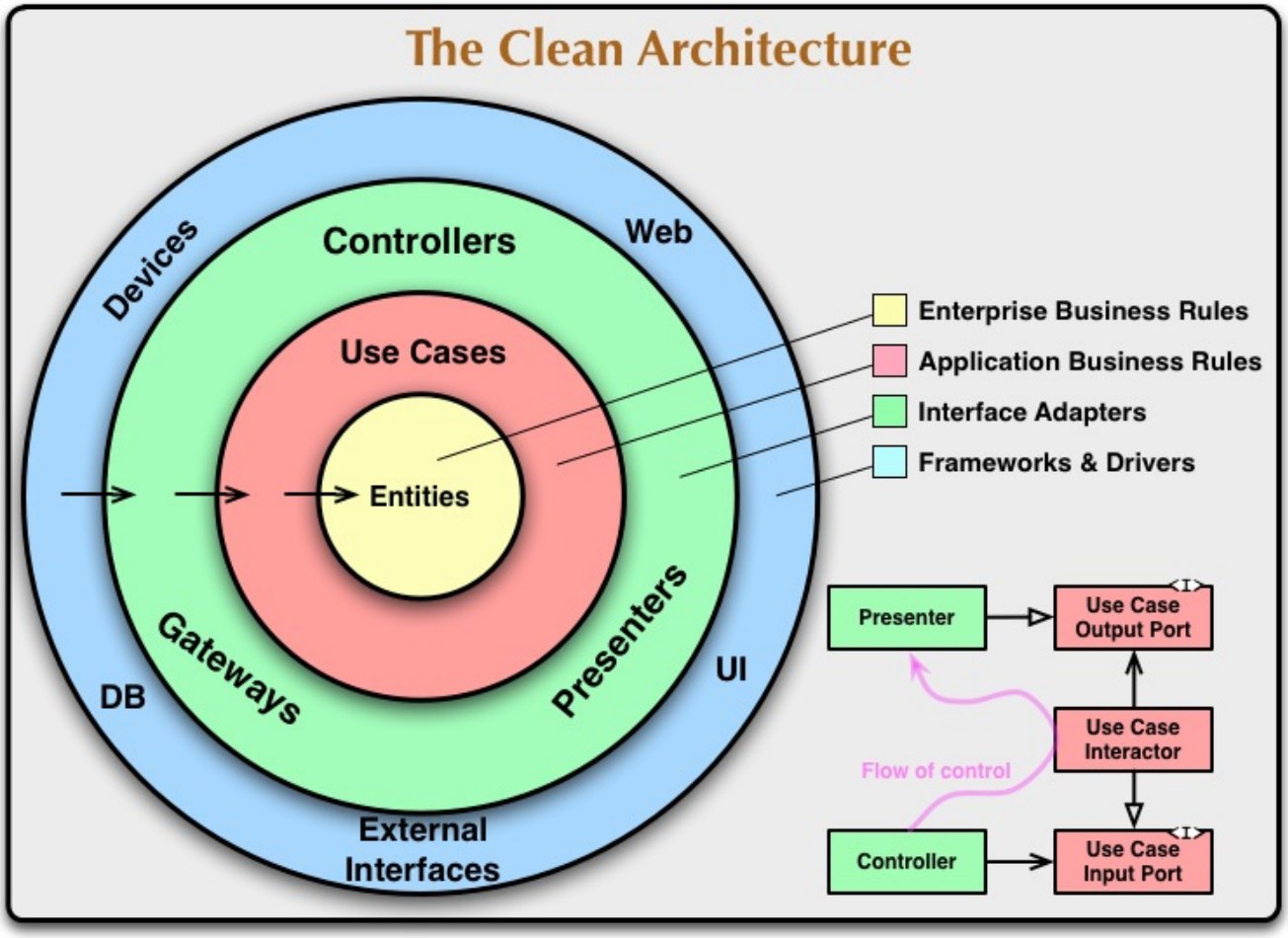
CS3219 Task B: CRUD Application Task

Name: Koh Vinleon
Matric Number: A0202155W
GitHub Link: https://github.com/glatiuden/CS3219-OTOT-TaskB

Task B1: Implementing Backend

This is an attempt in building a (semi) Clean Architecture Node.js backend.

Clean Architecture



Read more at Clean Coder Blog

Layer description:

- Entities: Contain enterprise business model/object
- Use Cases: Contain application business rules/logic
- Interface Adapter: Contains a set of adapters that convert data from entities/use-case layer to external dependencies such as DB or Web/HTTP
- Frameworks/Driver: Compose of frameworks and tools (DB, Web Frameworks)

References

- Using Clean Architecture for Microservice APIs in Node.js with MongoDB and Express
- Rules for clean code
- Node clean code architecture
- Application layer - use-cases
- Domain-driven Design articles
- Screaming architecture
- What is screaming architecture
- Clean architecture use-case structure
- Denormalize data
- Mongoose Database
- Expression documentation on API
- Bodyparser
- Winston-express for HTTP logging
- Winston for error logging
- Regex route express

Set Up

Database Used: Atlas MongoDB
Libraries Used: Winston, Nodemon, Mongoose and Lodash
Please ensure you are in the `/backend` folder (`cd backend`).

Please create a `.env` file in the backend directory with the following credentials.

```
MONGO_USERNAME="admin"
MONGO_PASSWORD="3YHYkUdqNUMykugo"
MONGO_DB="cs3219-otot-task-b"
```

Install the necessary modules

```
npm install
```

Start the server

```
npm run dev
```

Design

- All the endpoints are structured in this format `{URL}/api/{COLLECTION_NAME}`.

Note API

Method	Route	Description
POST	/api/note	Create a new note
GET	/api/note	Get all notes
GET	/api/note/:note_id	Get note by ID
PUT	/api/note	Update a note
DELETE	/api/note/:note_id	Soft delete a note
DELETE	/api/note/hard-delete/:note_id	Hard delete a note

- The results returned by the API must be `data`.
- For `GET`, there are two variants: one will get a specific record by `ID` while the other will get all the records from the database.
- For `DELETE`, there are two variants: one will perform a soft delete while the another will perform a hard delete.

Error Resiliency

- The controllers which require parameters use a validator middleware to ensure the required parameters are in place. If there are missing parameters or invalid data, the response (error) code is `422`.
- If there is an error encountered during the execution of a query, such as a record not found or an internal error, the response (error) code will be `404`.

Endpoint

- Localhost: http://localhost:5000
- Deployed Endpoint: https://asia-southeast1-cs3219-otot-task-b-325509.cloudfunctions.net/cs3219-otot-task-b-dev-app

▶ Run in Postman

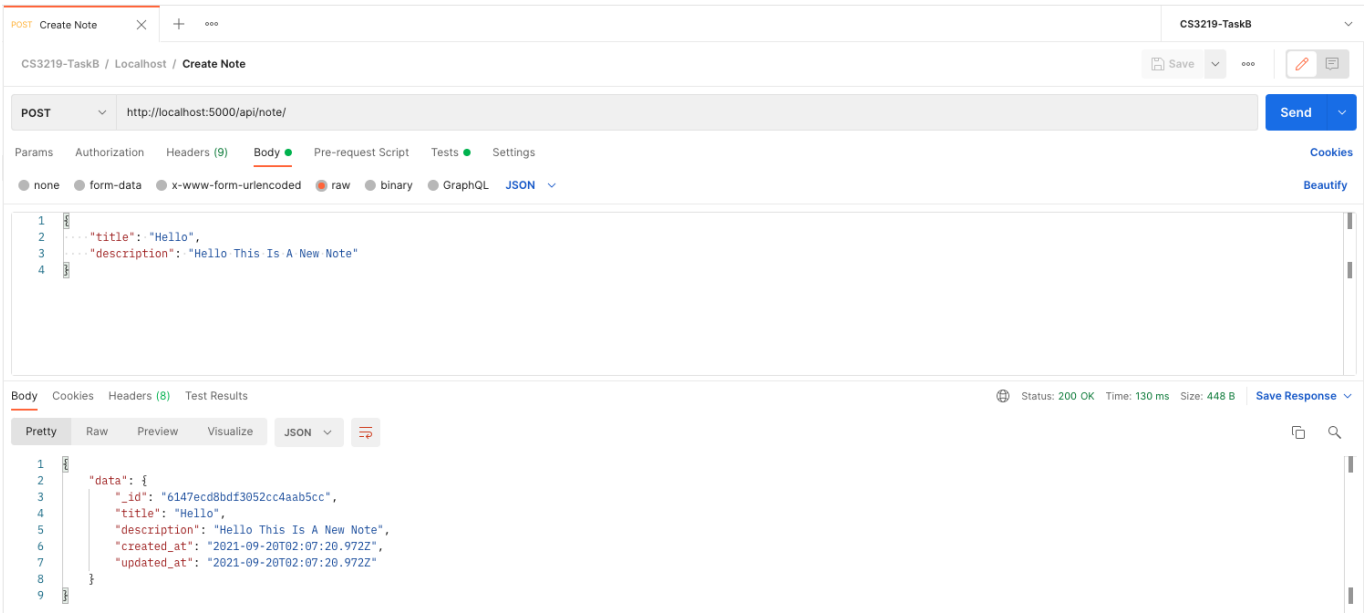
Alternatively, you may want to import it to your workspace via the JSON link or download the Postman JSON file in the Github Directory.

Demonstration

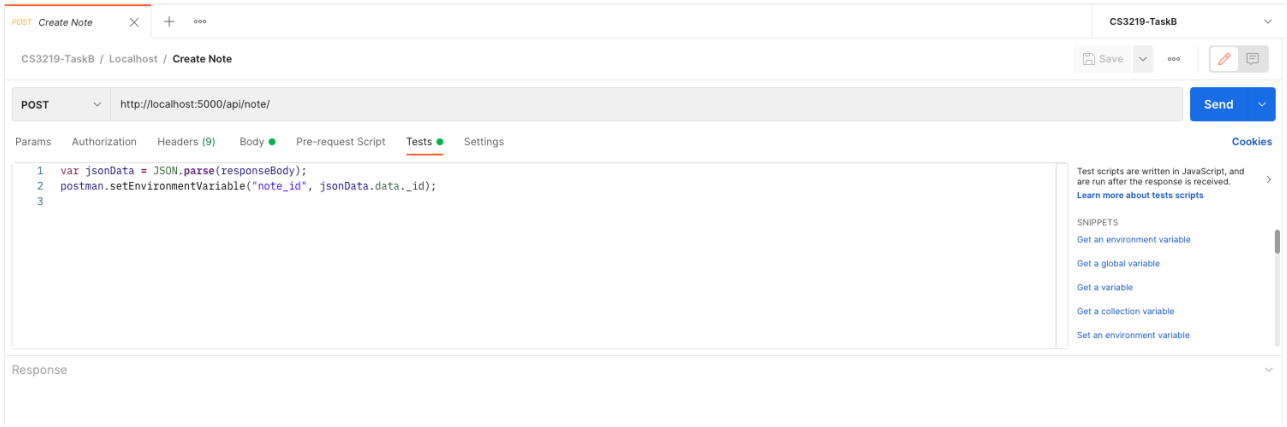
POST (CREATE)

- Method: `POST`
- Route: `/api/note`
- Description: Create new note
- Data Required (JSON): `title` (required), `description` (required)

Success (200)

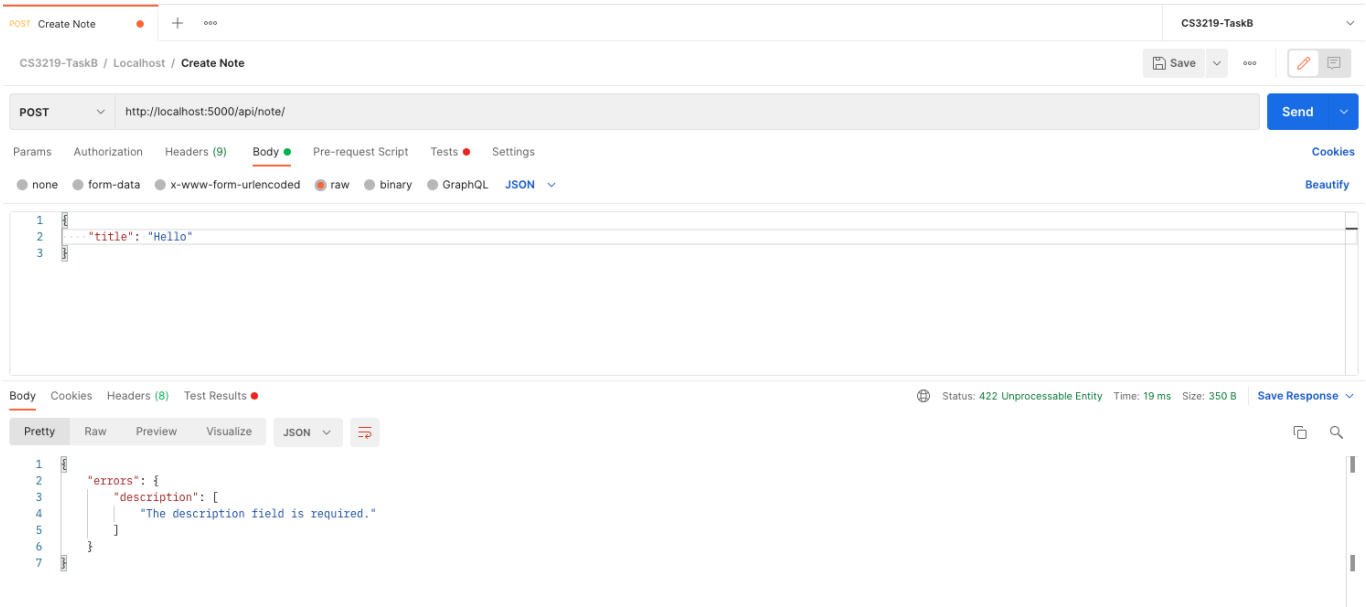


- For ease of demonstration and testing, the `note_id` returned in the body will be saved as a variable in Postman's local environment to be used in the subsequent requests.



Error (422)

- Occurs due to missing data fields.

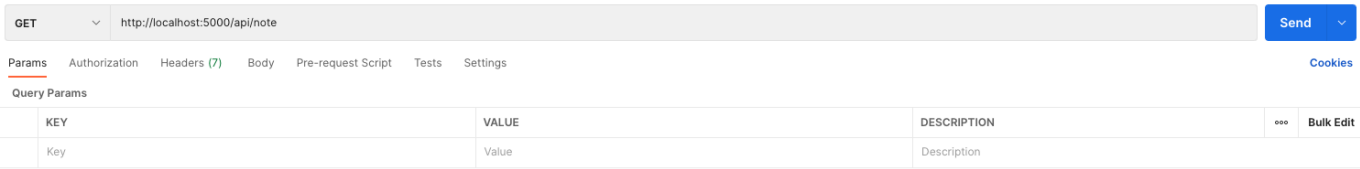


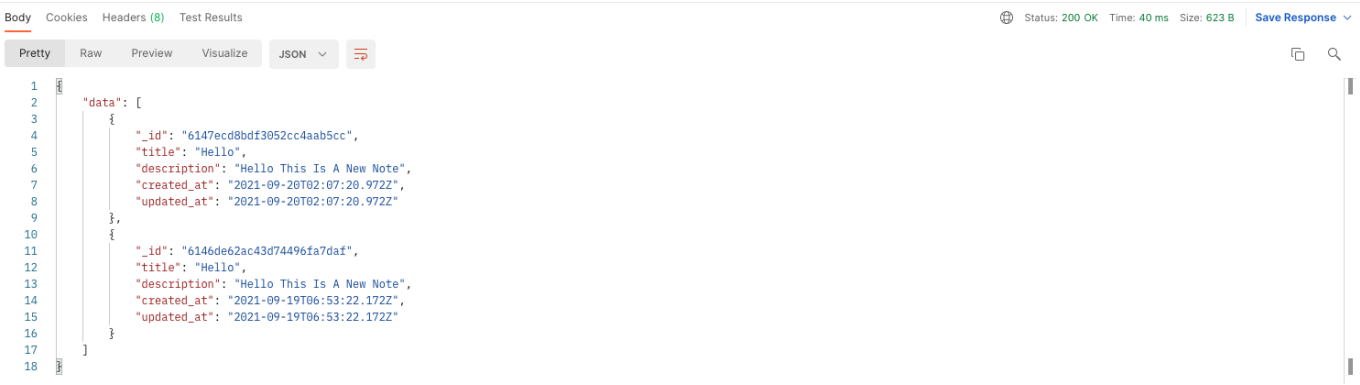
- Optimally, there can be an additional Error `404` if a note with the same `title` and `description` already exists in the database. However, this is omitted as it does not fit the context of a "note" application and for ease of testing.

GET (Retrieve)

- Method: `GET`
- Route: `/api/note`
- Description: Get all notes

Success (200)



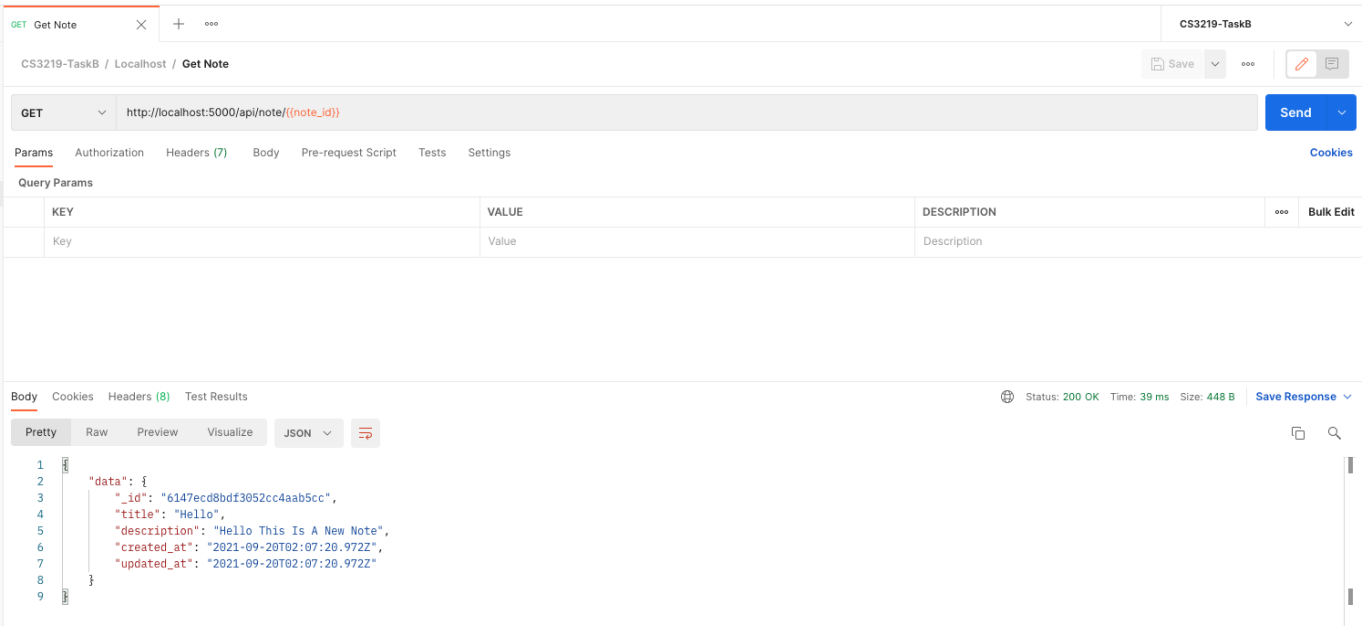


- Optimally, it can be an additional Error `204` (no content) if no notes are in the collections. I believe it's a debate between 204 and returning 200 with an empty array.
- For this task, I have chosen to follow 200 with an empty array.

GET (Retrieve By ID)

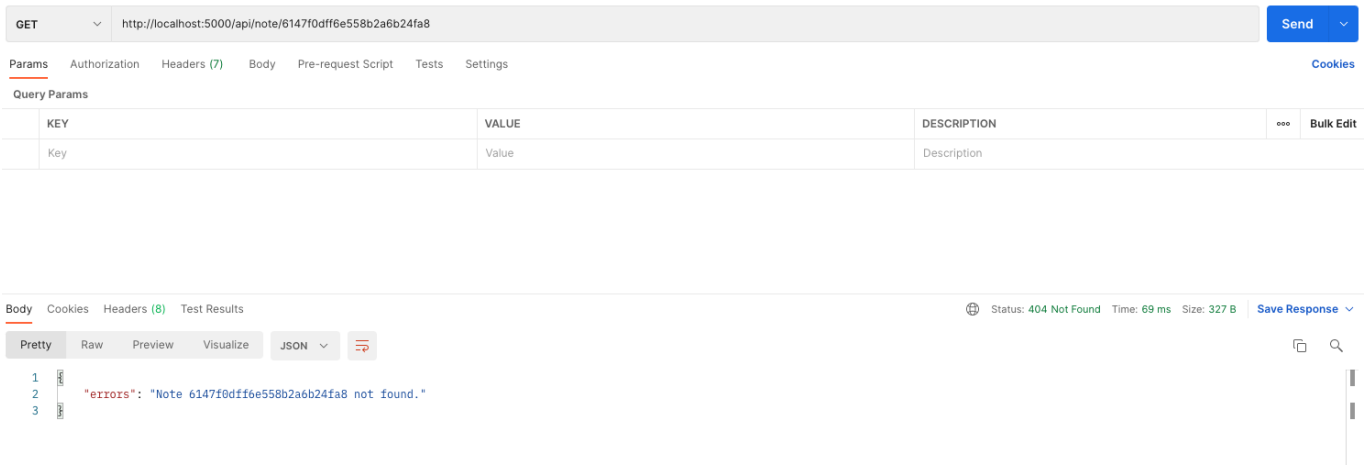
- Method: `GET`
- Route: `/api/note/:note_id`
- Description: Get all notes

Success (200)



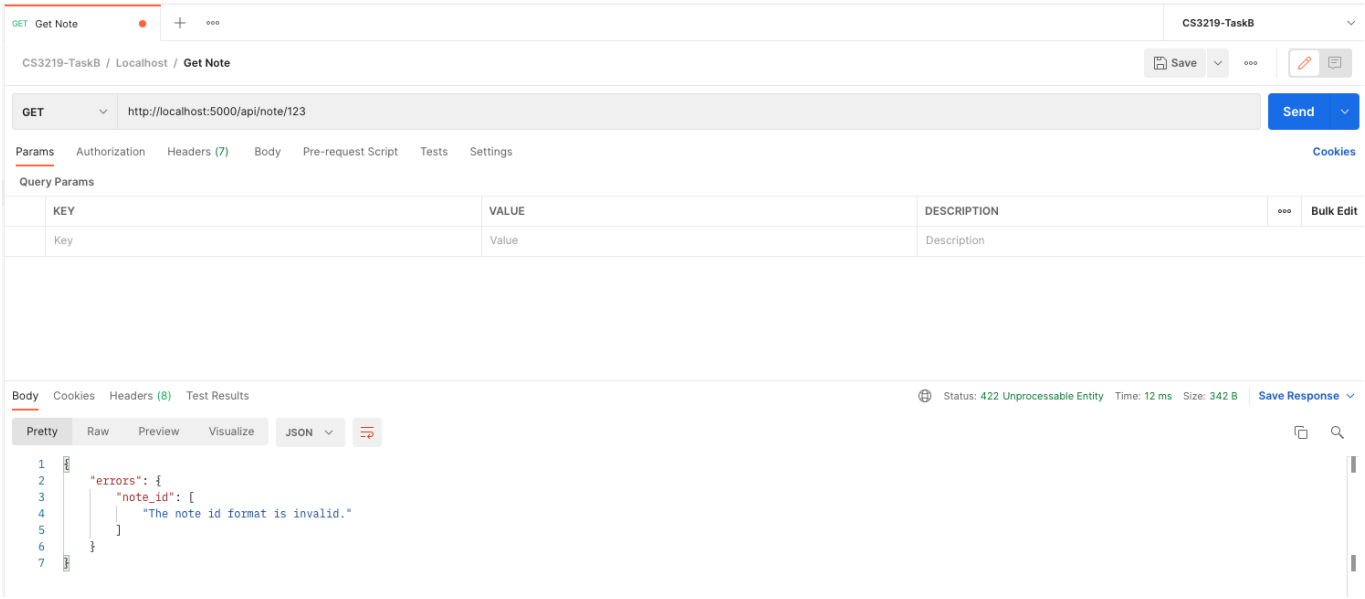
Error (404)

- Valid parameter present but data is not found in the database



Error (422)

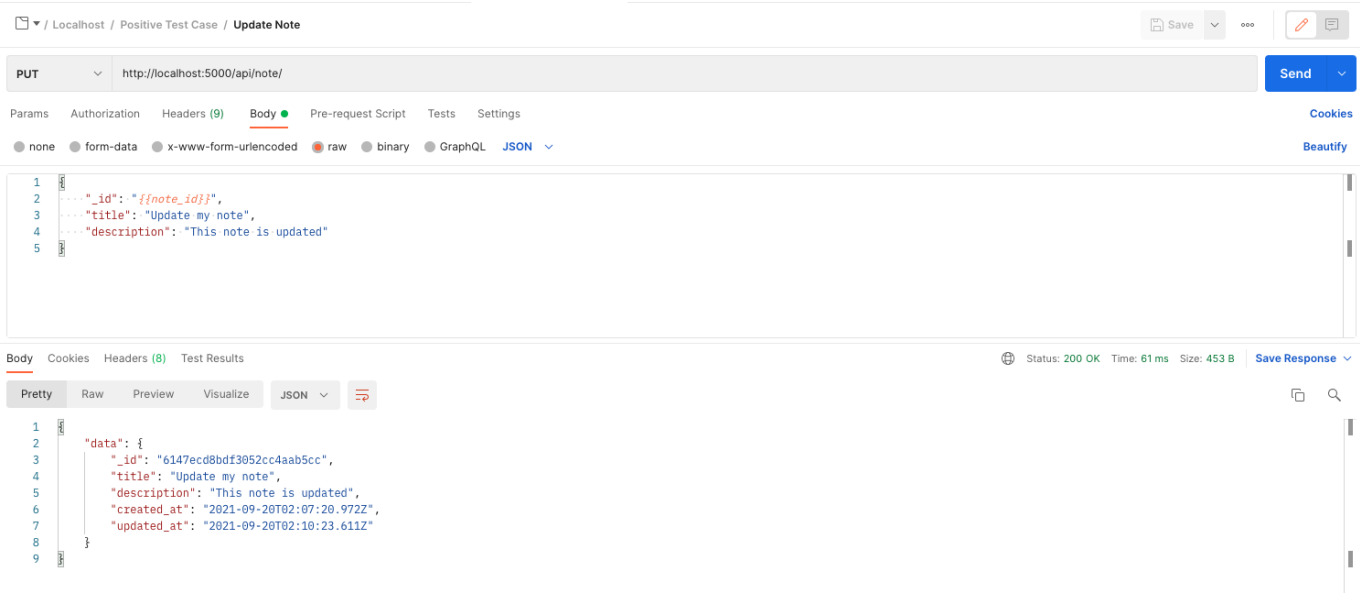
- Caused by invalid parameter (In this scenario, the `note_id` is not a valid ObjectId).



PUT (Update)

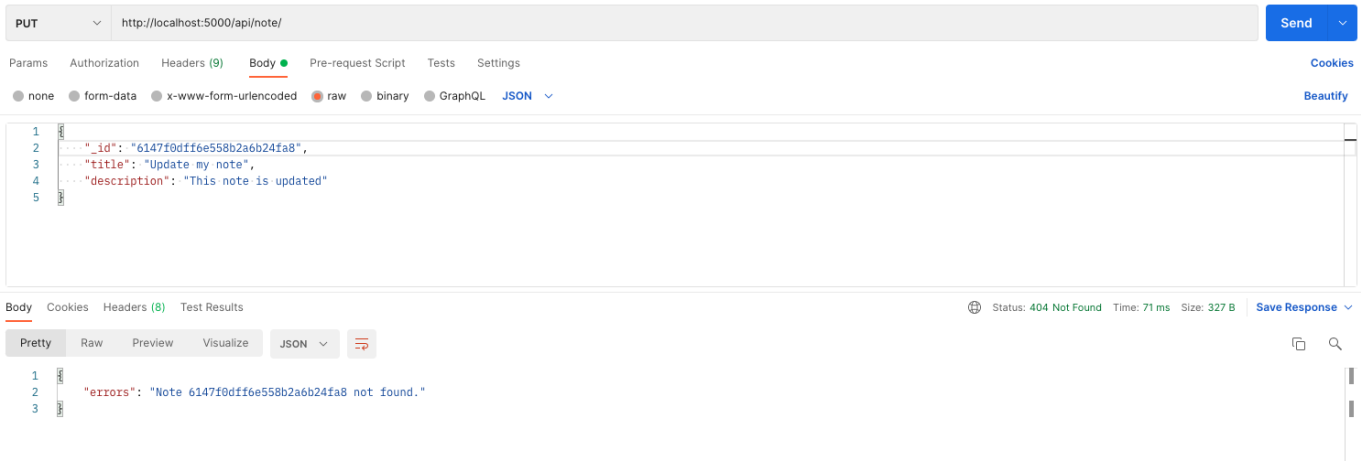
- Method: PUT
- Route: `/api/note/`
- Description: (Partial) Update existing note
- Data Required (JSON): `_id` (required), `title` (optional), `description` (optional)

Success (200)



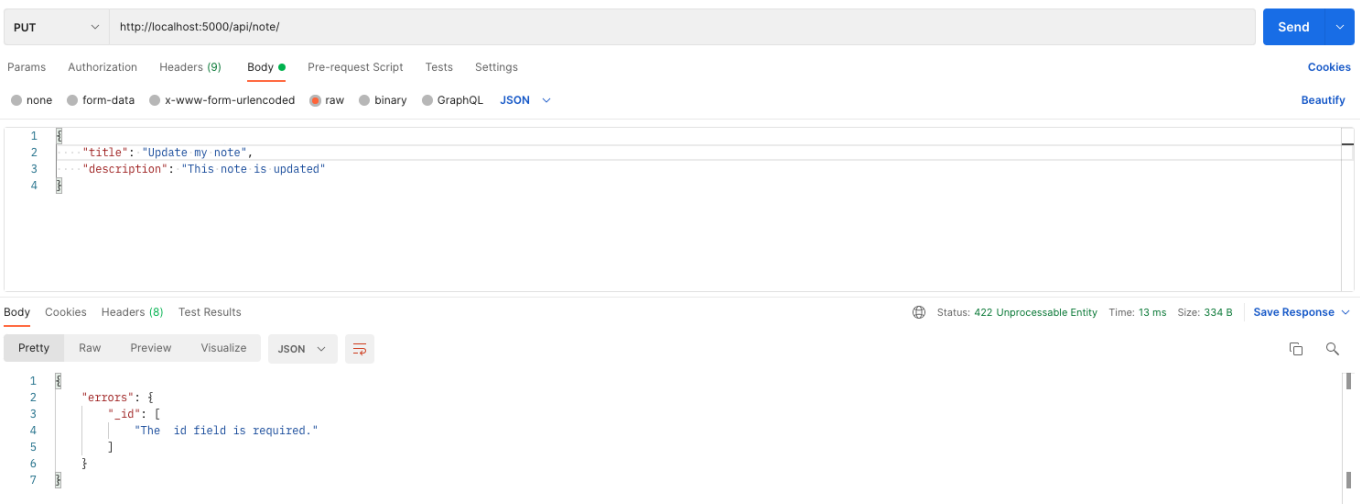
Error (404)

- Valid parameter present but data is not found in the database



Error (422)

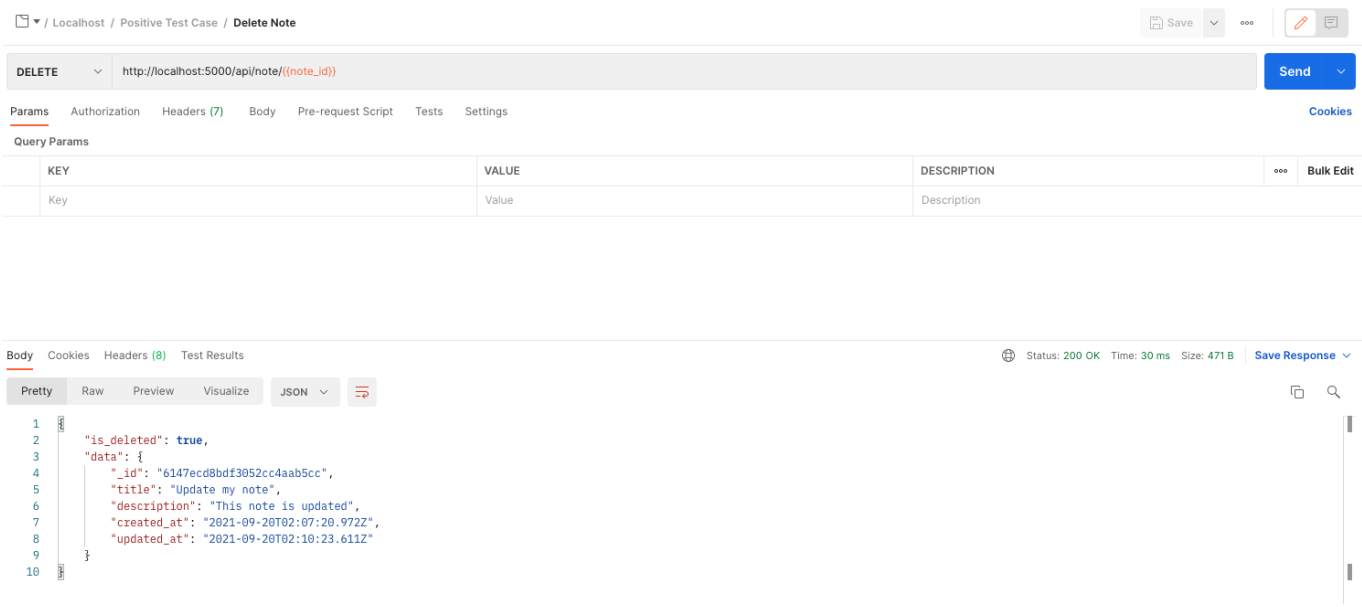
- The data field `_id` is missing
- As we are updating a note, `_id` is required to know which record to update.



Delete (Soft Delete)

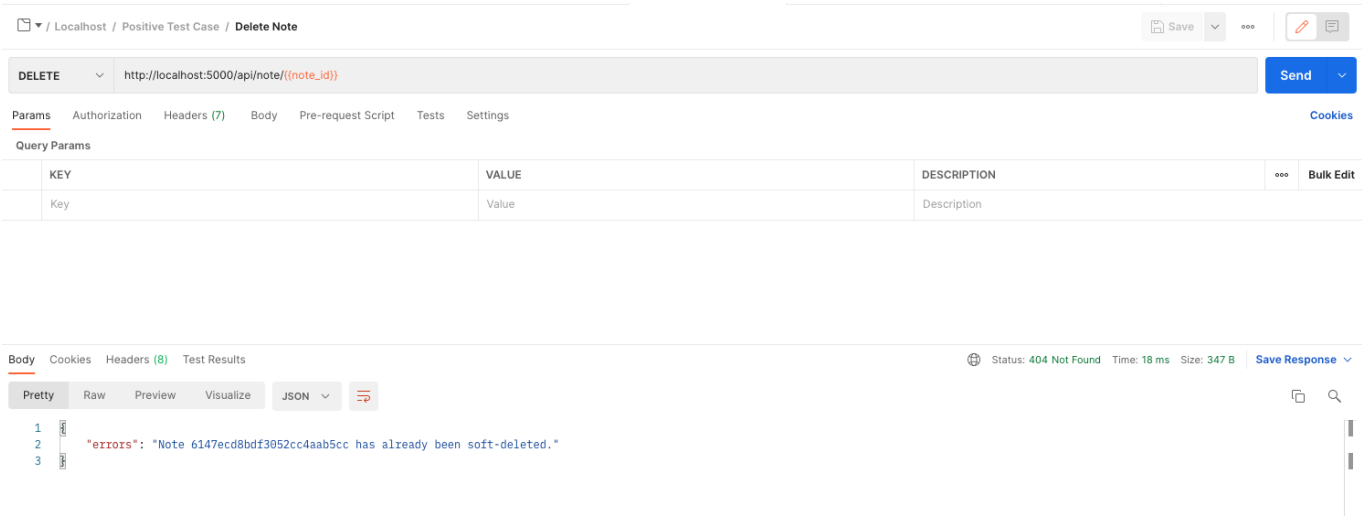
- Method: `DELETE`
- Route: `/api/note/:note_id`
- Description: Soft-delete an existing note

Success (200)

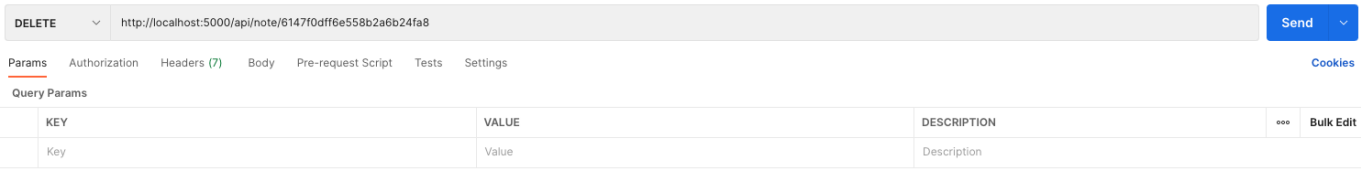


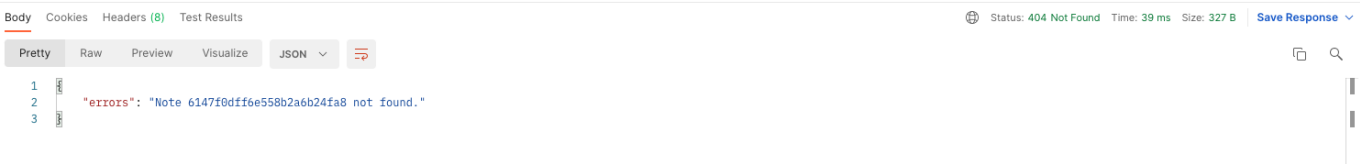
Error (404)

- Valid parameter but data has already been soft-deleted



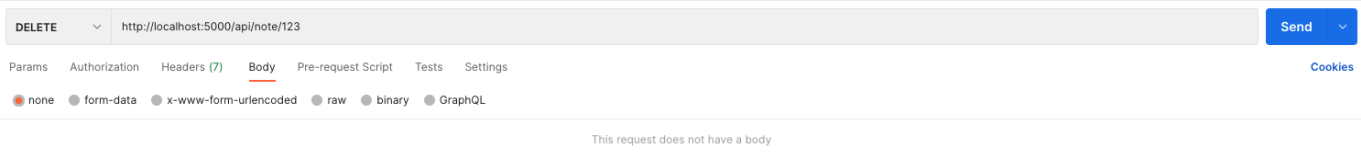
- Valid parameter present but data is not found in the database





Error (422)

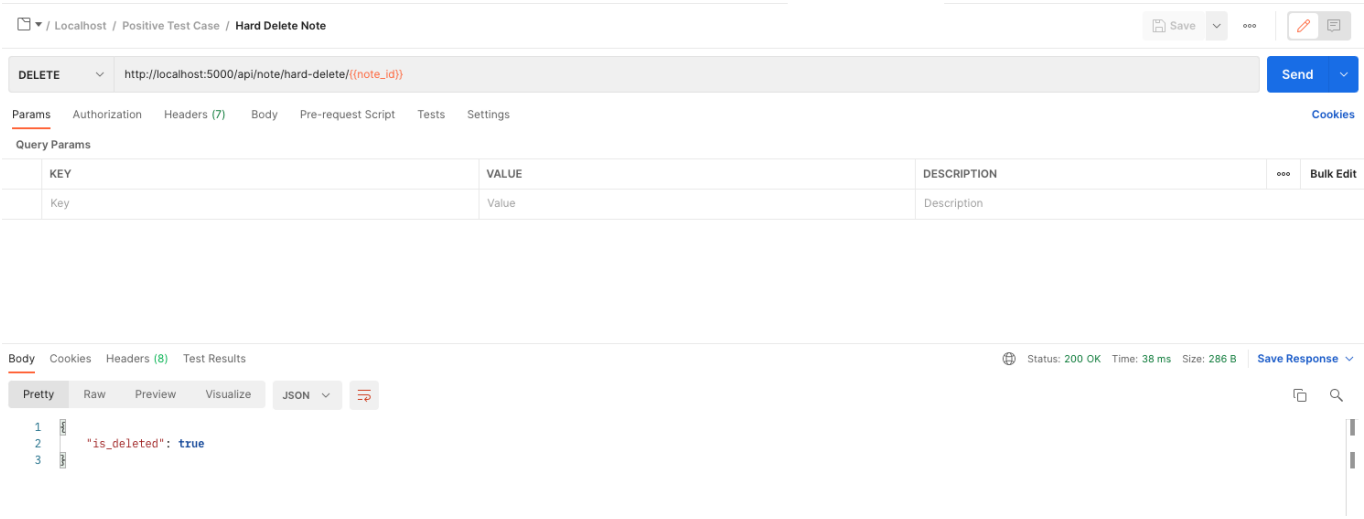
- Caused by invalid parameter (In this scenario, the `note_id` is not a valid ObjectId).
- As we are soft deleting a note, `_id` is required to know which record to soft delete.



Delete (Hard Delete)

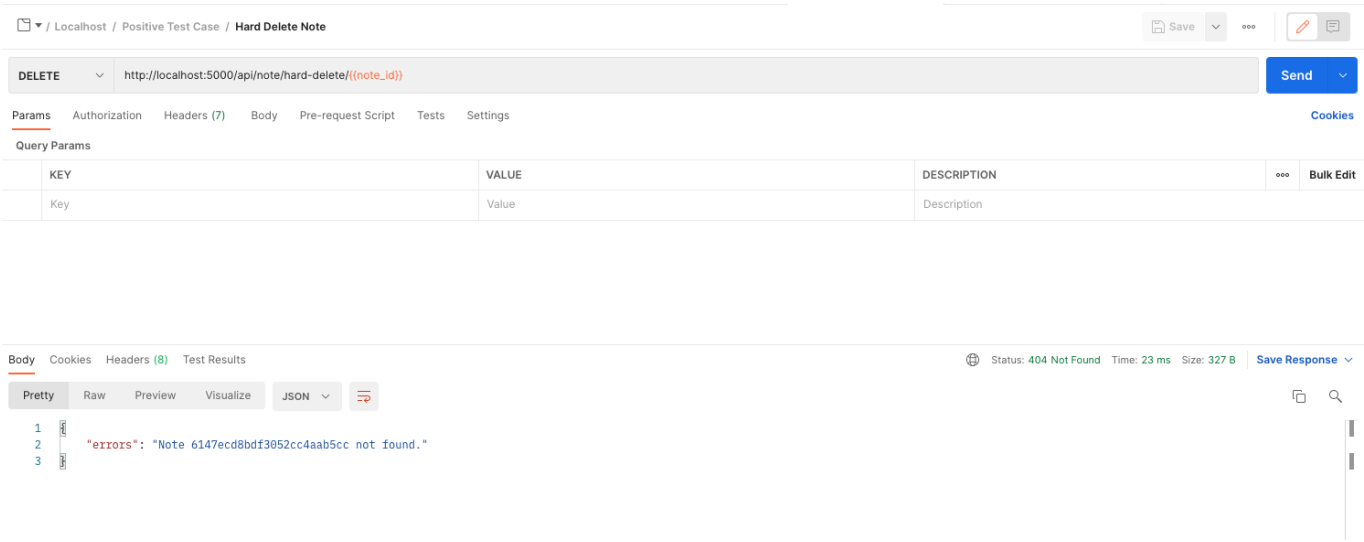
- Method: `DELETE`
- Route: `/api/note/hard-delete/:note_id`
- Description: Hard-delete an existing note

Success (200)



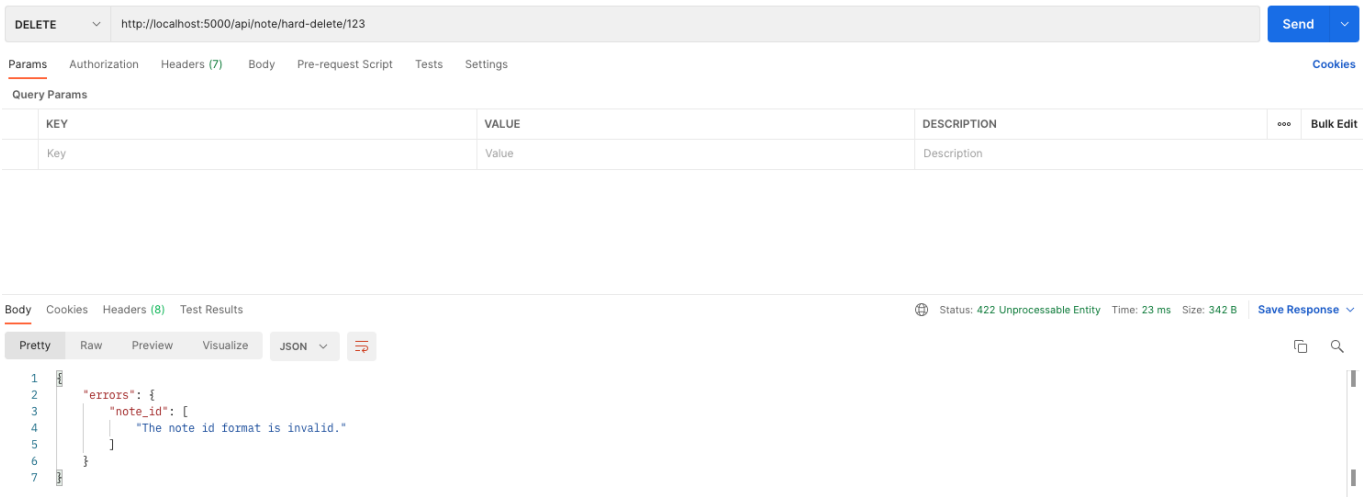
Error (404)

- Valid parameter present but data is not found in the database



Error (422)

- Caused by invalid parameter (In this scenario, the `note_id` is not a valid ObjectId).
- As we are hard deleting a note, `_id` is required to know which record to hard delete.



Task B2: Testing through Continuous Integration (CI)

Test Frameworks: Mocha & Chai

The tests will covers all the available requests `POST`, `GET` (get by ID & get all), `PUT` and `DELETE` (soft delete and hard delete), which is split into positive (200) and negative (404 and 422) test cases. This ensures that the API endpoint responses are accurate.

Run the test locally

```
npm run test
```

Running the test through CI

Code Snippet from `.travis.yml`

```yaml
language: node_js
node_js:
- node
services:
- mongodb
install:
- npm install
jobs:
  include:
  - stage: test
    script: npm test
```

Travis has been integrated into the repository. `npm run test` is executed whenever the codes are pushed into the repository, under the job stage `test`.

This is a screenshot of an example of the test.

```
$ npm install                                                                                    install   34.15s
$ npm test                                                                                                 17.59s

> [secure]1@1.0.0 test
> env TS_NODE_COMPILER_OPTIONS='{"module": "commonjs" }' mocha --exit --timeout 10000 -r ts-node/register './src/tests/*.ts'

Setting up database...
Listening on port 5000


  Notes Postive Test Cases
    POST /
Successfully connected to DB
verbose: Note created {"note_id":"6144cdbf17024daea00d608f","timestamp":"2021-09-17T17:17:54.819Z"}
http:   HTTP  POST /api/note 200  3676ms {"metadata":{"timestamp":"2021-09-17T17:17:54.825Z"}}
      ✔ Should create a note (3705ms)
    GET /
verbose: Notes retrieved {"notes_count":2005,"timestamp":"2021-09-17T17:17:56.384Z"}
http:   HTTP  GET /api/note/ 200  1557ms {"metadata":{"timestamp":"2021-09-17T17:17:56.396Z"}}
      ✔ Should fetch all notes (1566ms)
verbose: Note retrieved {"note_id":"6144cdbf17024daea00d608f","timestamp":"2021-09-17T17:17:56.634Z"}
http:   HTTP  GET /api/note/6144cdbf17024daea00d608f 200  229ms {"metadata":{"timestamp":"2021-09-17T17:17:56.641Z"}}
      ✔ Should fetch single note that was previously created (243ms)
    PUT /
verbose: Note updated {"note_id":"6144cdbf17024daea00d608f","timestamp":"2021-09-17T17:17:57.331Z"}
http:   HTTP  PUT /api/note 200  689ms {"metadata":{"timestamp":"2021-09-17T17:17:57.337Z"}}
      ✔ Should update note that was previously created (693ms)
    DELETE /
verbose: Note soft-deleted {"note_id":"6144cdbf17024daea00d608f","timestamp":"2021-09-17T17:17:57.799Z"}
http:   HTTP  DELETE /api/note/6144cdbf17024daea00d608f 200  457ms {"metadata":{"timestamp":"2021-09-17T17:17:57.800Z"}}
      ✔ Should soft delete note that was previously created (462ms)
verbose: Note hard-deleted {"note_id":"6144cdbf17024daea00d608f","timestamp":"2021-09-17T17:17:58.260Z"}
http:   HTTP  DELETE /api/note/hard-delete/6144cdbf17024daea00d608f 200  457ms {"metadata":{"timestamp":"2021-09-17T17:17:58.261Z"}}
      ✔ Should hard delete note that was previously created (459ms)

  Notes Negative Test Cases
    POST /
http:   HTTP  POST /api/note 422  1ms {"metadata":{"timestamp":"2021-09-17T17:17:58.266Z"}}
      ✔ Should create a note
    GET /
http:   HTTP  GET /api/note/123 422  1ms {"metadata":{"timestamp":"2021-09-17T17:17:58.271Z"}}
      ✔ Should not fetch a note due to invalid ID
error: Note 613f4186abe8ac519b619877 not found. {"timestamp":"2021-09-17T17:17:58.502Z"}
http:   HTTP  GET /api/note/613f4186abe8ac519b619877 404  227ms {"metadata":{"timestamp":"2021-09-17T17:17:58.503Z"}}
      ✔ Should not fetch a note due to object not found (230ms)
    PUT /
http:   HTTP  PUT /api/note 422  1ms {"metadata":{"timestamp":"2021-09-17T17:17:58.507Z"}}
      ✔ Should not update any note due to invalid ID
error: Note 613f4186abe8ac519b619877 not found. {"timestamp":"2021-09-17T17:17:58.737Z"}
http:   HTTP  PUT /api/note 404  226ms {"metadata":{"timestamp":"2021-09-17T17:17:58.738Z"}}
      ✔ Should not update any note due to object not found (230ms)
    DELETE /
http:   HTTP  DELETE /api/note/123 422  0ms {"metadata":{"timestamp":"2021-09-17T17:17:58.749Z"}}
      ✔ Should not soft delete note due to invalid ID
error: Note 613f4186abe8ac519b619877 not found. {"timestamp":"2021-09-17T17:17:58.987Z"}
http:   HTTP  DELETE /api/note/613f4186abe8ac519b619877 404  227ms {"metadata":{"timestamp":"2021-09-17T17:17:58.988Z"}}
      ✔ Should not soft delete note due to object not found (232ms)
http:   HTTP  DELETE /api/note/hard-delete/123 422  1ms {"metadata":{"timestamp":"2021-09-17T17:17:58.994Z"}}
      ✔ Should not hard delete note due to invalid ID
error: Note 613f4186abe8ac519b619877 not found. {"timestamp":"2021-09-17T17:17:59.230Z"}
http:   HTTP  DELETE /api/note/hard-delete/613f4186abe8ac519b619877 404  226ms {"metadata":{"timestamp":"2021-09-17T17:17:59.231Z"}}
      ✔ Should not hard delete note due to invalid ID (231ms)


  15 passing (8s)

The command "npm test" exited with 0.
store build cache                                                                                cache.2


Done. Your build exited with 0.
```

References

- https://medium.com/@asciidev/testing-a-node-express-application-with-mocha-chai-9592d41c0083
- https://gist.github.com/cklanac/81a6f49fabb52b3c95dff397fe62c771

Task B3: Deployment through Continuous Deployment (CD)

Serverless Service: Serverless Google Cloud Functions

This task is accomplished using the Serverless Framework via Google Cloud Functions.

A `serverless.yml` has been set up as a set of instructions to deploy to Google Cloud Functions.

We can either deploy locally or via CD in Travis.

Deploying locally

```
npm run deploy
```

Deploying through CD

Similar to Task B2, `npm run deploy` under the job stage `deploy` is executed whenever the codes are pushed into the repository after the `test` stage is completed.

Code snippet from `.travis.yml`

```yaml
- stage: deploy
  install:
  - npm install -g serverless
  before_script:
  - openssl aes-256-cbc -K $encrypted_3c84dcdc6bbe_key -iv $encrypted_3c84dcdc6bbe_iv
    -in .env.enc -out .env -d
  - openssl aes-256-cbc -K $encrypted_4e8c5512ae30_key -iv $encrypted_4e8c5512ae30_iv
    -in serverless-key.json.enc -out serverless-key.json -d
  script:
  - npm run deploy
```

This is a screenshot of an example of continuous deployment.

```
$ npm install -g serverless                                                                                install    29.61s
$ openssl aes-256-cbc -K $encrypted_3c84dcdc6bbe_key -iv $encrypted_3c84dcdc6bbe_iv -in .env.enc -out .env -d   before_script.1   0.01s
$ openssl aes-256-cbc -K $encrypted_4e8c5512ae30_key -iv $encrypted_4e8c5512ae30_iv -in serverless-key.json.enc -out serverless-key.json -d   before_script.2   0.01s
$ npm run deploy                                                                                                   367.44s

> [secure]1@1.0.0 deploy
> sls deploy

Serverless: DOTENV: Loading environment variables from .env:
Serverless:      - MONGO_USERNAME
Serverless:      - MONGO_PASSWORD
Serverless:      - MONGO_DB
Serverless: Configuration warning at 'provider.region': should be equal to one of the allowed values [us-central1, us-east1, us-east4, europe-west1, europe-west2, asia-east2, asia-northeast1, asia-
northeast2, us-west2, us-west3, us-west4, northamerica-northeast1, southamerica-east1, europe-west3, europe-west6, australia-southeast1, asia-south1, asia-southeast2, asia-northeast3]
Serverless:
Serverless: Learn more about configuration validation here: http://slss.io/configuration-validation
Serverless:
Serverless: Compiling with Typescript...
Serverless: Using local tsconfig.json
Serverless: Typescript compiled.
Serverless: Packaging service...
Serverless: Excluding development dependencies...
Serverless: Compiling function "app"...
Serverless: Uploading artifacts...
Serverless: Artifacts successfully uploaded...
Serverless: Updating deployment...
Serverless: Checking deployment update progress...
.................................................................
Serverless: Done...
Service Information
service: [secure]
project: [secure]-325509
stage: dev
region: asia-southeast1

Deployed functions
app
  https://asia-southeast1-[secure]-325509.cloudfunctions.net/[secure]-dev-app

Serverless: Removing old artifacts...
Serverless: Deprecation warnings:

Starting with next major, Serverless will throw on configuration errors by default. Adapt to this behavior now by adding "configValidationMode: error" to service configuration
More Info: https://www.serverless.com/framework/docs/deprecations/#CONFIG_VALIDATION_MODE_DEFAULT

Support for "package.include" and "package.exclude" will be removed with next major release. Please use "package.patterns" instead
More Info: https://www.serverless.com/framework/docs/deprecations/#NEW_PACKAGE_PATTERNS

The command "npm run deploy" exited with 0.
store build cache                                                                                                  cache.2


Done. Your build exited with 0.
```

The application is deployed to https://asia-southeast1-cs3219-otot-task-b-325509.cloudfunctions.net/cs3219-otot-task-b-dev-app.

References

- https://www.serverless.com/framework/docs/providers/google/guide
- https://blog.travis-ci.com/2019-05-30-setting-up-a-ci-cd-process-on-github

Task B4: Implement a frontend

- **Frontend Framework**: Next.js (React.js)
- **UI Framework**: Material-UI

This is an attempt in creating a frontend using Next.js. The web application supports the CRUD operations created in Task B1.

As part of the learning objectives, the codes are structured in an MVC folder structure, along with using React's useReducer as a store.

Please ensure you are in the `frontend` directory (`cd frontend`).

Please create a `.env` file with the following variables:

```
DB_HOST_URL = "https://asia-southeast1-cs3219-otot-task-b-
325509.cloudfunctions.net/cs3219-otot-task-b-dev-app"
```

Install the necessary modules

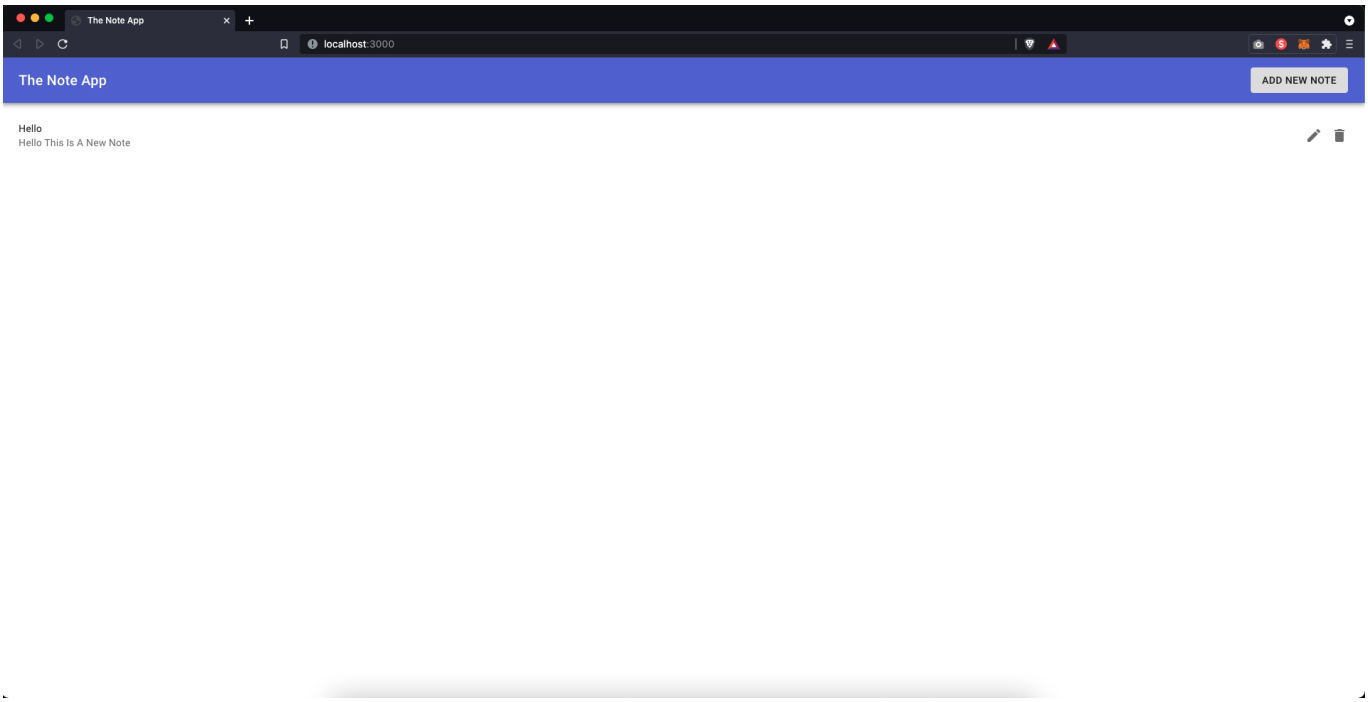
```
npm install
```

Start the server

```
npm run dev
```

Endpoint

- Localhost: http://localhost:5000
- Deployed Endpoint: https://cs3219-otot-task-b-325509.as.r.appspot.com/



Learning Outcome

- Despite the learning objectives being to use an MVC in real-life frameworks, the newer frameworks are no longer based on the "MVC" structure.
- The closest thing to MVC was Redux, which goes from Reducer -> Store -> View.
- In this task, I tried to replicate as closely as possible by utilizing controllers (which will interact with the APIs) and models (to define the attributes) while using React's reducer and store functionality.