Example of WebAPIs

Software Engineering - Tutorial

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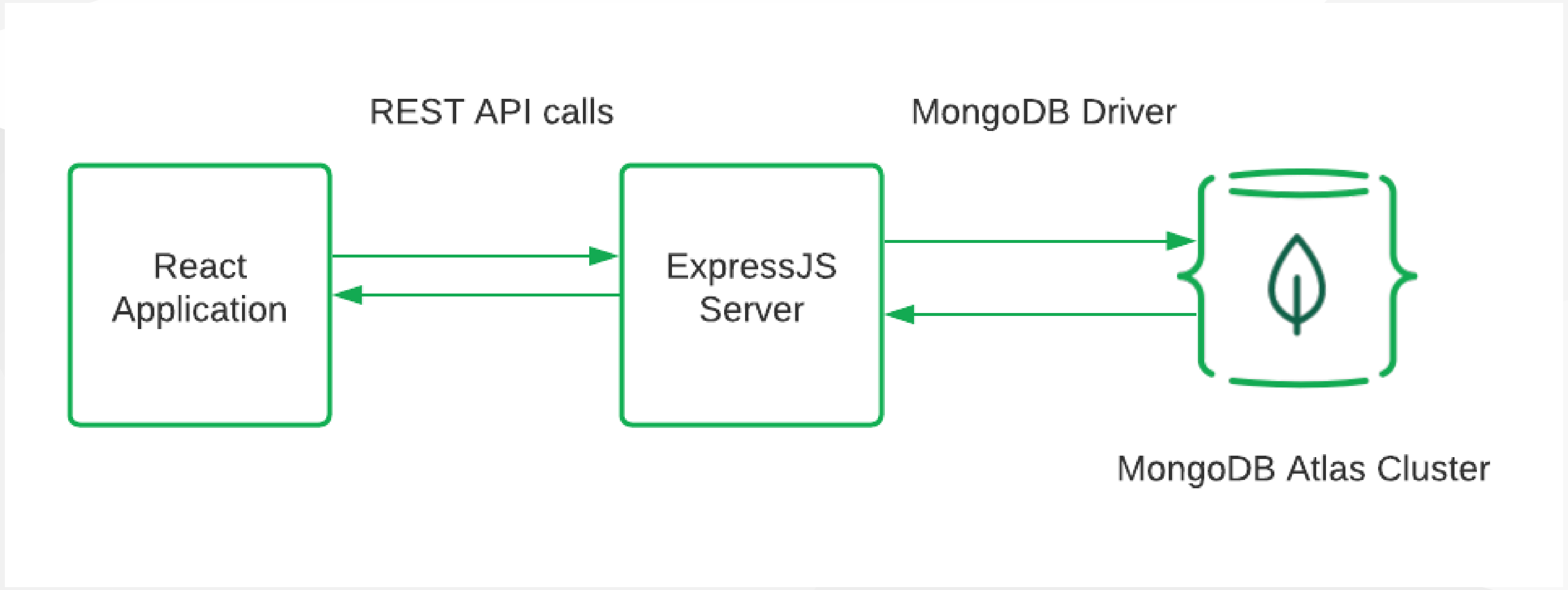
Project Architecture

Express allows us to create a back-end middle tier running Node.js server exposing REST API routes to our application.

The **Express.js** server also connects to the **MongoDB Atlas** cluster via the **Node.js** Driver.

The **front-end** application will be written in React to use the **API endpoints** hosted on the **Express.js** server.

Project Architecture



Step 1: Planning the API to implement

Our API User Stories

- I can create a new tea object and add it to the database
- I can get all the tea from the database
- I can delete all the tea in the database
- I can get a single tea by querying its name
- I can delete a single tea from the database

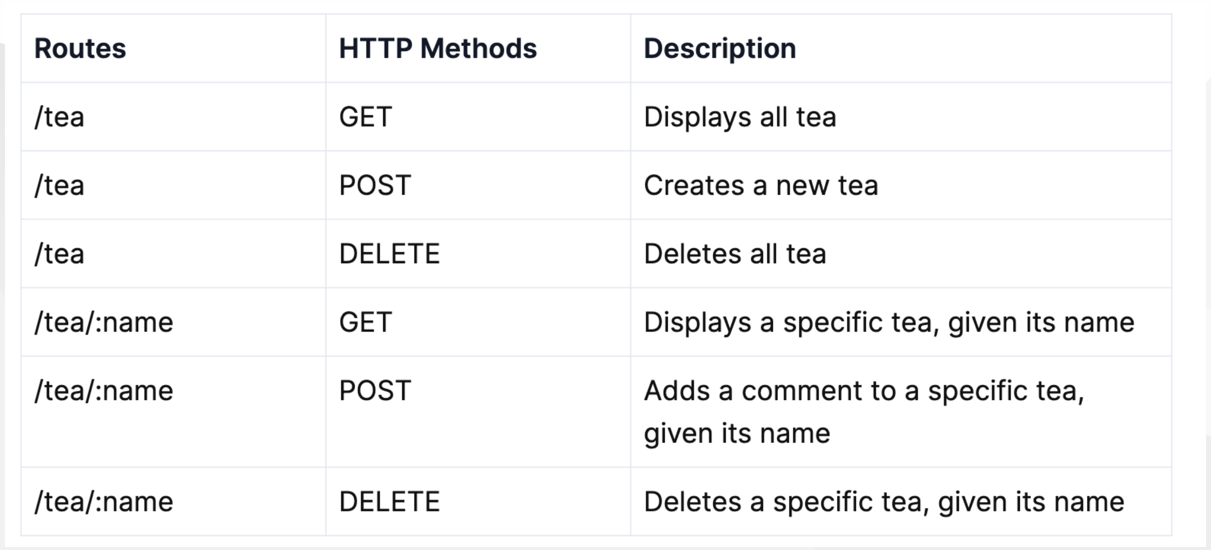
Our Tea Object

> Based on our user stories and how we want to use the API, we can draft a sample **tea object** that the API can return. This helps us to decide what properties to include in the object early in the stage of making this API. So, for our API, a tea object might look like:

```
{
    "name": "Jasmine Tea",
    "image": "an image file url",
    "description": "Jasmine tea is tea scented with the aroma of jasmine blossoms.",
    "keywords": "aromatic, china, sweet",
    "origin":"China",
    "brew time": 2,
    "temperature": 80,
    "comments": []
}
```

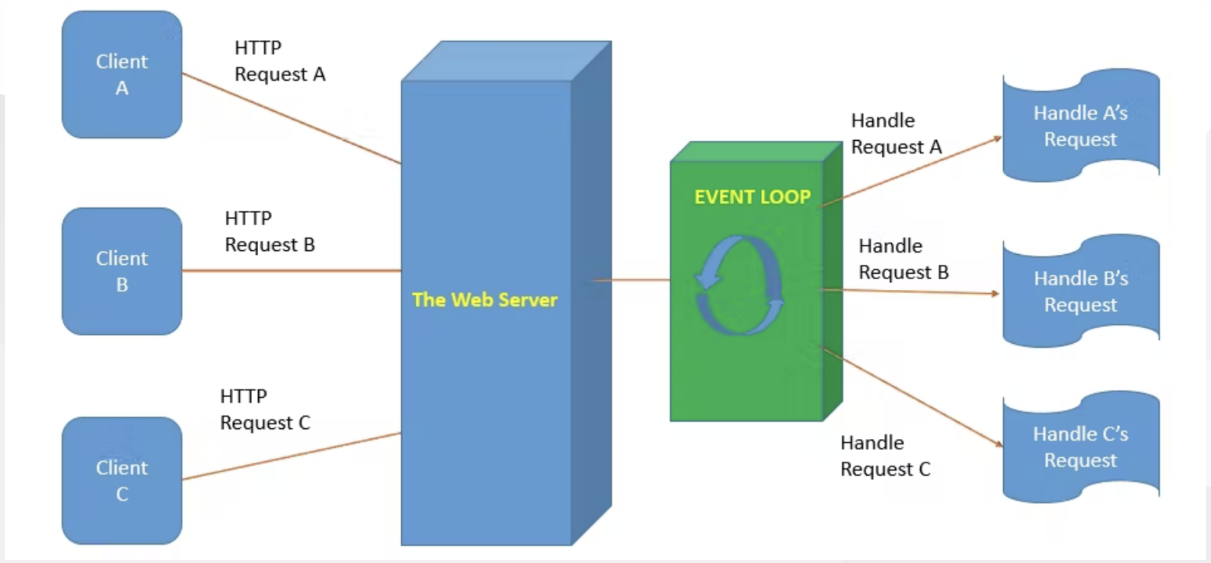
Step 2: Designing Structure for your API

> The way to design an API is to visualize its routes and request methods.



Routes	HTTP Methods	Description
/tea	GET	Displays all tea
/tea	POST	Creates a new tea
/tea	DELETE	Deletes all tea
/tea/:name	GET	Displays a specific tea, given its name
/tea/:name	POST	Adds a comment to a specific tea, given its name
/tea/:name	DELETE	Deletes a specific tea, given its name

> Node.js has a built-in HTTP module which it uses to make HTTP requests and transfer data from the server to the client. Here's a diagram illustrating how it works.



WebAPIs development with Express

How to develop a backend server exposing a REST APIs using Express.

Express

Express is a minimal and flexible Node.js web application framework that provides a robust set of features for web and mobile applications. (Source: https://expressjs.com/).

Let's rewrite our web server using *Express*:

```
const express=require('express');
const app=express();


app.get("/", function (req, res) {
  res.send(req.headers, req.originalUrl, req.method, req.body);
});

app.listen(3000, () =>
  console.log('Demo app listening on port 3000!'),
);
```

Routing with Express

There are a few interesting concepts that we can highlight in this trivial example:

- we can listen to specific http verbs (`app.get`)
- we can specify specific routes (`'/'`)

Route definition takes the following structure: `app.METHOD(PATH, HANDLER)`

> https://expressjs.com/en/starter/basic-routing.html

We can focus on the services that we want to implement, without worriying about the logic for handling the request (e.g., checking manually that the request method is GET, and that the request url is '/').

What are controllers?

> Controllers are typically **callback functions** that corresponds to the routers to handle requests. It is a good design principle to keep the code concise and readable.
> A sample route might look like:

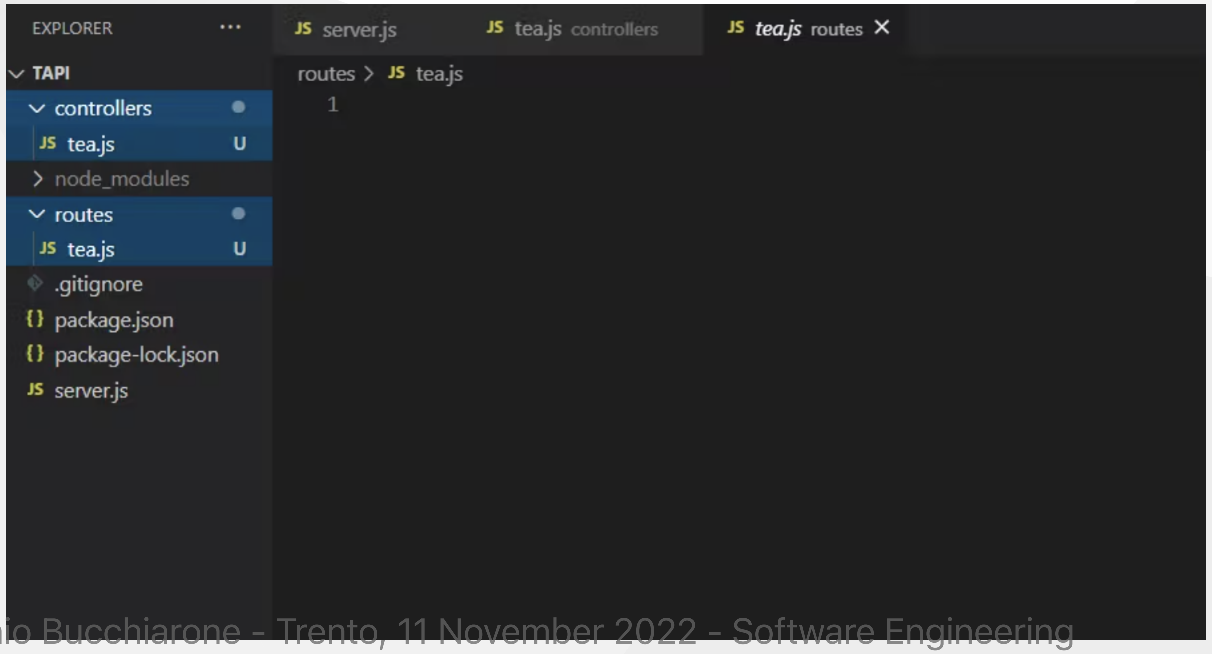
```
// Syntax
app.method('<path>', callbackFunction)

// Example
app.get("/", function (req, res) {
  res.json({message: "Hello world!"});
});
```

Step 1: Create folders and files

> In your project's root directory, create 2 folders and name them 'routes' and 'controllers'.

> Then, in each folder, create a 'tea.js' file for our tea route and tea controller.
> It is a convention to name the controller the same as the route which it is handling.

> Your directory should look like:



Step 2: The First Route and Controller

- Now, open your **routes/tea.js** file. We can create our first route as follows:

1. Create an express router object to set up our routes
2. Import our tea controller from our controllers/tea.js file we created earlier
3. Create our first route with the controller function as the callback to handle the request.
4. Export the route to use in our server.js

```
const express = require('express'); //import express

// 1.
const router  = express.Router();
// 2.
const teaController = require('../controllers/tea');
// 3.
router.post('/tea', teaController.newTea);
// 4.
module.exports = router; // export to use in server.js
```

> At this point, we have not yet created the newTea function but we'll do that right now.

- In controllers/tea.js:

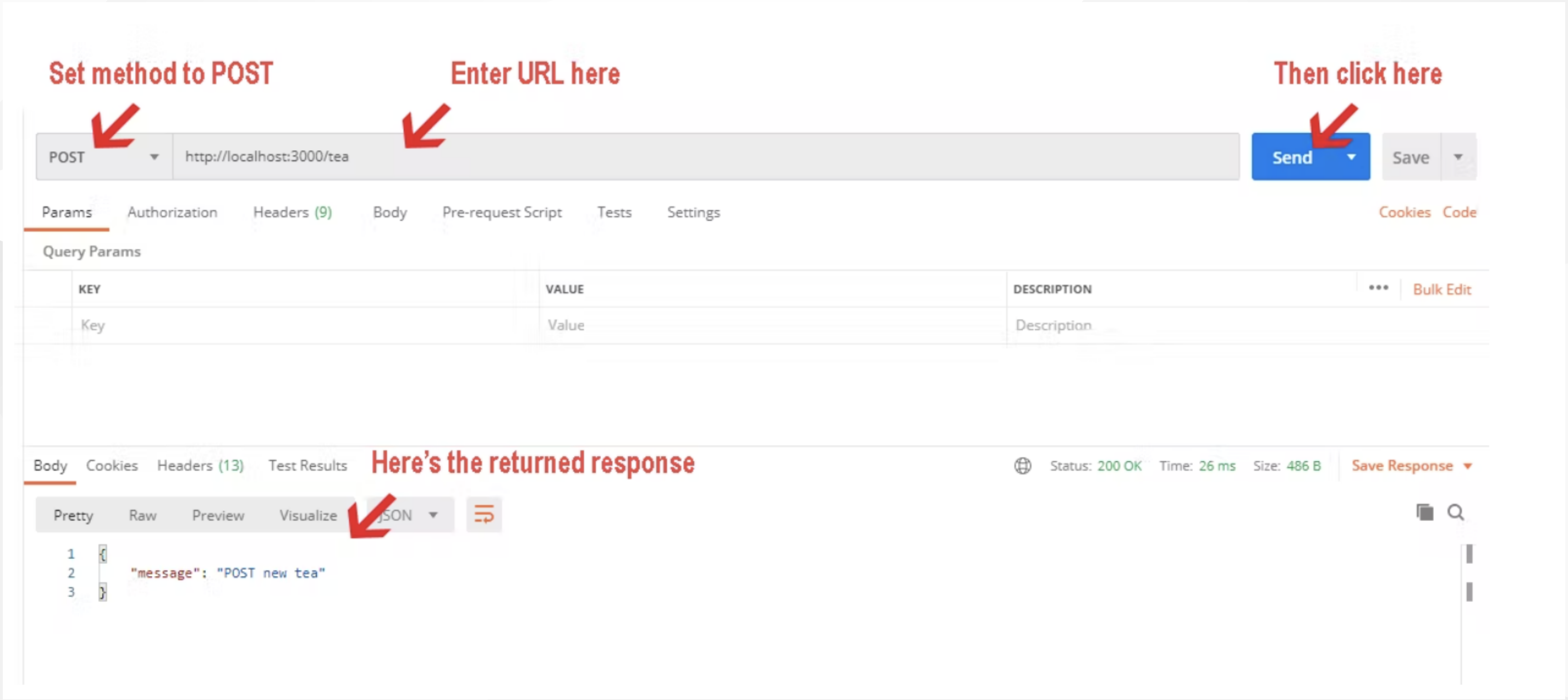
```
// newTea function for post tea route
const newTea = (req, res, next) => {
   res.json({message: "POST new tea"}); // dummy function for now
};

module.exports = {newTea};
```

> Now your first **route** and its **controller** is successfully created!
>
> Let's add the **routes** to the **server** so that it can access them.

- Our **server.js** is now updated with 2 lines:

```
const routes = require('./routes/tea'); //to import the routes/tea.js
app.use('/', routes); //to use them via express.
```

Using Postman to test the web server and APIs



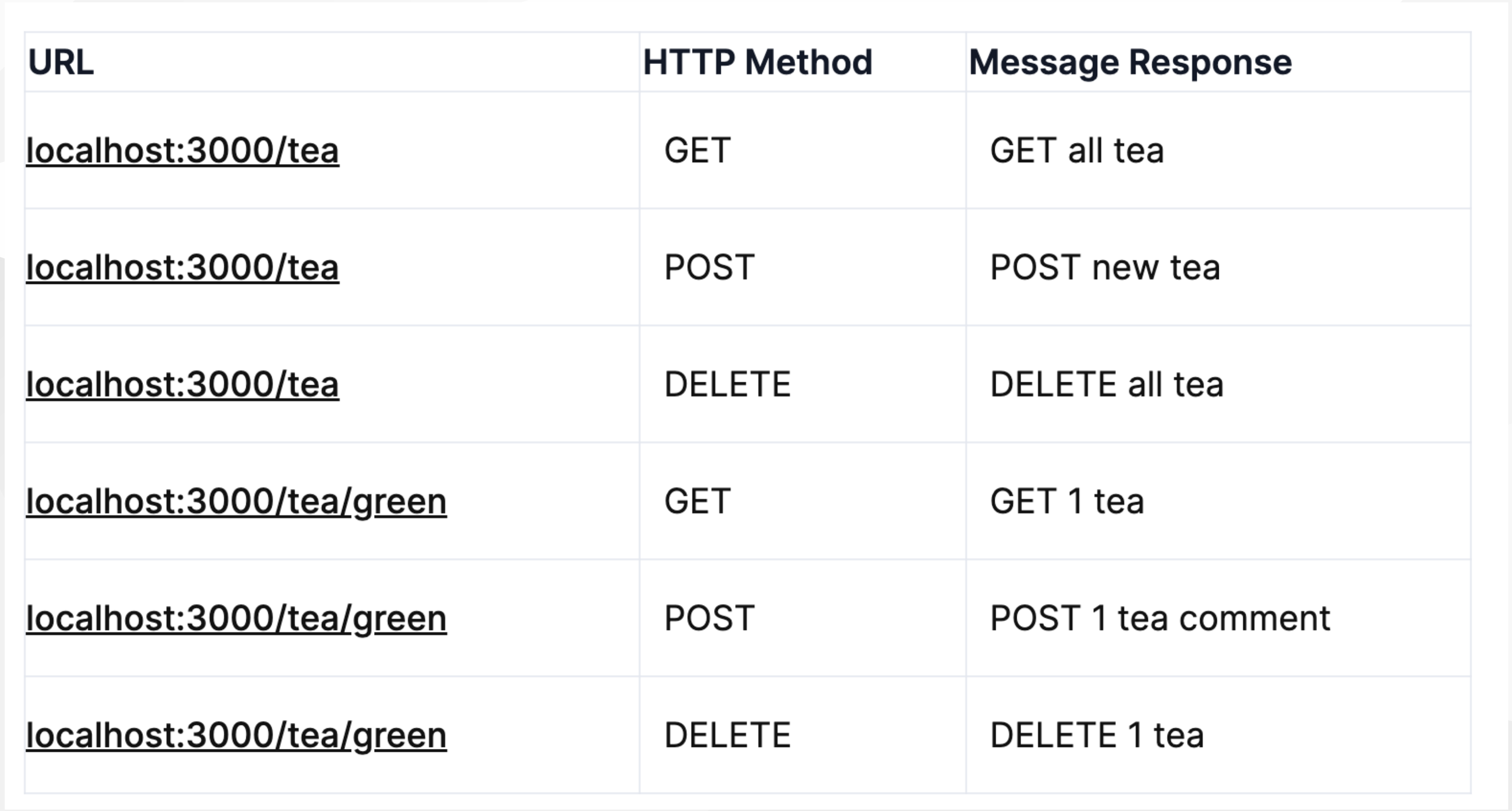
```
{
    "message": "POST new tea"
}
```

Create all routes and API endpoints

```
const express = require('express');
const router  = express.Router();
const teaController = require('../controllers/tea');

router.get('/tea', teaController.getAllTea);
router.post('/tea', teaController.newTea);
router.delete('/tea', teaController.deleteAllTea);

router.get('/tea/:name', teaController.getOneTea);
router.post('/tea/:name', teaController.newComment);
router.delete('/tea/:name', teaController.deleteOneTea);

module.exports = router;
```

```
//GET '/tea'
const getAllTea = (req, res, next) => {
    res.json({message: "GET all tea"});
};

//POST '/tea'
const newTea = (req, res, next) => {
    res.json({message: "POST new tea"});
};

//DELETE '/tea'
const deleteAllTea = (req, res, next) => {
    res.json({message: "DELETE all tea"});
};

//GET '/tea/:name'
const getOneTea = (req, res, next) => {
    res.json({message: "GET 1 tea"});
};

//POST '/tea/:name'
const newComment = (req, res, next) => {
    res.json({message: "POST 1 tea comment"});
};

//DELETE '/tea/:name'
const deleteOneTea = (req, res, next) => {
    res.json({message: "DELETE 1 tea"});
};

//export controller functions
module.exports = {
    getAllTea,
    newTea,
    deleteAllTea,
    getOneTea,
    newComment,
    deleteOneTea
};
```

APIs



URL	HTTP Method	Message Response
localhost:3000/tea	GET	GET all tea
localhost:3000/tea	POST	POST new tea
localhost:3000/tea	DELETE	DELETE all tea
localhost:3000/tea/green	GET	GET 1 tea
localhost:3000/tea/green	POST	POST 1 tea comment
localhost:3000/tea/green	DELETE	DELETE 1 tea

Connect API to MongoDB

```
npm install --save mongoose
```

- After installing mongoose, add the following to our **server.js** file:

```
 //import mongoose
const mongoose = require('mongoose');

//establish connection to database
mongoose.connect(
    'mongodb+srv://<username>:<password>@cluster0.eetsx.mongodb.net/<dbname>',
    { useNewUrlParser: true, useUnifiedTopology: true },
    (err) => {
        if (err) return console.log("Error: ", err);
        console.log("MongoDB Connection -- Ready state is:", mongoose.connection.readyState);
    }
);
```

For security reasons

- If you are adding this project to a **public repository**, it is best that no one can see the MongoDB URI since we have included our password, a sensitive information, in it.
- we can create an **.env file** in our root directory and write our URI inside

```
MONGODB_URI='mongodb+srv://<username>:<password>@cluster0.eetsx.mongodb.net/tea'
```

> Back to **server.js**, replace the uri inside **mongoose.connect()** with **process.env.MONGODB_URI** so we can hide this sensitive information.

```
mongoose.connect(
   process.env.MONGODB_URI,
   { useNewUrlParser: true, useUnifiedTopology: true },
   (err) => {
       if (err) return console.log("Error: ", err);
       console.log("MongoDB Connection -- Ready state is:", mongoose.connection.readyState);
   }
);
```

Create the Tea Model

- First, create a **'models'** folder.
- Then, create a **tea.js** file inside the folder.
- This is where our **tea model** will be.
- Now, let's create a new **schema** inside our models/tea.js file.
- Then **export the module** to use in our tea controller.

```
// A sample tea object
{
    "name": "Jasmine Tea",
    "image": "an image file url",
    "description": "Jasmine tea is tea scented with the aroma of jasmine blossoms.",
    "keywords": "aromatic, china, sweet",
    "origin":"China",
    "brew_time": 2,
    "temperature": 80,
    "comments": ["text": "I am a comment", "date": Date String]
}
```

```
//Syntax
property: {type: SchemaType (i.e. String, Date, Number),
                  other options (i.e. default, required)}

//Examples
name: {type: String, required: true}
description: String   //short for {type: String}
```

Here's our tea schema (in models/tea.js):

```
const mongoose = require("mongoose"); //import mongoose

// tea schema
const TeaSchema = new mongoose.Schema({
    name: {type:String, required:true},
    image: String,
    description: String,
    keywords: String,
    origin: String,
    brew_time: Number,
    temperature: Number,
    comments: [{ text: String, date: {type:String, default: new Date()} }]
});

const Tea = mongoose.model('Tea', TeaSchema); //convert to model named Tea
module.exports = Tea; //export for controller use
```

> Let's import our **tea model** we created into the **controllers/tea.js**

```
//import tea model
const Tea = require('../models/tea');
```

newTea API

- In this function, we will create a **new tea object** by supplying its key-value pairs to **req.body** and then save it to the database.
- First, we need to be able to parse **form data** with our Express server. We can install the **multer package** with:

```
npm install --save multer
```

- Import multer to our routes/tea.js file:

```
const multer = require('multer');
const upload = multer();
```

- Add **upload.none()** in the route. This enables our newTea function to read our form data.

```
router.post("/tea", upload.none(), teaController.newTea);
```

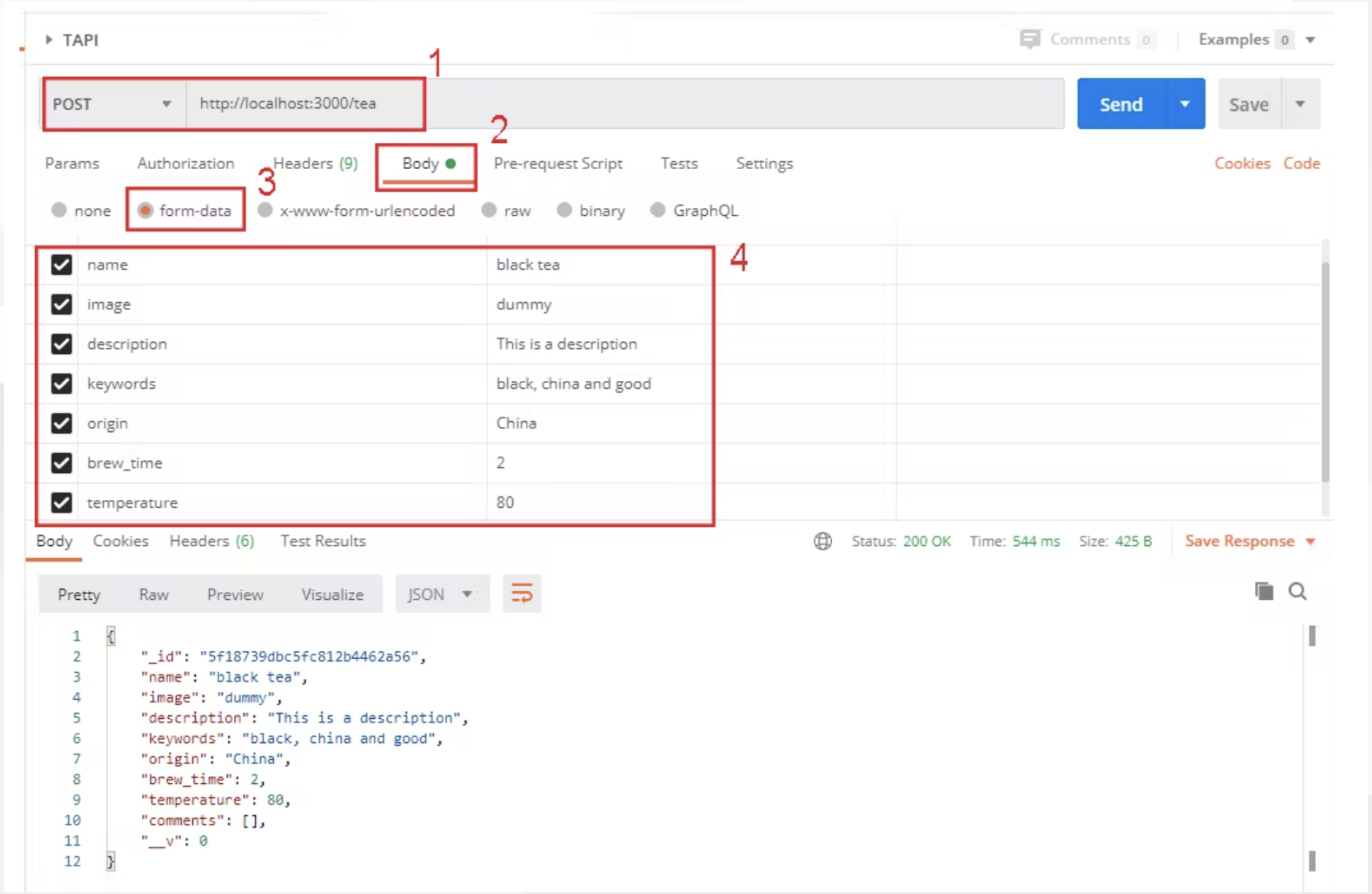
- Then, we must make sure we don't accidentally POST a tea with an identical name.
- So our newTea function should check if the new tea's name from **req.body.name** has already exists in the database.
- If it does, don't add this tea.
- If it doesn't, then create a new tea object with the key-value pairs from the **req.body**.
- **Save** the new tea object to the database.
    - To check whether a tea name already exists in the database, we can use a mongoose query method called **findOne()**, which returns one object from the database that matches the condition supplied.

- In **controllers/tea.js**:

```
//POST tea
const newTea = (req, res) => {
    //check if the tea name already exists in db
    Tea.findOne({ name: req.body.name }, (err, data) => {

        //if tea not in db, add it
        if (!data) {
            //create a new tea object using the Tea model and req.body
            const newTea = new Tea({
                name:req.body.name,
                image: req.body.image, // placeholder for now
                description: req.body.description,
                keywords: req.body.keywords,
                origin: req.body.origin,
                brew_time: req.body.brew_time,
                temperature: req.body.temperature,
            })

            // save this object to database
            newTea.save((err, data)=>{
                if(err) return res.json({Error: err});
                return res.json(data);
            })
        //if there's an error or the tea is in db, return a message
        }else{
            if(err) return res.json(`Something went wrong, please try again. ${err}`);
            return res.json({message:"Tea already exists"});
        }
    })
};
```

Testing on POSTman

1. Make sure the method is set to POST and the url is correct.
2. Click on the 'Body' tab to access the req.body.
3. Click on the form data radio button below.
4. Supply some test key-value pairs for the req.body.



POST http://localhost:3000/tea

Body: form-data

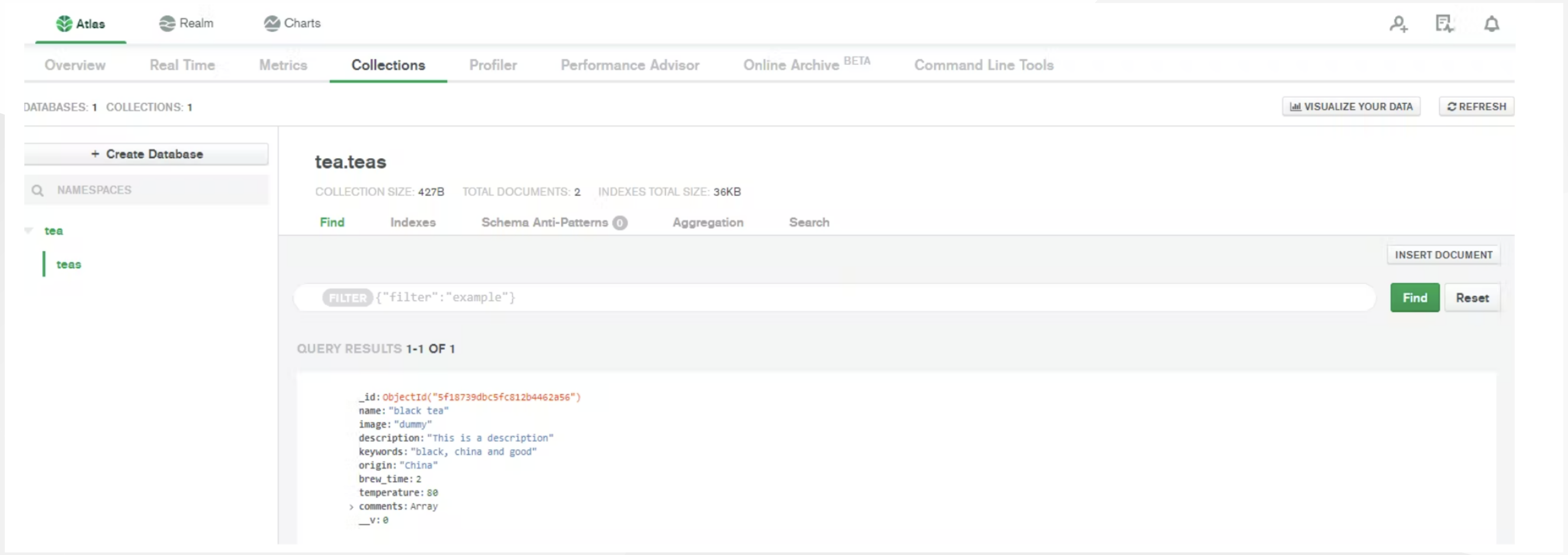
name	black tea
image	dummy
description	This is a description
keywords	black, china and good
origin	China
brew_time	2
temperature	80

Status: 200 OK Time: 544 ms Size: 425 B

```
{
    "_id": "5f18739dbc5fc812b4462a56",
    "name": "black tea",
    "image": "dummy",
    "description": "This is a description",
    "keywords": "black, china and good",
    "origin": "China",
    "brew_time": 2,
    "temperature": 80,
    "comments": [],
    "__v": 0
}
```

POSTman returns with the data we posted which means our **newTea** function is working.

If you check in **MongoDB**, you will see that it is indeed in our database.



tea.teas

COLLECTION SIZE: 427B TOTAL DOCUMENTS: 2 INDEXES TOTAL SIZE: 36KB

```
{"filter":"example"}
```

QUERY RESULTS 1-1 OF 1

```
  _id: ObjectId("5f18739dbc5fc812b4462a56")
  name: "black tea"
  image: "dummy"
  description: "This is a description"
  keywords: "black, china and good"
  origin: "China"
  brew_time: 2
  temperature: 80
> comments: Array
  __v: 0
```

getAllTea API

> To get all tea, our function will retrieve and return all the data from our database using the mongoose built-in find() method.
> We supply {} as the matching condition so that the all data will be returned.

```
//GET all teas
const getAllTea = (req, res) => {
    Tea.find({}, (err, data)=>{
        if (err){
            return res.json({Error: err});
        }
        return res.json(data);
    })
};
```

deleteAllTea API

> This function will delete all data in the database.
> We can simply do this with **deleteMany()** and supply the condition parameter with {} since we are deleting everything unconditionally.

```
//DELETE teas
const deleteAllTea = (req, res) => {
    Tea.deleteMany({}, err => {
        if(err) {
          return res.json({message: "Complete delete failed"});
        }
        return res.json({message: "Complete delete successful"});
    })
};
```

getOneTea API

> This function will retrieve and **return only one tea**, given its **name** as the matched condition.
> We can use **findOne()** for this.
> the server will retrieve the tea object with the name from req.params.name.

```
const getOneTea = (req, res) => {
    let name = req.params.name; //get the tea name

    //find the specific tea with that name
    Tea.findOne({name:name}, (err, data) => {
    if(err || !data) {
        return res.json({message: "Tea doesn't exist."});
    }
    else return res.json(data); //return the tea object if found
    });
};
```

Questions?

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