

How to create a REST API with Node.js and Express



[Akshaya Srikanth](#)

May 22, 2023 · 14 mins

Node.js is an ideal choice for developers who are looking to create fast and efficient web applications with [RESTful APIs](#). In fact, it is [the most widely used web development tool in the United States](#). But what makes Node.js so powerful? Why should you learn to use Node.js for building REST APIs, and what is the best way to go about it?

In this post, we'll explore the answers to these questions and more. By the end, you'll be able to set up a server, define routes, handle requests and responses, and work with databases. You can also get some hands-on experience by coding along with us and building a [user management API](#) with endpoints for user registration, login, profile management, and more.

Use the links below to navigate to the section that interests you most:

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- ✦ [What is Node.js?](#)
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Let's get started.

What is a REST API?

Related: [What is an API?](#)

[REST](#), which stands for REpresentational State Transfer, is a software development architecture that defines a set of rules for communication between a client and a server. Let's break this down a little more:

- ✦ A **REST client** is a code or app used to communicate with REST servers.
- ✦ A **server** contains resources that the client wants to access or change.
- ✦ A **resource** is any information that the API can return.

A REST API, also known as a RESTful API, is an API that conforms to the REST architecture. These APIs use the [HTTP](#) protocol to access and manipulate data on the server.

The essential [components of a REST API](#) include the [HTTP method](#), [endpoint](#), headers, and body. [Here's an example of a REST API](#) that gives you a list of astronauts who are currently in space.

HTTP methods

The HTTP method defines the action the client wants to make on the server, which includes creating, reading, updating, or deleting resources ([CRUD](#)). Here are four HTTP methods that are commonly used in REST APIs:

- ✦ [GET](#): used to retrieve resources.
- ✦ [POST](#): used to add resources.
- ✦ [PUT](#): used to update resources.
- ✦ [DELETE](#): used to delete resources.

Now that we've covered the fundamentals of RESTful APIs, let's look at why and how you can build them with Node.js.

What is Node.js?

By definition, Node.js is an open source and cross-platform JavaScript runtime environment that runs based on Chrome's V8 engine.

To break this down a little further, you can:

- ✦ ✦ Quickly find the source code for Node.js (open source).
- ✦ Run Node.js on Linux, Windows, or macOS (cross-platform).
- ✦ Execute your JavaScript program or application on the server instead of the browser using Node.js (runtime environment).

Why should you use Node.js and Express to build your REST API?

Here are four key advantages of Node.js and Express:

1. The ability to use a single language (JavaScript) for both client-side and server-side development.
2. Fast and powerful performance, owing to the ability to run multiple requests in parallel.
3. Middleware and routing capabilities that are built into Express to make API development quick and easy.
4. A large, active community of developers contributing to the ecosystem.

As you develop the user management API, you'll start seeing these benefits quickly. Let's get started.

Prerequisites

To follow along, you need to have the following:

- ✦ A GitHub account to clone the [companion repository](#)
- ✦ A Postman account to access the [user management API template](#)

If you don't have a Postman account yet, you can sign up for free [here](#).

Setting up a Node.js app

Step 1: Install Node.js and NPM

The first thing we'll need to do is install Node.js on our machine. You can download the latest LTS version from [the official Node.js website](#). Follow the prompts in the Node.js Installer and customize the defaults, if necessary. When you're done, you should have installed Node.js, as well as NPM (Node Package Manager). You can verify the installation by running the following commands in your terminal:

```
node -v  
npm -v
```

If you see the versions of Node.js and NPM show up, your installation was successful.

Step 2: Create a new project folder

Next, we'll create a new folder for the project by running the following command in your terminal (note that entering this command as-is will name your project "node rest api," but you can change the name, if you'd like):

```
mkdir node-rest-api
```

To navigate to your project, enter this command:

```
cd node-rest-api
```

Step 3: Initialize a new Node.js application

To initialize your app, run the following command in your terminal:

```
npm init
```

You will be prompted to enter your project name, description, and GitHub repository. You can accept the defaults by pressing Enter/Return, or customize them.

Next, open this project in your editor, where you will see a new file called `package.json`. This file contains the data you added about your project in the terminal. It also describes how you're going to run the project and lists its dependencies (frameworks and libraries).

Step 4: Install Express and other dependencies

From here on, you can run all your commands in your editor's terminal.

Run the following command to install the Express framework:

```
npm install express
```

Step 5: Import necessary modules

We'll start by creating a new file named `app.js` in the root of the project directory. We'll use this file to set up the app. Then, we'll load the dependencies so we can use them. In the `app.js` file, add the following code to import Express:

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

Now, let's set up Express to create an app and configure it to parse requests with JSON payloads. Here's the code you can add to do that:

```
const app = express ();  
app.use(express.json());
```

Step 6: Define a route that listens to requests

Now we need to make this application a server by getting it to listen for connections. To do this, we'll connect to a port to listen for incoming requests.

Create a new file called `config.js`. In this file, we'll add the following code to set a default port:

```
const PORT = process.env.PORT || 3000;
```

With the `process.env.PORT` variable, we set up the port automatically by allowing the API to be deployed to a cloud platform like AWS or Azure. In case the `process.env.PORT` variable is not set, we'll default to using port 3000.

Next, we'll add the following code to the `app.js` file in order to set up the server to listen on the specified port:

```
app.listen(PORT, () => {  
  console.log("Server Listening on PORT:", port);  
});
```

Step 7: Define an endpoint

Let's start by defining a status endpoint to ensure the API is working.

Express lets you define routes using the `app.METHOD()` function. Here, METHOD refers to the different HTTP methods, like GET, POST, PUT, and DELETE. For a GET request, you'd define the route by adding an `app.get()` function. This function has two parameters. We'll use the first parameter to define the path. In this case, it is the `/status` endpoint:

```
app.get("/status", ());
```

Next, we'll add a callback function as the second parameter, which defines what we will do when the request is called. This function has two parameters: the request object (which contains details like the HTTP method, headers, and request body) and the response object (which defines the information that we want to send). The response (`res`) object contains different methods of sending a response to the client, such as `res.send()`, `res.json()`, and `res.render()`.

Here's what it looks like now:

```
app.get("/status", (request, response));
```

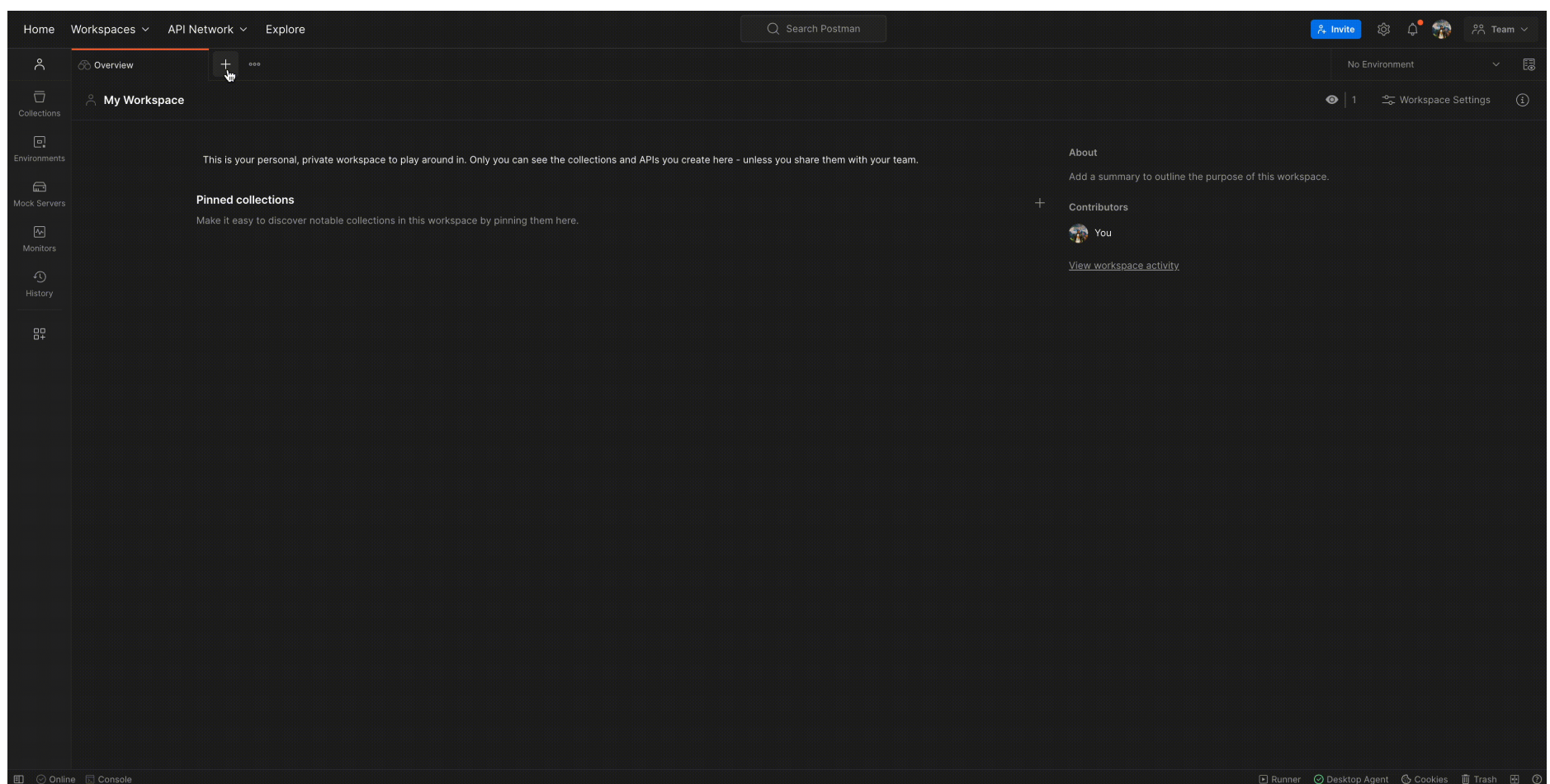
With `response.send()`, we then define the response we want to return. But since we want to send back JSON, we'll need to first define a JSON object. So, we define a status variable and create an object:

```
response.send(status) is now a function that takes the JSON object as the argument.

app.get("/status", (request, response) => {
  const status = {
    "Status": "Running"
  };

  response.send(status);
});
```

Challenge for you: Go to your [Postman account](#) and test the `/status` endpoint with the GET request method. You should get a response that says "Running," as shown below:



If you receive the expected response, congratulations! You've just created your first API.

Similarly, you can use `app.post()`, `app.put()`, and `app.delete()` to handle other request methods.

Creating a user management API with Node.js and Express

Now, we'll create the following [API endpoints](#) for user management:

1. POST `/signup`: Registering a new user
2. POST `/login`: Logging in
3. GET `/user`: Retrieving a user's profile (restricted to the user themselves)
4. PATCH `/users/:userId`: Updating a user's profile (restricted to the user themselves)
5. GET `/users/all`: Retrieving all users (available to all users)
6. PATCH `/user/change-role/:userId`: Updating a user's role (restricted to admins)

7. DELETE /user/:userId: Deleting a user (restricted to admins)

We'll also look at how you can use JSON web tokens (JWTs) to set up authentication for certain endpoints.

We recommend trying out the [user management API](#) to understand what responses you can expect.

Test the user management API faster

Use this template to quickly test how the API behaves before you start building it.

[Use Template](#)

To get started, clone the [companion repository](#) that contains the entire code for the app and use this tutorial to understand the *basics* of how we go about creating the user management app.

Once you've cloned the repository, navigate to the `e-commerce-service` project, where you'll find the following folders:

- ✦ `authorization`: contains everything related to the `/signup` and `/login` endpoints.
- ✦ `common`: contains middlewares and models used for all endpoints.
- ✦ `storage`: stores all the data for the app locally.
- ✦ `users`: contains everything related to all of the user endpoints.

Run `npm install` to install the following libraries that we will be using:

- ✦ **Express**: A Node.js framework for API development.
- ✦ **Sequelize**: A Node.js ORM (object-relational mapper) tool that helps with connecting to a database.
- ✦ **SQLite3**: A library that helps us to create a database, define tables, and manage a SQLite database file.
- ✦ **jsonwebtoken**: An implementation of JSON Web Token (JWT), an open standard (RFC 7519), used to securely transmit information between parties as a JSON object.
- ✦ **AJV (Another JSON Schema Validator)**: A library that helps us validate the payload received against a structure defined using a JSON Schema.

Defining the user module

In real-world apps, we use databases to store data more efficiently. Since this is only a simple project, we wanted to keep things easy. So, we will build the API with SQLite, define the structure of the data in `common/models/User.js`, and store data in `storage/data.db`.

We'll start by creating a new file called `User.js`. Next, in the same file, we will define our schema, which holds all the properties of a user (such as `email`, `username`, and `password`).

We'll also specify the data type—and whether the data can be left void—for every user property. For the user ID, we'll use auto-increment to automatically create a unique number when a new record is inserted into the table:


```
const { DataTypes } = require("sequelize");
const { roles } = require(".././config");
const UserModel = {
  id: {
    type: DataTypes.INTEGER,
    autoIncrement: true,
    primaryKey: true,
  },
  username: {
    type: DataTypes.STRING,
    allowNull: false,
    unique: true,
  }
};
```

Similarly, you can also define other properties, such as `email`, `password`, `age`, `role`, `firstName`, and `lastName`, in the schema.

In the same `User.js` file, we will define an `initialize` method to register our schema with the Sequelize library and return a model. The returned model can then be used to manipulate (i.e., create, read, update, and delete) the data stored in the database.

Here's how you can define a function to create a user:

```
module.exports = {
  initialize: (sequelize) => {
    this.model = sequelize.define("user", UserModel);
  },

  createUser: (user) => {
    return this.model.create(user);
  }
};
```

You can also define wrapper functions that consume the Sequelize library to get and update entries in the database, just like we did for `createUser`.

Now, we're all set to define operations with the `user` module. Let's look at how to define the `/user` endpoint.

We'll start by creating a file named `UserController.js`, which will hold all the controller functions for the different routes related to the user module, like `getAllUsers`, `updateUserDetails`, etc.

Refer to the example below to understand how to set up the `getAllUsers` controller function. This function uses the `findAllUsers` function created in the `User.js` file above to fetch all the users from the table and return them in the response:

```
getAllUsers: (req, res) => {
  UserModel.findAllUsers({})
    .then((users) => {
      return res.status(200).json({
        status: true,
        data: users,
      });
    })
    .catch((err) => {
      return res.status(500).json({
        status: false,
        error: err,
      });
    });
},
```

We will import the `UserController` in the `users/route.js` file and define the route as shown below:

```
router.get("/", UserController.getAllUser);
```

Next, we need to register the `users/routes.js` file in our `index.js` file so that any calls made to the `/user` endpoints are routed to the correct file. To do that, we add the following code:

```
const UserRoutes = require("./users/routes");

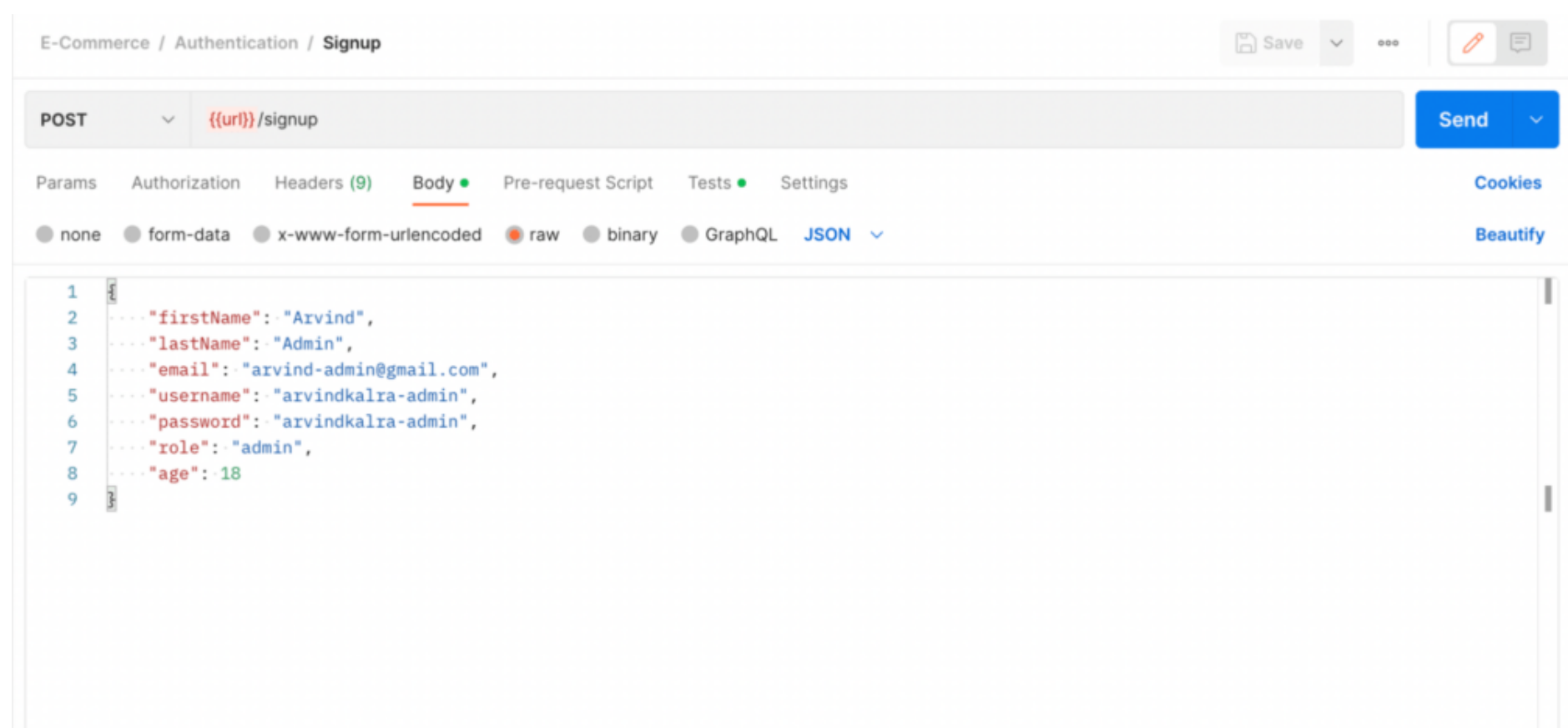
app.use("/user", UserRoutes);
```

Defining the auth module

In this tutorial, we'll implement authentication and authorization using JSON Web Tokens (JWT). JWT generates a valid token for the user and ensures that only authenticated users can access specific API endpoints.

When the user provides the necessary payload while registering or logging in, we will provide a token in return. The token typically expires after a period of time. To keep things simple, we will only focus on creating a single token.

Now we can define the `/signup` endpoint. The payload needs to contain `firstName`, `lastName`, `email`, `username`, `password`, `role`, and `age`. Here's an example:



We will set up a controller to create a new user in the User table using helper functions defined in `User.js` —and also generate a JWT that will be returned as the response. Additionally, before storing the user in the table, we will hash the password using the SHA246 algorithm for better security:

```
module.exports = {
  register: (req, res) => {
    const payload = req.body;

    let encryptedPassword = encryptPassword(payload.password);
    let role = payload.role;

    if (!role) {
      role = roles.USER;
    }

    UserModel.createUser(
      Object.assign(payload, { password: encryptedPassword, role })
    )
      .then((user) => {
        // Generating an AccessToken for the user, which will be
        // required in every subsequent request.
        const accessToken = generateAccessToken(payload.username, user.id);

        return res.status(200).json({
          status: true,
          result: {
            user: user.toJSON(),
            token: accessToken,
          },
        });
      })
      .catch((err) => {
        return res.status(500).json({
          status: false,
          error: err,
        });
      });
  },
};
```

The `generateAccessToken` function used in the code above uses the `jsonwebtoken` library to generate a JWT that can be returned back to the user.

Now, we need to create the route and invoke the controller function that we just created. We can do that by adding the following code in `authorization/routes.js`:

```
router.post( "/signup", AuthorizationController.register);
```

Likewise, you can also define the `/login` endpoint.

We also need to register the `authorization/routes.js` file in our `index.js` file so that any calls made to the `/login` or `/signup` endpoints are routed to the correct file. To do that, we add the following code:

```
const AuthorizationRoutes = require("../authorization/routes");
const UserRoutes = require("../users/routes");

app.use("/", AuthorizationRoutes);
app.use("/user", UserRoutes);
```

Defining permissions and validating data

We need to make sure that only authenticated users can securely access data in the Users resource.

Let us define a middleware that checks if the user is using a valid JWT. To do this, we'll add the following code in `common/middlewares/IsAuthenticatedMiddleware.js`:

```
module.exports = {
  check: (req, res, next) => {
    const authHeader = req.headers['authorization'];

    // IF no auth headers are provided
    // THEN return 401 Unauthorized error
    if (!authHeader) {
      return res.status(401).json({
        status: false,
        error: {
          message: 'Auth headers not provided in the request.'
        }
      });
    }
  }
}
```

Here, we're checking for the presence of auth headers. If no auth headers are provided, we return a 401 unauthorized error. Likewise, we also add checks and return the same error when a bearer auth header is not provided, or when a bearer auth header *is* provided, but a token is *not* provided.

In `common/middlewares/CheckPermissionMiddleware.js`, we'll check for permissions and validate if the user:

- ✦ exists in our database (to access the `/user` endpoint).
- ✦ has the required `Admin` role (to access the `/users/all` and `/user/change-role/:userId` endpoints).

Here, we'll check if a user is in our database, and return a 403 forbidden error if not:

```
module.exports = {
  has: (role) => {
    return (req, res, next) => {
      const {
        user: { userId },
      } = req;

      UserModel.findUser({ id: userId }).then((user) => {

        // IF user does not exist in our database, means something is fishy
        // THEN we will return forbidden error and ask user to login again
        if (!user) {
          return res.status(403).json({
            status: false,
            error: "Invalid access token provided, please login again.",
          });
        }
      })
    }
  }
}
```

Now, we'll add the authentication middleware to the user's module routes in `/users/routes.js`:

We can update the `getAllUsers` endpoint created to the code given below:

```
router.get("/", [IsAuthenticatedMiddleware.check, CheckPermissionMiddleware.has(roles.ADMIN)] ,
UserController.getAllUser);
```

This way, the `/user/all` endpoint can only be accessed by a logged in user who has the `Admin` role.

If you've tried this out on your own, congratulations on creating your first app using Node.js! You now have a solid foundation for building powerful and scalable APIs for your web applications.

You can continue building this app by adding or updating user properties, filtering the users by a particular property (with a query parameter), or connecting to another database like MongoDB etc or MySQL. You can also check out the product directory app added in the [Products](#) folder.

If you have any questions, suggestions, or feedback for us, feel free to drop them in the comments below. We'd love to hear from you!

Frequently asked questions about building APIs with Node.js

What database should I use with Node.js?

In this tutorial, we used SQLite to store the data in a file. SQLite is a great library that allows you to create a database, define tables, and manage a SQLite database file. It also helps you connect with a range of databases— including MongoDB, MySQL, and PostgreSQL—and run queries to manage data in the database. However, you can use any other database based on your requirements by installing the appropriate Node.js driver and modifying the controller functions to interact with the database.

What is the best framework for building REST APIs in Node.js?

While Feathers, Nest, LoopBack, and Moleculer are great frameworks for building REST APIs, here are a few reasons why Express is the best option:

- ✦ It offers features like Model-View-Controller (MVC), robust routing capabilities, and built-in middleware to enable you to create dynamic, scalable applications.
- ✦ It has a large Express community that can help you be faster and more efficient.
- ✦ It is easy to set up, learn, and use, making it an ideal choice for beginners.

This blog was co-authored by Arvind Kalra, who also worked on the companion code repository.

♥ +64

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6 thoughts on “How to create a REST API with Node.js and Express”




jessica

May 30, 2023

Creating a REST API with Node.js and Express is a crucial skill for businesses looking to build modern web applications. By hiring a Node.js developer experienced in REST API development, you can ensure a seamless and efficient process. Their expertise in handling routes, HTTP methods, request handling, and data manipulation will be invaluable. So, if you’re seeking to hire a Node.js developer, make sure to find someone who can effectively implement RESTful APIs using Node.js and Express, bringing your web application to life with robust and scalable backend functionality.



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arnav

July 14, 2023

Your way of describing the Rest API is extremely marvelous. It clears me all point very neatly. Right now I am creating my API but i have a problem actually i have a mongodb field age and i want to search user as =24, =24 by res query object but problem is this that query object return me string and my parseInt() function can return only equal to (=) so how can i calculate less than equal to (=). i have got NaN error.



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Akshaya Srikanth


AUTHOR

July 18, 2023

Hey Arnav, thank you for your feedback. 😊 You might find the solution you’re looking for here – <https://stackoverflow.com/questions/tagged/mongodb>



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Yash Gupta

August 5, 2023



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Absolutely amazing blogs on Rest API .

Thank you very much for such informative blogs



anon

August 18, 2023

can I get the full code, bcz I got an error router is not defined. Where you defined the router and from what/where ?

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Postman Editor

October 9, 2023

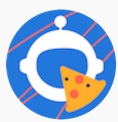
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