

# A Smart Guide to Building Web Applications

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# Chapter 1

## Introduction

This small booklet has X parts illustrating small aspects of the construction of a web server in JavaScript, a static web page using basic technologies like HTML and CSS. And then how to develop a dynamic web page with events and dynamic construction of HTML elements.

The goal of this booklet is to illustrate the different aspects of the construction of a web server in TypeScript. The booklet is not intended to be a complete reference, but rather a quick guide to get you started.

## Part I

# A Web Server in TypeScript

## Chapter 2

# Setting up your first node application

To start this adventure, we will start by setting up a simple **Node.js** application. This will allow us to run JavaScript and TypeScript code outside of the browser. Node.js is a JavaScript runtime environment that allows us to run JavaScript and TypeScript code outside of the browser.

1. To start with you need to install **Node.js** in your computer. You can download it from the Node.js<sup>1</sup> website. Next, we are going to use command line instructions and a text editor. The recommended editor for this journey is Visual Studio Code, with a few plug-ins that will be highlighted along the way.
2. To start, you need to create a directory for your project and initialize it.

```
mkdir myproject
```

---

<sup>1</sup><https://nodejs.org>

```
cd myproject  
npm init -y
```

These commands will add a `package.json` file to your project. This file contains all the configuration information for your project.

3. Next, you need to install the TypeScript compiler and initialize it.

```
npm install -g typescript  
tsc --init  
npm install ts-node typescript --save-dev
```

These commands will add the file `tsconfig.json` to your project and install the necessary packages. This will contain the information for the TypeScript compiler to compile your code.

4. Next, you need to write your first TypeScript file. Create a file called `index.ts` in a folder called `src`.

**TODO:** Create `src` folder: add code snippet

```
console.log("Hello World");
```

5. Change your `package.json` file and modify the “start” script to run your program.

```
"scripts": {  
  "start": "ts-node index.ts"  
},
```

6. Finally, you can run your program with the following command:

```
npm start
```

You should see the message “Hello World” printed in the console. Congratulations, you have succeeded in writing and running your first TypeScript application.

## Chapter 3

# Setting up your first web server

A Web server is a program that listens to requests from a browser and returns a response. Responses can be HTML pages, images, JSON data, etc. Content can be either static if provided by an existing file in the server filesystem, or dynamic if it is created on demand and based on the information from the request.

1. Start by clearing the `index.ts` file. To start designing a basic web server, we will use the `http` module. Write the following declarations into the `index.ts` file.

```
import http from 'http'
```

2. Then we need some constants to determine the address and port of our server. Write the following declarations next to the previous one.

```
const host = 'localhost';  
const port = 8080;
```

3. Next, we need to write a function that will handle the requests. This function accepts two objects as parameters: the request and the response. For now, we are just going to return a simple HTML page for all requests. Write the following code in the `index.ts` file.

```
function doRequests(  
  req:IncomingMessage,  
  res:ServerResponse) {  
  
  const page = `  
    <HTML>  
      <BODY>  
        Hello, World! from the server  
      </BODY>  
    </HTML>  
  `;  
  
  res.setHeader("Content-Type",  
                "text/html");  
  res.writeHead(200)  
  res.end(page)  
}
```

Notice that the immutable variable `page` contains the HTML code for a simple page and that the object `res` is used to set the headers, and the return code of the response. The `end` method is used to send the result to the browser, in the body section. Notice the use of the backtick quotes to define a string over several lines in the file.

Since we need to use type annotations for the function parameters, we need to import types `IncomingMessage` and `ServerResponse`. So, we need to update our import statement to include these.

```
import http, {IncomingMessage,  
              ServerResponse} from 'http'
```

4. Next, we need to create the server and start listening to requests. Write the following code in your file:

```
const server =
  http
    .createServer(doRequests);

server.listen(
  port,
  host,
  () => {
    console.log(`Server is running on http
      ://${host}:${port}`);
  }
);
```

We first create an object called **server** based on the previously defined function **doRequests**. Then we call the **listen** method on the server object to start listening to requests. The **listen** method accepts three parameters: the port, the host, and a callback function that is called when the server is ready to accept requests. In this case, the backtick quotes are used to define an interpolated string with the host and port values.

5. Your **index.ts** file should look like this by now:

```
import http, {IncomingMessage,
  ServerResponse} from 'http'
const host = 'localhost';
const port = 8080;

function doRequests(
  req:IncomingMessage,
  res:ServerResponse) {
  const page = `
    <HTML>
```



```

        <BODY>
            Hello, World! from the server
        </BODY>
    </HTML>
    `

    res.setHeader("Content-Type", "text/html");
    res.writeHead(200)
    res.end(page)
}

const server =
    http
      .createServer(doRequests);

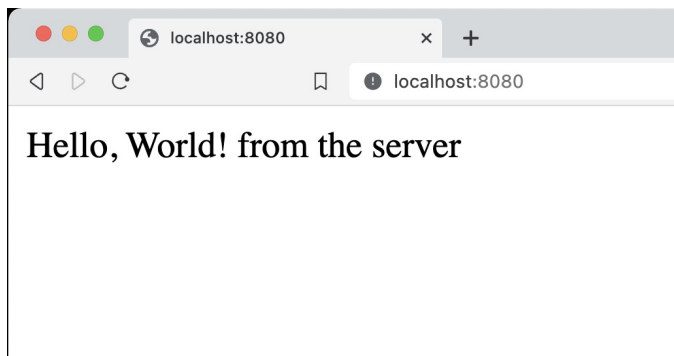
server.listen(
    port,
    host,
    () => {
        console.log(`Server is running on http
                    ://${host}:${port}`);
    }
);

```

6. Finally, you can run your program with the following command:

```
npm start
```

You should see the message “Server is running on `http://localhost:8080`” printed in the console. If you go to a browser and use that same URL, you should see



Congratulations, you have succeeded in writing and running your webserver using TypeScript.

(You can find the final code in the file `index.ts` in the folder `chapter2` of this guide.)

## Chapter 4

# Returning a 404 error

In the previous example, your web server returns a successful response when you access the URL (`localhost:8080`).

When accessing a URL, your browser receives the response (i.e. the content of the webpage), and also receives an HTTP code denoting the nature of the response. In the previous case, since the response is successful (i.e. the page exists and no error occurred when accessing it), the server returns the HTTP status code `200 OK`.

However, in some cases, accessing a URL may return an error. For instance, when you access a non-existing page<sup>1</sup>, you typically receive a `404 Not Found` status code. This signals to your web browser that the page does not exist, and allows it to react accordingly<sup>2</sup>.

Let's change the code in our web server to return a `404 Not found`. Start by opening the `index.ts` file in the root of your project, and find the following line:

```
res.writeHead(200)
```

---

<sup>1</sup>

<sup>2</sup>For an extensive list of HTTP status codes, you can check this<sup>3</sup> page.

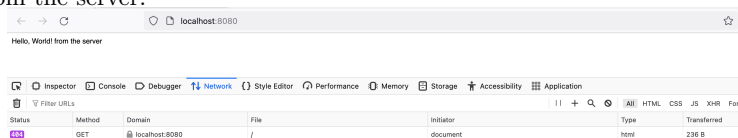
This makes your webserver return a 200 OK status code. Let's change this to return **404 Not found**:

```
res.writeHead(404)
```

Now, run your web-server again:

```
npm start
```

If you navigate with your browser to the URL (`localhost:8080`), you still see the same page as before. To see the error code, you can open the developer tools<sup>4</sup>, and then open the **Network** tab. Now, if you reload the page, you should see the 404 error being returned from the server.



In general, a web server should return a different page depending on the HTTP status code. We'll explore this in the next step, where we will return a **404 Not found** page if a user tries to access a non-existing file.

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<sup>4</sup>In Firefox: **Tools > Browser Tools > Web Developer Tools**; In Chrome: **View > Developer > Developer Tools**.

## Chapter 5

### Loading files from the web server

## Chapter 6

# Returning dynamic content

Use a form to upload parameters.

## **Chapter 7**

# **Webservices: returning JSON data**

## Part II

# A Web page using HTML and CSS



## Chapter 8

# HTML: Writing your first web page

## **Chapter 9**

# **HTML: The anatomy of an HTML element**

## **Chapter 10**

# **HTML: Basic Text Formatting**

## **Chapter 11**

### **HTML: Adding images**

## **Chapter 12**

# **HTML: Linking different pages**

## Chapter 13

# HTML: Formatting with stylesheets

## **Chapter 14**

# **HTML: Basic Layout with CSS**

## **Chapter 15**

# **HTML: Making requests with Forms**



## Part III

# Reactive pages: Events and JavaScript

## Part IV

# Dynamic pages with JavaScript