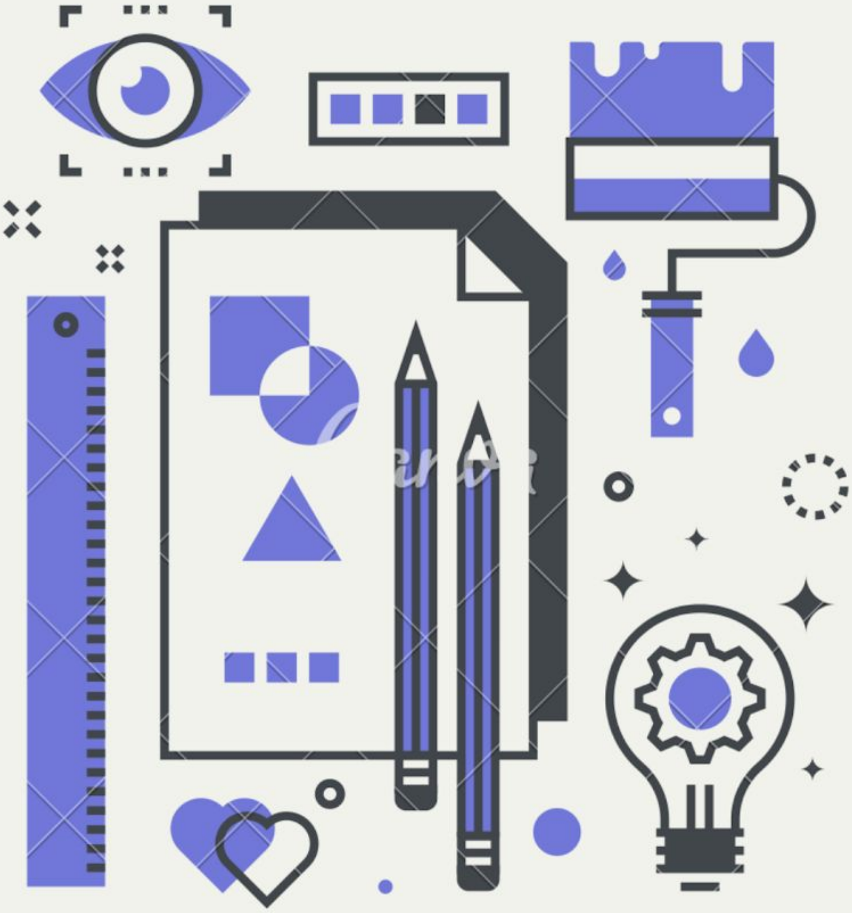
LEARN NODE IN A WEEK

LET US NODE



BY SHAHID SHAIKH

Let us Node

Learn Node in one Week!

This book is designed to teach you Node in one week. All you need to do is follow it day wise. Each day covers important topics related to Node to get you started.

We don't cover in depth topics as this book is for beginners readers. We cover topics that are required to get you started developing applications using Node.

This book is divided into 7 days sections. We expect you to give us 30 minutes per day and cover the topic days wise. It's simple and easy to follow.

Here are the topics we are going to cover each day:

- Day 1: Node basic concepts - Libuv, Event loop, Libev.
- Day 2: Building a Web Server in Node.
- Day 3: Node modules and NPM.
- Day 4: File system module.
- Day 5: Express framework.
- Day 6: Databases - MySQL, MongoDB, PostgreSQL and Redis.
- Day 7: Deployment - deploying applications in Digitalocean Server.

After reading this book, you should be able to build applications using Node and deploy it on a live server.

Day 1
Node Basics

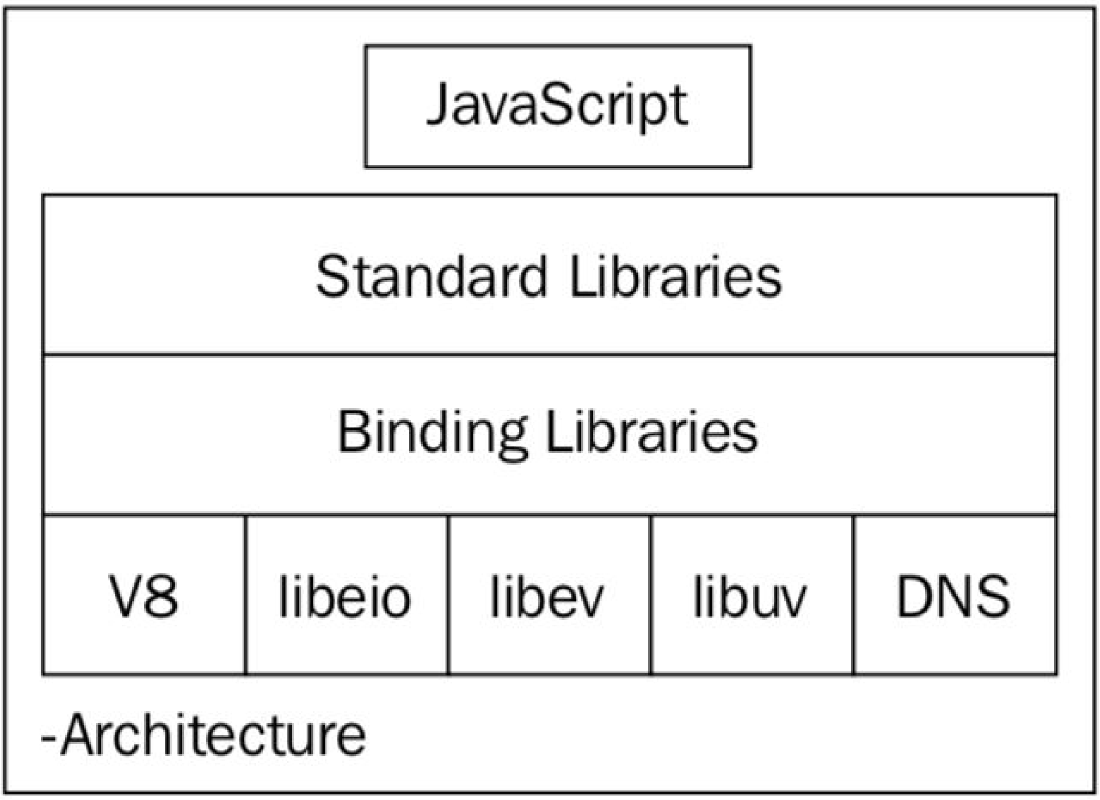
Hello there, welcome to the Let us Node day 1. Today, we are going to cover the basics of Node, how it works and in the end perform the installation of Node in your respective operating system.

So for the next 30 minutes, let’s read together.

How Node Works

Node.js runs on top of V8—Chrome runtime engine—that compiles the **JavaScript** code in the **native** machine code (one of the reasons why Google Chrome runs fast and consumes a lot of memory), followed by the custom C++ code.

The original version has 8,000 lines of code (LOC)—and then, the standard libraries for programmers. The following is the figure of Node.js architecture:



-Architecture

V8

The V8 JavaScript engine is an open source JavaScript engine developed for the **Chrome** project. The innovation behind V8 is that it compiles the JavaScript code in native machine code and executes it.

The developers of V8 used the just-in-time (JIT) compiler methodology to improve the code compilation time. It is open source and is used in the Node.js and MongoDB project.

Link: https://github.com/v8/v8

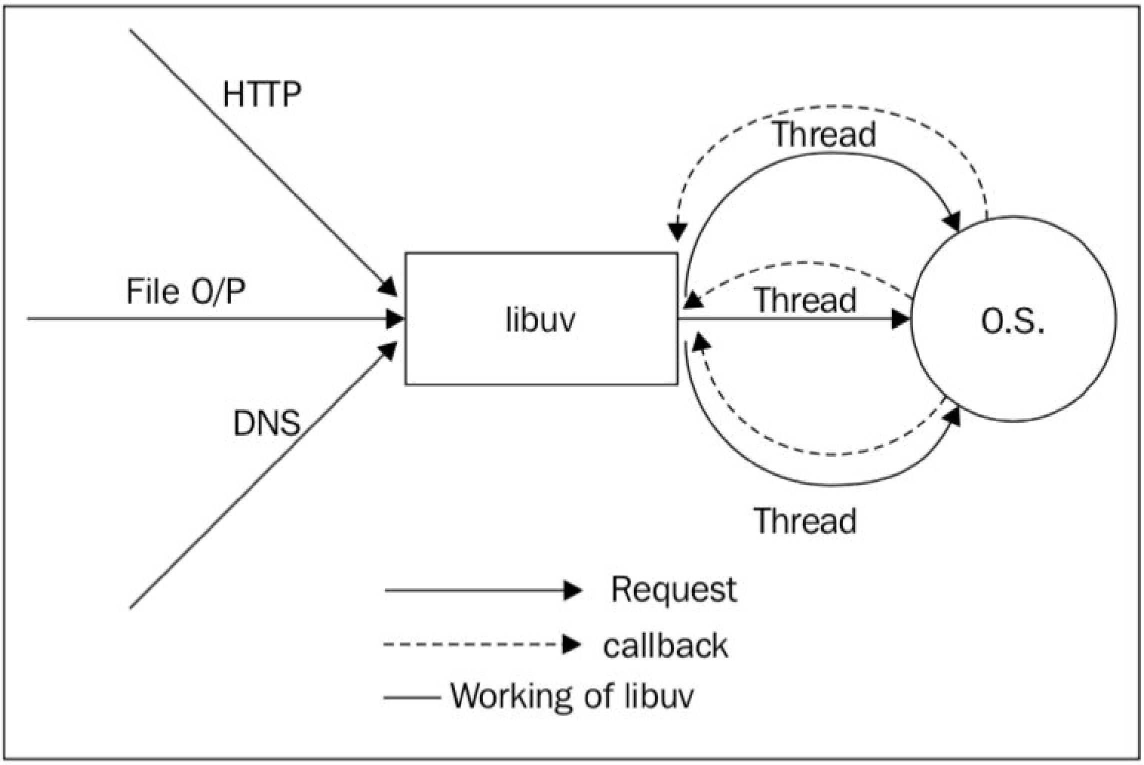
Event driven I/O – libuv

The libuv library is a cross-platform library that provides an asynchronous I/O facility by enabling an event-driven I/O operation. The libuv library creates a thread for the I/O operation (file, DNS, HTTP, and so on) and returns callback.

Upon completion of the particular I/O operation, it returns the events so that the callee program does not have to wait for the completion of I/O operation.

Working of libuv – core of Node.js

As we mentioned above, libuv assigns threads for the I/O operation and returns the callback to the callee program. Therefore, Node.js internally creates **threads** for I/O operation; however, it gives the programmer access to a **single runtime** thread. In this way, things are simple and sweet:



When you make an HTTP request to the web server built using Node. It creates the libuv thread and is ready to accept another request.

As soon as the events are triggered by libuv, it returns the response to the user. The libuv library provides the following important core features:

- Fully featured event loop
- Asynchronous filesystem operations
- Thread pool
- Thread and synchronization primitives
- Asynchronous TCP and UDP sockets
- Child process
- Signal handling

The libuv library internally uses another famous library called **libeio**, which is designed for **threading** and **asynchronous** I/O events and **libev**, which is a high-performance event loop.

Therefore, you can treat libuv as a package wrapper for both of them.

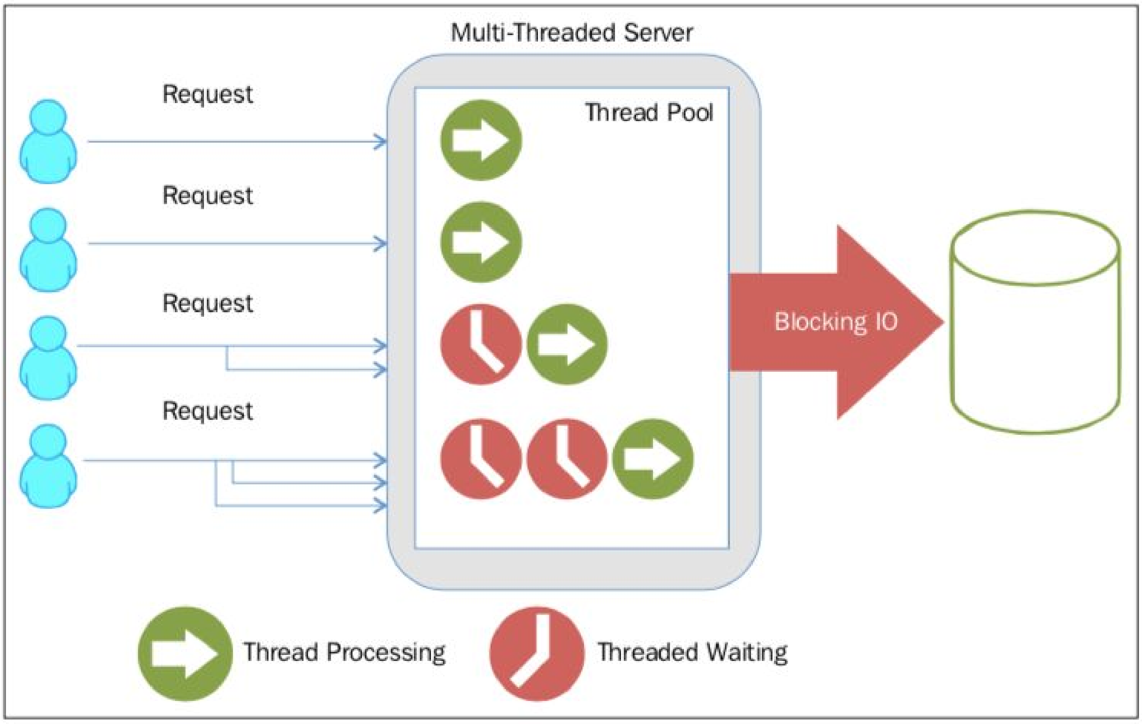
Let’s learn a little bit about multi threading and single threading.

Multi-threading approach provides **parallelism** using threads so that multiple programs can simultaneously run.

With advantages come the problems too; it is really difficult to handle concurrency and **deadlock** in a multi-threading system.

On the other hand, with single-threading, there is no chance of deadlock in the process and managing the code is also easy. You can still hack and busy the event loop for no reason; however, that's not the point.

Consider the following working diagram that is developed by **StrongLoop**—one of the core maintainers of Node.js:

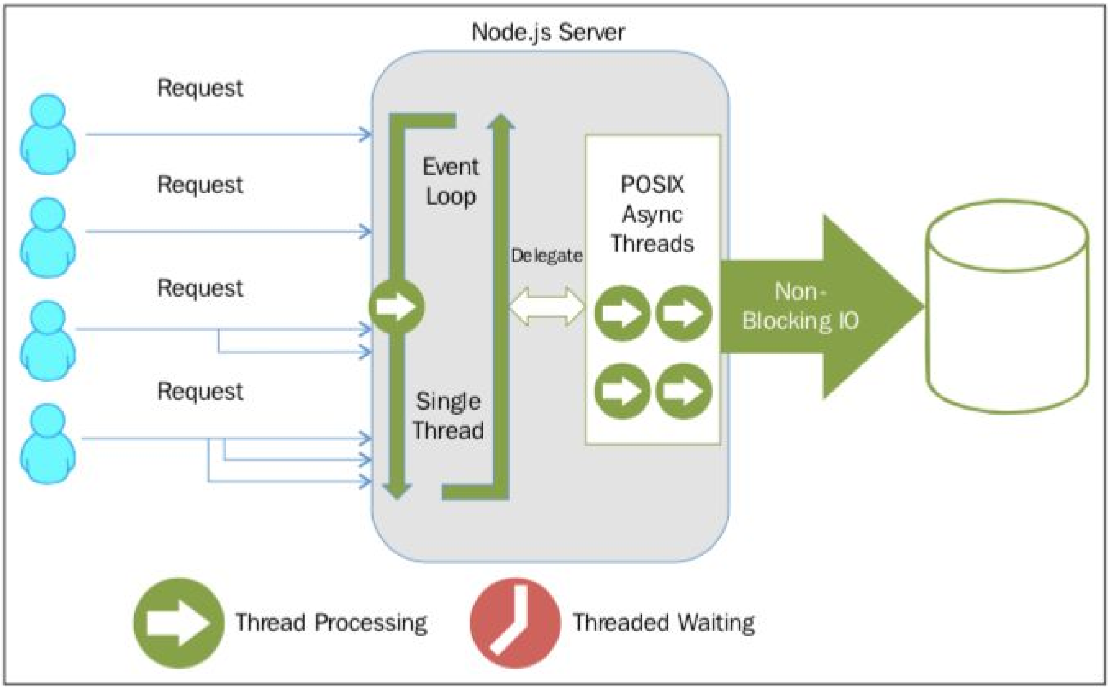


Node.js uses single-threading for runtime environment; however, internally, it does create multiple threads for various I/O operations.

It doesn't imply that it creates threads for each connection, libuv contains the Portable Operating System Interface (POSIX) system calls for some I/O operations.

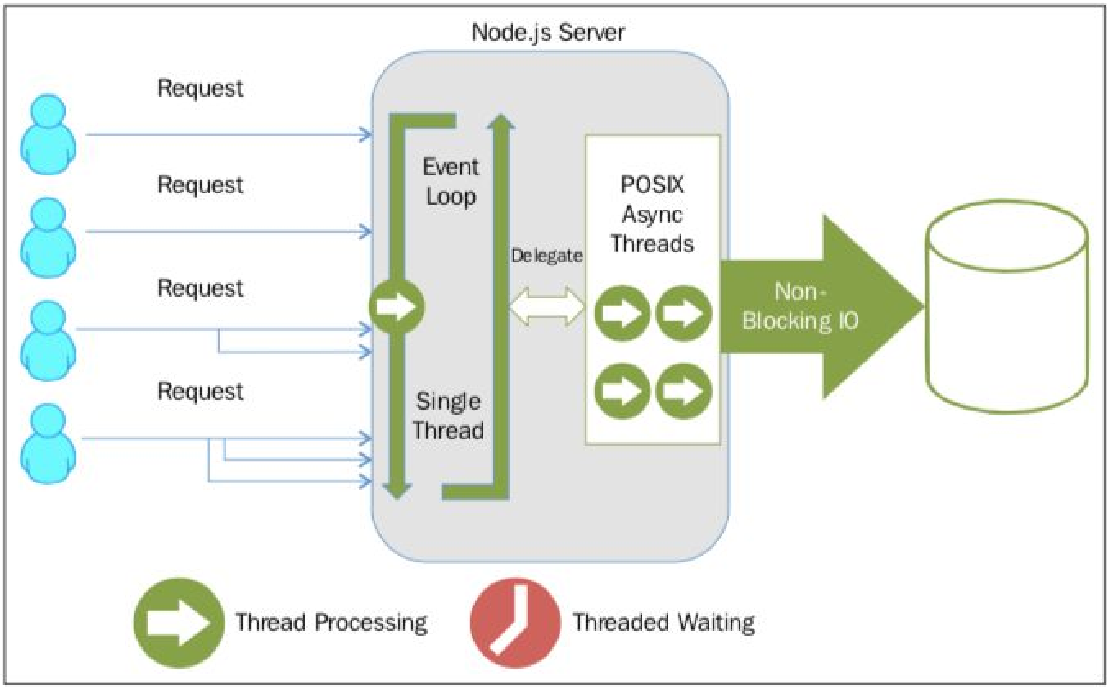
Multi-threading blocks the I/O until the particular thread completes its operation and results in overall slower performance.

Consider the following image:



If the single-threading programs work correctly, they will never block the I/O and will be always ready to accept new connections and process them.

Let's refer to the diagram from the last lesson.



As you can see in the diagram, I/O does not get blocked by any thread in Node.js. Then, how does it notify particular processes that the task has been done or an error has occurred?

Importance of event loop

Node.js is **asynchronous** in nature and you need to program it in an asynchronous way, which you cannot do unless you have a clear understanding of the event loop.

If you know how the event loop works, you will no longer get confused and hopefully, never **block** the event loop.

How Event Loop Works

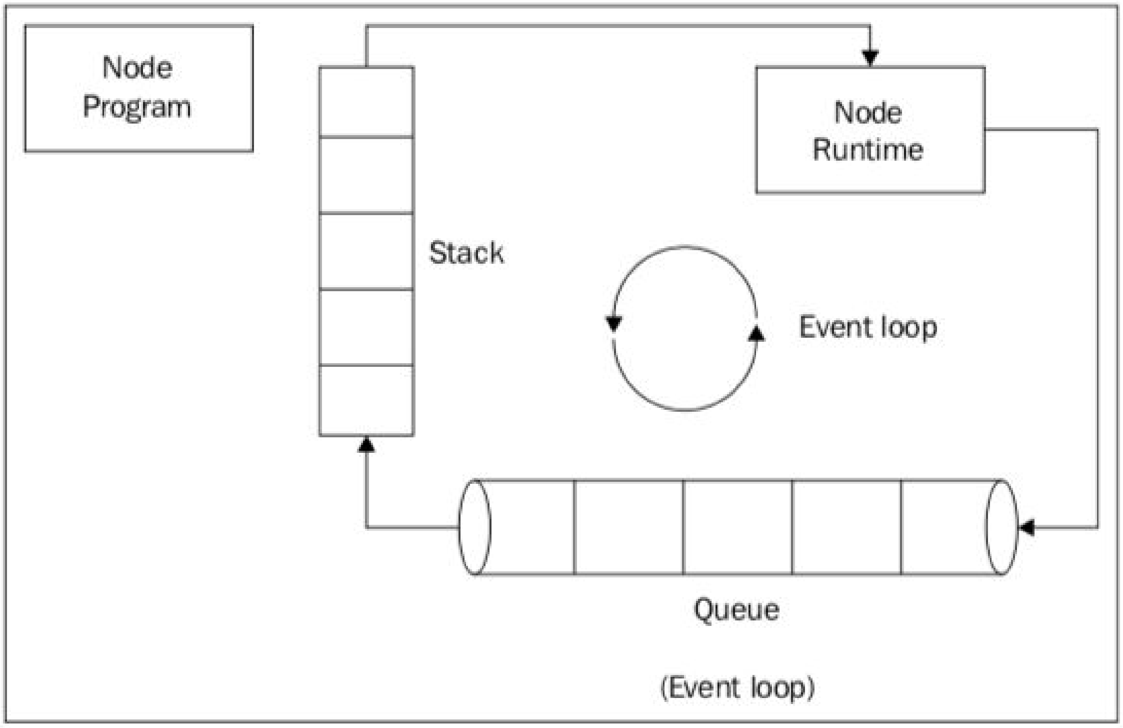
The Node.js runtime system has an execution **stack**, where it pushes every task to execute.

Operating system pops the task from the execution stack and conducts the necessary action required to run the task.

To run the asynchronous code, this approach won't work. The libuv library introduces a **queue** that stores the callback for each asynchronous operation.

Event loop runs on a specific interval, which is called **tick** in the Node.js terminology, and checks the stack.

If the stack is empty, it takes the callback from the queue and pushes it in the stack for execution, as shown in the following figure:



The libuv library creates the thread and returns the callback to us.

As it's an asynchronous operation, it goes to the queue instead of the stack and the event loop fetches it when the stack is empty and does the execution. You can validate the same concept using the **setTimeout()** function.

Consider the following code:

```
console.log('i am first');

setTimeout(timeout() => {
  console.log('i am second');
}, 5000);

console.log('i am third');
```

If you run the previous code, you will get an output similar to the following:

```
i am first
i am third
i am second
```

The reason is obvious, **setTimeout()** waits for five seconds and prints its output; however, that does not block the event loop. Let's set the timer to 0 seconds and see what happens:

```
console.log('i am first');

setTimeout(timeout() => {
  console.log('i am second');
}, 0);

console.log('i am third');
```

The output is still the same:

```
i am first
i am third
i am second
```

Why so? Even if you set the timer to 0, it goes in the queue; however, it is immediately processed as its time is 0 second.

The event loop recognizes that the stack is still not empty, that is, the third console was in process; therefore, it pushes the callback after the next tick of the event loop.

Alright, we have covered the core and basic concepts of Node. If you want to deep dive further, please navigate to Node official documentation.

Let’s proceed and install Node in our operating system.

Installing Node in Your Operating System

Based on which operating system you are using, you can skip to the sections accordingly.

To install Node in Windows Operating System, follow these steps:

- **Step 1:** Download the Installer

  Download the Node installer from the official site.

- **Step 2:** Run the installer.

  Run the installer and click **Next** until the setup wizard is complete.

- Step 3: Verify the installation

  Open **command prompt** or **PowerShell** and run the following command. **node -v** It should return the node version.

- Step 4: Update the NPM

```
npm install -g npm
```

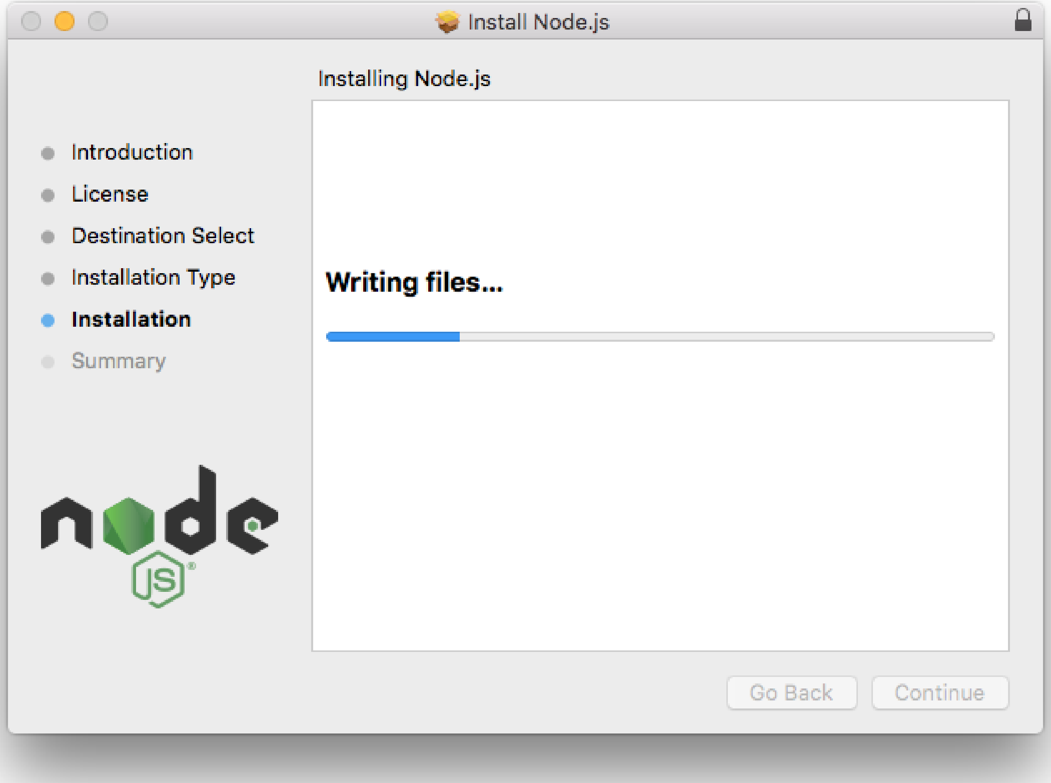
To install Node in **Mac**, follow these steps:

- Step 1: Download the Installer

  Download the Node installer from the official site.

- Step 2: Run the installer

Run the installer and click **Continue** until the setup wizard is complete.



Installing Node.js

Writing files...

- Step 3: Verify the installation

  Open terminal and run the following command.

  node -v

  It should return the node version.

- Step 4: Update the NPM using the following command.

```
npm install -g npm
```

To install Node in the **Ubuntu** operating system, open the terminal and run the following command one by one.

```
curl -sL https://deb.nodesource.com/setup_12.x | sudo -E bash -
```

Then,

```
sudo apt-get install -y nodejs
```

Also, install the build tools.

```
sudo apt-get install -y build-essential
```

Update the NPM.

```
sudo npm install -g npm
```

Verify the installation, run the following command.

```
node -v
```

It should return the version of Node installed in your system. In our case, it should be V12.

Awesome. We are good for the day, see you tomorrow.

Day 2
Building Web Server

Hey there, welcome to the day 2 of Let us Node. Today, we are going to learn how to create a simple web server using Node using a built in **http** module.

So for the next 30 minutes, let's read together.

Let's build a simple Web application that prints **Hello World** on the browser upon user's request. We will use the native **http** module of Node to achieve the Web Server functionality. Here is the code:

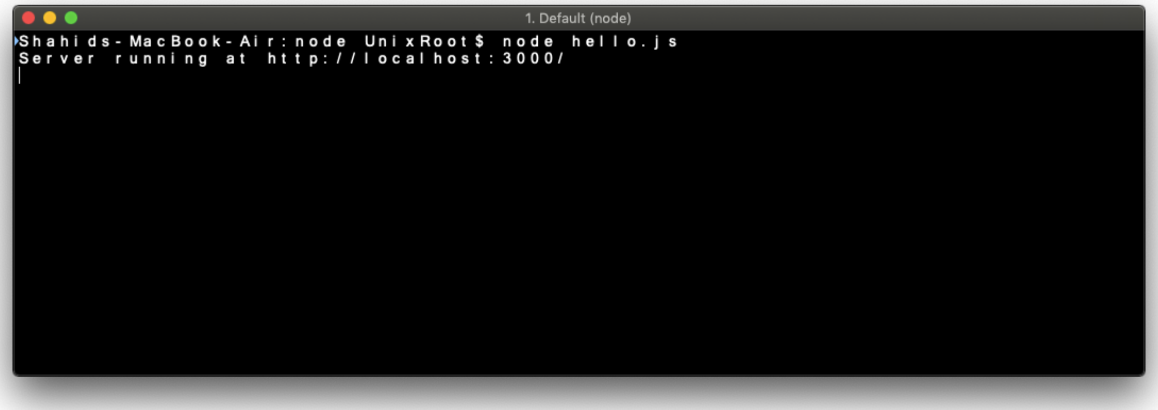
```
const http = require('http');
const hostname = 'localhost';
const port = 3000;
const server = http.createServer((req, res) => {
  res.statusCode = 200;
  res.setHeader('Content-Type', 'text/plain');
  res.end('Hello World ');
});

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

Copy/paste it in a new file. Name the file as **hello.js** and save it.

To run this code, open your terminal and switch to the location where you have stored the file. Run this command to execute your code.

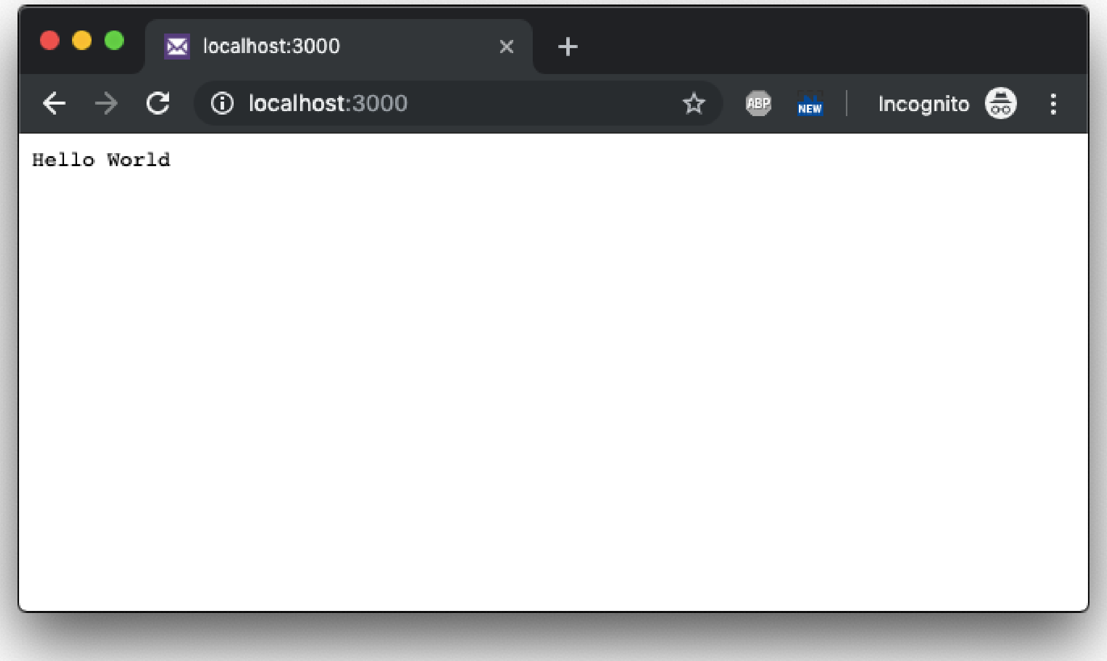
```
node hello.js
```

You should have the following message on the terminal.



```
Shahids-MacBook-Air:node UnixRoot$ node hello.js
Server running at http://localhost:3000/
```

Open your browser and type **localhost:3000** and hit enter. You should see the following message.



```
Hello World
```

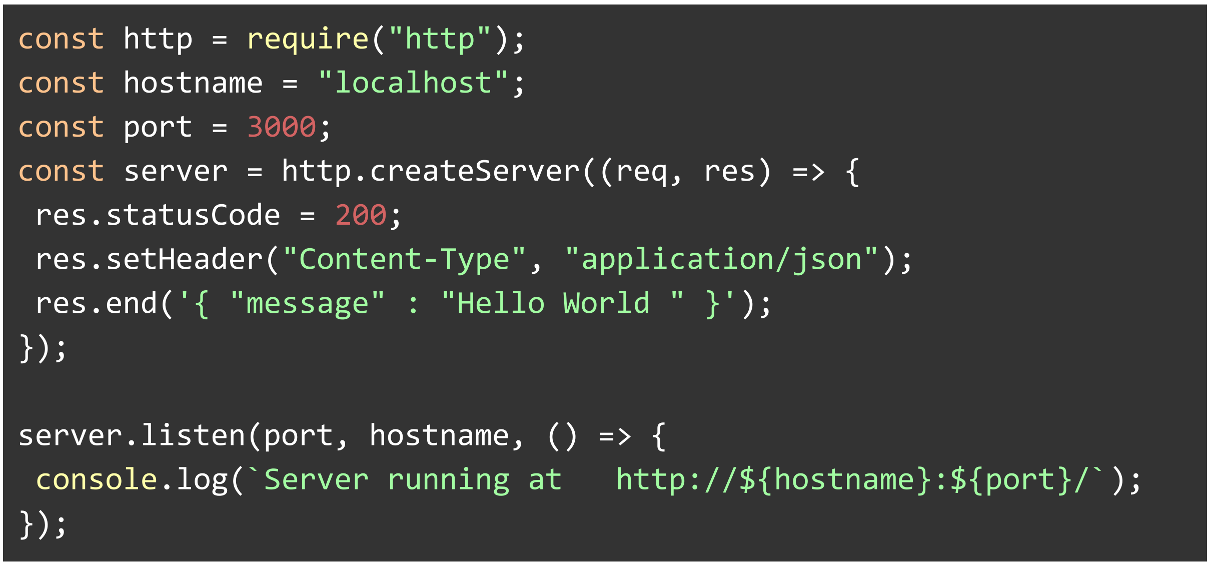
Congratulations!

You have just developed your first Node program.

Our server responds to a simple message as a text, however, in practice we need to handle different types of responses.
Let's look over some of the common response types.

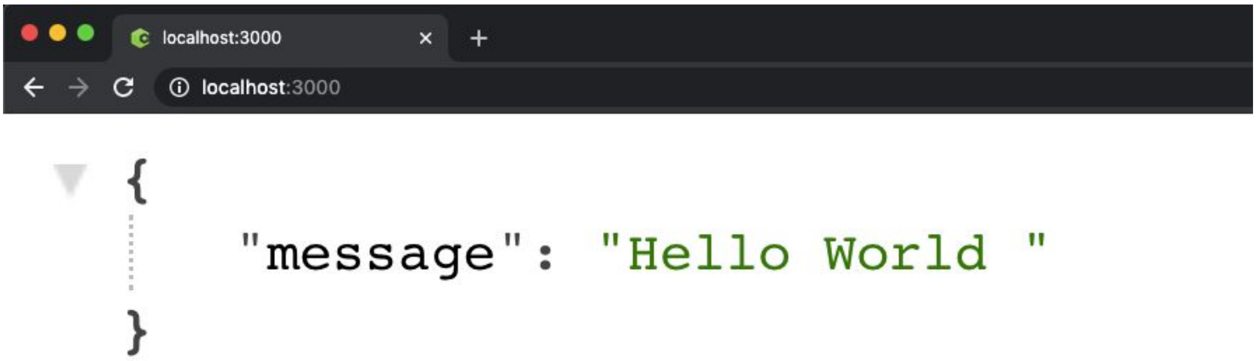
One of the most common responses that you need to handle while developing a Node application is JSON.

Here is how you can send JSON responses.



```
const http = require("http");
const hostname = "localhost";
const port = 3000;
const server = http.createServer((req, res) => {
 res.statusCode = 200;
 res.setHeader("Content-Type", "application/json");
 res.end('{ "message" : "Hello World " }');
});

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

If you run this code, and navigate to the browser, you should see the following response.

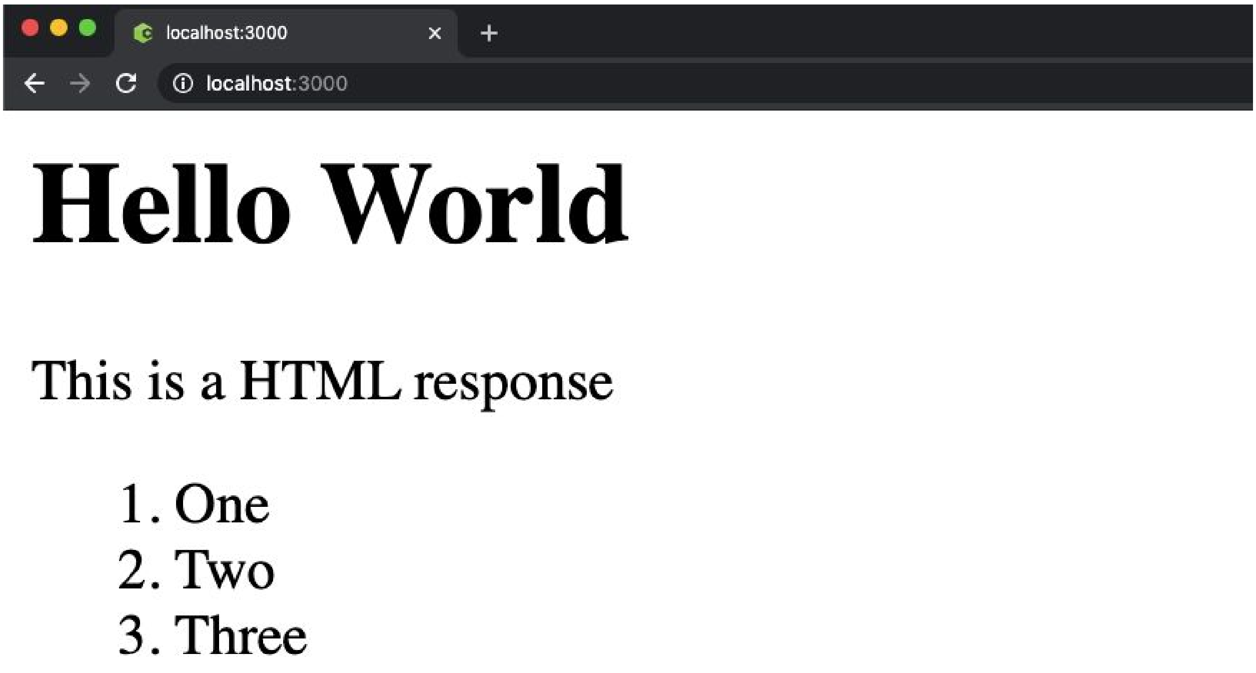


```
{
    "message": "Hello World "
}
```

Let’s look over how to send HTML as a response.

```
const http = require("http");
const hostname = "localhost";
const port = 3000;
const server = http.createServer((req, res) => {
 res.statusCode = 200;
 res.setHeader("Content-Type", "text/html");
 res.end(
   "<h1>Hello World</h1><p>This is a HTML
response</p><ol><li>One</li><li>Two</li><li>Three</li></ol>"
 );
});

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

When you run this code, you should see the following response.



Hello World

This is a HTML response

1. One
2. Two
3. Three

Awesome.

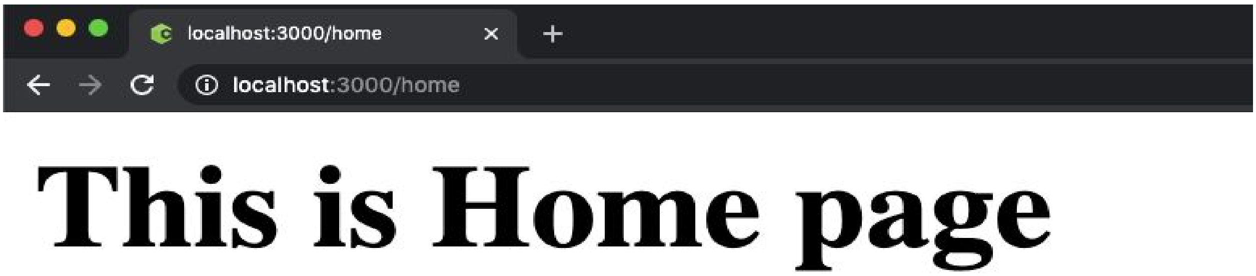
Let’s go ahead and create different routes to support multiple responses.

Check out the code shown below.

```
const http = require("http");
const hostname = "localhost";
const port = 3000;
const server = http.createServer((req, res) => {
 res.statusCode = 200;
 res.setHeader("Content-Type", "text/html");
 switch (req.url) {
   case "/home":
     res.writeHead(200);
     res.end("<h1>This is Home page</h1>");
     break;
   case "/about":
     res.writeHead(200);
     res.end("<h1>This is About page</h1>");
     break;
   default:
     break;
 }
});

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

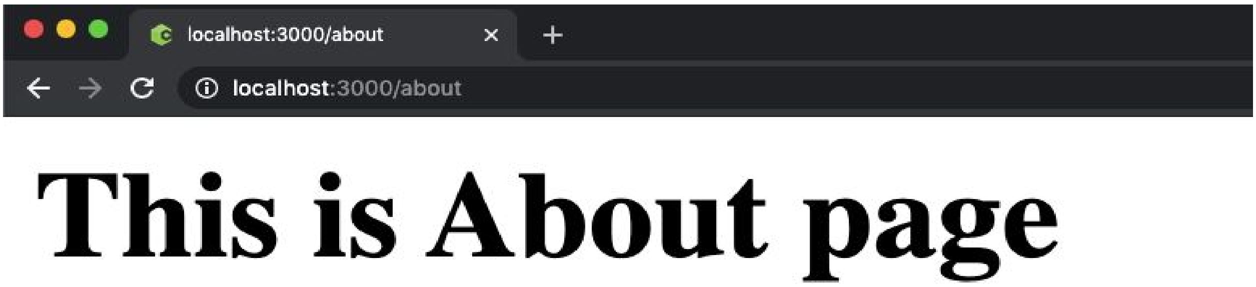
As you can see, we are using **switch** cases to determine different routes and on each route, we are sending different responses to each route.

Navigate your browser to **localhost:3000/home** to view the response.



This is Home page

Navigate your browser to **localhost:3000/about** to view the second response.



This is About page

Very well. We have built the custom routes as well. We are done for the day, see you tomorrow.

Day 3
Node modules

Node modules are the basic building block of the Node program.

Node module is a set of functions that can be reused in your application.

Node has built-in modules as well as you can create your own node modules.

Some of the famous built-in node modules are **fs**, **net**, **http** and many of the popular modules such as **express**, **nodemailer** built on top of these built-in modules.

We can install node modules using node package manager or called **npm**.

You can install node modules using the following command.

Open your terminal/command prompt and run this command.

```
npm install
```

Or

```
npm i
```

For example:

```
npm install express
```

You can also install the module and write it in your **package.json** file using the following command.

```
npm install --save express
```

Or

```
npm i --S express
```

You can use the following command to uninstall node modules.

```
npm remove
```

If you want to remove the module entry from the **package.json** file, use this command.

```
npm remove --save
```

You can create your own node module as well. All you need to do is create a function and export it for the reusability.

For example, consider this code which can act as a node module.

```
const calc = (a,b,p) => {
    if(a || b || p ) {
        return "Please provide all parameters";
    }
    switch(p) {
        case '+': {
            return a+b;
            break;
        }
        case '-': {
            return a-b;
            break;
        }
        case '*': {
            return a*b;
            break;
        }
        case '/': {
            return a/b;
            break;
        }
        default:{return;}
    }
}
exports.calc=calc; //very important line
```

You can reuse this module in your code like this:

```
var dt = require('./mymodule');
console.log(dt.calc(10,20,'+'));
```

This is a really simple example. However, this gives an idea about how to create node modules. If you are interested in more detailed information, visit this tutorial.

Node modules are managed by the file called **package.json**. This file contains the list of the packages your project is using along with the version number etc.

A typical **package.json** file looks like this:

```
{
 "name": "codeforgeek-app-server",
 "version": "1.0.0",
 "description": "",
 "main": "app.js",
 "scripts": {
   "start": "node app.js"
 },
 "keywords": [],
 "author": "",
 "license": "ISC",
 "dependencies": {
   "async": "^3.1.0",
   "axios": "^0.19.0",
   "bcrypt": "^4.0.1",
   "chalk": "^2.4.2",
   "connect-redis": "^4.0.4",
   "cors": "^2.8.5",
   "express": "^4.17.1",
   "mongodb": "^3.2.7",
   "nconf": "^0.10.0",
   "nodemailer": "^6.3.0",
   "pug": "^2.0.4",
   "reading-time": "^1.2.0",
   "redis": "^2.8.0",
   "winston": "^3.2.1"
 }
}
```

We also specify details such as project name, version, entry file of the project in the **package.json**.

All the dependencies that are installed using **npm install** command is listed in the package.json. You should always maintain the updated version of **package.json** while dealing with the packages.

We are done for the day.

See you tomorrow :)

Day 4
Files

The **fs** module provides an API for interacting with the file system of your operating system. To use this module, require it in your code like this:

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

There are lots of methods provided under this node module to perform various tasks such as creating files, writing data into file, reading data from files etc.

You can use **fs.readFile()** or **fs.readFileSync()** method to read files in Node.

For example: Using the **readFile()** method.

```
const fs = require('fs');
fs.readFile('./lorem.txt', (err, data) => {
  if(err) {
    return console.log('Error occurred while reading file');
   }
  console.log(data.toString());
});
```

Using the **readFileSync()** method.

```
const fs = require('fs');
const data = fs.readFileSync('./lorem.txt');
console.log(data.toString());
```

The simplest approach to check whether the file exists or not is by using the **readFile()** function.

However, this function does open the file descriptor and occupies some memory too.

If you just want to check the file existences in the system, I highly recommend the **access()** function. Here is the code:

```
const fs = require('fs');
const path = './config.js';
fs.access(path, fs.F_OK, (err) => {
  if (err) {
    console.error(err);
    return;
  }
});
```

The file system module provides three methods to create files:

1. fs.open()
2. fs.writeFile()
3. fs.appendFile()

fs.open() method opens a new file or creates a new empty file if it does not exist in the specified path.

It takes the second parameter which acts as a flag such as **w** for writing, **w+** for reading and writing etc. Code:

```
const fs = require('fs');
fs.open('file.txt', 'w', (err, file) => {
  if (err) {
    throw err;
  }
  console.log('Saved!');
});
```

fs.writeFile() method allows you to create or replace files with the content.

If a file exists, it will replace the content with the provided content and if the file does not exist, it will create it.

```
const fs = require('fs');
fs.writeFile('file.txt', 'Hello Word!', (err) => {
  if (err) {
    throw err;
  }
console.log('Saved!'); });
```

fs.appendFile() method appends the provided content at the end of the file.

```
const fs = require('fs');
fs.appendFile('file.txt', ' Hello World', (err) => {
  if (err) {
    throw err;
  }
  console.log('Updated!');
})
```

To delete a file, we can use **fs.unlink()** method.

```
const fs = require('fs');
fs.unlink('file.txt', (err) => {
  if (err) {
    throw err;
  }
  console.log('File deleted!');
});
```

To rename a file, we can use the fs.rename**()** method.

```
const fs = require('fs');
fs.rename('newfile.txt', 'oldfile.txt', (err) => {
  if (err) {
    throw err;
  }
  console.log('File Renamed!');
});
```

You can also copy files using the fs.copy() method.

```
const fs = require('fs');
fs.copyFile(file.txt', 'copyfile.txt', (err) => {
  if (err) {
    throw err;
  }
  console.log('File is copied!');
});
```

You can check more functions in the **fs documentation** page.

That’s it for today, see you tomorrow :)

Day 5
Express
Framework

Express is a popular framework to develop web applications in Node.

Express is widely used and can be used to develop web applications such as Web Server, REST API Server, Streaming engine, etc.

In this section, we are going to learn about express and we will create a simple web server with different routes.

Terminologies we will use in this section are:

- route: This means an endpoint. for example: facebook.com/profile so profile is a route.
- middleware: A set of functions that will be executed in the chosen order.

Let's begin.

Create a new folder and switch to it using a terminal or command prompt.

Create a new node project using the following command.

```
npm init --y
```

This will create a sample **package.json** for your project. To install the **express** module, run the following command.

```
npm install --save express
```

The latest version of the express framework will be installed in your project. Now create a new file and name it **app.js**. In this file, we will write our web server using express.

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

app.listen(process.env.port || 3000);

console.log('Web Server is listening at port '+ (process.env.port
|| 3000));
```

In the code shown above, we have required the **express** module and created a new instance of it.

In the end, we have started our Server using the **listen()** function.

Routers are simply an endpoint of a server.

For example, **facebook.com/codeforgeek**, here the **codeforgeek** is a route.

We need to create **routers** in our web application to serve different requests. We will create the following routes in our web application.

- home
- profile
- login
- logout

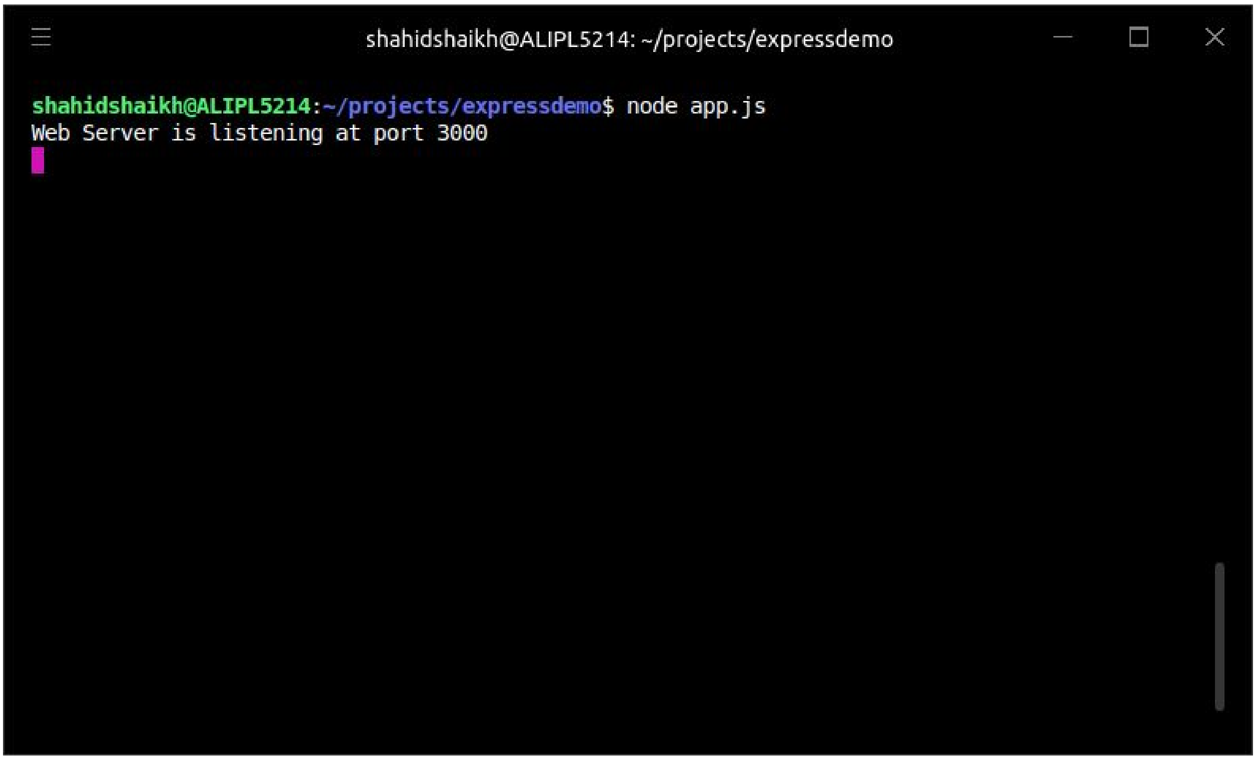
Express routers allow us to serve different HTTP methods such as GET, POST, PUT, DELETE, HEAD. Here is how to create a router.

```
const express = require('express');
const app = express();
const router = express.Router();

router.get('/home', (req,res) => {
  res.send('Hello World, This is home router');
});

router.get('/profile', (req,res) => {
  res.send('
    Hello World, This is profile router
  ');
});

router.get('/login', (req,res) => {
  res.send('
    Hello World, This is login router
  ');
});

router.get('/logout', (req,res) => {
  res.send('
   Hello World, This is logout router
  ');
});

app.use('/', router);

app.listen(process.env.port || 3000);

console.log('Web Server is listening at port '+ (process.env.port
|| 3000));
```

Let's run our application, save the file and run the code using the following command.

```
node app.js
```

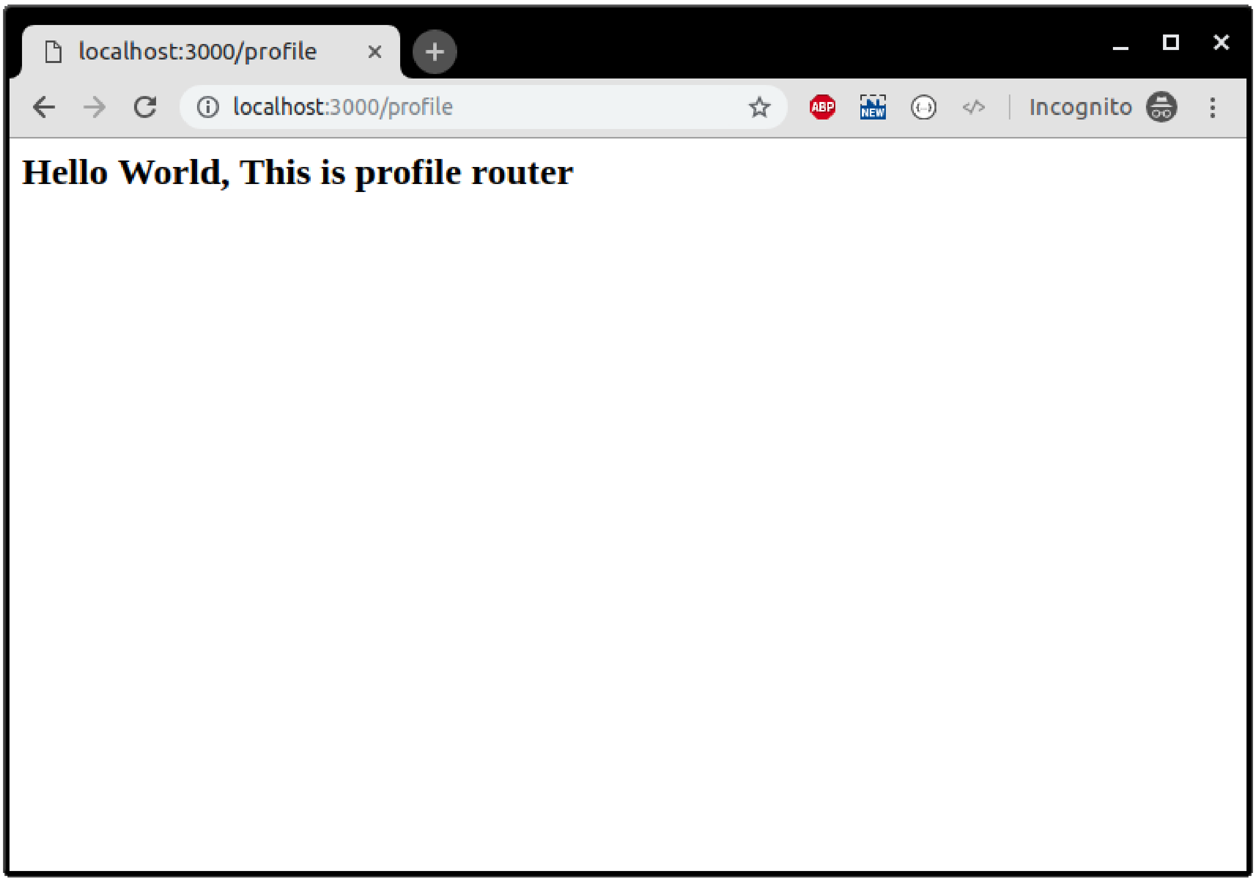
You should see the following message in the terminal.



```
shahidshaikh@ALIPL5214:~/projects/expressdemo$ node app.js
Web Server is listening at port 3000
```

Open your browser and visit the routes.

Here is the profile page.



Hello World, This is profile router

You can also send HTML/JSON/XML as a response.

Learn how to render HTML in Express: [Render HTML file in ExpressJS]()

Middleware functions as the name suggests can be used to make changes in the request/response lifecycle of the express. There are five types of middleware functions in the express.

1. Application middleware
2. Router middleware
3. Error-handling middleware
4. Built-in middleware
5. Third-party middleware

Application middleware

We can use middleware in the application object of express. For example:

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

app.use((req, res, next) => {
  console.log('Time:', Date.now());
  next();
});

app.listen(process.env.port || 3000);

console.log('Web Server is listening at port '+ (process.env.port
|| 3000));
```

Router middleware

In a similar way as application middleware, we can use router middleware. For example:

```
const express = require('express');
const app = express();
const router = express.Router();

router.use((req, res, next) => {
  console.log('Time:', Date.now());
  next();
});


router.get('/home', (req,res) => {
  res.send("ok")
});

app.use('/', router);
app.listen(process.env.port || 3000);

console.log('Web Server is listening at port '+ (process.env.port
|| 3000));
```

Error-handling middleware

We can use this middleware to catch errors.

```
app.use((err, req, res, next) => {
  res.status(500).send('Something broke!')
});
```

Learn more about this function here.

Built-in middleware

Express provides some middleware by default such as **static**, **json** etc.

Third-party middleware

We can use third party middlewares such as **body-parser**. Here is how we can install third party middleware.

```
npm install body-parser
```

To use this middleware, we need to require our code and load it.

```
const express = require('express');
const bodyParser = require('body-parser');
const app = express();
const router = express.Router();

router.get('/home', (req,res) => {
  res.send('
   Hello World, This is home router
  ');
});

router.get('/profile', (req,res) => {
  res.send('
   Hello World, This is profile router
  ');
});

router.get('/login', (req,res) => {
  res.send('
   Hello World, This is login router
  ');
});

router.get('/logout', (req,res) => {
  res.send('
   Hello World, This is logout router
  ');
});

app.use(bodyParser.json());

app.use('/', router);

app.listen(process.env.port || 3000);

console.log('Web Server is listening at port '+ (process.env.port
|| 3000));
```

We can handle sessions in Express using **express-session** middleware. We can use this middleware to create, track and delete sessions.

```
npm install --save express-session
```

To use this module in our code, load this as a middleware.

```
app.use(session({secret: 'some secrets'}));
```

Now, we can use **req.session** object to create, track and delete sessions.

To learn more about the session, please read this article.

We can also use external stores such as Redis to store session values instead of storing in the memory.

We will learn more about the databases tomorrow. See you then.

Day 6
Databases

Welcome to the day six of Let us Node. Today we are going to learn about integration of databases with Node.

Database is an integral part of any application. You must know how to use it with Node to build a complete application.

We are going to cover the following databases:

- MySQL
- MongoDB
- PostgreSQL
- Redis

Let's begin with MySQL.

MySQL is a very popular SQL database. Learn how to connect, query and use it with NodeJS.

MySQL is a very popular database and has been used in millions of applications. We can use MySQL with Node as well.

We need to install the module name as **mysql** to use it with MySQL database.

> *You need to have MySQL database installed in your system before proceeding.*

To install the module:

```
npm install --save mysql
```

Here is how we can establish the connection to MySQL engine.

```
const mysql = require("mysql");

const pool = mysql.createPool({
 connectionLimit: 100,
 host: "localhost",
 user: "root",
 password: "",
 database: "database_name",
 debug: false,
});


pool.query("SELECT * from <table_name> LIMIT 10", (err, rows) => {
 if (err) {
   console.log("error occurred during the connection.");
 }
 console.log(rows[0]);
});
```

You can execute the queries such as INSERT, UPDATE and DELETE in a similar fashion. Learn more in detail about using Node and MySQL.

Let's learn about MongoDB.

MongoDB

MongoDB is a very popular NoSQL database. Learn how to connect, query and use it with NodeJS.

MongoDB is one of the most popular general purpose NoSQL database engines.
You can use MongoDB to develop a wide range of applications.

To be able to experiment with MongoDB, you need to install the MongoDB database in your system.

Click here to visit the official site and download the latest version of MongoDB.

Assuming you have MongoDB installed, let's install the MongoDB driver for Node.

```
npm install --save mongodb
```

We need to require the module and then connect to the MongoDB instance. Here is the code.

```
const mongo = require("mongodb");
const url = "mongodb://localhost:27017/test";

mongo.connect(url, { useNewUrlParser: true }, (err, db) => {
 if (err) {
   console.log(err);
   process.exit(0);
 }
 console.log("database connected!");
 db.close();
});
```

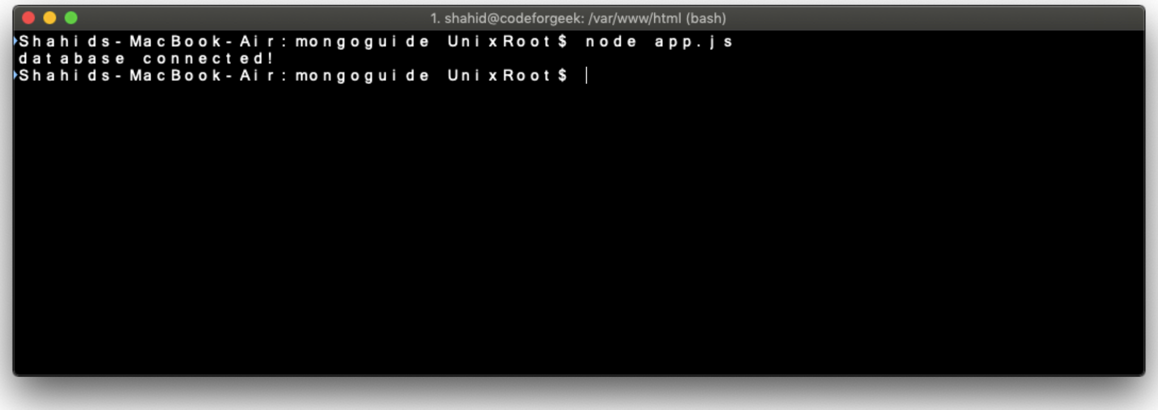
MongoDB runs on port **27017**. We can connect to any database we like to work with.

In the code shown above, we are connecting to the **test** database.

We are using **connect()** method to establish a connection with the database. Save the code above in a file called '**app.js**' and run the file:

```
node app.js
```

You should see output similar to this:



```
Shahids-MacBook-Air:mongoguide UnixRoot$ node app.js
database connected!
Shahids-MacBook-Air:mongoguide UnixRoot$ |
```

In order to store data in the MongoDB database you need to create a **collection**.

Think of collection as a **table** in SQL database. You can either create a collection in the MongoDB shell or you can do it in code. Here is how you can do it in code.

```
const mongo = require("mongodb");
const url = "mongodb://localhost:27017/";

mongo.connect(url, { useNewUrlParser: true }, (err, db) => {
 if (err) {
   console.log(err);
   process.exit(0);
 }
 console.log("database connected!");
 var dbo = db.db("test");
 dbo.createCollection("customers", (err, result) => {
   if (err) {
     console.log(err);
     process.exit(0);
   }
   console.log("collection created!");
   db.close();
 });
});
```

Let's try to add some data in the MongoDB collection.

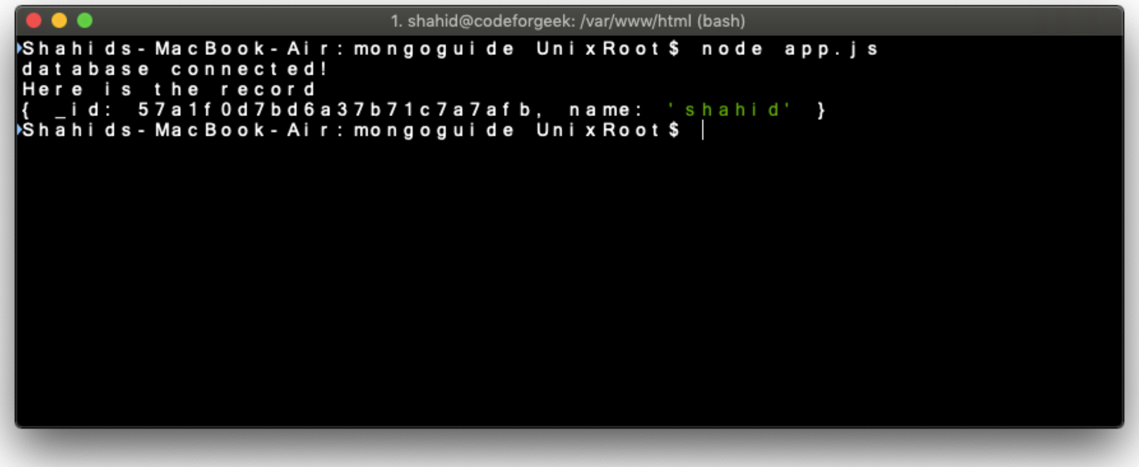
MongoDB stores data in a JSON format. JSON is a key-value based data format widely used across various layers of softwares.

```
const mongo = require("mongodb");
const url = "mongodb://localhost:27017/";
mongo.connect(url, { useNewUrlParser: true }, (err, db) => {
 if (err) {
   console.log(err);
   process.exit(0);
 }
 let data = { id: 100, name: "Shahid" };
 var dbo = db.db("test");
 console.log("database connected!");
 dbo.collection("user").insert(data, (err, result) => {
   if (err) {
     console.log(err);
     process.exit(0);
   }
   console.log("records added.");
   console.log(result);
   db.close();
 });
});
```

You can also search for the data inside the collection using **findOne()** function.

```
const mongo = require("mongodb");
const url = "mongodb://localhost:27017/";

mongo.connect(url, { useNewUrlParser: true }, (err, db) => {
 if (err) {
   console.log(err);
   process.exit(0);
 }

 let data = { id: 100, name: "Shahid" };
 var dbo = db.db("test");
 console.log("database connected!");

 dbo.collection("user").findOne({}, (err, result) => {
   if (err) {
     console.log(err);
     process.exit(0);
   }
   console.log("Here is the record");
   console.log(result);
   db.close();
 });
});
```

After running the code above, you should see a record similar to this.



```
Shahids-MacBook-Air:mongoguide UnixRoot$ node app.js
database connected!
Here is the record
{ _id: 57a1f0d7bd6a37b71c7a7afb, name: 'shahid' }
Shahids-MacBook-Air:mongoguide UnixRoot$ |
```

You can also perform tons of other operations such as query(), sort(), delete() etc. Learn more about MongoDB here.

Let's proceed towards the next database, PostgreSQL.

PostgreSQL

PostgreSQL is a very popular SQL database. Learn how to connect, query and use it with NodeJS.

PostgreSQL, also referred to as **Postgres**, is a free and popular relational database system.

Postgres competes with relational databases like MySQL, SQL Server or MariaDB.

You need to have Postgres installed in your system to continue with this tutorial. Visit the official download page to install Postgres to grab a copy and install Postgre in your system.
We need to create a user credential in Postgres in order to connect to the database. Connect to Postgres using the default credentials. Run this command in your terminal.

```
psql postgres
```

Create a new user.

```
CREATE ROLE codeforgeek WITH LOGIN PASSWORD 'somepassword'
```

Give permission to the new user.

```
ALTER ROLE codeforgeek CREATEDB;
```

Now, exit from the current session and login again with your new user credentials.

```
psql -d postgres -U codeforgeek
```

Create a new database.

```
CREATE DATABASE users;
```

Switch to a new database.

```
c users;
```

Create a new table.

```
users=> CREATE TABLE profile (
  ID SERIAL PRIMARY KEY,
  name VARCHAR(30),
  email VARCHAR(30)
);
```

Insert some records.

```
INSERT
INTO profile (name, email)
VALUES
('Jerry', 'jerry@example.com'),
('George', 'george@example.com');
```

Let's connect to it using our Node program. Install the dependency.

```
npm install --save pg
```

Create an app.js file and add the following code in it.

```
const Pool = require("pg").Pool;
const pool = new Pool({
 user: "codeforgeek",
 host: "localhost",
 database: "users",
 password: "somepassword",
 port: 5432,
});

// read information from table
pool.query("SELECT * FROM profile ORDER BY id ASC", (error,
results) => {
 if (error) {
   console.log(error);
   return;
 }
 console.log(results);
});

// add a new user profile.
const name = "Shahid";
const email = "shahid@codeforgeek.com";

pool.query(
 "INSERT INTO profile (name, email) VALUES ($1, $2)",
 [name, email],
 (error, results) => {
   if (error) {
     console.log(error);
     return;
   }
   console.log(results);
 }
);
```

We created a new **Pool** connection to Postgres. We first executed a SELECT query using the Pool.query method. Pool connection automatically returns the connection to the pool after executing the query.

Let's proceed towards the final database in the section.

REDIS

Redis is the high-performance in-memory database used as a data structure store. Redis supports hash, strings, lists and other complicated data structures by maintaining very high performance.

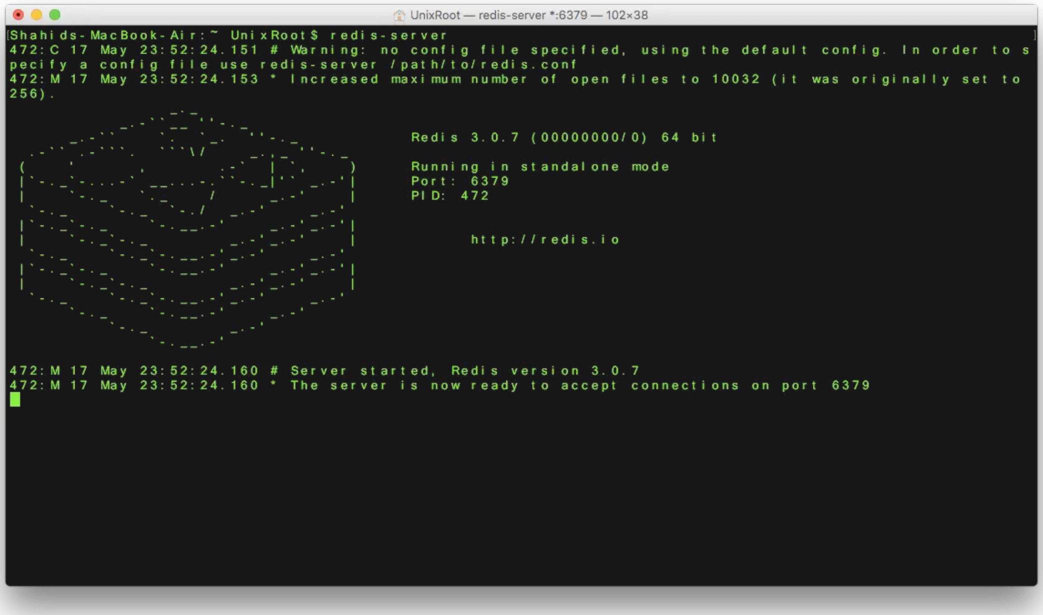
Redis along with Node.js can be used to solve various problems such as cache server or message broker.

You can install Redis in your system by following the official installation guides.

Once installed, you can run the Redis server using the following command.

```
redis-server
```

You should see the following in your terminal.



```
Shahids-MacBook-Air:~ UnixRoot$ redis-server
472:C 17 May 23:52:24.151 # Warning: no config file specified, using the default config. In order to s
pecify a config file use redis-server /path/to/redis.conf
472:M 17 May 23:52:24.153 * Increased maximum number of open files to 10032 (it was originally set to
256).
                _._
           _.-``__ ''-._
      _.-``    `.  `_.  ''-._           Redis 3.0.7 (00000000/0) 64 bit
  .-`` .-```.  ```\/    _.,_ ''-._
 (    '      ,       .-`  | `,    )     Running in standalone mode
 |`-._`-...-` __...-.``-._|'` _.-'|     Port: 6379
 |    `-._   `._    /     _.-'    |     PID: 472
  `-._    `-._  `-./  _.-'    _.-'
 |`-._`-._    `-.__.-'    _.-'_.-'|
 |    `-._`-._        _.-'_.-'    |           http://redis.io
  `-._    `-._`-.__.-'_.-'    _.-'
 |`-._`-._    `-.__.-'    _.-'_.-'|
 |    `-._`-._        _.-'_.-'    |
  `-._    `-._`-.__.-'_.-'    _.-'
      `-._    `-.__.-'    _.-'
          `-._        _.-'
              `-.__.-'

472:M 17 May 23:52:24.160 # Server started, Redis version 3.0.7
472:M 17 May 23:52:24.160 * The server is now ready to accept connections on port 6379
```

To access the Redis command line interface, run the following command from a separate terminal.

```
redis-cli
```

To configure Redis with Node, we need to install the Redis driver.

```
npm i --S redis
```

Here is the sample code to connect to Redis server.

```
var redis = require('redis');
var redisClient = redis.createClient({host : 'localhost', port :
6379});

redisClient.on('ready',function() {
 console.log("Redis is ready");
});

redisClient.on('error',function() {
 console.log("Error in Redis");
});
```

When you run this command, you should have the connection with the Redis.

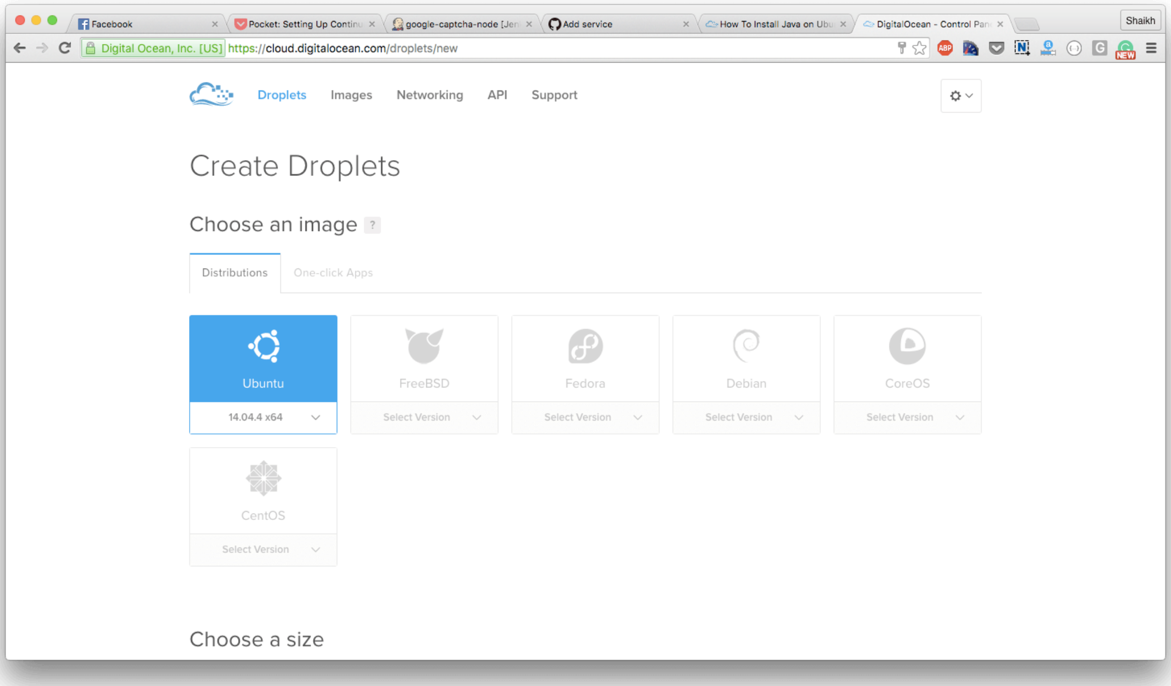
You can use set(), get() and other Redis commands to perform various operations.

To dig deeper into Redis, you can visit the following article. That's it for today, see you tomorrow.

Day 7
Deployment

Let's learn how to deploy our Node application. I deploy all my projects on DigitalOcean. I highly recommend it to developers. If you have never tried DigitalOcean, give it a shot with a $10 discount for the first month.

Click here to go to DigitalOcean droplet creation screen.



Choose a **$5 plan** and create the droplet. After creating a droplet wait for some time, DigitalOcean will send you an email containing the credentials. Login to your droplet using the following command.

```
ssh username@dropletip
```

Provide the password given in the email and you are good to go.

Once you are logged in, update the system using the following command.

```
sudo apt-get update
```

Install Git.

```
sudo apt-get install git
```

Install the latest Node on your Server.

```
curl -sL https://deb.nodesource.com/setup_12.x | sudo -E bash -
```

```
sudo apt-get install -y nodejs
```

Install PM2 process manager.

```
npm install -g pm2
```

Our server is ready to host our Node applications.

Github is a code hosting platform. Learn how to host your code in Github platform.

Let's push our code to Github. Go to Github.com and create a new repository.

Copy the repository path. Assuming you have Git installed in your machine. Switch to the project directory and execute these commands one by one.

```
git init
git add .
git commit - m "first push"
git remote add origin << github repo URL >>
git push origin master
```

Login to your Server using SSH.

```
ssh yourusername@dropletIP
```

Clone the Github project.

```
git clone
```

Switch to the project directory.

```
cd project_name
```

Install dependencies.

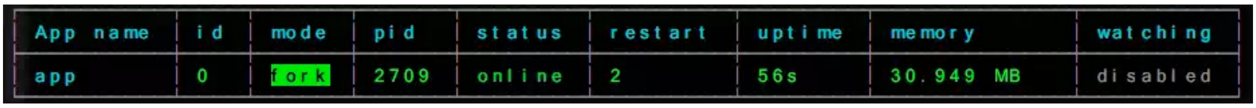
```
npm install
```

Run the Node project using PM2.

PM2 is a process management tool for Node. Using PM2 we can ensure 99% uptime of your application.

```
pm2 start file_name.js
```

Test your application using Droplet IP and port on which your application is running.



```
│ App name │ id │ mode │ pid  │ status │ restart │ uptime │ memory    │ watching │
│ app      │ 0  │ fork │ 2709 │ online │ 2       │ 56s    │ 30.949 MB │ disabled │
```

Awesome. You have successfully developed and deployed your application.

Summary

Hey, looks like we made it till here. I hope by end of this book, you have gained a quick and useful insights about Node to kic

Bonus - Crypto Module

Let's understand the difference between encryption and hashing.

Encryption

Encryption is the cryptography practice of transforming information in a way that only someone with a valid key can decrypt and read it. Encryption is a two-way function. When you encrypt something, you're doing so with the intention of decrypting it later. To encrypt data, we use an algorithm also called a cipher. The algorithm uses the key (and other related things) to encrypt the information. A person with the same key can decrypt and read the information.

Hashing

Hashing is the cryptography practice of using an algorithm to transform information of any size to fixed length size. This is called a hash value or hash or hash digest. Encryption is a two-way function i.e one needs to decrypt the information whilst hashing is a one-way function i.e once the information is hashed, it can't be transformed back to its original form. While it's technically possible to reverse-hash it but the computing power required makes it infeasible to do so.

Crypto is an in built node module to handle encryption and hashing related tasks.

Node provides a built-in library called 'crypto' which you can use to perform cryptographic operations on data. You can do cryptographic operations on strings, buffers, and streams. To begin with, install the library if it's not pre-packaged with Node.

```
npm install crypto --save
```

You can use various algorithms like AES, ECDH, Diffie-Hellman, etc. Check out the crypto modules at the official site of Node. For example, consider this code snippet.

```
const crypto = require("crypto");
const algorithm = "aes-256-cbc";
const key = crypto.randomBytes(32);
const iv = crypto.randomBytes(16);

// encrypt the text
function encrypt(text) {
 let cipher = crypto.createCipheriv("aes-256-cbc",
Buffer.from(key), iv);
 let encrypted = cipher.update(text);
 encrypted = Buffer.concat([encrypted, cipher.final()]);
 return {
   iv: iv.toString("hex"),
   encryptedData: encrypted.toString("hex"),
 };
}

// decrypt the text
function decrypt(text) {
 let iv = Buffer.from(text.iv, "hex");
 let encryptedText = Buffer.from(text.encryptedData, "hex");
 let decipher = crypto.createDecipheriv("aes-256-cbc",
Buffer.from(key), iv);
 let decrypted = decipher.update(encryptedText);
 decrypted = Buffer.concat([decrypted, decipher.final()]);
 return decrypted.toString();
}

var hw = encrypt("Some serious stuff");
```

```
console.log(hw);
console.log(decrypt(hw));
```

In the code shown above, we are encrypting data with a random key and initialization vector.

For more information, you can read our article on encryption and decryption here.

Bcrypt is a third party tool to handle cryptography related tasks.

The bcrypt node modules provide an easy way to create and compare hashes. Let's learn how to use it. First, install the module.

```
npm i --S bcrypt
```

Here is the code to generate a hash.

```
const bcrypt = require("bcrypt");
bcrypt.hash("data", 10, (err, hash) => {
 if (err) {
   console.log("error...");
   return;
 }
 console.log(hash);
});
```

Here is how to verify the hash.

```
const bcrypt = require("bcrypt");

bcrypt.compare("data", hash, (err, result) => {
 if (err) {
   console.log("error...");
   return;
```

```
  }

  if (result) {
    // hash matched
  } else {
    // hash does not match
  }
});
```

You can use this module to generate a hash for passwords and store them in the database.
You can later compare it with the password entered by the user.

For more information about password hashing, read this article.