Class 18: Node.js, Express.js, & MongoDB

- Review: Last Class
- REST API Design for collections and resources
- MongoDB Node.js Driver
- Express.js Route Parameters
- Using the Debugger
- Route Parameter Validation
- Response Status Codes in Express.js

Review

Review: HTTP

Hyper**t**ext **T**ransfer **P**rotocol

An application-layer protocol for transmitting resources between client and web servers.

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: REST (or RESTful) API

An **A**pplication **P**rogramming **I**nterface 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.

Review: Express.js

A backend web application framework for building web servers and RESTful APIs in Node.js.

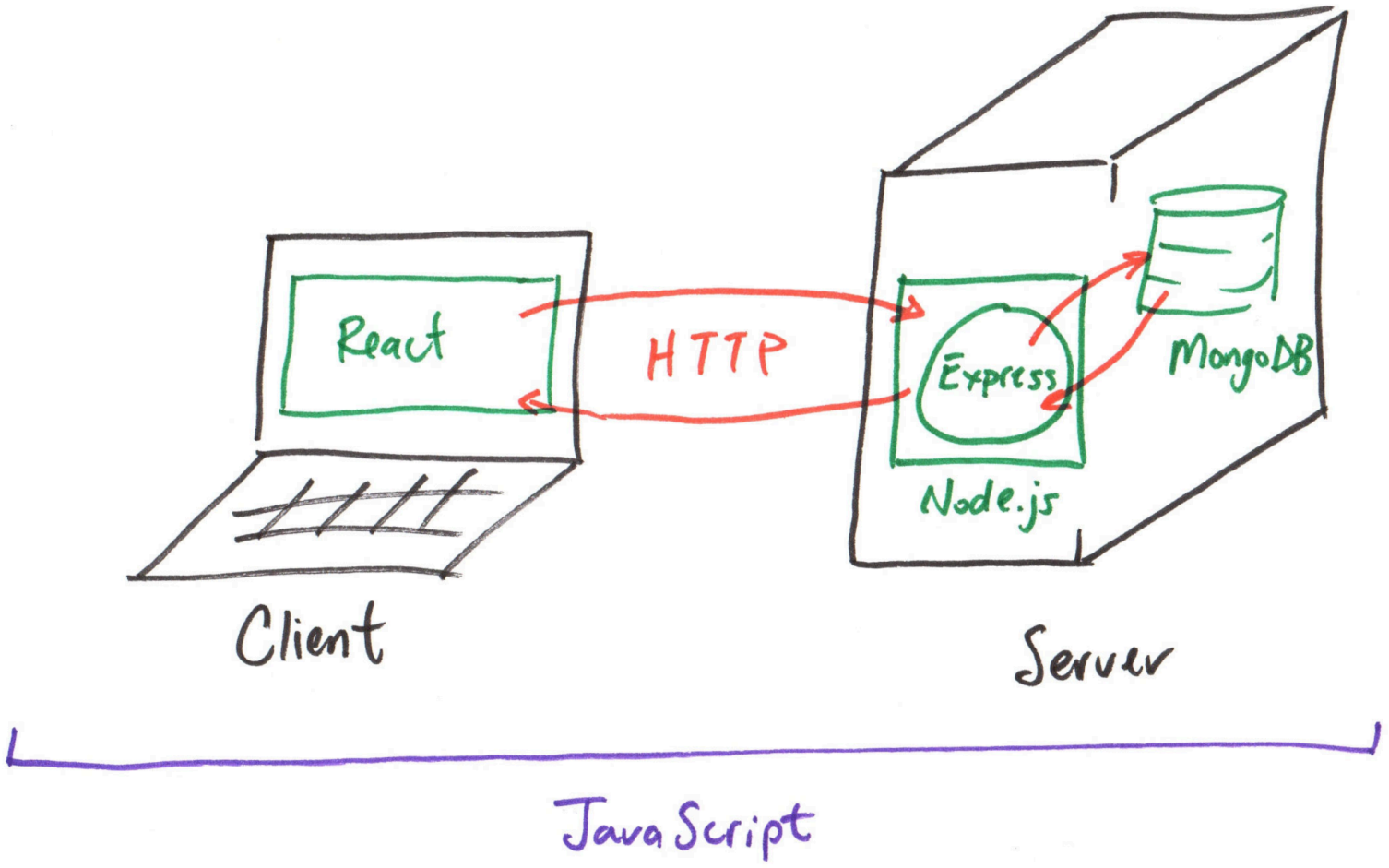
```
// GET: /api/documents
app.get('/api/documents', async (req, res) => {
  const documents = [
    { name: "Apple", category: "fruit", ... },
    { name: "Banana", category: "fruit", ... }
  ]

  res.status(200).json(documents)
})
```

Activity: REST Client Review

Test the `/api/documents` endpoint using `httpBook`.

Review: MERN Stack



Introduction to REST API Design

REST API Design

Endpoint: A URI that corresponds to a specific resource or collection of resources in a RESTful API.

Collection Endpoint: An endpoint that corresponds to a collection of resources named using a plural noun that describes that resource.
Example: `GET /api/documents`

Resource Endpoint: An endpoint that corresponds to a specific resource in a collection, identified by a unique identifier path segment appended to the collection endpoint.
Example: `GET /api/documents/69c3d6d488562e515a8ce5c5`

Activity: REST API Design Critique

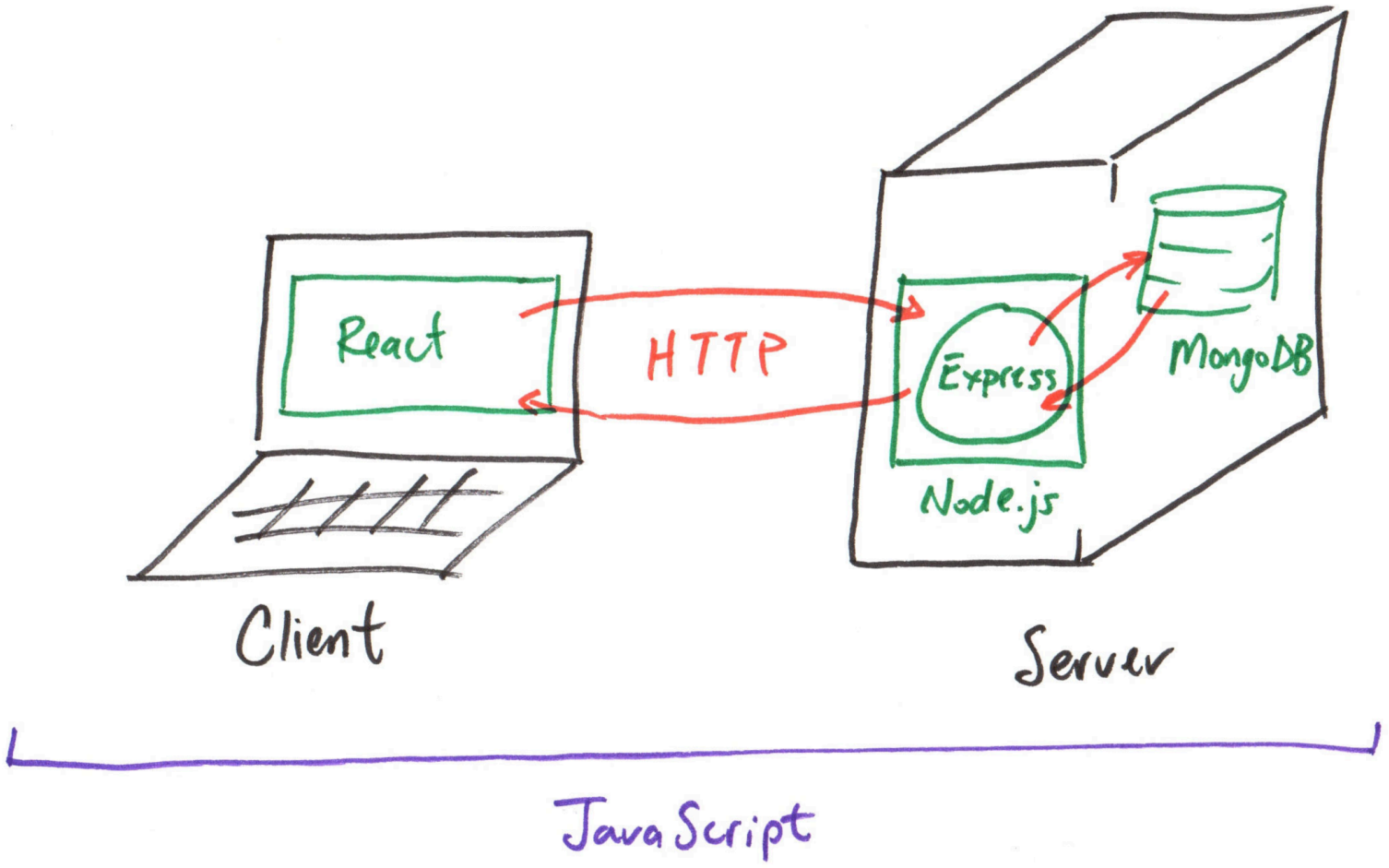
Working with your peers (2-4), review the REST API of our Express.js server for design best practices and correct any issues that you find.

Collection Endpoint: An endpoint that corresponds to a collection of resources named using a plural noun that describes that resource.

Example: `GET /api/documents`

MongoDB Node.js Driver

Express.js + MongoDB



Activity: Connect to MongoDB with Node.js

```
const client = new MongoClient(process.env.MONGODB_URI)
try {
  const conn = await client.connect()
  // Keep the database reference available for future routes.
  app.locals.db = conn.db('app')
} catch (error) {
  // eslint-disable-next-line no-console
  console.error('failed to connect to mongodb:', error)
  process.exit(1)
}
```

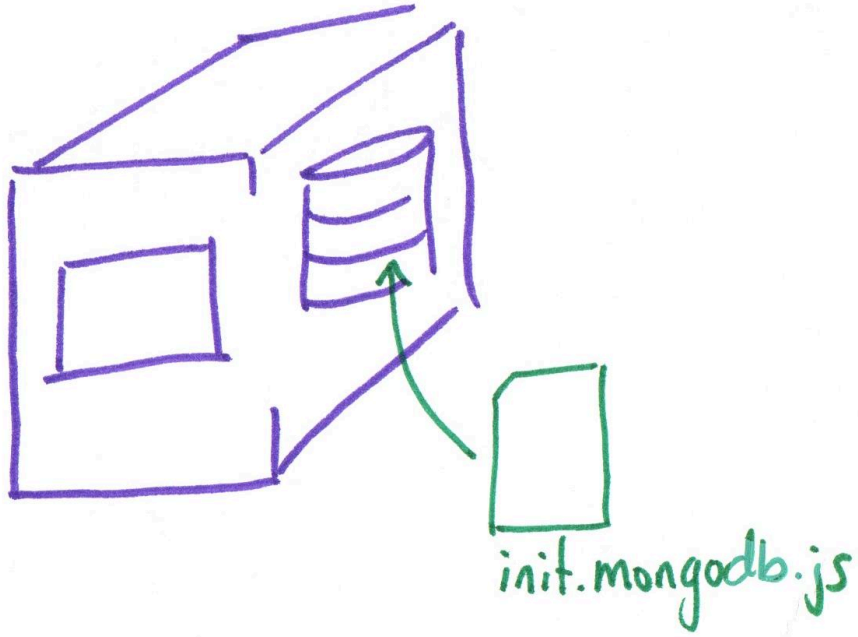
Activity: Query MongoDB with Node.js

Query the `produce` collection for all documents and return them as an array.

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

Gotcha: Initializing the Database

We use `init.mongodb.js` to initialize our database.



Activity: Resource Endpoint Query

Resource Endpoint: An endpoint that corresponds to a specific resource in a collection, identified by a unique identifier path segment appended to the collection endpoint.
Example: `GET /api/documents/69c3d6d488562e515a8ce5c5`

Working with your peers (2-4), test a query to find a specific document in the `produce` collection by its `_id` field.

Test your query using MongoDB Shell (`mongosh`) and then document your answer on your handout.

Gotcha: MongoDB ObjectIds

`_id` is **not** a string!

MongoDB uses the `ObjectId` type for the `_id` field of documents.

When querying for a document by its `_id`, you convert the string representation of the `ObjectId` into an actual `ObjectId` type:

```
const id = "69c3d6d488562e515a8ce5be";
const objectId = ObjectId(id);
```

Activity: Resource Endpoint Implementation

Working with your peers (2-4), use the Mongo Shell query to retrieve the **banana** document from the `produce` collection and implement a resource endpoint in your Express.js server to retrieve that same document by its `_id`.

Test the endpoint using `httpBook` to ensure that it returns the correct document.

Gotcha: MongoDB Shell and Node.js Driver Syntax

Mongo Shell and MongoDB Node.js Driver syntax are very similar, but **they are not the same!**

Refer to the **Node.js Driver documentation** for the correct syntax when using the MongoDB Node.js Driver in your Express.js server.

MongoDB Shell

```
db.documents.findOne({
  _id: ObjectId("69c3d6d488562e515a8ce5be")
})
```

MongoDB Node.js Driver

```
await app.locals.db.collection('documents')
  .findOne({
    _id: new ObjectId("69c3d6d488562e515a8ce5be")
  })
```

Activity: Resource Endpoint Query (Node.js Driver)

Working with your peers (2-4), write the **Node.js Driver** code to query the `produce` collection for a single document with the `_id` of the **banana** document on your **handout**. Then update the server code.

MongoDB Shell

```
db.documents.findOne({
  _id: ObjectId("69c3d6d488562e515a8ce5be")
})
```

MongoDB Node.js Driver

```
await app.locals.db.collection('documents')
  .findOne({
    _id: new ObjectId("69c3d6d488562e515a8ce5be")
  })
```

Route Parameters

Review: REST API Design

Collection Endpoint: An endpoint that corresponds to a collection of resources named using a plural noun that describes that resource.
Example: `GET /api/documents`

Resource Endpoint: An endpoint that corresponds to a specific resource in a collection, identified by a unique identifier path segment appended to the collection endpoint.
Example: `GET /api/documents/69c3d6d488562e515a8ce5c5`

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
})
```

Activity: Resource Endpoint with Route Parameter

Working with your peers (2-4), update your resource endpoint implementation to use a route parameter for the document `_id` instead of hardcoding the banana `_id` in the query.

Test the endpoint using `httpBook` with **valid** and **invalid** `_id` values.

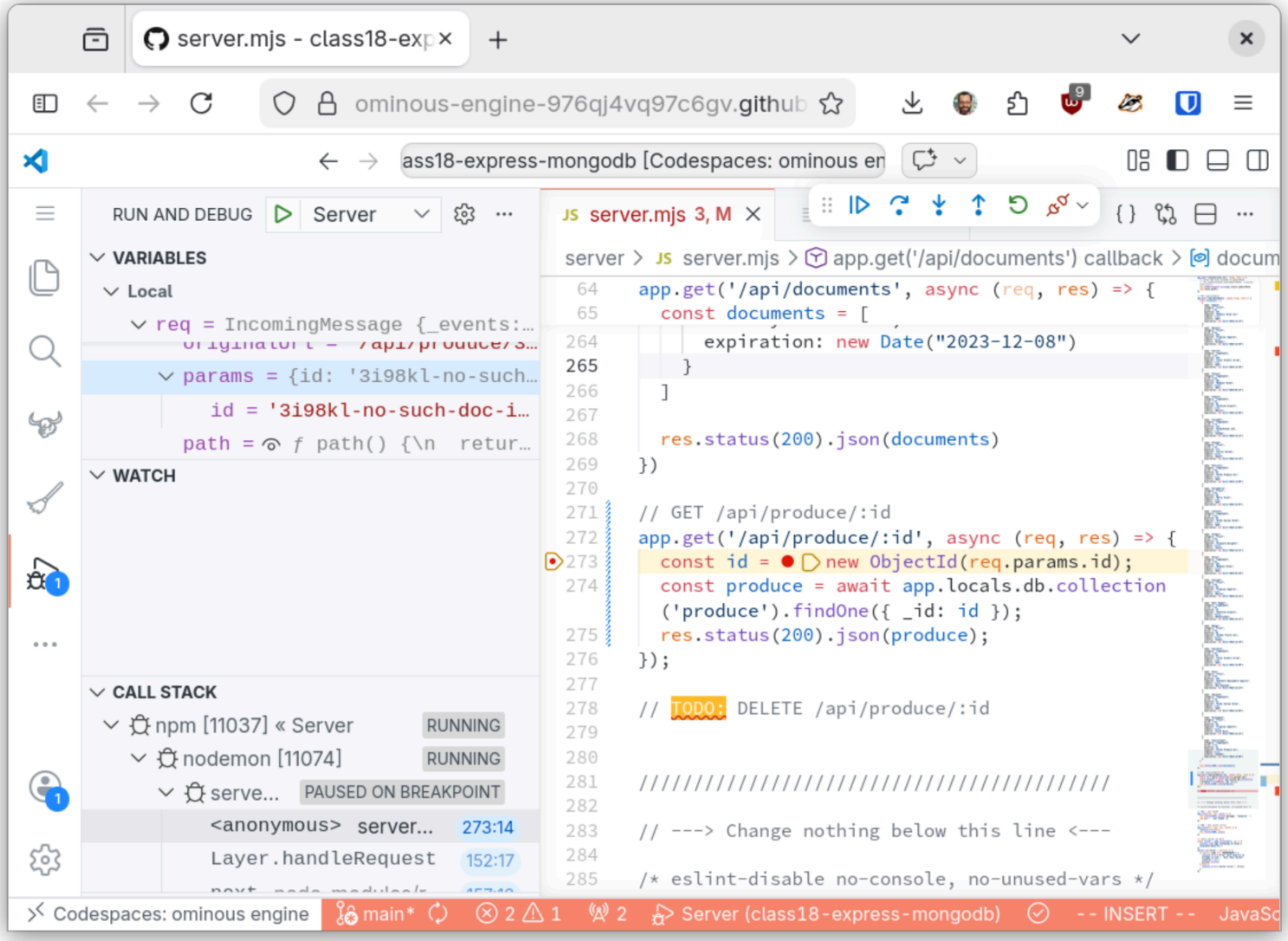
Using the Debugger

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
app.get('/api/documents', async (req, res) => {
const documents = [
expiration: new Date("2023-12-08")
}
]
res.status(200).json(documents)
})
// GET /api/produce/:id
app.get('/api/produce/:id', async (req, res) => {
const id = new ObjectId(req.params.id);
const produce = await app.locals.db.collection
('produce').findOne({ _id: id });
res.status(200).json(produce);
});
// TODO: DELETE /api/produce/:id
// ---> Change nothing below this line <---
/* eslint-disable no-console, no-unused-vars */
Codespaces: ominous engine
main*
2 1
2
Server (class18-express-mongodb)
-- INSERT --

Activity: Debugging a Resource Endpoint

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.

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: 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.

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.

Use the debugger to inspect the response status code and body for both cases.

Found Resource

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

Not Found

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

Summary

Summary

- REST API have collection endpoint and resource endpoints named after the resource.
- MongoDB Shell and MongoDB Node.js Driver have similar but different syntax.
- Express.js route parameters capture dynamic values from the URL path.
- Always validate route parameter values before using them in your code.
- Always return the appropriate HTTP status code in your API responses.

What's Next

Today: Homework 3 Released

Friday: Practice Problem Workshop (Express.js, HTTP, Express.js + MongoDB)

Wednesday, *after* Break: Homework 3 Due.