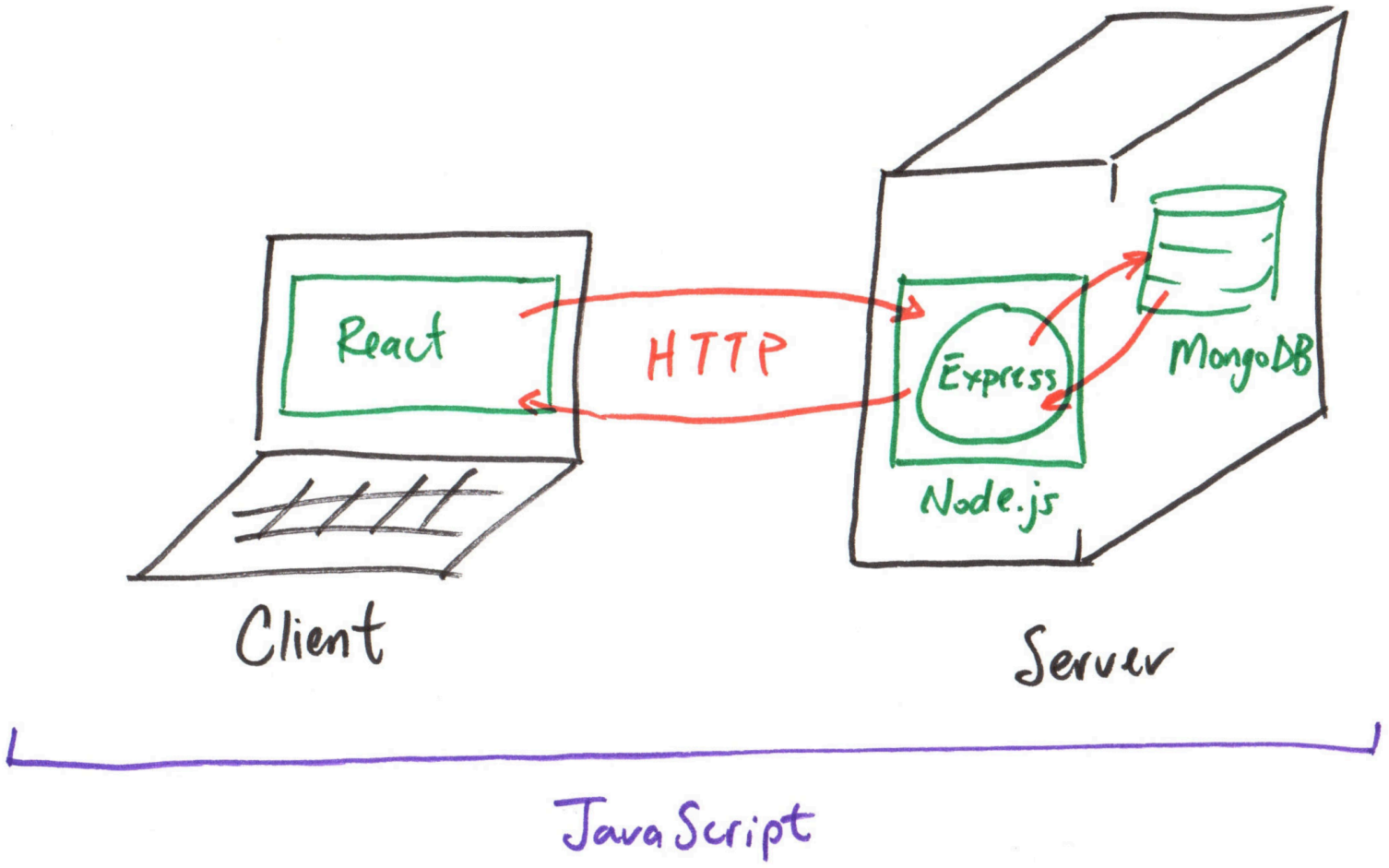
Class 19: REST API Design

- Review: Express.js + MongoDB
- Route Parameter Validation
- REST API Design Principles
- REST API Design Gotchas
- Homework 3 Gotchas

Review

Review: MERN Stack



Review: HTTP Request & Response

Request:

```
METHOD PATH HTTP/1.1
```

Example:

```
GET /index.html HTTP/1.1
```

Response:

```
HTTP/1.1 STATUS_CODE STATUS_MESSAGE

PAYLOAD
```

Example:

```
HTTP/1.1 200 OK

<html>
  <body>...</body>
</html>
```

Review: MongoDB Node.js Driver

The MongoDB Node.js Driver is a library that provides an interface for connecting to and interacting with a MongoDB database from a Node.js application.

Example:

```
const documents = await app.locals.db.collection('produce')
  .find()
  .toArray();
```

Review: Express.js Route Parameters

Express.js supports **route parameters** to capture dynamic values from the URL path.

Any **path segment** that starts with a colon (`:`) in the route definition is treated as a route parameter. Access route parameters using `req.params` object.

Example: (`id` parameter)

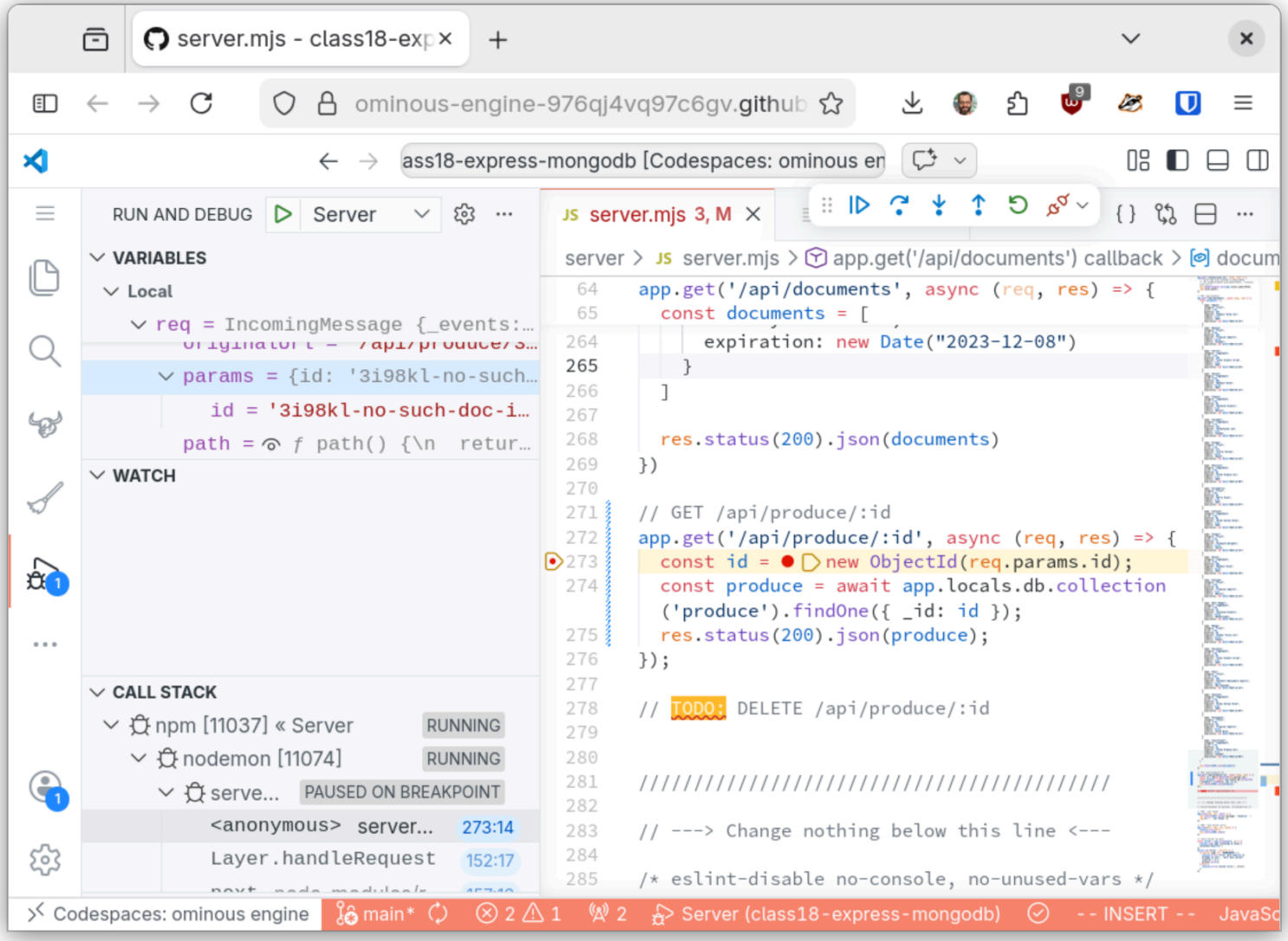
```
app.get('/api/documents/:id', async (req, res) => {
  const id = req.params.id
})
```

Review: Debugger

Using the debugger you can inspect the state of a running program at a specific point in time to inspect its state (i.e. variable values).

To pause the execution at a line of code, **insert a breakpoint** at that line by clicking in the gutter.

Then **resume** execution or **step** to the next line of code and pause again to inspect the state of the program at that line.


server.mjs - class18-exp
ominous-engine-976qj4vq97c6gv.github
ass18-express-mongodb [Codespaces: ominous en
RUN AND DEBUG
Server
VARIABLES
Local
req = IncomingMessage {_events:…
params = {id: '3i98kl-no-such…
id = '3i98kl-no-such-doc-i…
path = ƒ path() {\n retur…
WATCH
CALL STACK
npm [11037] « Server
RUNNING
nodemon [11074]
RUNNING
serve...
PAUSED ON BREAKPOINT
<anonymous> server...
273:14
Layer.handleRequest
152:17
server.mjs 3, M
server > server.mjs > app.get('/api/documents') callback > docum
64 app.get('/api/documents', async (req, res) => {
65 const documents = [
264 expiration: new Date("2023-12-08")
265 }
266]
267
268 res.status(200).json(documents)
269 })
270
271 // GET /api/produce/:id
272 app.get('/api/produce/:id', async (req, res) => {
273 const id = new ObjectId(req.params.id);
274 const produce = await app.locals.db.collection
('produce').findOne({ _id: id });
275 res.status(200).json(produce);
276 });
277
278 // TODO: DELETE /api/produce/:id
279
280
281 //
282
283 // ---> Change nothing below this line <---
284
285 /* eslint-disable no-console, no-unused-vars */
Codespaces: ominous engine
main*
2 1
2
Server (class18-express-mongodb)
-- INSERT --

Route Parameter Validation

Gotcha: Invalid Route Parameters

Never trust the value of a route parameter. Always validate the value to ensure it's the correct format, type, or value before using it in your code.

Trusting invalid route parameter values can lead to errors in your code, like exceptions, or even security vulnerabilities.

Activity: Invalid Route Parameter

Working with your peers (2-4), use the **debugger** to inspect the state of the program when using an **invalid** `_id` value in the resource endpoint query.

Discuss how you might validate the `_id` route parameter to prevent this error from occurring.

Activity: Route Parameter Validation

Working with your peers (2-4), Validate the `id` route parameter in your resource endpoint implementation to ensure that it's a valid `ObjectId` string before using it in the query.

Test your implementation using both **valid** and **invalid** `_id` values using the **debugger**.

Tip: The `ObjectId.isValid(id)` method validates the **format** of ObjectId strings.

Response Status Codes in Express.js

HTTP Status Codes

Always return the appropriate HTTP status code in your response to indicate the result of the request in your API.

Found Resource

`200 OK`

The request was successful and the server is returning the requested resource in the response body.

Not Found

`404 Not Found`

The requested resource was not found on the server.

Status Codes in Express.js

Always set the status code **before** sending the response.

Found Resource

```
res.status(200).json(document)
```

Not Found

```
res.status(404).send()
```

Activity: Status Codes in Resource Endpoint

Working with your peers (2-4), update your resource endpoint implementation to return the appropriate status code for both **valid** and **invalid** `_id` values.

Found Resource

```
res.status(200).json(document)
```

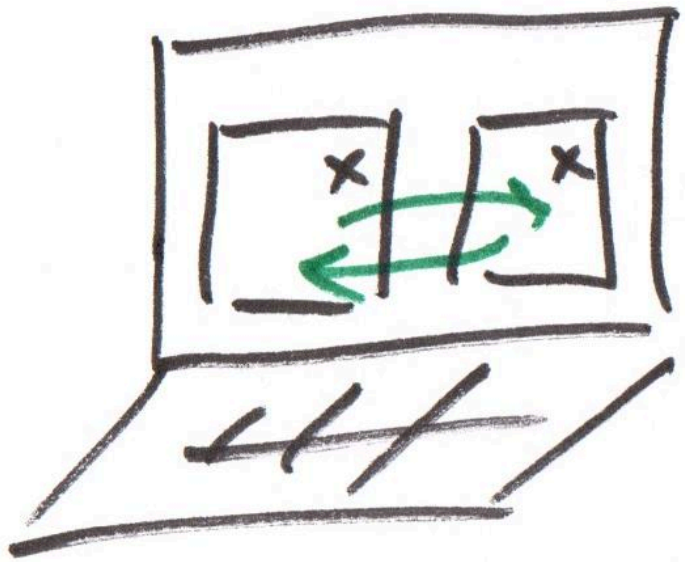
Not Found

```
res.status(404).send()
```

REST API Design

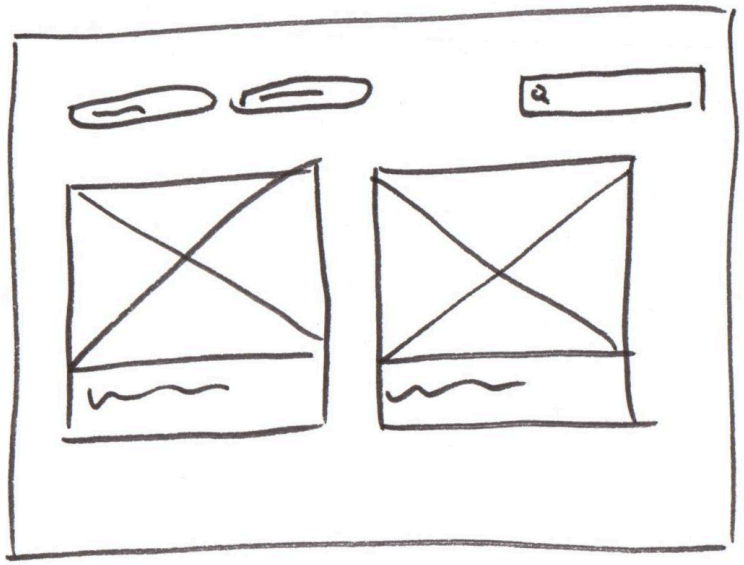
API: Application Programming Interface

An **A**pplication **P**rogramming **I**nterface is a set of rules and protocols that allows different software pieces to communicate and transfer data with each other.



An API is a User Interface

Graphical User Interface



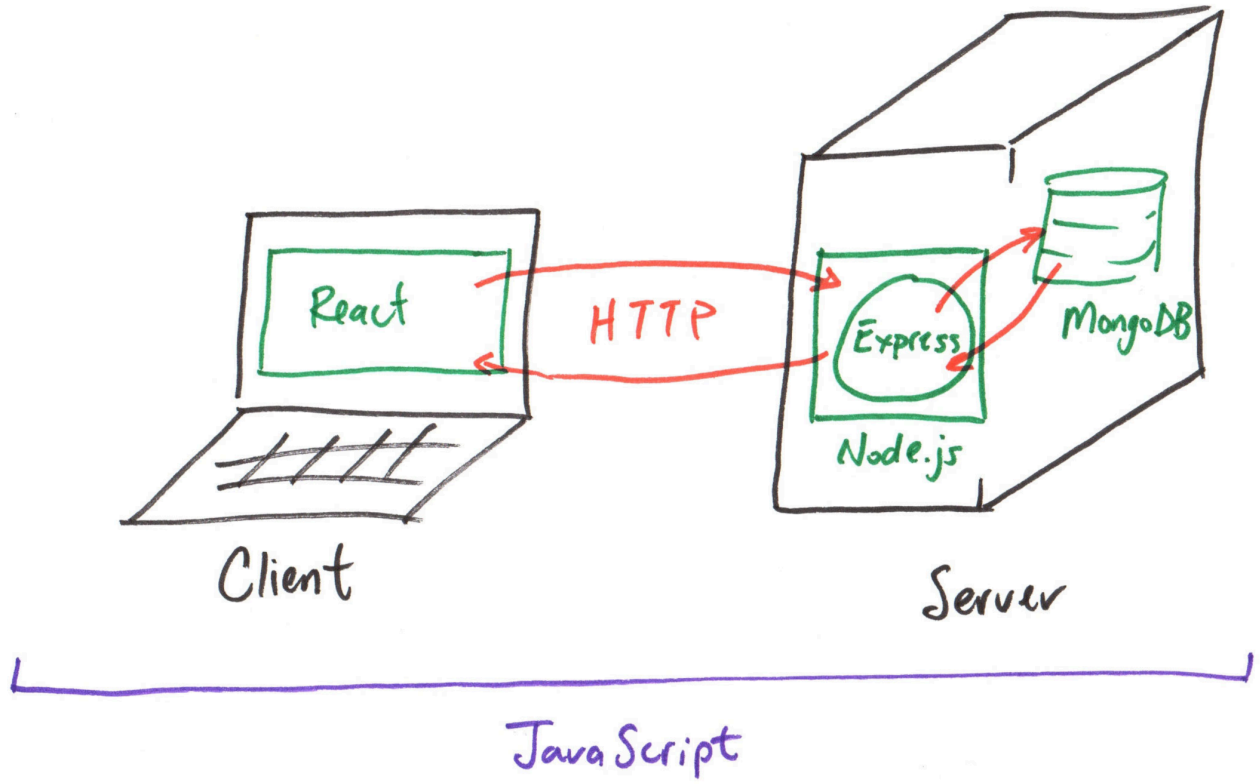
Designed for **End-Users**

Application Programming Interface

```
GET /api/documents
GET /api/documents/:id
```

Designed for **Developers**

MERN + API



- **REST**
- **GraphQL**
- SOAP
- XMLRPC

REST API

Representtation **S**tate **T**ransfer API is a type of API that adheres to the constraints of REST architecture to support communication between client and server to exchange resources, like data and media.

A **RESTful API** supports the **creation**, **retrieval**, **updating**, and **deletion** of resources (CRUD operations) using HTTP methods.**

REST Design Principles

- ALL **CRUD** operations are defined by **HTTP methods**:
  `POST`, `GET`, `PUT`, `PATCH`, and `DELETE`.
- All **resources** are accessed using **URI endpoints** that represent a **specific resource** or **collection of resources**.
  `GET /api/documents` and `GET /api/documents/:id`
- Every HTTP request to the API is **independent** of all other requests (i.e. stateless).
  (The request contains all the information needed to process the request.)

REST API HTTP Methods

CRUD Operation	HTTP Method
Create (document)	`POST`
Read (collection)	`GET`
Read (document)	`GET`
Update (replace document)	`PUT`
Update (modify document)	`PATCH`
Delete (document)	`DELETE`

Activity: REST API HTTP Methods

Working with your peers (2-4), identify the appropriate HTTP method for each CRUD operation for designing a REST API for the **produce** collection.

CRUD Operation	HTTP Method
Create (document)	`POST`
Read (collection)	`GET`
Read (document)	`GET`
Update (replace document)	`PUT`
Update (modify document)	`PATCH`
Delete (document)	`DELETE`

Resource and Collection Endpoint URIs

Collection Endpoint

`/api/PLURAL_NOUN`

Example: `/api/documents`

Resource Endpoint

`/api/PLURAL_NOUN/:id`

Example: `/api/documents/12345`

Activity: REST API Endpoint URIs

Working with your peers (2-4), identify the appropriate URI for each CRUD operation for designing a REST API for the **produce** collection.

Collection Endpoint

`/api/PLURAL_NOUN`

Example: `/api/documents`

Resource Endpoint

`/api/PLURAL_NOUN/:id`

Example: `/api/documents/12345`

REST API Request Body

The **request body** of a REST API request contains the data needed to create or update a resource. (Think of this as what you're **uploading** from the client to the server.)

The request body is typically sent in **JSON format** and must be parsed by the server to access the data.

Some requests, like `GET`, do not have a request body because they are only retrieving data from the server.

Activity: REST API Request Body

Working with your peers (2-4), identify which CRUD operations require a request body and what data should be included in the request body for designing a REST API for the **produce** collection.

Response Status Codes

HTTP status codes are standardized codes that indicate the result of an HTTP request. They are categorized into five classes:

- **1xx:** Informational
- **2xx:** Success
- **3xx:** Redirection
- **4xx:** Client Error
- **5xx:** Server Error

REST API Response Status Codes

CRUD Operation	Success Code	Error Code
Create (document)	`201 Created`	`400 Bad Request`
Read (collection)	`200 OK`	`404 Not Found`
Read (document)	`200 OK`	`404 Not Found`
Update (replace document)	`200 OK` or `204 No Content`	`400 Bad Request`
Update (modify document)	`200 OK` or `204 No Content`	`400 Bad Request`
Delete (document)	`204 No Content`	`404 Not Found`

Activity: REST API Response Status Codes

Working with your peers (2-4), identify the appropriate HTTP status code for both success and error cases for each CRUD operation for designing a REST API for the **produce** collection.

CRUD Operation	Success Code	Error Code
Create (document)	`201 Created`	`400 Bad Request`
Read (collection)	`200 OK`	`404 Not Found`
Read (document)	`200 OK`	`404 Not Found`
Update (replace document)	`200 OK` or `204 No Content`	`400 Bad Request`
Update (modify document)	`200 OK` or `204 No Content`	`400 Bad Request`
Delete (document)	`204 No Content`	`404 Not Found`

REST API Response Body

The **response body** of a REST API response contains the data returned from the server to the client. (Think of this as what you're **downloading** from the server to the client.)

The response body is typically sent in **JSON format** and must be parsed by the client to access the data.

Though if there is no data to return, like in a successful `DELETE` request, the response body can be empty with a status code of `204 No Content`.

Activity: REST API Response Body

Working with your peers (2-4), identify which CRUD operations require a response body and what data should be included in the response body for designing a REST API for the **produce** collection.

Hierarchical Resources

In some cases, resources may have a hierarchical relationship, such as a **document** resource that belongs to a **collection** resource. In this case, the URI for the resource endpoint should reflect this hierarchy.

Example:

- `GET /api/posts`
- `GET /api/post/:collectionId/comments`
- `GET /api/post/:collectionId/comments/:commentId`

Gotchas: REST API Design

- URIs are **nouns** that represent resources, not **verbs** that represent actions.
  yes: `POST /api/orders` **no:** `GET /api/create-order`
- Avoid file extensions in URIs, like `.json` or `.xml`, to allow for flexibility in response formats.
  yes: `GET /api/documents/12345` **no:** `GET /api/documents/12345.json`
- Resources are **plural nouns** to represent collections of resources.
  yes: `GET /api/documents` **no:** `GET /api/document`

Homework 3 Gotchas

Homework 3 Gotchas

- Only **read** operations in MongoDB return document(s); **create**, **update**, and **delete** operations return a result object that contains information about the operation, but not the document(s) itself.
- MongoDB is strictly typed: string ≠ ObjectId
- Express **routes** define the **HTTP verb/method**.
- Always use **await** when making calling the database; otherwise, you'll get a pending **promise** instead of the result.

Summary

Summary

- Validate route parameters to prevent errors and security vulnerabilities in your API.
- Use the appropriate HTTP status codes in your API responses to indicate the result of the request.
- Design REST APIs using the principles of REST architecture, including using HTTP methods for CRUD operations and using URIs to represent resources and collections of resources.

What's Next

Wednesday:

- Class: Filtering, Text Search, & API Query Parameters
- Homework 3 Due
- Project 2, Milestone 3 Assigned

Friday: Practice Problem Workshop

Next Week: Exam I