Exercise 13

Create a simple GraphQL server in Node.js using Mongo as a database server

Prior Knowledge
Unix Command Line Shell
Some simple JavaScript (node.js)

Learning Objectives
Understand GraphQL

Software Requirements
Node.js
npm/yarn
Mongo
Visual Studio Code

Thanks to this guide which this is heavily based on:

https://freo.me/do-node-graphql

1. First let's install MongoDB client tools

   ```
   sudo apt install mongodb-clients mongo-tools -y
   ```

2. Now let's run mongodb in a container:

   ```
   docker run -p 27017:27017 mongo
   ```

3. Check it works:

   ```
   mongo
   ```

   ```
   MongoDB shell version v3.6.3
   connecting to: mongodb://127.0.0.1:27017
   MongoDB server version: 3.6.3
   Server has startup warnings:
   2019-11-27T08:42:30.127+0000 I STORAGE  [initandlisten]
   2019-11-27T08:42:30.127+0000 I STORAGE  [initandlisten] ** WARNING: Using the XFS
   filesystem is strongly recommended with the WiredTiger storage engine
   2019-11-27T08:42:30.127+0000 I STORAGE  [initandlisten] **          See
   http://dochub.mongodb.org/core/prodnotes-filesystem
   2019-11-27T08:42:30.707+0000 I CONTROL  [initandlisten]
   2019-11-27T08:42:30.707+0000 I CONTROL  [initandlisten] ** WARNING: Access control is
   not enabled for the database.
   2019-11-27T08:42:30.707+0000 I CONTROL  [initandlisten] **          Read and write
   access to data and configuration is unrestricted.
   2019-11-27T08:42:30.707+0000 I CONTROL  [initandlisten]
   >
   ```

4. Type
   ```
   exit
   ```
   to leave the mongo client command prompt.

5. Clone my simple sample repository:

   ```
   cd ~
   git clone https://github.com/pzfreo/graphql-example.git
   cd graphql-example
   yarn install
   ```

6. Import some data into Mongo:

   ```
   mongoimport -d test -c bios bios.json
   ```

   This is this data:
   https://docs.mongodb.com/manual/reference/bios-example-collection/

7. Have a look using the mongo client

   ```
   mongo

   > use test
   switched to db test

   > db.bios.find({})
   ```
   You should see something like:

   ```
   { "_id" : 4, "name" : { "first" : "Kristen", "last" : "Nygaard" },
   "birth" : ISODate("1926-08-27T04:00:00Z"), "death" :
   ISODate("2002-08-10T04:00:00Z"), "contribs" : [ "OOP", "Simula" ],
   "awards" : [ { "award" : "Rosing Prize", "year" : 1999, "by" :
   "Norwegian Data Association" }, { "award" : "Turing Award", "year" :
   2001, "by" : "ACM" }, { "award" : "IEEE John von Neumann Medal",
   "year" : 2001, "by" : "IEEE" } ] }
   ```

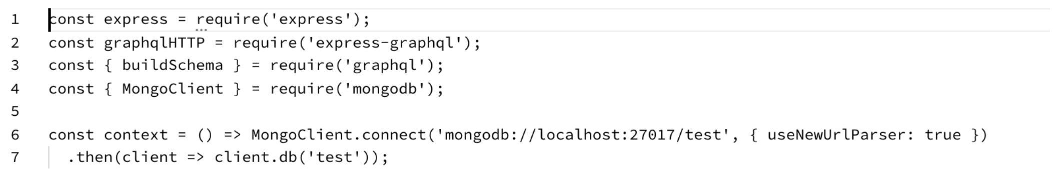
8. Exit the mongo client

9. Please note that we haven't set up any security for the database. This is not a good thing. Don't do this in production :-)

10. Take a look at our app:

    ```
    code index.js
    ```

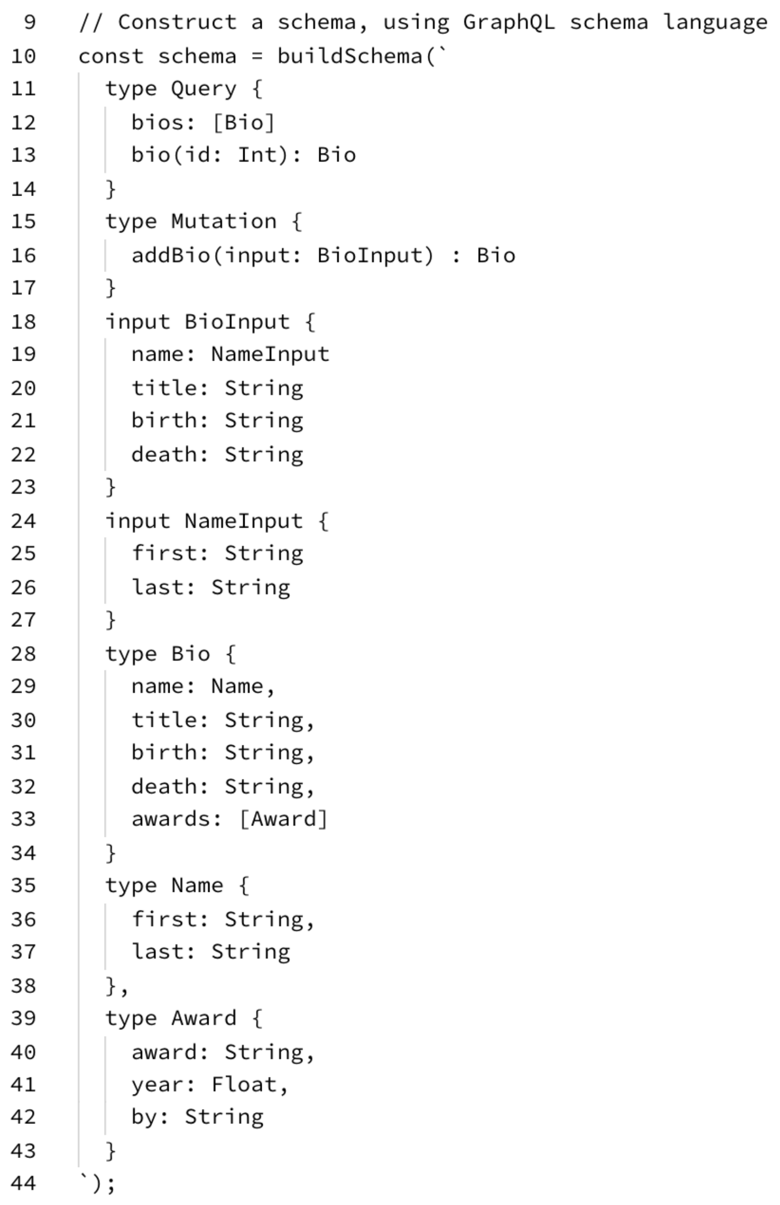
    The first part imports and sets up the connection to the Mongo database.



```
const express = require('express');
const graphqlHTTP = require('express-graphql');
const { buildSchema } = require('graphql');
const { MongoClient } = require('mongodb');

const context = () => MongoClient.connect('mongodb://localhost:27017/test', { useNewUrlParser: true })
  .then(client => client.db('test'));
```

Next is the definition of the GraphQL schema.



```
// Construct a schema, using GraphQL schema language
const schema = buildSchema(`
  type Query {
    bios: [Bio]
    bio(id: Int): Bio
  }
  type Mutation {
    addBio(input: BioInput) : Bio
  }
  input BioInput {
    name: NameInput
    title: String
    birth: String
    death: String
  }
  input NameInput {
    first: String
    last: String
  }
  type Bio {
    name: Name,
    title: String,
    birth: String,
    death: String,
    awards: [Award]
  }
  type Name {
    first: String,
    last: String
  },
  type Award {
    award: String,
    year: Float,
    by: String
  }
`);
```

The next interesting part is:

```
// Provide resolver functions for your schema fields
const resolvers = {
  bios: (args, context) =>context().then(db => db.collection('bios').find().toArray()),
  bio: (args, context) =>context().then(db => db.collection('bios').findOne({ _id: args.id })),
  addBio: (args, context) => context()
    .then(db => db.collection('bios').insertOne(
        { name: args.input.name,
          title: args.input.title,
          death: args.input.death,
          birth: args.input.birth}))
    .then(response => response.ops[0])
};
```

This defines what queries do when called.

For example,

- when you do a GraphQL query “bios”
- this will do a mongodb

  `db.collection(‘bios’).find().toArray().`

The rest of the file is basically "boilerplate" and would be almost the same in any other example using express-graphql to implement graphql.

```
const app = express();
app.use('/graphql', graphqlHTTP({
  schema,
  rootValue: resolvers,
  context,
  graphiql: true
}));
app.listen(4000);

console.log(`🚀 Server ready at http://localhost:4000/graphql`);
```

One interesting thing to note is the enabling of *GraphiQL:*

```
graphiql: true
```

This is super cool and we'll see it in a minute.

11. Start the server

```
$ node index.js
🚀 Server ready at http://localhost:4000/graphql
```

12. You may see a warning:

```
node:4087) [MONGODB DRIVER] Warning: 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.
```

Ignore this!

13. In a new terminal window try:

    ```
    http localhost:4000/graphql query='{ bios { name { first }}}'
    ```

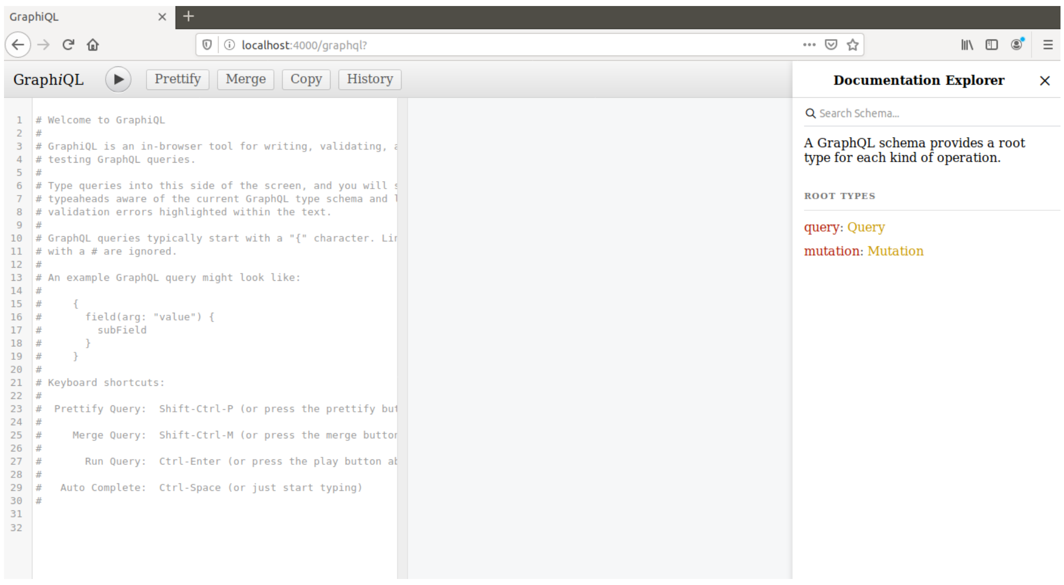
    You should see something like:

    ```
    HTTP/1.1 200 OK
    Connection: keep-alive
    Content-Length: 298
    Content-Type: application/json; charset=utf-8
    Date: Wed, 27 Nov 2019 08:56:09 GMT
    ETag: W/"12a-aMvPeBKQdQnnT/UJvxWxZ4tD9Pc"
    X-Powered-By: Express

    {
        "data": {
            "bios": [
                {
                    "name": {
                        "first": "Kristen"
                    }
                },
                {
                    "name": {
                        "first": "Ole-Johan"
                    }
                },
    …
    }
    ```

14. Now browse to http://localhost:4000/graphql
    This is the GraphiQL interface (pronounced "graphical").

    You should see something like:



```
# Welcome to GraphiQL
#
# GraphiQL is an in-browser tool for writing, validating, a
# testing GraphQL queries.
#
# Type queries into this side of the screen, and you will s
# typeaheads aware of the current GraphQL type schema and l
# validation errors highlighted within the text.
#
# GraphQL queries typically start with a "{" character. Lir
# with a # are ignored.
#
# An example GraphQL query might look like:
#
#     {
#       field(arg: "value") {
#         subField
#       }
#     }
#
# Keyboard shortcuts:
#
#  Prettify Query:  Shift-Ctrl-P (or press the prettify but
#
#     Merge Query:  Shift-Ctrl-M (or press the merge buttor
#
#       Run Query:  Ctrl-Enter (or press the play button ab
#
#   Auto Complete:  Ctrl-Space (or just start typing)
#
```

A GraphQL schema provides a root type for each kind of operation.

ROOT TYPES

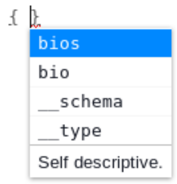
query: Query
mutation: Mutation

15. Have a read of the commented out help.

16. Below the comments start typing:

    ```
    { bi
    ```

You will see the auto-completion kick in:



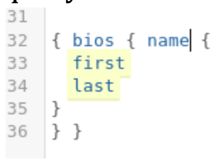
```
{ }
```

17. Add name to the query:

```
{ bios { name
} }
```

18. Hit the Play button or Ctrl-Enter

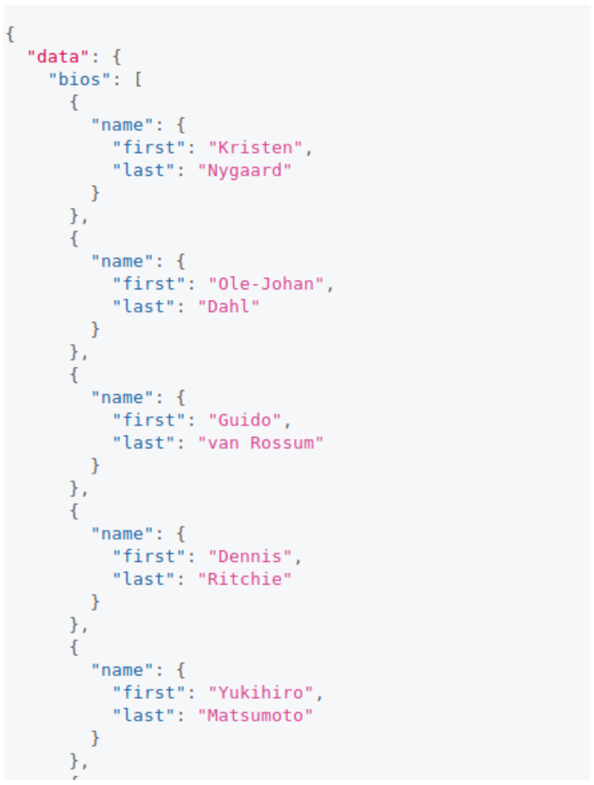
19. You will see GraphiQL will add first / last into the query to make it into a valid query:



```

{ bios { name {
    first
    last
  }
} }
```

20. You should see the query response like this:



```
{
  "data": {
    "bios": [
      {
        "name": {
          "first": "Kristen",
          "last": "Nygaard"
        }
      },
      {
        "name": {
          "first": "Ole-Johan",
          "last": "Dahl"
        }
      },
      {
        "name": {
          "first": "Guido",
          "last": "van Rossum"
        }
      },
      {
        "name": {
          "first": "Dennis",
          "last": "Ritchie"
        }
      },
      {
        "name": {
          "first": "Yukihiro",
          "last": "Matsumoto"
        }
      },
```

21. If we look at the schema (in index.js) again, you should see this part:

```
type Query {
    bios: [Bio]
    bio(id: Int): Bio
}
```

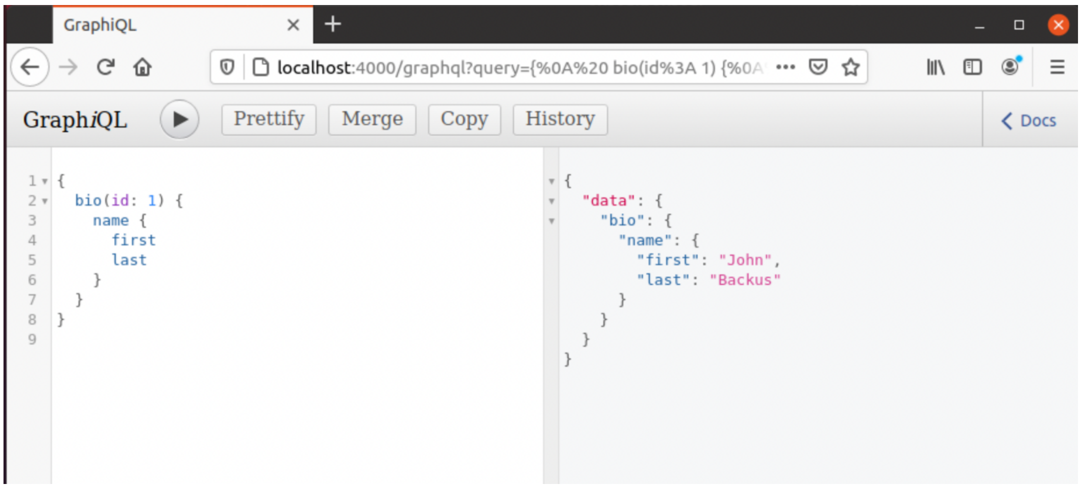
And this is the corresponding code:

```
bios: (args, context) =>context().then(db =>
      db.collection('bios').find().toArray()),
bio: (args, context) =>context().then(db =>
      db.collection('bios').findOne({ _id: args.id })),
```

What this means, is that the "bios" query has no parameters and pulls back all the records from the collection (find()), while the "bio" query has a single parameter (id) and queries the collection to findOne with that id.

22. Try out the find one method:

```
{ bio(id:1) {
  name {
    first
    last
  }
}}
```



```
{
  bio(id: 1) {
    name {
      first
      last
    }
  }
}
```

```
{
  "data": {
    "bio": {
      "name": {
        "first": "John",
        "last": "Backus"
      }
    }
  }
}
```

23. Updates in GraphQL are called mutations.

    Here is the part of the schema that lets us do an update:

```
type Mutation {
  addBio(input: BioInput) : Bio
}
input BioInput {
  name: NameInput
  title: String
  birth: String
  death: String
}
input NameInput {
  first: String
  last: String
}
```

    And here is the code that is called when you do a mutation:

```
addBio: (args, context) => context()
  .then(db => db.collection('bios').insertOne(
      { name: args.input.name,
        title: args.input.title,
        death: args.input.death,
        birth: args.input.birth}))
  .then(response => response.ops[0])
```

24. Try adding some data into the database:

```
mutation {
      addBio(input: { name: { first: "John", last: "Smith" } })
      { name { first, last } }
}
```

25. Rerun the “bios” query and you will now see John Smith in the list

26. Re-run the update and new query from HTTPie (i.e. not using GraphiQL)

27. Is GraphQL “restful”? What reasons do you have for saying yes or no?

That’s all for a basic intro to GraphQL

Extensions:

1. Add a query to search by first name and return all the records with that first name.

2. If you have done the API management lab, add your GraphQL API as a managed API (you will need to create the schema as a separate file)

   Hints are here:
   https://apim.docs.wso2.com/en/latest/learn/design-api/create-api/create-a-graphql-api/

3. **(Harder!)**
   Create an Order service that has a similar schema to our RESTful service but uses GraphQL instead.