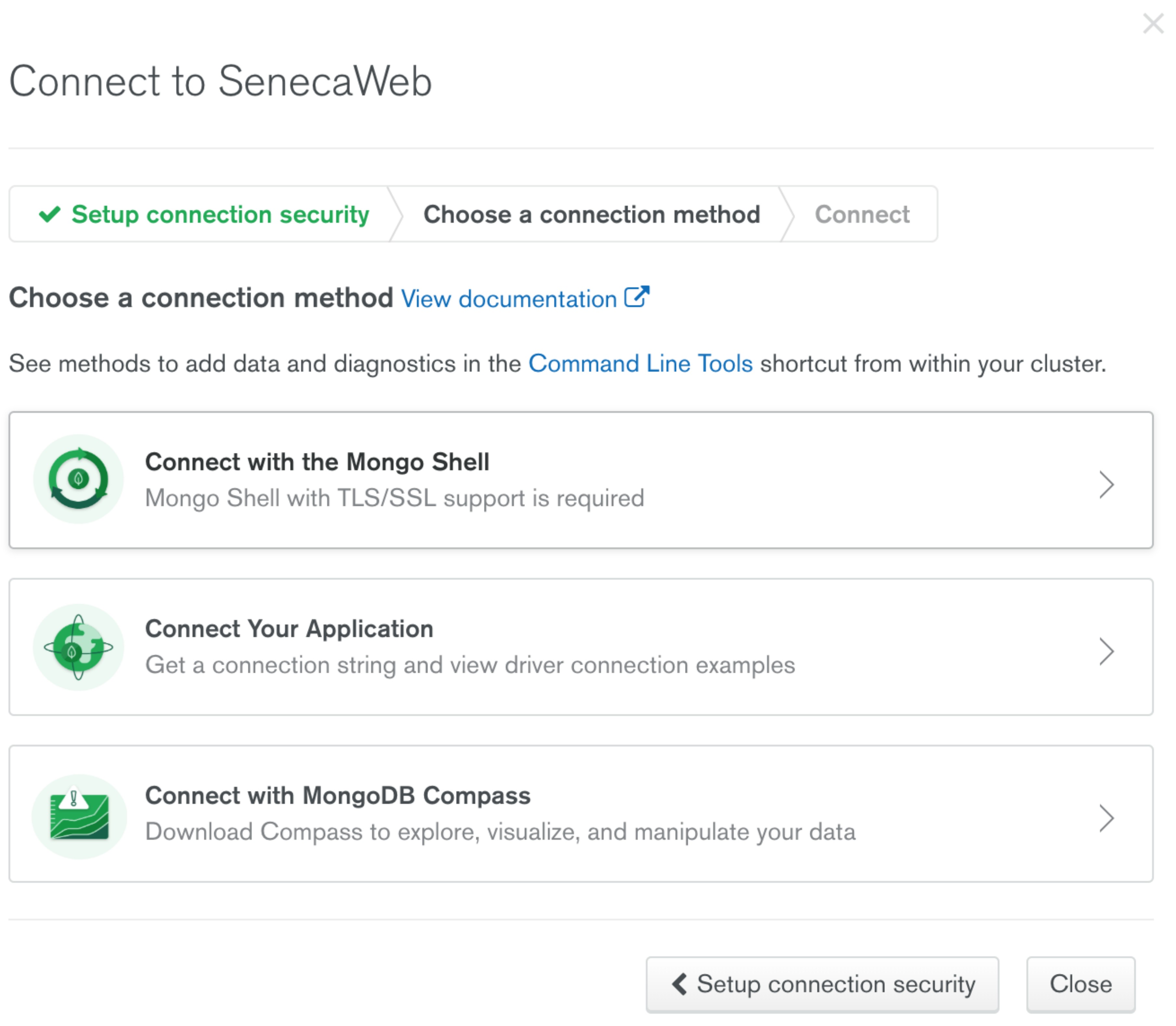


Once your cluster has been created, you can click the “CONNECT” button. This will cause a new modal to appear, which will allow us to Whitelist IP Address to connect to the cluster, as well as to create a “MongoDB User”.

1. For this step, click the “Add a Different IP Address” button and enter “0.0.0.0/0” for the IP Address and “All” for the Description. You can then click the “Add IP Address” button. Essentially, we’re allowing all IP addresses to connect to our cluster. This will make it easier for us to work with the databases in the cluster. If we were creating a cluster for Production, we would ensure that only our deployed app has access.

2. For “Create a MongoDB User”, pick something that you will remember, ie: Username: “dbUser” and Password: (something that you will remember). Once the data is entered, you can click the “Create MongoDB User” button.

Once this is complete, click the “Choose a connection method” button at the bottom of the modal window. This will bring you to a new screen allowing you to choose how you wish to “Connect to SenecaWeb”:



Connect to SenecaWeb

✓ Setup connection security | Choose a connection method | Connect

Choose a connection method View documentation

See methods to add data and diagnostics in the Command Line Tools shortcut from within your cluster.

Connect with the Mongo Shell
Mongo Shell with TLS/SSL support is required

Connect Your Application
Get a connection string and view driver connection examples

Connect with MongoDB Compass
Download Compass to explore, visualize, and manipulate your data

< Setup connection security | Close

From here, click on the “Connect Your Application” button.

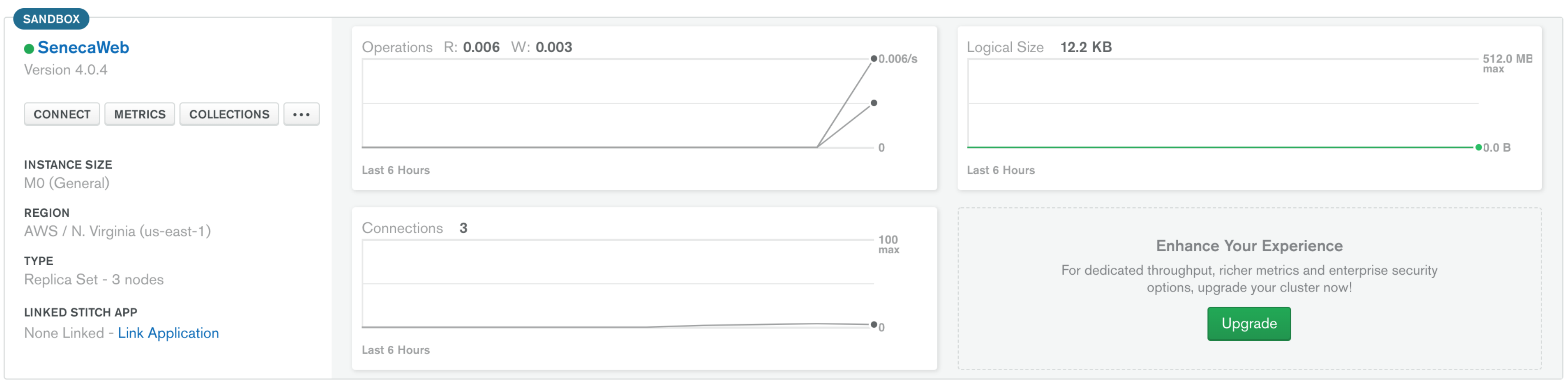
Under the first option, make sure that Node.js is selected for “Driver” and “Version” is set to 3.6 or later. Select the connection string and copy it (alternatively hitting the “Copy” button). Next, paste it in a text file for now. You will notice that there’s a space for <password> - simply replace this with the actual password that you created for user “dbUser” (above).

Once you have copied the connection string, you can close the modal window using the “Close” button located at the bottom of the modal window.

Creating a Database on MongoDB Atlas

Now that the “SenecaWeb” cluster is all set up, we can add a Database to connect to. We’ll be creating a “web322_week8” database for the sake of the example.

To get started, click the blue “SenecaWeb” link from the “Clusters Overview” Section:



SANDBOX
● SenecaWeb
Version 4.0.4

CONNECT | METRICS | COLLECTIONS | ···

INSTANCE SIZE
M0 (General)

REGION
AWS / N. Virginia (us-east-1)

TYPE
Replica Set - 3 nodes

LINKED STITCH APP
None Linked - Link Application

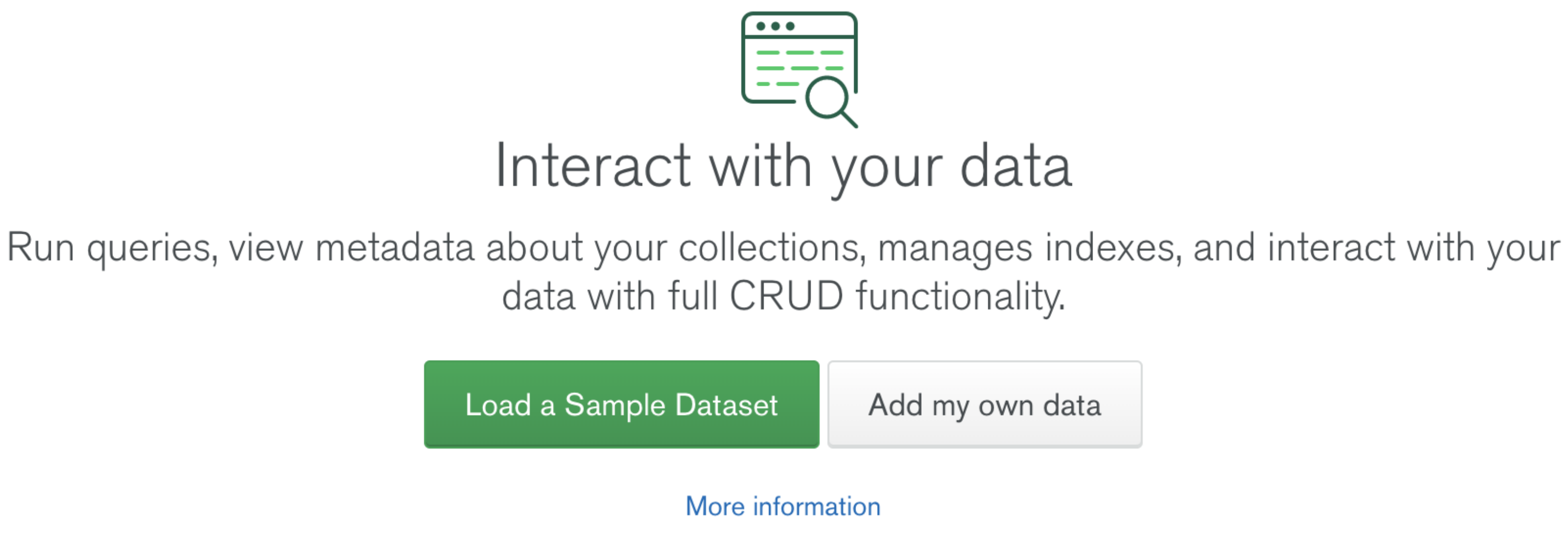
Operations R: 0.006 W: 0.003
0.006/s
0
Last 6 Hours

Logical Size 12.2 KB
512.0 MB max
0.0 B
Last 6 Hours

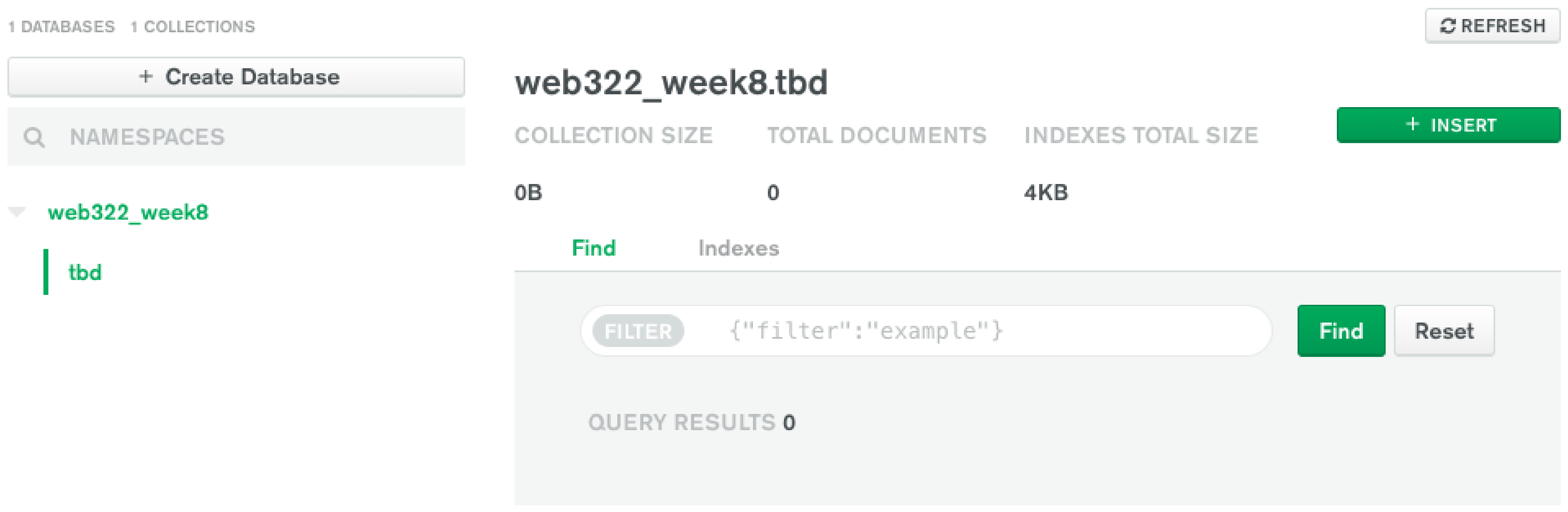
Connections 3
100 max
0
Last 6 Hours

Enhance Your Experience
For dedicated throughput, richer metrics and enterprise security options, upgrade your cluster now!
Upgrade

This will take you to a detailed view of your “SenecaWeb” cluster. From here, you will notice a “Collections” tab. Click this to open the data on all “Collections” contained in this cluster. Since we have not created any Databases yet, we will be greeted with the following message:


Interact with your data
Run queries, view metadata about your collections, manages indexes, and interact with your data with full CRUD functionality.
Load a Sample Dataset
Add my own data
More information

Go ahead and click the “Add my own data” button. This will open a small modal window asking for the “Database Name” and “Collection Name”. For “Database Name” enter “web322_week8” and for “Collection Name” simply enter “tbd” since we don’t know what collections we will have just yet, and we cannot proceed without entering one (Note: ensure that “CAPPED COLLECTION” remains unchecked). With the data entered, click the green “Create” button. Once this is complete, you will be shown the following information under “collections”:



Unfortunately, we cannot have a Database in MongoDB Atlas without a collection, so leave “tbd” there for the time being. We can remove it later.

Updating the connection string to point to our new “web322_week8” database.

Now that we have a new Database online with MongoDB Atlas, we can update our *connection string* to point to it (NOTE: This is what is used in the “mongo.connect” and “mongo.createConnection” methods mentioned below).

To accomplish this, simply take your original *connection string* and look for the text <dbname>. To connect to a specific database, simply **replace** the string <dbname> with the actual database name, ie: **web322_week8**.

Mongoose.js

When we work with MongoDB in node, we won’t work directly with the MongoDB driver. Instead we will use a popular open source module that wraps up the Mongo driver and provides extra functionality for declaring schemas/models, validating documents on save, having virtual properties on a model, and instance and static methods on a model object.

Installing mongoose is easy when you have node installed. Just use npm install to grab it.

```
npm install mongoose
```

This will save it to your package.json file and allow you to require it and start building model files and working with documents.

Querying MongoDB with Mongoose in Node.js

Now that we have mongoose installed we can start looking at how the basic CRUD operations work (note: the examples in this lecture are based on Mongoose version 4).

Let’s start with an example app that will make use of at least one route for each of the main CRUD operations: Create, Read, Update, Delete. In Mongoose we use the functions: save(), find(), update(), and remove().

Let’s define a simple schema for the “company” objects mentioned earlier in the lecture:

Setting up a schema

Company schema

For our company we will want at a minimum a company name, address, phone number, employee count, and country, to match the structure of the company object we have already inserted. MongoDB will automatically include the _id field, so we don’t need it in our schema (all documents inserted get an _id field by default). The previous document did not have an employee count so we will make sure the default for the count is 0 if this field does not exist on a document. The next time a document is saved which has missing fields that the schema supports, any defaults will be applied.

```
var mongoose = require("mongoose");
var Schema = mongoose.Schema;
var companySchema = new Schema({
  "companyName":  String,
  "address": String,
  "phone": String,
  "employeeCount": {
    "type": Number,
    "default": 0
  },
  "country": String
});

var Company = mongoose.model("web322_companies", companySchema);
```

A schema is like a blueprint for a document that will be saved in the DB. It’s somewhat like a class or struct definition in other languages you are used to. We are defining the fields that can exist on a document for this collection, and setting their expected types, default values, and sometimes if they are required, or have an index on them.

In the above, we have defined a Company schema, with 5 properties as discussed, and set their types appropriately. The employee count is not just a simple number, we also want to include a default value of 0 of the count field is not supplied. Using defaults where it makes sense to have them is good practice.

The last line of code tells mongoose to register this schema (companySchema) as a model and connect it to the web322_companies collection (Note: the “web322_companies” collection will be automatically created if it doesn’t exist yet). We can then use the Company variable to make queries against this collection and insert, update, or remove documents from the Company model.

Now let’s add a second company to the database using mongoose in node.js instead of the mongo shell.

Here is a simple app you can run with node.js and it will insert another company to the db.

```
// require mongoose and setup the Schema
var mongoose = require("mongoose");
var Schema = mongoose.Schema;

// connect to the localhost mongo running on default port 27017
mongoose.connect("mongodb://localhost/web322");
```

```
// define the company schema
var companySchema = new Schema({
  "companyName":  String,
  "address": String,
  "phone": String,
  "employeeCount": {
    "type": Number,
    "default": 0
  },
  "country": String
});
// register the Company model using the companySchema
// use the web322_companies collection in the db to store documents
var Company = mongoose.model("web322_companies", companySchema);

// create a new company
var kwikEMart = new Company({
  companyName: "The Kwik-E-Mart",
  address: "Springfield",
  phone: "212-842-4923",
  employeeCount: 3,
  country: "U.S.A"
});

// save the company
kwikEMart.save((err) => {
  if(err) {
    console.log("There was an error saving the Kwik-E-Mart company");
  } else {
    console.log("The Kwik-E-Mart company was saved to the web322_companies collection");
  }
  // exit the program after saving
  process.exit();
});
```

Now we can add a findOne() call to find this company using mongoose. Modify the save call in the code above to look like this:

```
// save the company
kwikEMart.save((err) => {
    if(err) {
      console.log("There was an error saving the Kwik-E-Mart company");
    } else {
        console.log("The Kwik-E-Mart company was saved to the web322_companies collection");
        Company.findOne({ companyName: "The Kwik-E-Mart" })
        .exec()
        .then((company) => {
            if(!company) {
                console.log("No company could be found");
            } else {
                console.log(company);
            }
            // exit the program after saving and finding
            process.exit();
        })
        .catch((err) => {
            console.log(`There was an error: ${err}`);
        });
    }
});
```

.exec()

The .exec() call is added after a mongoose query to tell mongoose to return a promise. If you leave out the .exec(), mongoose will still work with .then() calls but the object returned will not be a proper promise. It is good practice to always use .exec() after your query has been setup and before the .then() method is invoked.

Arrays and Recursive Schemas

Before we move on to "The rest of the CRUD" below, let's take a quick look at how we can define a "recursive" schema. Essentially, this is a schema that contains an array of elements with the same schema as the definition. We can use this to store tree structures such as file / folder hierarchies or comment trees for a blog post. For example: say we wish to store a tree of comments, where each comment can have one or more comments, which can have one or more comments, and so on. We can specify our recursive "commentSchema" using the following code:

```
const commentSchema = new Schema({
    comment: String,
    author: String,
    date: Date
});

commentSchema.add({ comments: [commentSchema] });
```

Here, we add a "comments" field with a type of "[commentSchema]" to the original "commentSchema". Using this syntax, we indicate that all "comments" will consist of an Array defined by "commentSchema". Now, we can easily create documents that appear in this format, ie:

```
var commentChain = new Comment({
    comment: "Star Wars is awesome",
    author: "Author 1",
    date: new Date(),
    comments: [{
        comment: "I agree",
        author: "Author 2",
        date: new Date(),
        comments: [{
            comment: "I agree with Author 2",
            author: "Author 3",
            date: new Date(),
            comments: []
        }]
    }]
});
```

Quick Note: Multiple Connections

Using Mongoose, it is also possible to have multiple connections configured for your application. If this is the case, we just have to make a few small changes on how we **connect** to each DB, and how we define our models (**NOTE**: the use of the "encodeURIComponent" is necessary if your password contains special characters, ie "$") :

```
// ...

let pass1 = encodeURIComponent("pa$$word1"); // this step is needed if there are special characte
let db1 = mongoose.createConnection(`mongodb://dbUser:${pass1}@senecaweb-shard-00-00-abcde.mongod

// verify the db1 connection

db1.on('error', (err)=>{
  console.log("db1 error!");
});

db1.once('open', ()=>{
  console.log("db1 success!");
});

// ...

let pass2 = encodeURIComponent("pa$$word2"); // this step is needed if there are special characte
let db2 = mongoose.createConnection(`mongodb://dbUser:${pass2}@senecaweb-shard-00-00-abcde.mongod

// ...

var model1 = db1.model("model1", model1Schema); // predefined "model1Schema" used to create "mode

var model2 = db2.model("model2", model2Schema); // predefined "model2Schema" used to create "mode

// ...
```

Instead of using **"connect"**, we instead use **"createConnection"** and save the result as a reference to the connection (ie: **"db1"** and **"db2"** from above). We can then use **db1** or **db2** to create models on each database separately. Additionally, if we want to *test* the connection, we can use the **.on()** and **.once()** methods of each connection.

Connection Warnings

Depending on the version of mongoose that you're using, you may encounter warnings such as:

`DeprecationWarning: current URL string parser is deprecated, and will be removed in a future version. To use the new parser, pass option { useNewUrlParser: true } to MongoClient.connect.`

or

`DeprecationWarning: current Server Discovery and Monitoring engine is deprecated, and will be removed in a future version. To use the new Server Discover and Monitoring engine, pass option { useUnifiedTopology: true } to the MongoClient constructor..`

To resolve these, simply add the suggested options to an object and pass them in as the 2nd parameter to your connect / createConnection method, ie:

```
let db1 = mongoose.createConnection("Your connection string here", {useNewUrlParser: true, useUni
```

The rest of the CRUD

Now that we've discussed find, let's talk about the other functions used with mongoose to do the rest of the CRUD functionality. Here are some examples of other find methods, inserting, updating, and removing documents.

save()

To "save" (create) a new document, we must first create the document in code using a reference to the schema object we want. Then we can call a built in method, .save() on the model object to save it.

```
var kwikEMart = new Company({ ... });

kwikEMart.save((err) => {
  if(err) {
    // there was an error
    console.log(err);
  } else {
    // everything good
    console.log(kwikEMart);
  }
});
```

Note: We can also pass a second parameter to the save callback, ie:

```
save((err,data)=>{ });
```

where “data” will contain the document just saved to the colection. This can be useful if we wish to obtain the automatically generated “_id” field (using data._id) immediately after creating the document.

find()

```
Company.find({ companyName: "The Kwik-E-Mart"})
//.sort({}) //optional "sort" - https://docs.mongodb.com/manual/reference/operator/aggregation/so
.exec()
.then((companies) => {
  // companies will be an array of objects.
  // Each object will represent a document that matched the query

  // Convert the mongoose documents into plain JavaScript objects
  companies = companies.map(value => value.toObject());

});
```

Selecting specific fields

If we wish to limit the results to include only specific fields, we can pass the list of fields as a space-separated string in the second parameter to the find() method, ie:

```
Company.find({ companyName: "The Kwik-E-Mart"}, "address phone")
//.sort({}) //optional "sort" - https://docs.mongodb.com/manual/reference/operator/aggregation/so
.exec()
.then((companies) => {
  // companies will be an array of objects.
  // Each object will represent a document that matched the query

  // Convert the Mongoose documents into plain JavaScript objects
  companies = companies.map(value => value.toObject());
});
```

For complex queries (ie: “greater than”, “in”, “or”, etc, etc.) see the Mongoose Query Guide and the MongoDB documentation under Query and Projection Operators

Note: You will notice that in our “then” callback function(s), we have line:

```
// Convert the Mongoose documents into plain JavaScript objects
companies = companies.map(value => value.toObject());
```

This is to ensure that our returned “companies” Mongoose documents are converted to plain JavaScript objects.

updateOne() / updateMany()

We use the schema object to update vs an instance of a model like we did with save(). update() takes 3 arguments: the query to select which documents to update, the fields to set for the documents that match the query (see update operators, ie: $set, $push and $addToSet), and an option for if you want to update multiple matching documents or only the first match.

```
Company.updateOne( // can also use updateMany to update multiple documents at once
  { ... query ... },
  { $set: { ... fields to set ... } }
).exec();

Example:
Company.updateOne(
  { companyName: "The Kwik-E-Mart"},
  { $set: { employeeCount: 3 } }
).exec();
```

deleteOne() / deleteMany()

```
Company.deleteOne({ ... query ... }) // can also use deleteMany to delete multiple documents at o
.exec()
.then();

Example:
Company.deleteOne({ companyName: "The Kwik-E-Mart" })
.exec()
.then(() => {
  // removed company
  console.log("removed company");
})
.catch((err) => {
  console.log(err);
});
```

Indexes

Indexes are a large enough topic on their own for an entire week of lecture. For the scope of this course we will talk about the most common type of index used in MongoDB that you will need for every collection.

Unique indexes

A unique index is applied at the database level and can be attached to one or more fields of a document. The first example of a unique index would be on the _id field of all documents that MongoDB adds automatically. As mentioned above every document gets an _id field added to it by default and that _id value is globally unique across the DB. MongoDB automatically adds the _id field to your documents but it also adds a unique index to the _id field for the schema. Mongoose schemas can be customized to add your own additional unique index constraints to other fields as needed. Mongoose will add the indexes, if they don't exist, to the collections in your db when your app starts up and initializes.

The most common use for this is when you want to enforce a unique value across all documents in a collection on a certain field. A perfect use case for this would be on the companyName for our company schema above. It wouldn't make sense to have multiple companies with the same name in the system. To add a unique index in to the companyName field, we just have to add unique:true to the schema declaration from before.

```
// define the company schema
var companySchema = new Schema({
  "companyName":  {
    "type": String,
    "unique": true
  },
  "address": String,
  "phone": String,
  "employeeCount": {
    "type": Number,
    "default": 0
  },
  "country": String
});
```

Remember: Your indexes are stored **in MongoDB** and will be enforced by the database.

Let's look at the finalized code and what happens when we try to insert a company with a companyName that already exists when the companyName has a unique index.

```
// require mongoose and setup the Schema
var mongoose = require("mongoose");
var Schema = mongoose.Schema;

// connect to the localhost mongo running on default port 27017
mongoose.connect("mongodb://localhost/web322");

// define the company schema
var companySchema = new Schema({
  "companyName": {
    type: String,
    unique: true
  },
  "address": String,
  "phone": String,
  "employeeCount": {
    "type": Number,
    "default": 0
  },
  "country": String
});
var Company = mongoose.model("web322_companies", companySchema);

// create a new company
var kwikEMart = new Company({
  companyName: "The Kwik-E-Mart",
  address: "Springfield",
  phone: "212-842-4923",
  employeeCount: 3,
  country: "U.S.A"
});

// save the company
kwikEMart.save((err) => {
  if(err) {
    console.log(`There was an error saving the Kwik-E-Mart company: ${err}`);
  } else {
    console.log("The Kwik-E-Mart company was saved to the web322_companies collection");
  }
  Company.find({ companyName: "The Kwik-E-Mart" })
  .exec()
  .then((company) => {
    if(!company) {
      console.log("No company could be found");
    } else {
      console.log(company);
    }
    // exit the program after saving
    process.exit();
  })
  .catch((err) => {
    console.log(`There was an error: ${err}`);
  });
});
```

Running it a second time:

```
$ node week8
There was an error saving the Kwik-E-Mart company: WriteError({"code":11000,"index":0,
"errmsg":"E11000 duplicate key error collection: web322.web322_companies index:
companyName_1 dup key: { : \"The Kwik-E-Mart\" }","op":{"companyName":"The Kwik-E-
Mart","address":"Springfield","phone":"212-842-4923","country":"U.S.A","_id":"5864148f8e6a8028309
":3,"__v":0}})
[ { _id: 586412c78b50ee22cc9691d6,
    companyName: 'The Kwik-E-Mart',
    address: 'Springfield',
    phone: '212-842-4923',
    country: 'U.S.A',
    __v: 0,
    employeeCount: 3 } ]
```

As you can see MongoDB threw back an error (E11000 duplicate key error). This is the most common form of error you'll encounter on saving a document to the database. You can handle it and act according to what your application should do.

Week 8 example

The week 8 example explores connecting to a mongoDB database and saving records for metadata about a photo upload. It allows the owner to upload a photo, add a name, email, and caption to the photo, and save it. The photo itself will be written to the file system and the supporting data about the photo will be saved in a document in the web322_week8_photos collection. Try it out with a local install of MongoDB and then try creating a MongoDB Atlas account and connecting your MongoDB Atlas db to your week8 example running on Heroku.

Sources

- MongoDB official documentation
- Mongoose documentation
- MongoDB Cheat Sheet