Node Js

LEARN IN 1 DAY

KRISHNA RUNGTA

Learn NodeJS in 1 Day

By Krishna Rungta

Table Of Content

Chapter 5: Node.js with Express

1. What is Express.js
2. Installing and using Express
3. What are Routes
4. Sample Web server using express.js

Chapter 6: Node.js with MongoDB

1. Node.js and NoSQL Databases
2. Using MongoDB and Node.js
3. How to build a node express app with MongoDB to store and serve content

Chapter 7: Promise, Generator, Event and Filestream

1. What are promises
2. Callbacks to promises
3. Generating promises with the BlueBird library
4. Creating a custom promise
5. Callbacks vs generators
6. Filestream in Node.js
7. Emitting Events

Chapter 8: Testing with Jasmine

1. Overview of Jasmine for testing Node.js applications
2. How to use Jasmine to test Node.js applications

Chapter 1: Introduction

The modern web application has really come a long way over the years with the introduction of many popular frameworks such as bootstrap, Angular JS, *etc.* All of these frameworks are based on the popular JavaScript framework.

But when it came to developing server based applications there was just kind of a void, and this is where Node.js came into the picture.

Node.js is also based on the JavaScript framework, but it is used for developing server-based applications. While going through the entire tutorial, we will look into Node.js in detail and how we can use it to develop server based applications.

What is node.js

Node.js is an open-source, cross-platform runtime environment used for development of server-side web applications. Node.js applications are written in JavaScript and can be run on a wide variety of operating systems.

Node.js is based on an event-driven architecture and a non-blocking Input/Output API that is designed to optimize an application's throughput and scalability for real-time web applications.

Over a long period of time, the framework available for web development were all based on a stateless model. A stateless model is where the data generated in one session (such as information about user settings and events that occurred) is not maintained for usage in the next session with that user.

A lot of work had to be done to maintain the session information between requests for a user. But with Node.js there is finally a way for web applications to have a real-time, two-way connections, where both the client and server can initiate communication, allowing them to exchange data freely.

Why use Node.js

We will have a look into the real worth of Node.js in the coming chapters, but what is it that makes this framework so famous. Over the years, most of the applications were based on a stateless request-response framework. In these sort of applications, it is up to the developer to ensure the right code was put in place to ensure the state of web session was maintained while the user was working with the system.

But with Node.js web applications, you can now work in real-time and have a 2-way communication. The state is maintained, and the either the client or server can start the communication.

Features of Node.js

Let's look at some of the key features of Node.js

1. Asynchronous event driven IO helps concurrent request handling – This is probably the biggest selling points of Node.js. This feature basically means that if a request is received by Node for some Input/Output operation, it will execute the operation in the background and continue with processing other requests.

This is quite different from other programming languages. A simple example of this is given in the code below

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

        fs.readFile("Sample.txt",function(error,data)

      {

                          console.log("Reading Data completed");

});
```

- The above code snippet looks at reading a file called Sample.txt. In other programming languages, the next line of processing would only happen once the entire file is read.
- But in the case of Node.js the important fraction of code to notice is the declaration of the function ('function(error,data)'). This is known as a callback function.
- So what happens here is that the file reading operation will start in the background. And other processing can happen simultaneously while the file is being read. Once the file read operation is completed, this anonymous

function will be called and the text "Reading Data completed" will be written to the console log.

2. Node uses the V8 JavaScript Runtime engine, the one which is used by Google Chrome. Node has a wrapper over the JavaScript engine which makes the runtime engine much faster and hence processing of requests within Node also become faster.
3. Handling of concurrent requests – Another key functionality of Node is the ability to handle concurrent connections with a very minimal overhead on a single process.
4. The Node.js library used JavaScript – This is another important aspect of development in Node.js. A major part of the development community are already well versed in javascript, and hence, development in Node.js becomes easier for a developer who knows javascript.
5. There are an Active and vibrant community for the Node.js framework. Because of the active community, there are always keys updates made available to the framework. This helps to keep the framework always up-to-date with the latest trends in web development.

Who uses Node.js

Node.js is used by a variety of large companies. Below is a list of a few of them.

- Paypal – A lot of sites within Paypal have also started the transition onto Node.js.
- LinkedIn - LinkedIn is using Node.js to power their Mobile Servers, which powers the iPhone, Android, and Mobile Web products.
- Mozilla has implemented Node.js to support browser APIs which has half a billion installs.
- Ebay hosts their HTTP API service in Node.js

When to use and not use Node.js

Node.js is best for usage in streaming or event-based real-time applications like

1. Chat applications
2. Game servers – Fast and high-performance servers that need to processes thousands of requests at a time, then this is an ideal framework.
3. Good for collaborative environment – This is good for environments which manage document. In document management environment you will have multiple people who post their documents and do constant changes by checking out and checking in documents. So Node.js is good for these environments because the event loop in Node.js can be triggered whenever documents are changed in a document managed environment.
4. Advertisement servers – Again here you could have thousands of request to pull advertisements from the central server and Node.js can be an ideal framework to handle this.
5. Streaming servers – Another ideal scenario to use Node is for multimedia streaming servers wherein clients have request's to pull different multimedia contents from this server.

Node.js is good when you need high levels of concurrency but less amount of dedicated CPU time.

Best of all, since Node.js is built on javascript, it's best suited when you build client-side applications which are based on the same javascript framework.

When to not use Node.js

Node.js can be used for a lot of applications with various purpose, the only scenario where it should not be used is if there are long processing times which

is required by the application.

Node is structured to be single threaded. If any application is required to carry out some long running calculations in the background. So if the server is doing some calculation, it won't be able to process any other requests. As discussed above, Node.js is best when processing needs less dedicated CPU time.

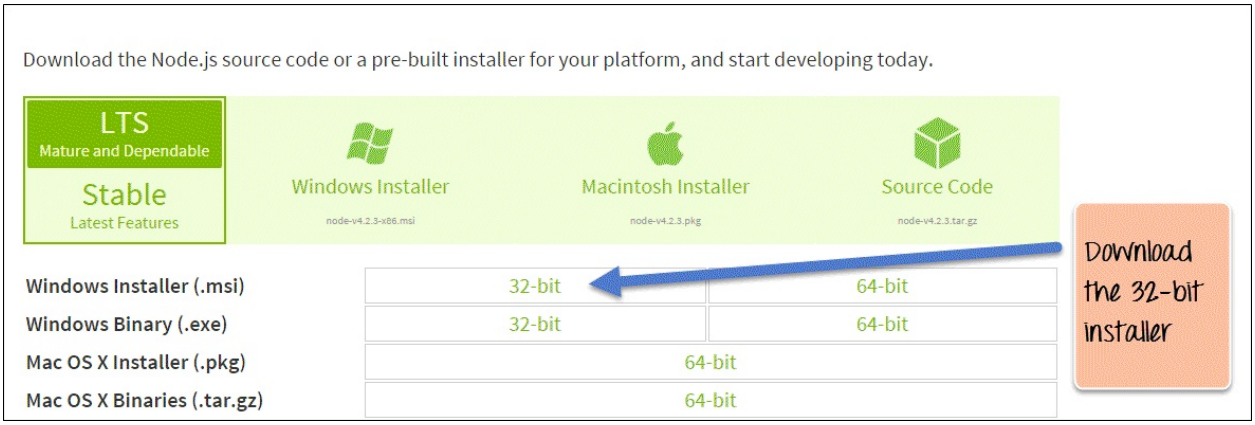
Chapter 2: Download & Install Node.js

To start building your Node.js applications, the first step is the installation of the node.js framework. The Node.js framework is available for a variety of operating systems right from Windows to Ubuntu and OS X. Once the Node.js framework is installed you can start building your first Node.js applications.

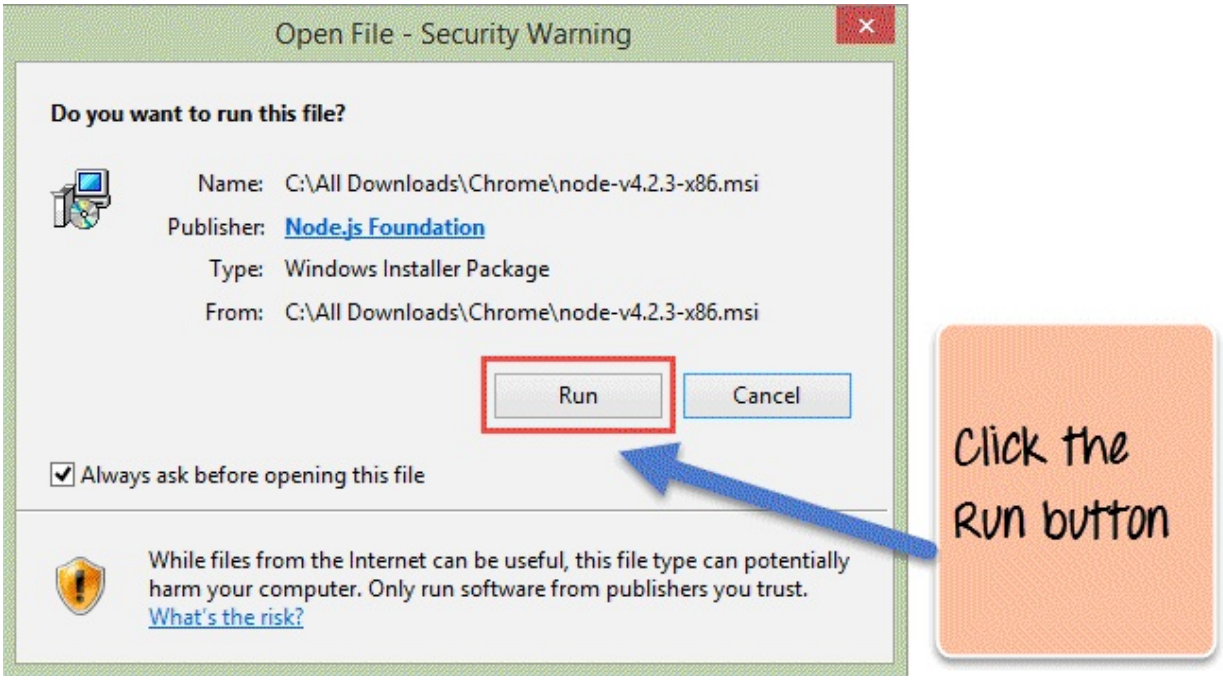
Node.js also has the ability to embedded external functionality or extended functionality by making use of custom modules. These modules have to be installed separately. An example of a module is the MongoDB module which allows you to work with MongoDB databases from your Node.js application.

How to install node.js

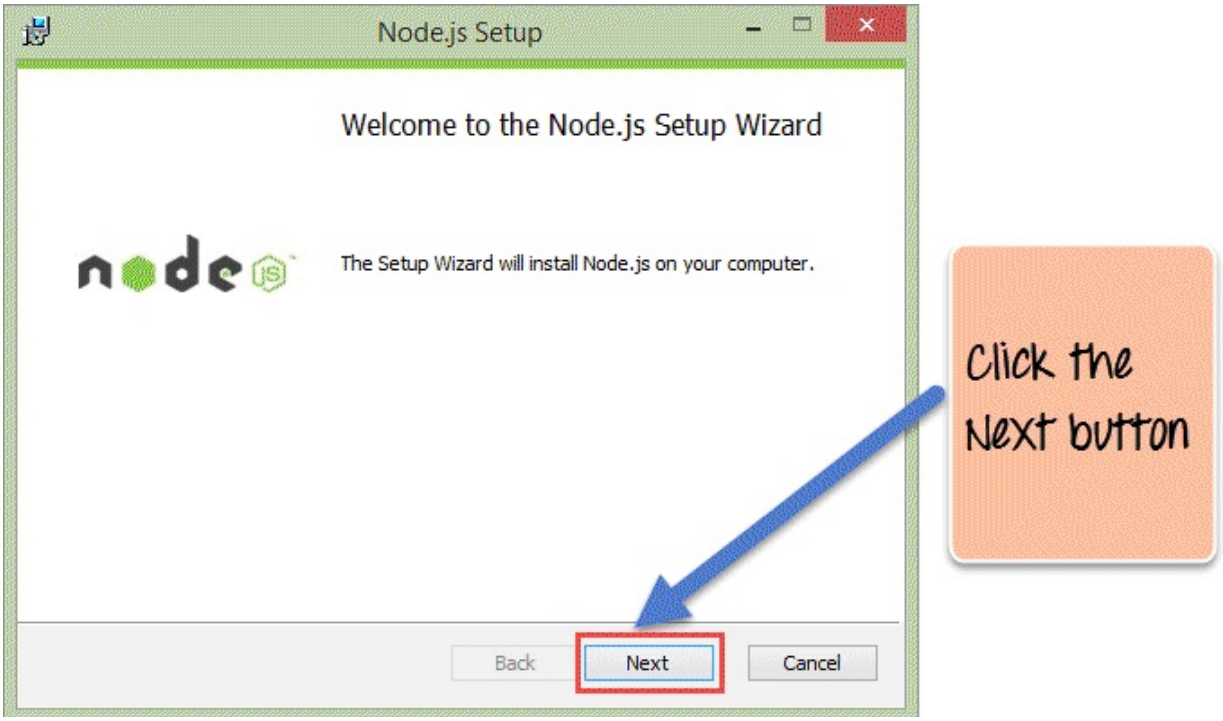
The first steps in using Node.js is the installation of the Node.js libraries on the client system. To perform the installation of Node.js, perform the below steps;
Step 1) Go to the site **https://nodejs.org/en/download/** and download the necessary binary files. In our example, we are going to the download the 32-bit setup files for Node.js.



Step 2) Double click on the downloaded .msi file to start the installation. Click the Run button in the first screen to begin the installation.



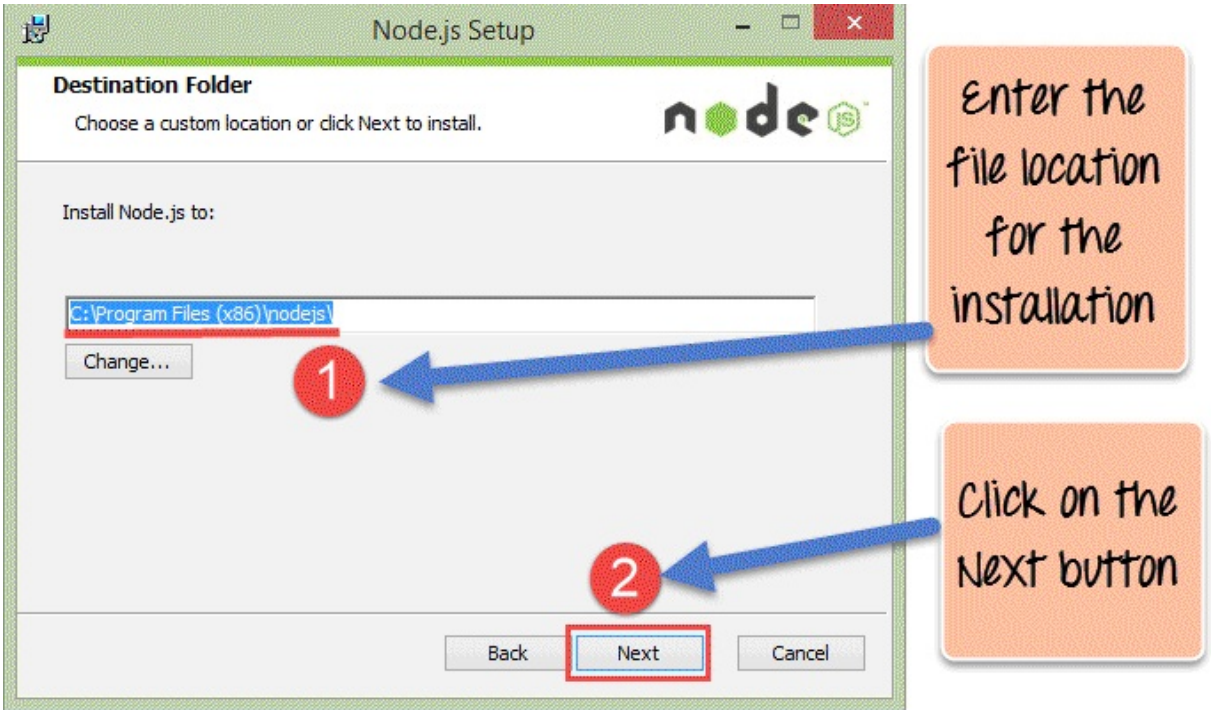
Step 3) In the next screen, click the "Next" button to continue with the installation



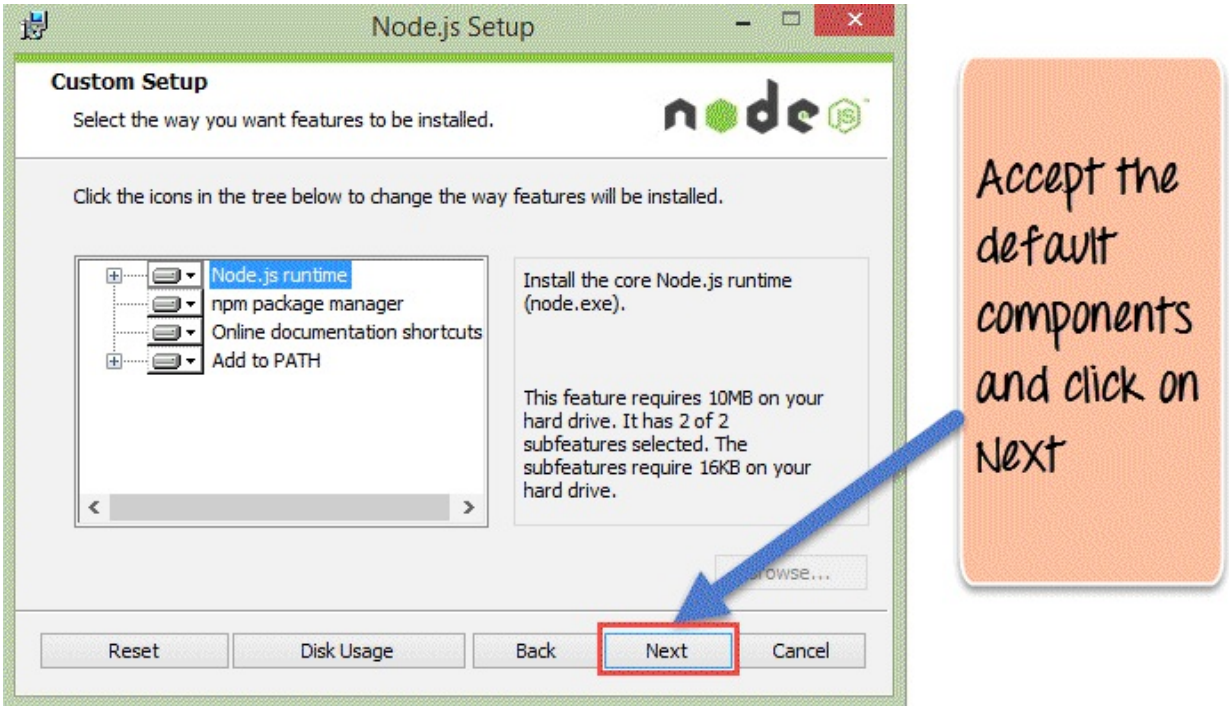
Step 4) In the next screen Accept the license agreement and click on the Next button.

Step 5) In the next screen, choose the location where Node.js needs to be installed and then click on the Next button.

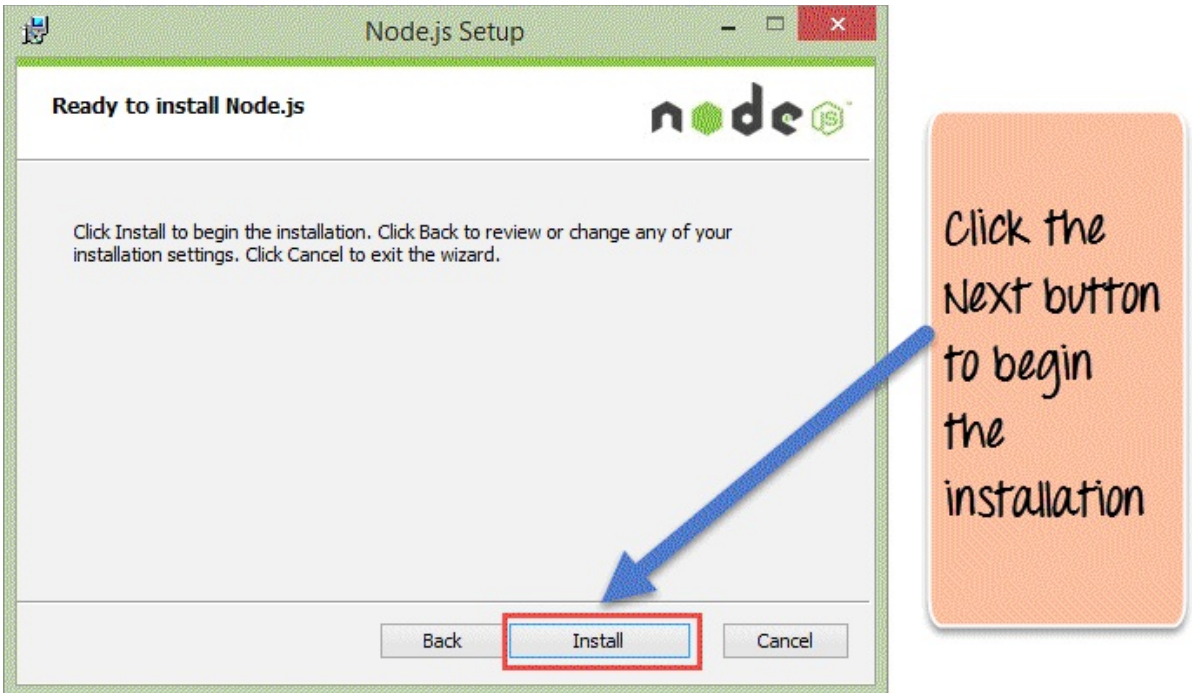
1. First enter the file location for the installation of Node.js. This is where the files for Node.js will be stored after the installation.
2. Click on the Next button to proceed ahead with the installation.



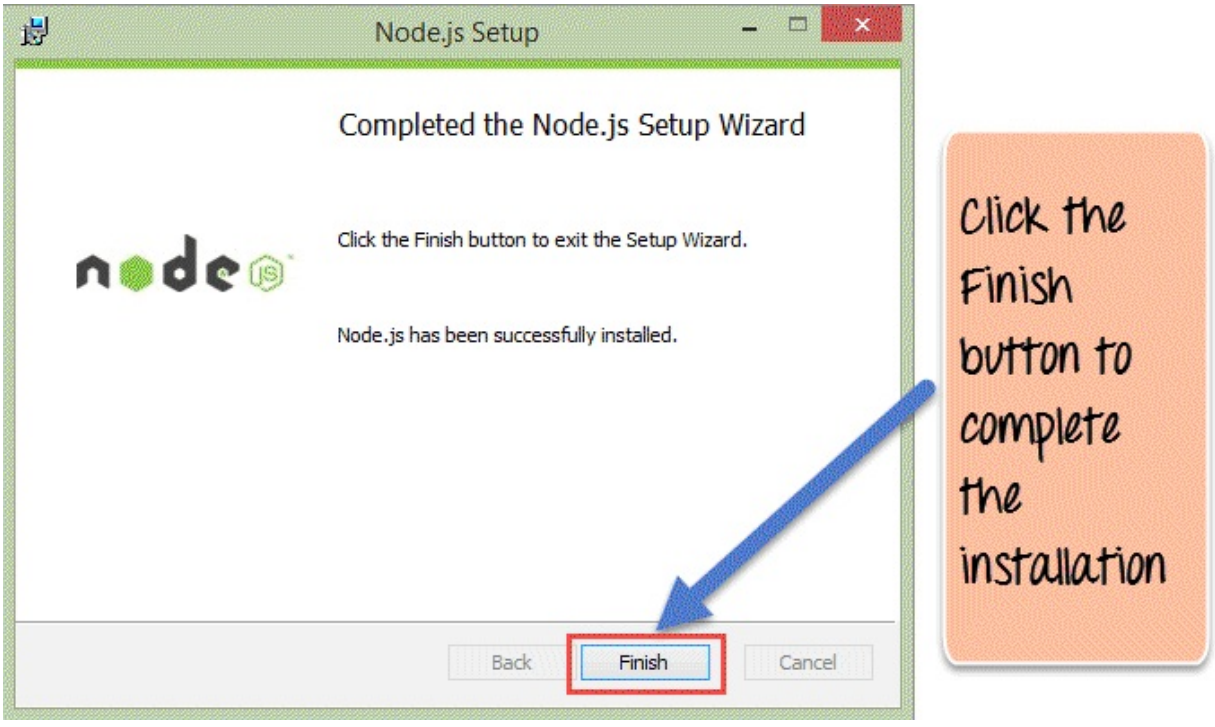
Step 6) Accept the default components and click on the next button.



Step 7) In the next screen, click the Install button to start the installation.



Step 8) Click the Finish button to complete the installation.



Installing node through a package manager

The other way to install Node.js on any client machine is to use a "package manager".

On windows, the node package manager is known as Chocolatey. It was designed to be a decentralized framework for quickly installing applications and tools that you need.

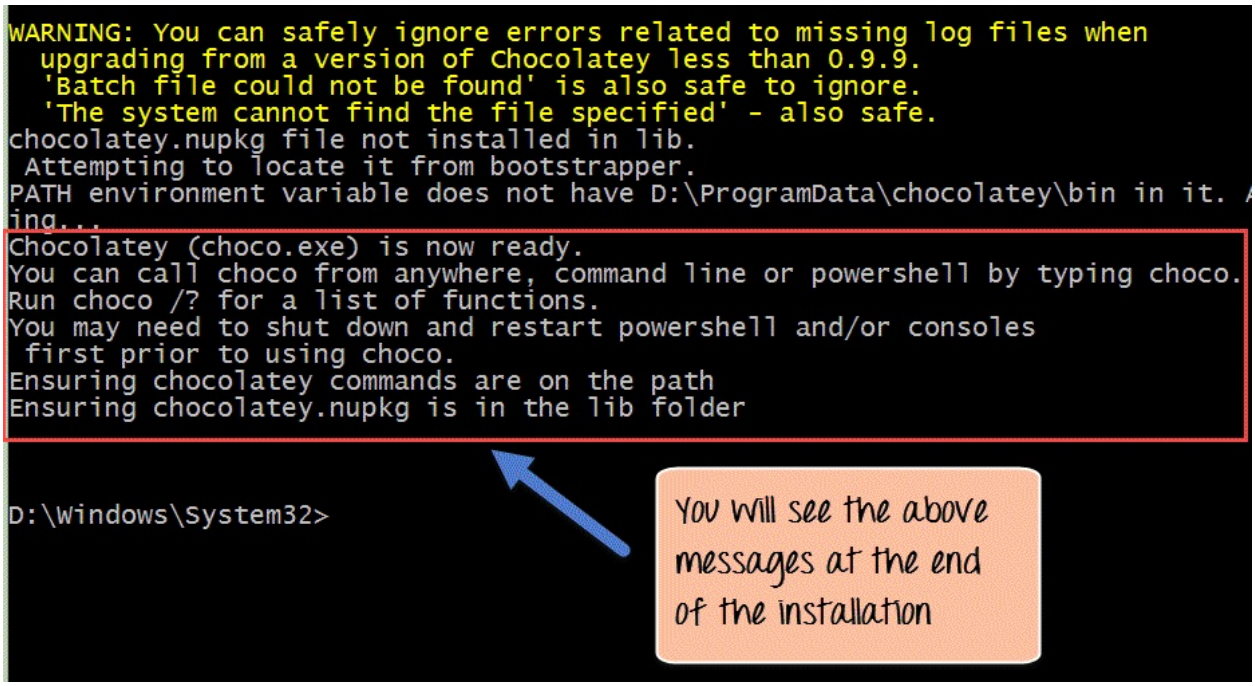
To install Node.js via Chocolatey, the following steps need to be performed.

Step 1) Installing Chocolatey – The Chocolatey website (**https://chocolatey.org/**) has very clear instructions on how this framework needs to be installed.

- The first steps is to run the below command in the command prompt windows. This command is taken from the Chocolatey web site and is the standard command for installing Node.js via Chocolatey.
- The below command is a PowerShell command which calls the remote PowerShell script on the Chocolatey website. This command needs to be run in a PowerShell command window.
- This PowerShell script does all the necessary work of downloading the required components and installing them accordingly.

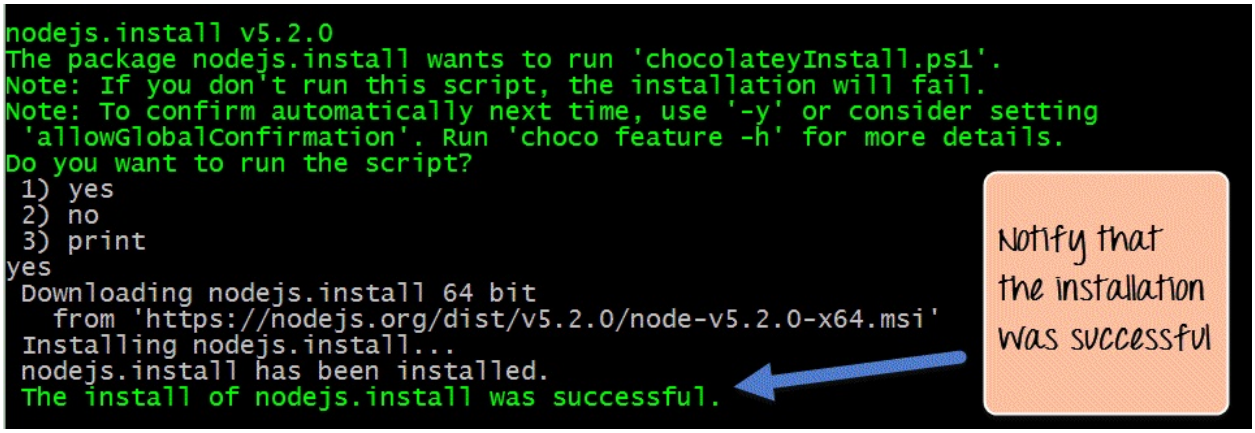
@powershell -NoProfile -ExecutionPolicy Bypass -Command "iex ((new-object wet.webclient).DownloadString('https://chocolatey.org/install.ps1'))" && SET

PATH=%PATH%;%ALLUSERSPROFILE%\chocolatey\bin



Step 2) The next step is to install Node.js to your local machine using the Chocolatey, package manager. This can be done by running the below command in the command prompt.

cinst nodejs install



If the installation is successful, you will get the message of the successful installation of Node.js.

Note: If you get an error like “C:\ProgramData\chocolatey\lib\libreoffice\tools\chocolateyInstall.ps1” Then

manually cleate the folder in the path

Running your first Hello world application in Node.js

Once you have downloaded and installed Node.js on your computer, lets try to display "Hello World" in a web browser.

Create file Node.js with file name firstprogram.js

```
var http = require('http');

http.createServer(function (req, res) {
    res.writeHead(200, {'Content-Type': 'text/html'});
    res.end('Hello World!');
}).listen(8080);
```

Code Explanation:

1. The basic functionality of the "require" function is that it reads a JavaScript file, executes the file, and then proceeds to return an object. Using this object, one can then use the various functionalities available in the module called by the require function. So in our case, since we want to use the functionality of http and we are using the require(http) command.

2. In this 2nd line of code, we are creating a server application which is based on a simple function. This function is called, whenever a request is made to our server application.

3. When a request is received, we are asking our function to return a "Hello World" response to the client. The writeHead function is used to send header

data to the client and while the end function will close the connection to the client.

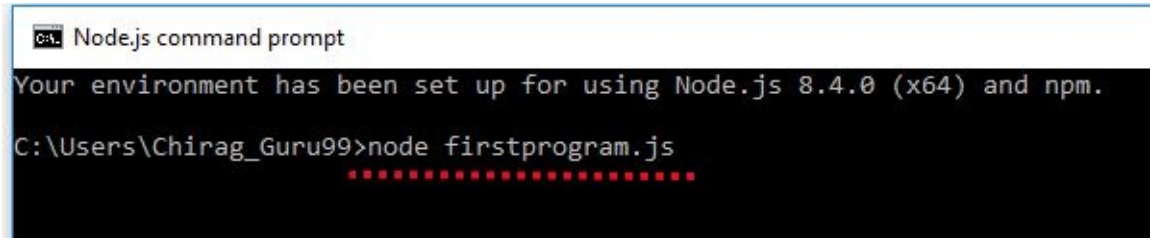
4. We are then using the .listen function to make our server application listen to client requests on port no 8080. You can specify any available port over here.

Executing the code

Step 1) Save the file on your computer: C:\Users\Your Name\ firstprogram.js

Step 2) In the command prompt, navigate to the folder where the fike is stored. Enter the command

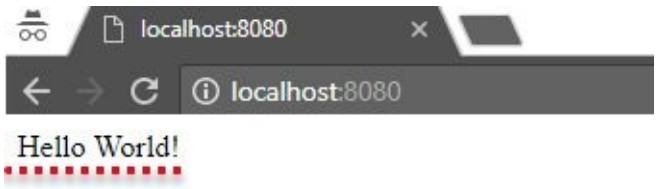
Node firstprogram.js



Step 3) Now, your computer works as a server! If anyone tries to access your computer on port 8080, they will get a "Hello World!" message in return!

Step 4) Start your internet browser, and type in the address:
http://localhost:8080

OutPut



Summary

- We have seen the installation of Node.js via the msi installation module which is available on the Node.js website. This installation installs the necessary modules which are required to run a Node.js application on the client.
- Node.js can also be installed via a package manager. The package manager for windows is known as Chocolatey. By running some simple commands in the command prompt, the Chocolatey package manager automatically downloads the necessary files and then installs them on the client machine.
- A simple Node.js application consists of creating a server which listens on a particular port. When a request comes to the server, the client automatically sends a 'Hello World' response to the client.

Chapter 3: Modules

A module in Node.js is a logical encapsulation of code in a single unit. It's always a good programming practice to always segregate code in such a way that makes it more manageable and maintainable for future purposes. That's where modules in Node.js comes in action.

Since each module is an independent entity with its own encapsulated functionality, it can be managed as a separate unit of work.

During this tutorial, we will see how we can make use of modules in Node.js.

What are modules in Node.js?

As stated earlier, modules in Node js are a way of encapsulating code in a separate logical unit. There are many readymade modules available in the market which can be used within Node js.

Below are some of the popular modules which are used in a Node js application

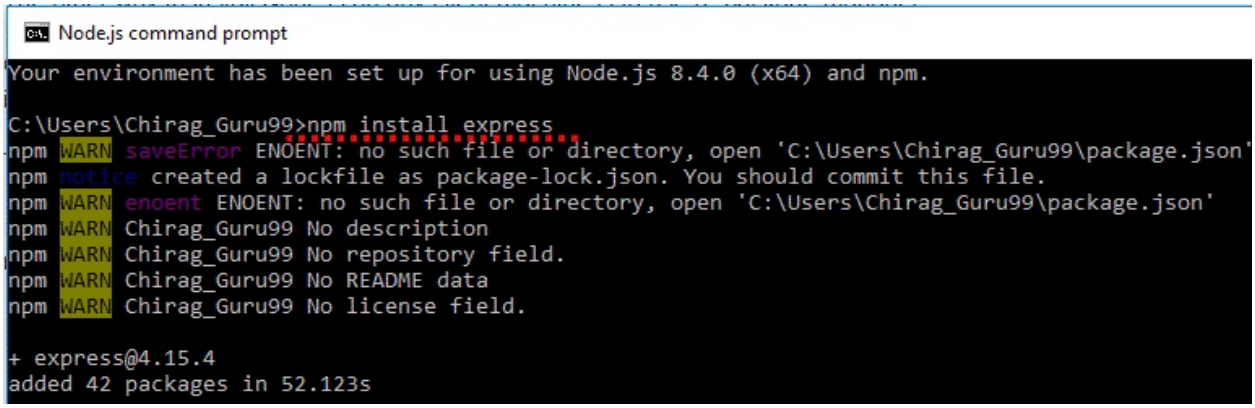
1. **Express framework** – Express is a minimal and flexible Node js web application framework that provides a robust set of features for the web and mobile applications.
2. **Socket.io -** Socket.IO enables real-time bidirectional event-based communication. This module is good for creation of chatting based applications.
3. **Jade -** Jade is a high-performance template engine and implemented with JavaScript for node and browsers.
4. **MongoDB -** The MongoDB Node.js driver is the officially supported node.js driver for MongoDB.
5. **Restify -** restify is a lightweight framework, similar to express for building REST APIs
6. **Bluebird -** Bluebird is a fully featured promise library with focus on innovative features and performance

Using modules in Node.js

In order to use modules in a Node.js application, they first need to be installed using the Node package manager.

The below command line shows how a module "express" can be installed.

npm install express



- The above command will download the necessary files which contain the "express modules" and take care of the installation as well
- Once the module has been installed, in order to use a module in a Node.js application you need to use the 'require' keyword. This keyword is a way that Node.js uses to incorporate the functionality of a module in an application.

Let's look at an example how we can use the "require" keyword. The below "Guru99" code example shows how to use the require function var express=require('express'); var app=express(); app.set('view emngine','jade'); app.get('/',function(req,res) { }); var server=app.listen(3000,function() { });

1. In the first statement itself, we are using the "require" keyword to include the express module. The "express" module is an optimized JavaScript

library for Node.js development. This is one of the most commonly used Node.js modules.

2. After the module is included, in order to use the functionality within the module, an object needs to be created. Here an object of the express module is created.
3. Once the module is included using the "require" command and an "object" is created, the required methods of the express module can be invoked. Here we are using the set command to set the view engine, which is used to set the templating engine used in Node.js. **Note:-**(Just for the reader's understanding, a templating engine is an approach for injecting values in an application by picking up data from data files. This concept is pretty famous in Angular JS wherein the curly braces {{ key }} is used to substitutes values in the web page. The word 'key' in the curly braces basically denotes the variable which will be substituted by a value when the page is displayed.)
4. Here we are using the listen method to make the application listen on a particular port number.

Creating NPM modules

Node.js has the ability to create custom modules and allows you to include those custom modules in your Node.js application.

Let's look at a simple example of how we can create our own module and include that module in our main application file. Our module will just do a simple task of adding 2 numbers.

Let's follow the below steps to see how we can create modules and include them in our application.

Step 1) Create a file called "Addition.js" and include the below code. This file will contain the logic for your module.

Below is the code which would go into this file;

```
var exports=module.exports={};
exports.AddNumber=function(a,b)
{
return a+b;
};
```

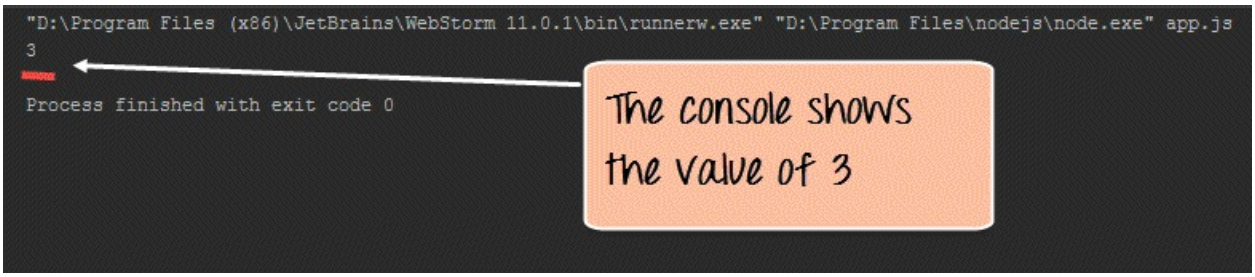
1. The "exports" keyword is used to ensure that the functionality defined in this file can actually be accessed by other files.
2. We are then defining a function called 'AddNumber'. This function is defined to take 2 parameters, a and b. The function is added to the module "exports" to make the function as a public function that can be accessed by other application modules.
3. We are finally making our function return the added value of the parameters.

Now that we have created our custom module which has the functionality of adding 2 numbers. It's now time to create an application, which will call this module.

In the next step, we will actually see how to create the application which will call our custom module.

Step 2) Create a file called "app.js," which is your main application file and add the below code var Addition=require('./Addition.js');
console.log(Addition.AddNumber(1,2));

1. We are using the "require" keyword to include the functionality in the Addition.js file.
2. Since the functions in the Addition.js file are now accessible, we can now make a call to the AddNumber function. In the function, we are passing 2 numbers as parameters. We are then displaying the value in the console.



Output:

- When you run the app.js file, you will get an output of value 3 in the console log.
- The result is because the AddNumber function in the Addition.js file was called successfully and the returned value of 3 was displayed in the console.

Note: - We are not using the "Node package manager" as of yet to install our Addition.js module. This is because the module is already part of our project on the local machine. The Node package manager comes in the picture when you publish a module on the internet which we see in the subsequent topic.

Extending modules

When creating modules, it is also possible to extend or inherit one module from another.

In modern day programming, it's quite common to build a library of common modules and then extend the functionality of these common modules if required.

Let's look at an example of how we can extend modules in Node.js.

Step 1) Create the base module.

In our example, create a file called "Tutorial.js" and place the below code.

In this code, we are just creating a function which returns a string to the console. The string returned is "Guru99 Tutorial".

```
var exports=module.exports={};
exports.tutorial=function()
{
console.log("Guru99 Tutotial")
}
```

1. The exports module is used so that whatever function is defined in this file can be available in other modules in Node.js
2. We are creating a function called tutorial which can be used in other Node.js modules.
3. We are displaying a string "Guru99 Tutorial" in the console when this function is called.

Now that we have created our base module called Tutorial.js. It's now time to create another module which will extend this base module.

We will explore how to do this in the next step.

Step 2) Next we will create our extended module. Create a new file called "NodeTutorial.js" and place the below code in the file.

```
var Tutor=require('./Tutorial.js');
exports.NodeTutorial=function()
{
console.log("Node Tutorial")
function pTutor()
{
var PTutor=Tutor
PTutor.tutorial;
}
}
```

Note, the following key points about the above code

1. We are using the "require" function in the new module file itself. Since we are going to extend the existing module file "Tutorial.js", we need to first include it before extending it.
2. We then create a function called "Nodetutorial." This function will do 2 things,

- It will send a string "Node Tutorial" to the console.
- It will send the string "Guru99 Tutorial" from the base module "Tutorial.js" to our extended module "NodeTutorial.js".

1. Here we are carrying out the first step to send a string to "Node Tutorial" to the console.
2. The next step is to call the function from our Tutorial module, which will output the string "Guru99 Tutorial" to the console.log.

Step 3) Create your main app.js file which is your main application file and include the below code.

```
var localTutor=require('./NodeTutorial.js');
localTutor.NodeTutorial();
```

```
localTutor.NodeTutorial.pTutor();
```

The above code does the following things;

1. Our main application file now calls the "NodeTutorial" module.
2. We are calling the "NodeTutorial" function. By calling this function, the text "Node Tutorial" will be displayed in the console log.
3. Since we have extended our Tutorial.js module and exposed a function called pTutor. It also calls the tutorial module in the Tutorial.js module, and the text "Guru99 Tutorial" will be displayed to the console as well.

Output:

Since we have executed the above app.js code using Node, we will get the following output in the console.log file

- Node Tutorial
- Guru99 Tutorial

Publishing NPM(Node Package Manager) Modules

One can publish their own module to their own Github repository.

By publishing your module to a central location, you are then not burdened with having to install yourself on every machine that requires it.

Instead, you can use the install command of npm and install your published npm module.

The following steps need to be followed to publish your npm module

Step 1) Create your repository on GitHub (an online code repository management tool). It can be used for hosting your code repositories.

Step 2) You need to tell your local npm installation on who you are. Which means that we need to tell npm who is the author of this module, what is the email id and any company URL, which is available which needs to be associated with this id. All of these details will be added to your npm module when it is published.

The below commands sets the name, email and URL of the author of the npm module.

npm set init.author.name "Guru99."

npm set init.author.email "guru99@gmail.com"

npm set init.author.url **http://Guru99.com**

Step 3) The next step is to login into npm using the credentials provided in the last step. To login, you need to use the below command npm login

Step 4) Initialize your package – The next step is to initialize the package to create the package.json file. This can be done by issuing the below command npm init

When you issue the above command, you will be prompted for some questions. The most important one is the version number for your module.

Step 5) Publish to GitHub – The next step is to publish your source files to GitHub. This can be done by running the below commands.

```
git add.
git commit -m "Initial release"
git tag v0.0.1
git push origin master --tags
```

Step 6) Publish your module – The final bit is to publish your module into the npm registry. This is done via the below command.

```
npm publish
```

Managing third party packages with npm

As we have seen, the "Node package manager" has the ability to manage modules, which are required by Node.js applications.

Let's look at some of the functions available in the node package manager for managing modules

1. Installing packages in global mode – Modules can be installed at the global level, which just basically means that these modules would be available for all Node.js projects on a local machine.
   The example below shows how to install the "express module" with the global option.

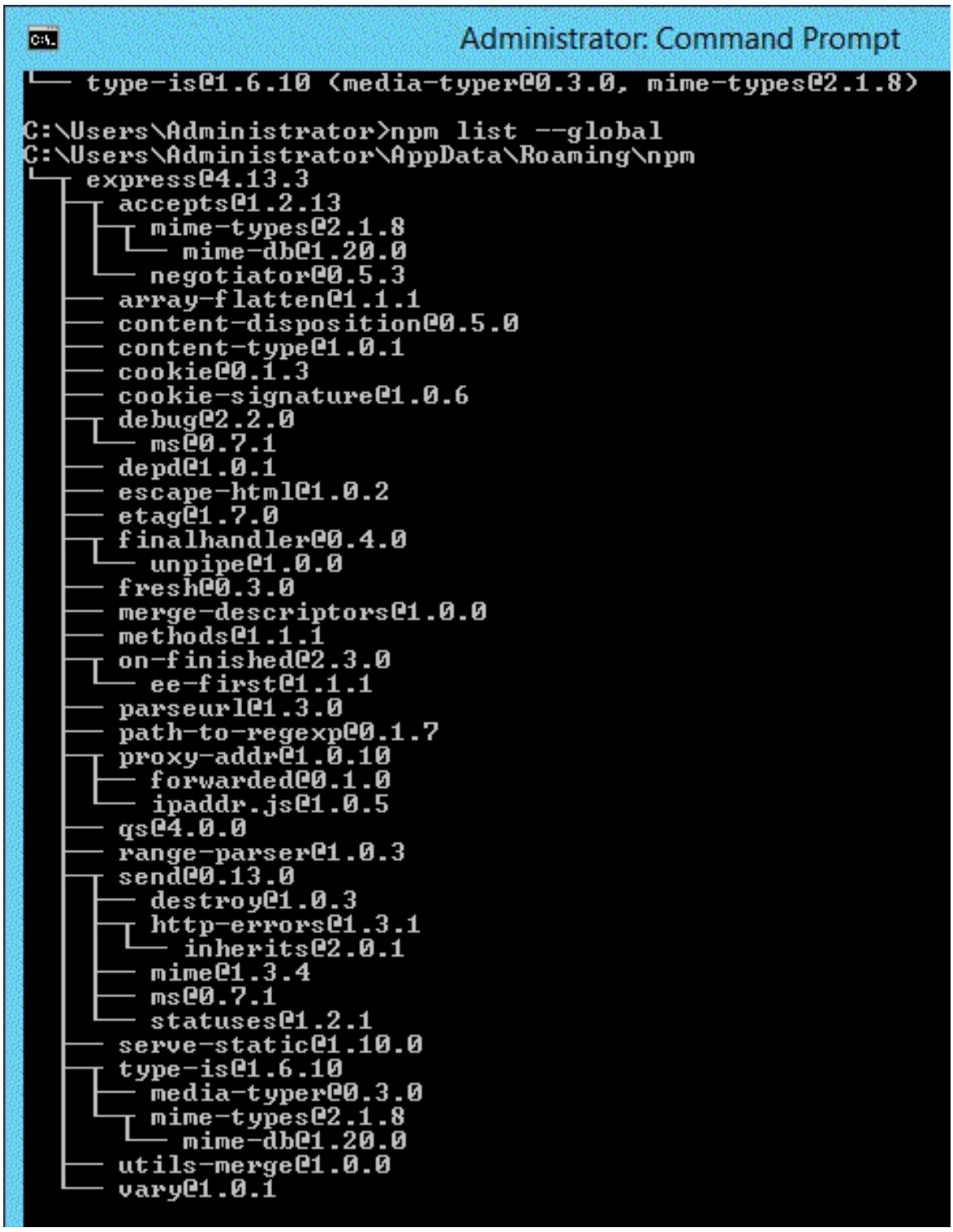
   npm install express –global

   The global option in the above statement is what allows the modules to be installed at a global level.

2. Listing all of the global packages installed on a local machine. This can be done by executing the below command in the command prompt **npm list --global**

   Below is the output which will be shown, if you have previously installed the "express module" on your system.

   Here you can see the different modules installed on the local machine.



3. Installing a specific version of a package – Sometimes there may be a requirement to install just the specific version of a package. Once you know what is the package and the relevant version that needs to be

installed, you can use the npm install command to install that specific version.
The example below shows how to install the module called underscore with a specific version of 1.7.0

npm install **underscore@1.7.0**

4. Updating a package version – Sometimes you may have an older version of a package in a system, and you may want to update to the latest one available in the market. To do this one can use the npm update command. The example below shows how to update the underscore package to the latest version

   npm update underscore

5. Searching for a particular package – To search whether a particular version is available on the local system or not, you can use the search command of npm. The example below will check if the express module is installed on the local machine or not.
   npm search express

6. Uninstalling a package – The same in which you can install a package, you can also uninstall a package. The uninstallation of a package is done with the uninstallation command of npm.
   The example below shows how to uninstall the express module

   npm uninstall express

What is the package.json file

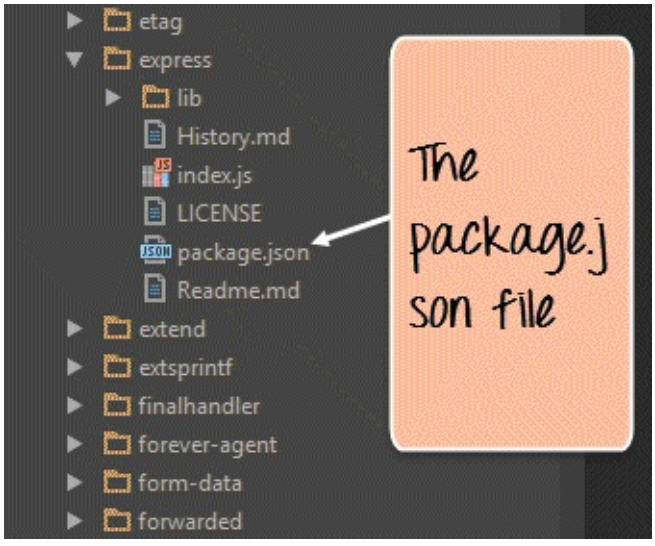
The "package.json" file is used to hold the **metadata about a particular project**. This information provides the Node package manager the necessary information to understand how the project should be handled along with its dependencies.

The package.json files contains information such as the project description, the version of the project in a particular distribution, license information, and configuration data.

The package.json file is normally located at the root directory of a Node.js project.

Let's take an example of how the structure of a module looks when it is installed via npm.

The below snapshot shows the file contents of the express module when it is included in your Node.js project. From the snapshot, you can see the package.json file in the express folder.



If you open the package.json file you will see a lot of information in the file.

Below is a snapshot of a portion of the file. The **express@~4.13.1** mentions the version number of the express module being used.

Summary

- A module in Node.js is a logical encapsulation of code in a single unit. Separation into modules makes code more manageable and maintainable for future purposes
- There are many modules available in the market which can be used within Node.js such as express, underscore, mongoDB, *etc.*
- The node package manager (npm) is used to download and install modules which can then be used in a Node.js application.
- One can create custom NPM modules, extend these modules and also publish these modules.
- The Node package manager has a complete set of commands to manage the npm modules on the local system such as the installation, uninstallation, searching, *etc.*

- The package.json file is used to hold the entire metadata information for an npm module.

Chapter 4: Create Server and Get Data

The Node.js framework is mostly used to create server based applications. The framework can easily be used to create web servers which can serve content to users.

There are a variety of modules such as the "http" and "request" module, which helps in processing server related requests in the web server space. We will have a look at how we can create a basic web server application using Node js.

Node as web server using HTTP

Let's look at an example of how to create and run our first Node js application.

Our application is going to create a simple server module which will listen on port no 7000. If a request is made through the browser on this port no, then server application will send a 'Hello' World' response to the client.

```
var http=require('http')
var server=http.createServer((function(request,response)
{
        response.writeHead(200,
        {"Content-Type" : "text/plain"));
        response.end("Hello World\n");
}));
server.listen(7000);
```

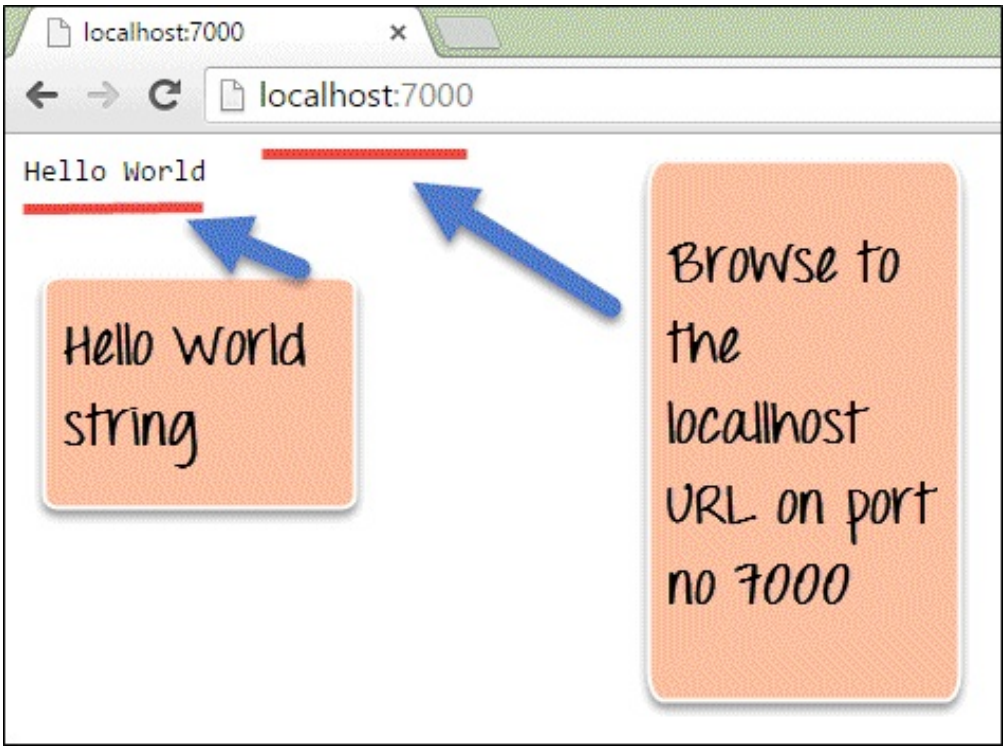
Code Explanation:

1. The basic functionality of the require function is that it reads a javascript file, executes the file, and then proceeds to return the exports object. So in our case, since we want to use the functionality of the http module, we use the require function to get the required functions from the http module so that it can be used in our application.
2. In this line of code, we are creating a server application which is based on a simple function. This function is called whenever a request is made to our server application.
3. When a request is received, we are saying to send a response with a header type of '200.' This number is the normal response which is sent in an http header when a successful response is sent to the client.
4. In the response itself, we are sending the string 'Hello World.'

5. We are then using the server.listen function to make our server application listen to client requests on port no 7000. You can specify any available port over here.

If the command is executed successfully, the following Output will be shown when you run your code in the browser.

Output:



From the output,

- You can clearly see that if we browse to the URL of localhost on port 7000, you will see the string 'Hello World' displayed in the page.
- Because in our code we have mentioned specifically for the server to listen on port no 7000, we are able to view the output when browsing to this url.

Here is the code for your reference

```
var http=require('http')
```

```
var server=http.createServer((function(request,response)
                                                {
response.writeHead(200,
{"Content-Type" : "text/plain"));
response.end("Hello World\n");
                                                }));
server.listen(7000);
```

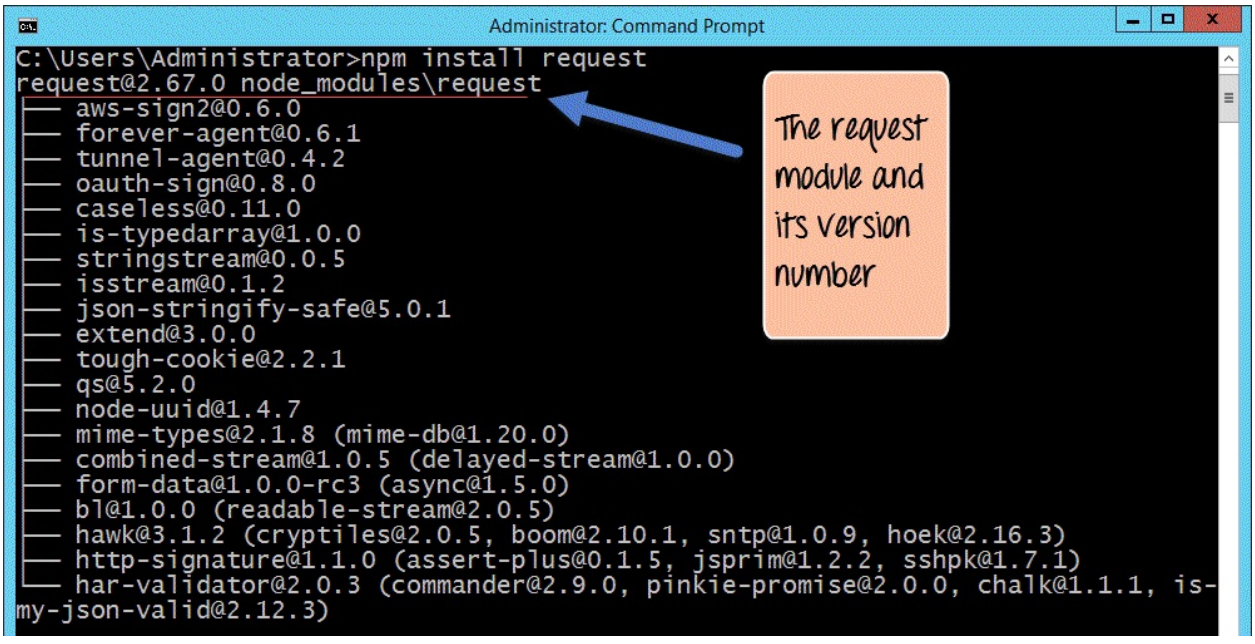
Handling GET Requests in Node.js

Making a GET Request to get the data from another site is relatively very simple in Node.js. To make a Get request in the node, we need to first have the request module installed. This can be done by executing the following line in the command line

npm install request

The above command requests the Node package manager to download the required request modules and install them accordingly.

When your npm module has been installed successfully, the command line will show the installed module name and version: <name>@<version>.



In the above snapshot, you can see that the 'request' module along with the version number 2.67.0 was downloaded and installed.

Now let's see the code which can make use of this 'request' command.

```
var request = require("request");

request("http://www.google.com",function(error,response,body)
        {
                console.log(body);
        });
```

Code Explanation:

1. We are using the 'require' module which was installed in the last step. This module has the necessary functions which can be used to make GET requests to websites.
2. We are making a GET Request to www.google.com and subsequently calling a function when a response is received. When a response is received the parameters(error, response, and body) will have the following values
   a. Error – In case there is any error received when using the GET request, this will be recorded here.
   b. Response-The response will have the http headers which are sent back in the response.
   c. Body-The body will contain the entire content of the response sent by Google.
3. In this, we are just writing the content received in the body parameter to the console.log file. So basically, whatever we get by going to **www.google.com** will be written to the console.log.

Here is the code for your reference

var request = require("request");

request("http://www.google.com",function(error,response,body)

{

console.log(body);

```
});
```

Summary

- The Node.js framework can be used to develop web servers using the 'http' module. The application can be made to listen on a particular port and send a response to the client whenever a request is made to the application.
- The 'request' module can be used to get information from web sites. The information would contain the entire content of the web page requested from the relevant web site.

Chapter 5: Node.js with Express

In this tutorial, we will also have a look at the express framework. This framework is built in such a way that it acts as a minimal and flexible Node.js web application framework, providing a robust set of features for building single and multipage, and hybrid web application.

What is Express.js

Express.js is a Node js web application server framework, which is specifically designed for building single-page, multipage, and hybrid web applications.

It has become the standard server framework for node.js. Express is the backend part of something known as the MEAN stack.

The MEAN is a free and open-source JavaScript software stack for building dynamic web sites and web applications which has the following components; **1) MongoDB** - The standard NoSQL database **2) Express.js** - The default web applications framework **3) Angular.js** - The JavaScript MVC framework used for web applications **4) Node.js** - Framework used for scalable server-side and networking applications.

The Express.js framework makes it very easy to develop an application which can be used to handle multiple types of requests like the GET, PUT, and POST and DELETE requests.

Installing and using Express

Express gets installed via the Node Package manager. This can be done by executing the following line in the command line **npm install express**

The above command requests the Node package manager to download the required express modules and install them accordingly.

Let's use our newly installed Express framework and create a simple "Hello World" application.

Our application is going to create a simple server module which will listen on port no 3000. In our example, if a request is made through the browser on this port no, then server application will send a 'Hello' World' response to the client.

```
var express=require('express');
var app=express();
app.get('/',function(req,res)
{
        res.send('Hello World!');
});

var server=app.listen(3000,function() {});
```

Code Explanation:

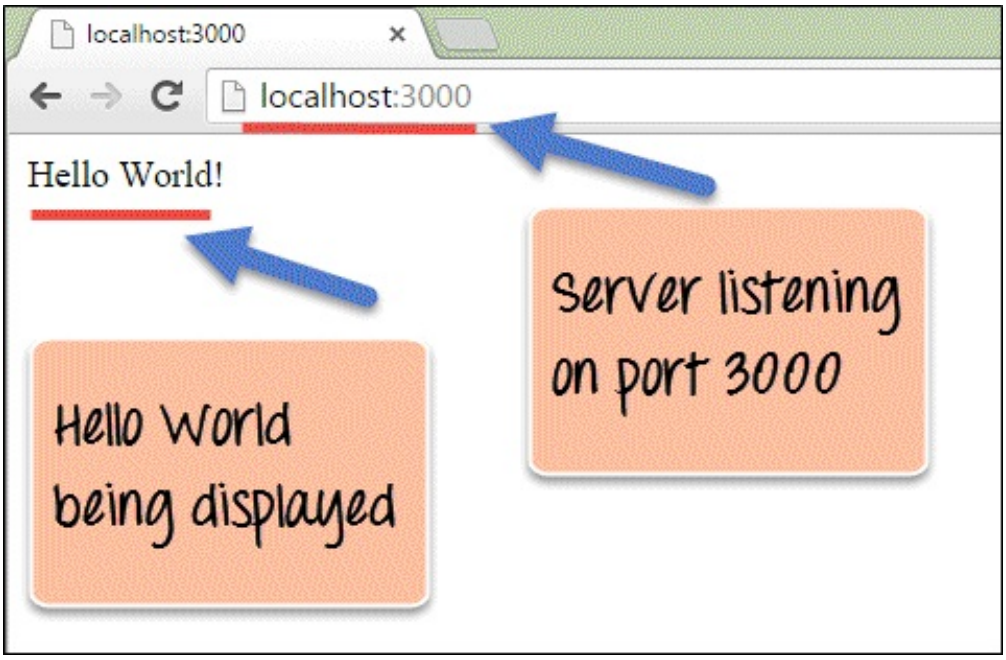
1. In our first line of code, we are using the require function to include the "express module."
2. Before we can start using the express module, we need to make an object of the express module.
3. Here we are creating a callback function. This function will be called whenever anybody browses to the root of our web application which is

http://localhost:3000 . The callback function will be used to send the string 'Hello World' to the web page.

4. In the callback function, we are sending the string "Hello World" back to the client. The 'res' parameter is used to send content back to the web page. This 'res' parameter is something that is provided by the 'request' module to enable one to send content back to the web page.
5. We are then using the listen to function to make our server application listen to client requests on port no 3000. You can specify any available port over here.3

If the command is executed successfully, the following Output will be shown when you run your code in the browser.

Output:



From the output,

- You can clearly see that we if browse to the URL of localhost on port 3000, you will see the string 'Hello World' displayed in the page.
- Because in our code we have mentioned specifically for the server to listen on port no 3000, we are able to view the output when browsing to this URL.

What are Routes

Routing refers for determining the way in which an application responds to a client request to a particular endpoint.

For example, a client can make a GET, POST, PUT or DELETE http request for various URL's such as the one's shown below; http://localhost:3000/Books

http://localhost:3000/Students

In the above example,

- If a GET request is made for the first URL, then the response should ideally be a list of books.
- If the GET request is made for the second URL, then the response should ideally be a list of Students.
- So based on the URL which is accessed, a different functionality on the web server will be invoked and accordingly the response will be sent to the client. This is the concept of routing.

Each route can have one or more handler functions, which are executed when the route is matched.

The general syntax for a route is shown below

```
app.METHOD(PATH, HANDLER)
```

Wherein,

1) app is an instance of the express module

2) METHOD is an HTTP request method (GET, POST, PUT or DELETE)

3) PATH is a path on the server.

4) HANDLER is the function executed when the route is matched.

Let's look at an example of how we can implement routes in express. Our example will create 3 routes as

1. A /Node route which will display the string "Tutorial on Node" if this route is accessed
2. A /Angular route which will display the string "Tutorial on Angular" if this route is accessed
3. A default route / which will display the string "Welcome to Guru99 Tutorials."

Our basic code will remain the same as previous examples. The below snippet is an add-on to show case how routing is implemented.

```
app.route('/Node).get(function(req.res)
{
res.send("Tutorial on Node");
});
app.route('Angular).get(function(req.res)
{
res.send("Tutorial on Angular");
});
app.get('',function(req,res)
{
res.send('Welcome to Guru99 Tutorials');
});
```

Code Explanation:

1. Here we are defining a route if the URL **http://localhost:3000/Node** is selected in the browser. To the route, we are attaching a callback function which will be called when we browse to the Node URL.

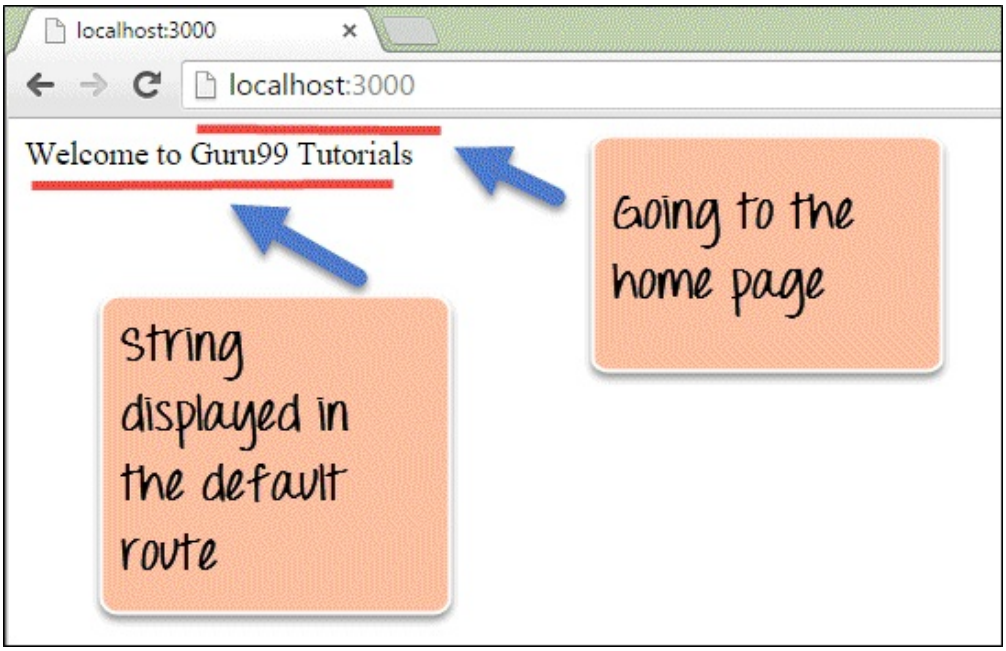
The function has 2 parameters.

- The main parameter we will be using is the 'res' parameter which can be used to send information back to the client.
- The 'req' parameter has information about the request being made. Sometimes additional parameters could be sent as part of the request being made, and hence the 'req' parameter can be used to find the additional parameters being sent.

2. We are using the send function to send the string "Tutorial on Node" back to the client if the Node route is chosen.
3. Here we are defining a route if the URL **http://localhost:3000/Angular** is selected in the browser. To the route, we are attaching a callback function which will be called when we browse to the Angular URL.
4. We are using the send function to send the string "Tutorial on Angular" back to the client if the Angular route is chosen.
5. This is the default route which is chosen when one browses to the route of the application –**http://localhost:3000**. When the default route is chosen, the message "Welcome to Guru99 Tutorials" will be sent to the client.

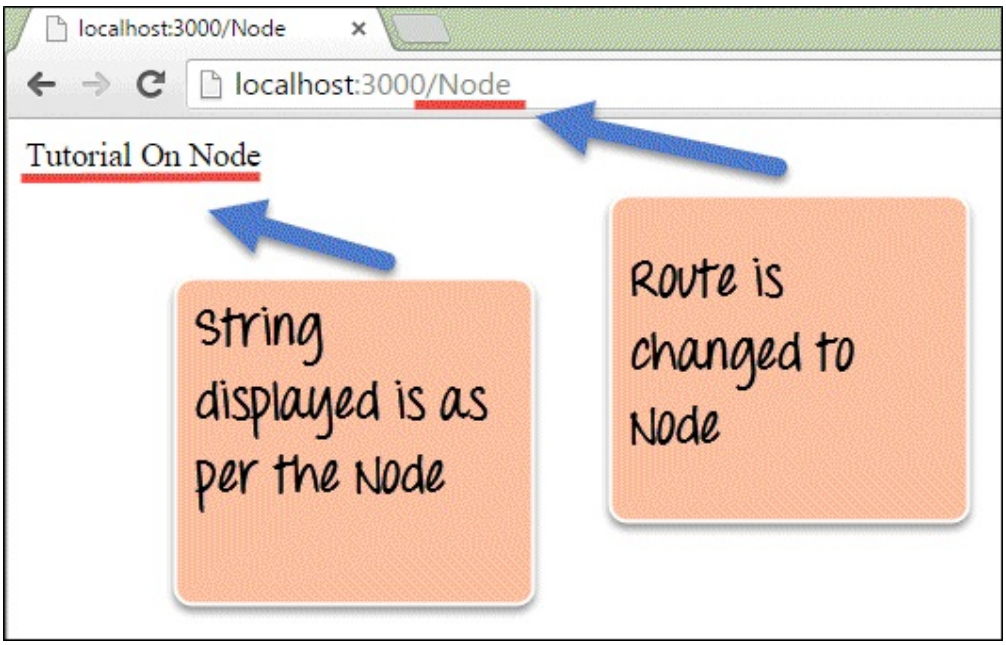
If the command is executed successfully, the following Output will be shown when you run your code in the browser.

Output:



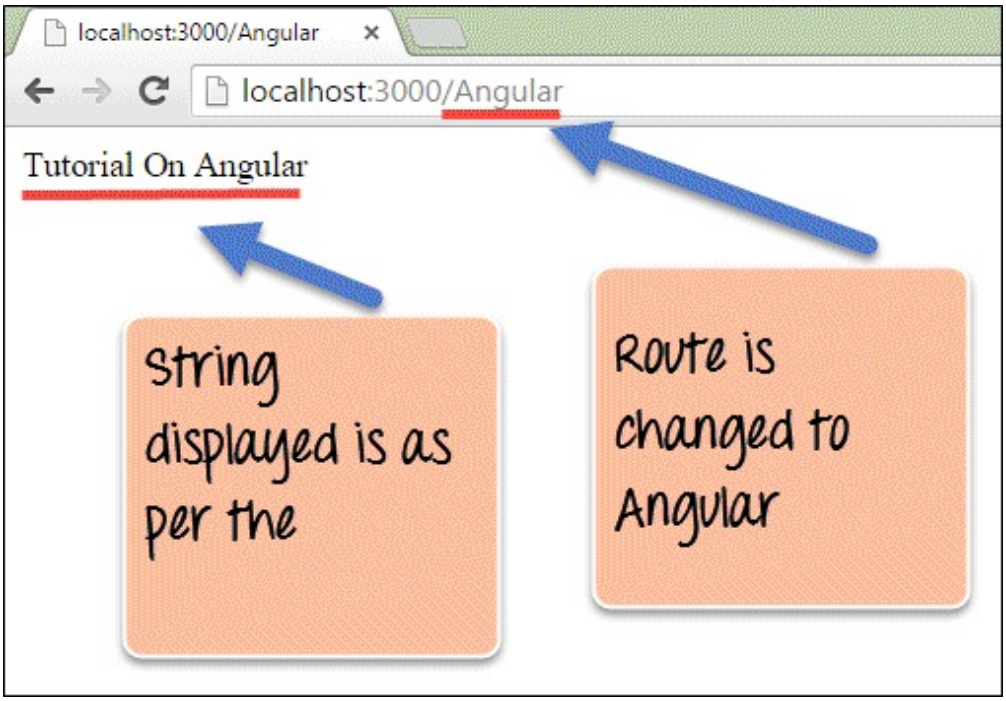
From the output,

- You can clearly see that we if browse to the URL of localhost on port 3000, you will see the string 'Welcome to Guru99 Tutorials' displayed on the page.
- Because in our code, we have mentioned that our default URL would display this message.



From the output,

- You can see that if the URL has been changed to /Node, the respective Node route would be chosen and the string "Tutorial On Node' is displayed.



From the output,

- You can see that if the URL has been changed to /Angular, the respective Node route would be chosen and the string "Tutorial On Angular" is displayed.

Sample Web server using express.js

From our above example, we have seen how we can decide on what output to show based on routing. This sort of routing is what is used in most modern day web applications. The other part of a web server is about using templates in Node js.

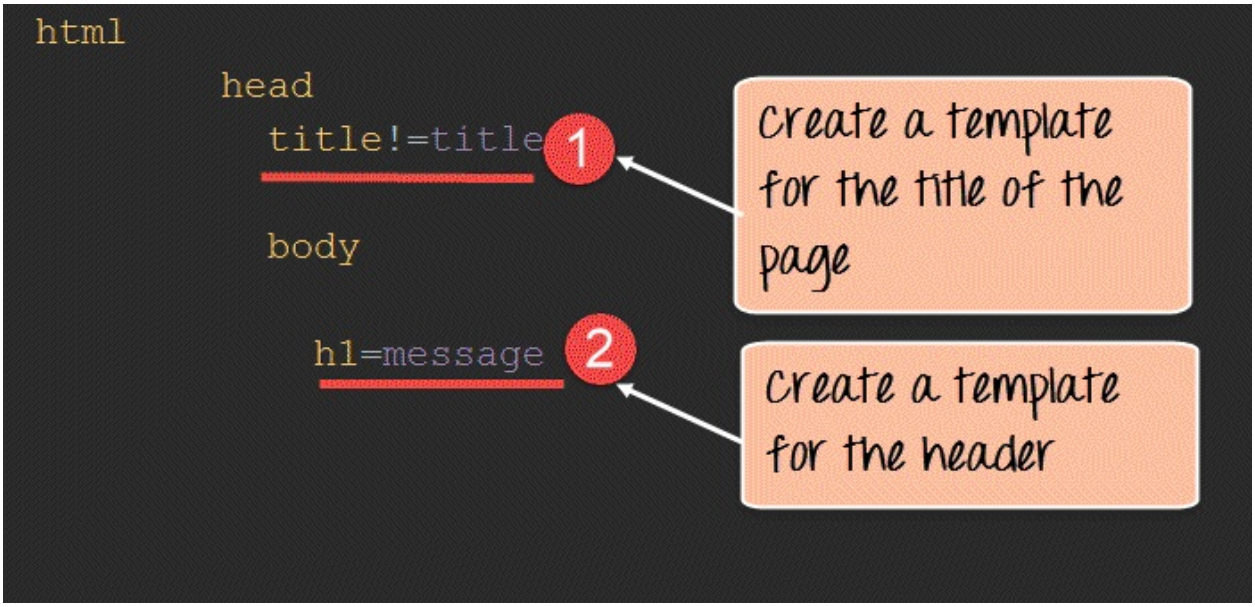
When creating quick on-the-fly Node applications, an easy and fast way is to use templates for the application. There are many frameworks available in the market for making templates. In our case, we will take the example of the jade framework for templating.

Jade gets installed via the Node Package manager. This can be done by executing the following line in the command line **npm install jade**

The above command requests the Node package manager to download the required jade modules and install them accordingly.

Let's use our newly installed jade framework and create some basic templates.

Step 1) The first step is to create a jade template. Create a file called index.jade and insert the below code



1. Here we are specifying that the title of the page will be changed to whatever value is passed when this template gets invoked.
2. We are also specifying that the text in the header tag will get replaced to whatever gets passed in the jade template.

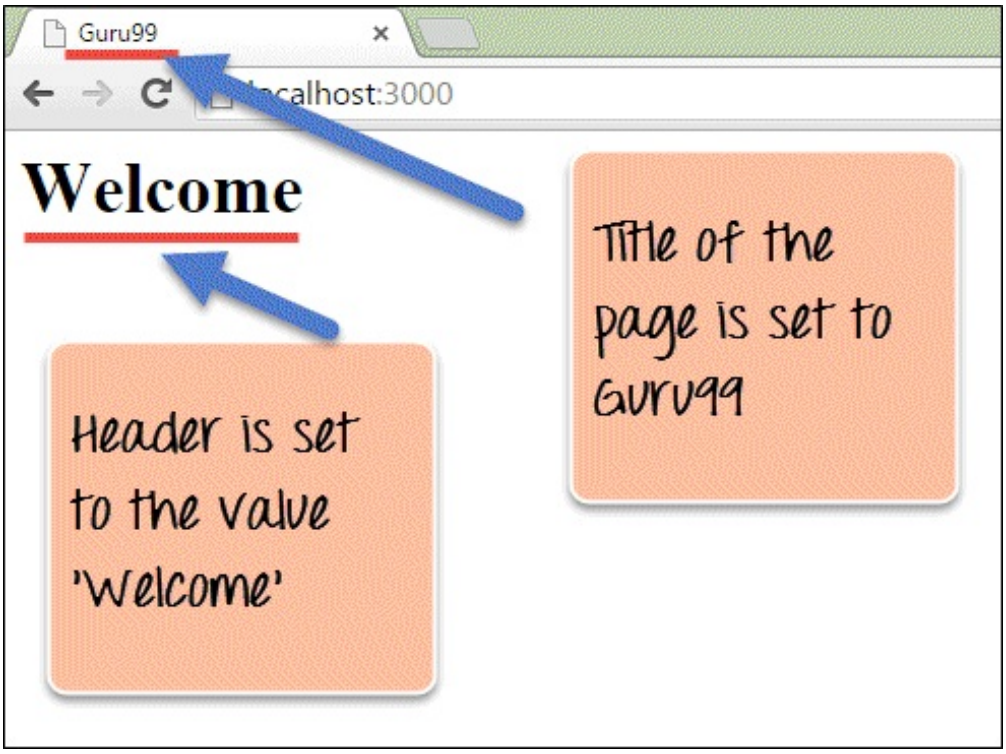
```
var express=require('express');

var app=express();

app.set('view engine','jade');

app.get('/',function(req,res)

{

        res.render('index',

                {title:'Guru99',message:'Welcome'})

});

var server=app.listen(3000,function() {});
```

Code Explanation:

1. The first thing to specify in the application is "view engine" that will be used to render the templates. Since we are going to use jade to render our templates, we specify this accordingly.
2. The render function is used to render a web page. In our example, we are rendering the template (index.jade) which was created earlier.
3. We are passing the values of "Guru99" and "Welcome" to the parameters "title" and "message" respectively. These values will be replaced by the 'title', and 'message' parameters declared in the index.jade template.

If the command is executed successfully, the following Output will be shown when you run your code in the browser.

Output:



From the output,

- We can see that the title of the page gets set to "Guru99" and the header of the page gets set to "Welcome."

- This is because of the jade template which gets invoked in our node js application.

Summary

- The express framework is the most common framework used for developing Node js applications. The express framework is built on top of the node.js framework and helps in fast-tracking development of server based applications.
- Routes are used to divert users to different parts of the web applications based on the request made. The response for each route can be varied depending on what needs to be shown to the user.
- Templates can be used to inject content in an efficient manner. Jade is one of the most popular templating engines used in Node.js applications.

Chapter 6: Node.js with MongoDB

Mostly all modern day web applications have some sort of data storage system at the backend to store data. For example, if you take the case of a web shopping application, data such as the price of an item or the number of items of a particular type would be stored in the database.

The Node js framework has the ability to work with databases which are commonly required by most modern day web applications. Node js can work with both relational (such as Oracle and MS SQL Server) and non-relational databases (such as MongoDB and MySQL). During this tutorial, we will see how we can use databases from within Node js applications.

Node.js and NoSQL Databases

Over the years, NoSQL database such as MongoDB and MySQL have become quite popular as databases for storing data. The ability of these databases to store any sort of content and particularly in any sort of format is what makes these databases so famous.

Node.js has the ability to work with both MySQL and MongoDB as databases. In order to use either of these databases, you need to download and use the required modules using the Node package manager.

For MySQL, the required module is called "mysql" and for using MongoDB the required module to be installed is "Mongoose."

With these modules, you can perform the following operations in Node.js

1. Manage the connection pooling – Here is where you can specify the number of MySQL database connections that should be maintained and saved by Node.js.
2. Create and close a connection to a database. In either case, you can provide a callback function which can be called whenever the "create" and "close" connection methods are executed.
3. Queries can be executed to get data from respective databases to retrieve data.
4. Data manipulation such as inserting data, deleting and updating data can also be achieved with these modules.

For the remaining topics, we will look at how we can work with MongoDB databases within Node.js.

Using MongoDB and Node.js

As discussed in the earlier topic, MongoDB is one of the most popular databases used along with Node.js.

During this chapter, we will see

How we can establish connections with a MongoDB database

How we can perform the normal operations of reading data from a database as well as inserting, deleting and updating records in a mongoDB database.

For the purpose of this chapter, let's assume that we have the below mongoDB data in place.

Database name: EmployeeDB

Collection name: Employee

```
Documents
{
        {Employeeid : 1, Employee Name : Guru99},
        {Employeeid : 2, Employee Name : Joe},
        {Employeeid : 3, Employee Name : Martin},
}
```

1. **Installing the NPM Modules** To access Mongo from within a Node application, a driver is required. There are number of Mongo drivers available, but MongoDB is among the most popular. To install the MongoDB module, run the below command
   npm install mongodb

2. **Creating and closing a connection to a MongoDB database.** The below code snippet shows how to create and close a connection to a MongoDB

database.

```
var MongoClient = require('mongodb').MongoClient;
var url = 'mongodb://localhost/EmployeeDB';

MongoClient.connect(url, function(err, db) {

      cursor.log("connected");

        db.close();

    });
```

Code Explanation:

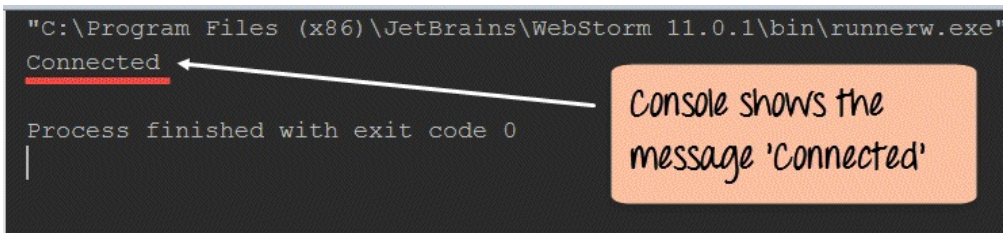
1. The first step is to include the mongoose module which is done through the require function. Once this module is in place, we can use the necessary functions available in this module to create connections to the database.
2. Next we specify our connect string to the database. In the connect string there are 3 key values which are passed.

- The first is 'mongodb' which specifies that we are connecting to a mongoDB database.
- The next is 'localhost' which means we are connecting to a database on the local machine.
- The next is 'EmployeeDB' which is the name of the database defined in our MongoDB database.

3. The next step is to actually connect to our database. The connect function takes in our URL and has the facility to specify a callback function. It will be called when the connection is opened to the database. This gives us the opportunity to know if the database connection was successful or not.
4. In the function, we are writing the string "Connection established" to the console to indicate that a successful connection was created.

5. Finally, we are closing the connection using the db.close statement.

If the above code is executed properly, the string "Connected" will be written to the console as shown below.



3. **Querying for data in a MongoDB database** – Using the MongoDB driver we can also fetch data from the MongoDB database.

The below section will show how we can use the driver to fetch all of the documents from our Employee collection (This is the collection in our MongoDB database which contains all the employee related documents. Each document has an object id, Employee name and employee id to define the values of the document) in our EmployeeDB database.

```
var MongoClient = require('mongodb').MongoClient;
var url = 'mongodb://localhost/EmployeeDB';

MongoClient.connect(url, function(err, db) {

    var cursor = db.collection('Employee').find();

    cursor.each(function(err, doc) {

        console.log(doc);

    });
});
```

Code Explanation:

1. In the first step, we are creating a cursor (A cursor is a pointer which is used to point to the various records fetched from a database. The cursor is

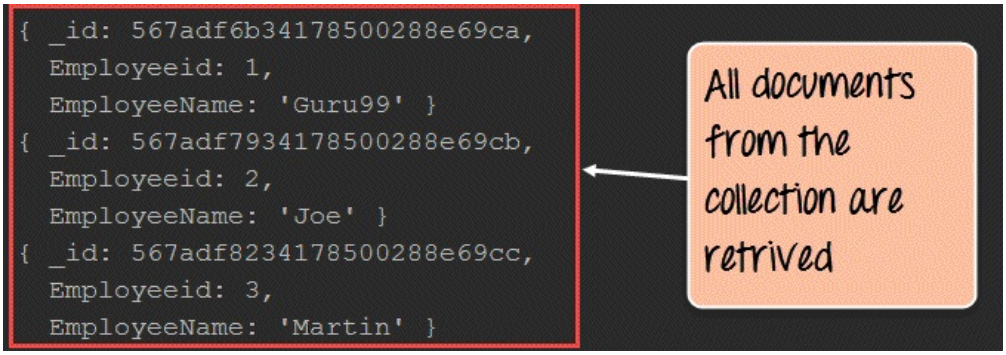
then used to iterate through the different records in the database. Here we are defining a variable name called cursor which will be used to store the pointer to the records fetched from the database.) which points to the records which are fetched from the MongoDb collection. We also have the facility of specifying the collection 'Employee' from which to fetch the records. The find() function is used to specify that we want to retrieve all of the documents from the MongoDB collection.

2. We are now iterating through our cursor and for each document in the cursor we are going to execute a function.
3. Our function is simply going to print the contents of each document to the console.

Note: - It is also possible to fetch a particular record from a database. This can be done by specifying the search condition in the find() function. For example, suppose if you just wanted to fetch the record which has the employee name as Guru99 then this statement can be written as follows "var cursor=db.collection('Employee').find()."

If the above code is executed successfully, the following output will be displayed in your console.

Output:



From the output,

- You will be able to clearly see that all the documents from the collection are retrieved. This is possible by using the find() method of the mongoDB

connection (db) and iterating through all of the documents using the cursor.

4. **Inserting documents in a collection** – Documents can be inserted into a collection using the insertOne method provided by the MongoDB library. The below code snippet shows how we can insert a document into a mongoDB collection.

```
var MongoClient = require('mongodb').MongoClient;
var url = 'mongodb://localhost/EmployeeDB';

MongoClient.connect(url, function(err, db) {

    db.collection('Employee').insertOne({
        Employeeid: 4,
        EmployeeName: "NewEmployee"
    });
});
```

Code Explanation:

1. Here we are using the insertOne method from the MongoDB library to insert a document into the Employee collection.
2. We are specifying the document details of what needs to be inserted into the Employee collection.

If you now check the contents of your MongoDB database, you will find the record with Employeeid of 4 and EmployeeName of "NewEmployee" inserted into the Employee collection.

Note: The console will not show any output because the record is being inserted in the database and no output can be shown here.

To check that the data has been properly inserted in the database, you need to execute the following commands in MongoDB

1. Use EmployeeDB
2. db.Employee.find({Employeeid :4 })

The first statement ensures that you are connected to the EmployeeDb database. The second statement searches for the record which has the employee id of 4.

5. **Updating documents in a collection** - Documents can be updated in a collection using the updateOne method provided by the MongoDB library. The below code snippet shows how to update a document in a mongoDB collection.

```
var MongoClient = require('mongodb').MongoClient;
var url = 'mongodb://localhost/EmployeeDB';

MongoClient.connect(url, function(err, db) {

    db.collection('Employee').updateOne({
        "EmployeeName": "NewEmployee"
    }, {
        $set: {
            "EmployeeName": "Mohan"
        }
    });
});
```

Code Explanation:

1. Here we are using the "updateOne" method from the MongoDB library, which is used to update a document in a mongoDB collection.
2. We are specifying the search criteria of which document needs to be updated. In our case, we want to find the document which has the EmployeeName of "NewEmployee."
3. We then want to set the value of the EmployeeName of the document from "NewEmployee" to "Mohan".

If you now check the contents of your MongoDB database, you will find the record with Employeeid of 4 and EmployeeName of "Mohan" updated in the Employee collection.

To check that the data has been properly updated in the database, you need to execute the following commands in MongoDB

1. Use EmployeeDB
2. db.Employee.find({Employeeid :4 })

The first statement ensures that you are connected to the EmployeeDb database. The second statement searches for the record which has the employee id of 4.

6. **Deleting documents in a collection** - Documents can be deleted in a collection using the "deleteOne" method provided by the MongoDB library. The below code snippet shows how to delete a document in a mongoDB collection.

```
var MongoClient = require('mongodb').MongoClient;
var url = 'mongodb://localhost/EmployeeDB';

MongoClient.connect(url, function(err, db) {

    db.collection('Employee').deleteOne(

        {
            "EmployeeName": "Mohan"
        }

    );
});
```

Code Explanation:

1. Here we are using the "deleteOne" method from the MongoDB library, which is used to delete a document in a mongoDB collection.
2. We are specifying the search criteria of which document needs to be deleted. In our case, we want to find the document which has the EmployeeName of "Mohan" and delete this document.

If you now check the contents of your MongoDB database, you will find the record with Employeeid of 4 and EmployeeName of "Mohan" deleted from the Employee collection.

To check that the data has been properly updated in the database, you need to execute the following commands in MongoDB

1. Use EmployeeDB
2. db.Employee.find()

The first statement ensures that you are connected to the EmployeeDb database. The second statement searches and display all of the records in the employee collection. Here you can see if the record has been deleted or not.

How to build a node express app with MongoDB to store and serve content

Building an application with a combination of both using express and MongoDB is quite common nowadays.

When working with JavaScript web based applications, one will normally here of the term MEAN stack.

- The term MEAN stack refers to a collection of JavaScript based technologies used to develop web applications.
- MEAN is an acronym for MongoDB, ExpressJS, AngularJS and Node.js.

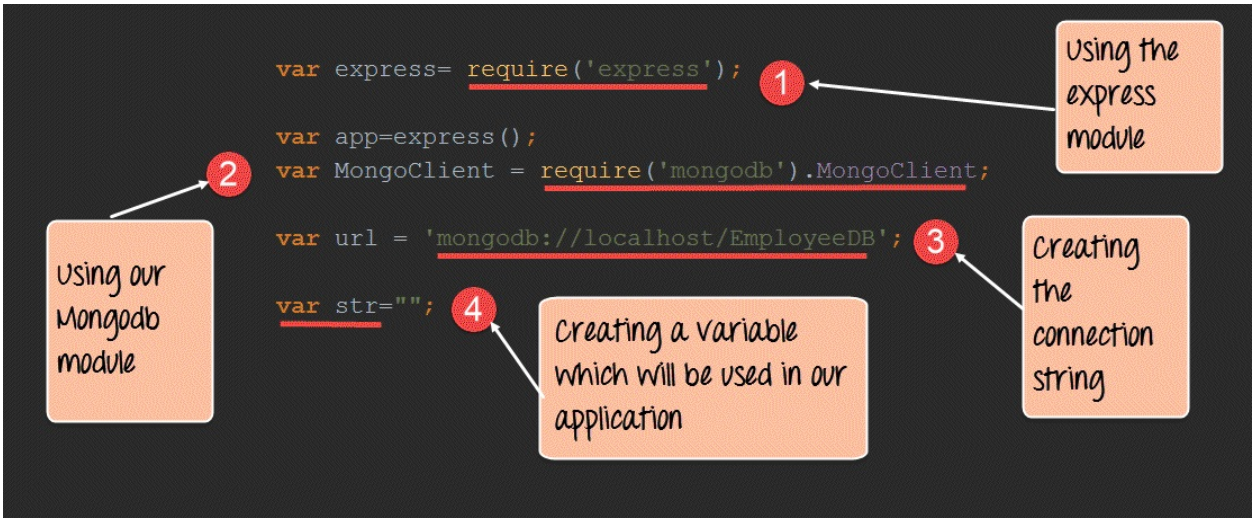
Hence, it's always good to understand how Node.js and MongoDB work together to deliver applications which interact with backend databases.

Let's look at a simple example of how we can use "express" and "MongoDB" together. Our example will make use of the same Employee collection in the MongoDB EmployeeDB database.

We will now incorporate Express to display the data on our web page when it is requested by the user. When our application runs on Node.js, one might need to browse to the URL **http://localhost:3000/Employeeid**.

When the page is launched, all the employee id in the Employee collection will be displayed. So let's see the code snippet in sections which will allow us to achieve this.

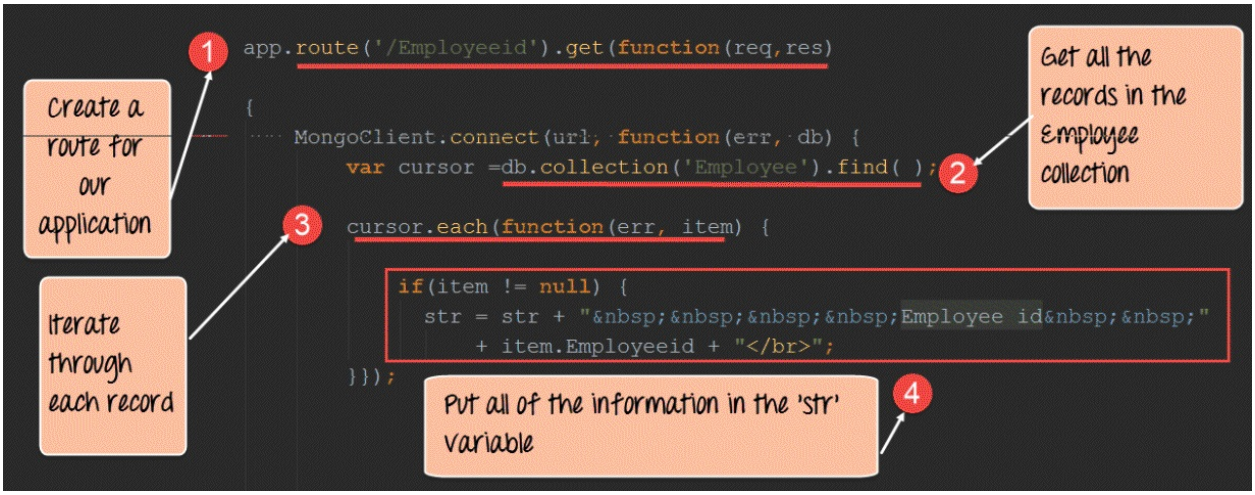
Step 1) Define all the libraries which need to be used in our application, which in our case is both the MongoDB and express library.



Code Explanation:

1. We are defining our 'express' library, which will be used in our application.
2. We are defining our 'express' library, which will be used in our application for connecting to our MongoDB database.
3. Here we are defining the URL of our database to connect to.
4. Finally, we are defining a string which will be used to store our collection of employee id which need to be displayed in the browser later on.

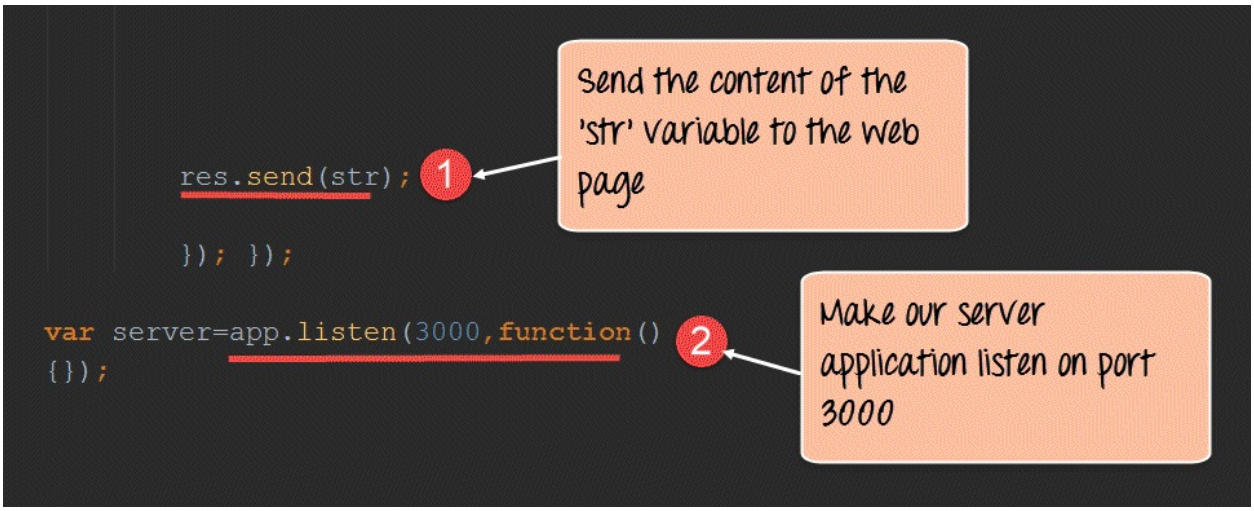
Step 2) In this step, we are now going to get all of the records in our 'Employee' collection and work with them accordingly.



Code Explanation:

1. We are creating a route to our application called 'Employeeid.' So whenever anybody browses to**http://localhost:3000/Employeeid** of our application, the code snippet defined for this route will be executed.
2. Here we are getting all of the records in our 'Employee' collection through the db.collection('Employee').find() command. We are then assigning this collection to a variable called cursor. Using this cursor variable, we will be able to browse through all of the records of the collection.
3. We are now using the cursor.each() function to navigate through all of the records of our collection. For each record, we are going to define a code snippet on what to do when each record is accessed.
4. Finally, we see that if the record returned is not null, then we are taking the employee via the command "item.Employeeid". The rest of the code is just to construct a proper HTML code which will allow our results to be displayed properly in the browser.

Step 3) In this step, we are going to send our output to the web page and make our application listen on a particular port.

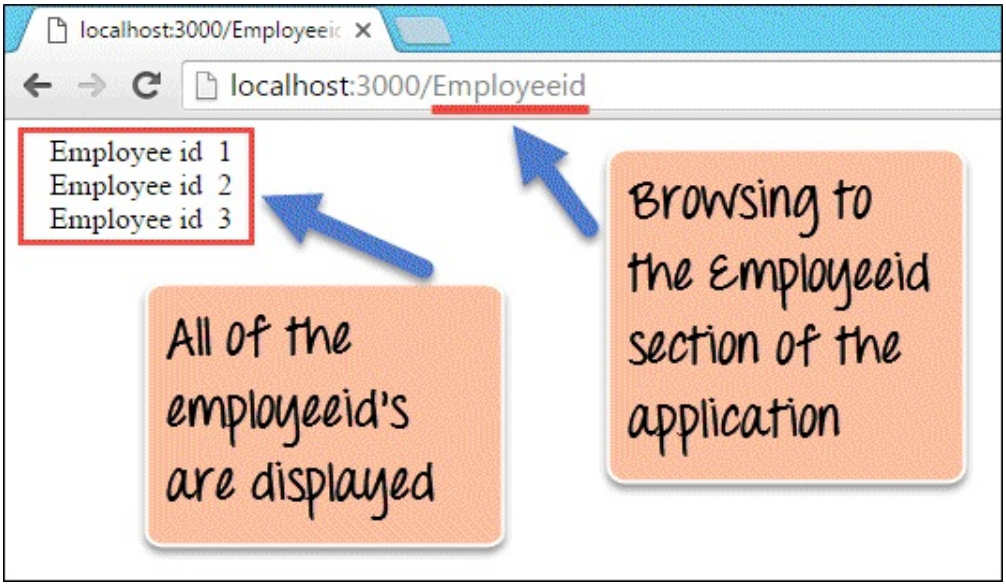


Code Explanation:

1. Here we are sending the entire content which was constructed in the earlier step to our web page. The 'res' parameter allows us to send content to our web page as a response.

2. We are making our entire Node.js application listen on port 3000.

Output:



From the output,

- It clearly shows that all of the employeeid's in the Employee collection were retrieved. This is because we use the MongoDB driver to connect to the database and retrieve all the Employee records and subsequently used "express" to display the records.

Here is the code for your reference

```
var express = require('express');
var app = express();
var MongoClient = require('mongodb').MongoClient;
var url = 'mongodb://localhost/EmployeeDB';
var str = "";

app.route('Employeeid').get(function(req, res)

    {
        MongoClient.connect(url, function(err, db) {
            var cursor = db.collection('Employee').find();
            /noinspection JSDeprecatedSymbols
            cursor.each(function(err, item) {
```

```
                if (item != null) {
                    str = str + "    Employee id  " +
item.Employeeid + "";
                }
            });
            res.send(str);
            db.close();
        });
    });

var server = app.listen(3000, function() {});
```

Note:cursor.each maybe deprecated based on version of your MongoDB driver. You can append //noinspection JSDeprecatedSymbols before cursor.each to circumvent the issue. Alternatively, you can use forEach. Below is the sample code using forEach

```
var express = require('express');
var app = express();
var MongoClient = require('mongodb').MongoClient;
var url = 'mongodb://localhost/EmployeeDB';
var str = "";

app.route('/Employeeid').get(function(req, res) {
   MongoClient.connect(url, function(err, db) {
       var collection = db.collection('Employee');
       var cursor = collection.find({});
       str = "";
       cursor.forEach(function(item) {
           if (item != null) {
                   str = str + "    Employee id  " +
item.Employeeid + "";
           }
       }, function(err) {
           res.send(str);
           db.close();
          }
       );
   });
});
var server = app.listen(8080, function() {});
```

Summary

- Node.js is used in conjunction with NoSQL databases to build a lot of modern days web applications. Some of the common databases used are MySQL and MongoDB.
- One of the common modules used for working with MongoDB databases is a module called 'MongoDB.' This module is installed via the Node package manager.
- With the MongoDB module, it's possible to query for records in a collection and perform the normal update, delete and insert operations.
- Finally, one of the modern practices is to use the express framework along with MongoDB to deliver modern day applications. The Express framework can make use of the data returned by the MongoDB driver and display the data to the user in the web page accordingly.

Chapter 7: Promise, Generator, Event and Filestream

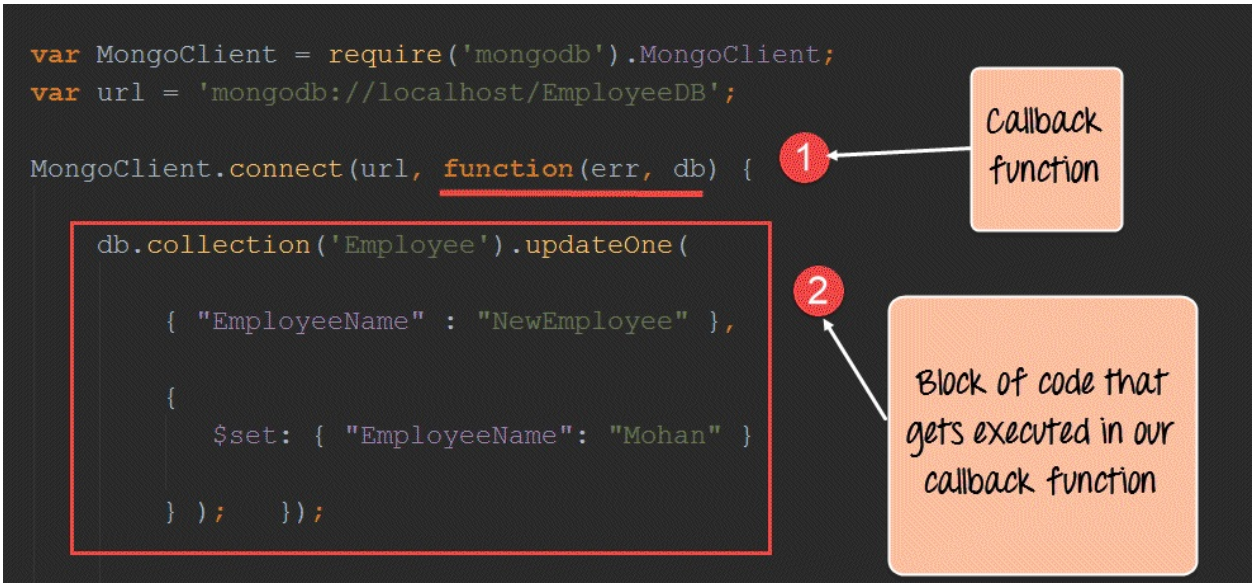
In previous tutorials, you would have seen callback functions which are used for Asynchronous events. But sometimes callback functions can become a nightmare when they start becoming nested, and the program starts to become long and complex.

In such cases, Node.js provides additional features to rectify problems which are encountered when using callbacks. These are classified into Promises, generates and events. During the course of this tutorial, we will learn and see these concepts in further detail.

What are promises

Before we start with promises, let's first revisit what are "callback" functions in Node.js. We have seen these callback functions a lot in the previous chapters, so let's quickly go through one of them.

The example below shows a code snippet, which is used to connect to a MongoDB database and perform an update operation on one of the records in the database.



1. In the above code, the part of the function(err,db) is known as the declaration of an anonymous or callback function. When the MongoClient creates a connection to the MongoDB database, it will return to the callback function once the connection operation is completed. So in a sense, the connection operations happens in the background, and when it is done, it calls our callback function. Remember that this is one of the key points of Node.js to allow many operations to happen concurrently and thus not block any user from performing an operation.

2. The second code block is what gets executed when the callback function is actually called. The callback function just updates one record in our MongoDB database.

So what is a promise then? Well, a promise is just an enhancement to callback functions in Node.js. During the development lifecycle, there may be an instance where you would need to nest multiple callback functions together. This can get kind of messy and difficult to maintain at a certain point in time. In short, a promise is an enhancement to callbacks that looks towards alleviating these problems.

The basic syntax of a promise is shown below;

```
var promise = doSomethingAync()
promise.then(onFulfilled, onRejected)
```

- "doSomethingAync" is any callback or asynchronous function which does some sort of processing.
- This time, when defining the callback, there is a value which is returned called a "promise."
- When a promise is returned, it can have 2 outputs. This is defined by the 'then clause'. Either the operation can be a success which is denoted by the 'onFulfilled' parameter. Or it can have an error which is denoted by the 'onRejected' parameter.

Note: So the key aspect of a promise is the return value. There is no concept of a return value when working with normal callbacks in Node.js. Because of the return value, we have more control of how the callback function can be defined.

In the next topic, we will see an example of promises and how they benefit from callbacks.

Callbacks to promises

Now let's look at an example of how we can use "promises" from within a Node.js application. In order to use promises in a Node.js application, the 'promise' module must first be downloaded and installed.

We will then modify our code as shown below, which updates an Employeename in the 'Employee' collection by using promises.

Step 1) Installing the NPM Modules

To use Promises from within a Node JS application, the promise module is required. To install the promise module, run the below command **npm install promise**

Step 2) Modify the code to include promises

```
var Promise = require('promise');
var MongoClient = require('mongodb').MongoClient;
var url = 'mongodb://localhost/EmployeeDB';

MongoClient.connect(url)
    .then(function(err, db) {
        db.collection('Employee').updateOne({
            "EmployeeName": "Martin"
        }, {
            $set: {
                "EmployeeName": "Mohan"
            }
        });
    });
```

Code Explanation:-

1. The first part is to include the 'promise' module which will allow us to use the promise functionality in our code.
2. We can now append the 'then' function to our MongoClient.connect function. So what this does is that when the connection is established to the database, we need to execute the code snippet defined thereafter.
3. Finally, we define our code snippet which does the work of updating EmployeeName of the employee with the name of "Martin" to "Mohan".

Note:-

If you now check the contents of your MongoDB database, you will find that if a record with EmployeeName of "Martin" exists, it will be updated to "Mohan."

To check that the data has been properly inserted in the database, you need to execute the following commands in MongoDB

1. Use EmployeeDB
2. db.Employee.find({EmployeeName :Mohan })

The first statement ensures that you are connected to the EmployeeDb database. The second statement searches for the record which has the employee name of "Mohan".

Dealing with nested promises

When defining promises, it needs to be noted that the "then" method itself returns a promise. So in a sense, promises can be nested or chained to each other.

In the example below, we use chaining to define 2 callback functions, both of which insert a record into the MongoDB database.

(**Note**: Chaining is a concept used to link execution of methods to one another. Suppose if your application had 2 methods called 'methodA' and 'methodB.' And the logic was such that 'methodB' should be called after 'methodA,' then you would chain the execution in such a way that 'methodB' gets called directly after 'methodA.') The key thing to note in this example is that the code becomes cleaner, readable and maintainable by using nested promises.

```
var Promise = require('promise');
var MongoClient = require('mongodb').MongoClient;
var url = 'mongodb://localhost/EmployeeDB';
MongoClient.connect(url)

.then(function(db) {
    db.collection('Employee').insertOne({
        Employeeid: 4,
        EmployeeName: "NewEmployee"
    })

    .then(function(db1) {
        db1.collection('Employee').insertOne({
            Employeeid: 5,
            EmployeeName: "NewEmployee1"
        })
    })
});
```

Code Explanation:-

1. We are now defining 2 "then" clauses which get executed one after the other. In the first then clause, we are passing the 'db' parameter which contains our database connection. We are then using the collection property of the 'db' connection to insert records into the 'Employee' collection. The 'insertOne' method is used to insert the actual document into the Employee collection.
2. We are then using the 2nd then clause also to insert another record into the database.

If you now check the contents of your MongoDB database, you will find the 2 record's inserted into the MongoDB database.

Generating promises with the BlueBird library

Bluebird is a fully-featured Promise library for JavaScript. The strongest feature of Bluebird is that it allows you to "promisify" other Node modules in order to use them asynchronously. Promisify is a concept applied to callback functions. This concept is used to ensure that every callback function which is called returns some sort of value.

So if a Node JS module contains a callback function which does not return a value, if we Promisify the node module, all the function's in that specific node module would automatically be modified to ensure that it returns a value.

So you can use BlueBird to make the MongoDB module run asynchronously. This just adds another level of ease when writing Node.js applications.

We will look at an example of how to use the bluebird module.

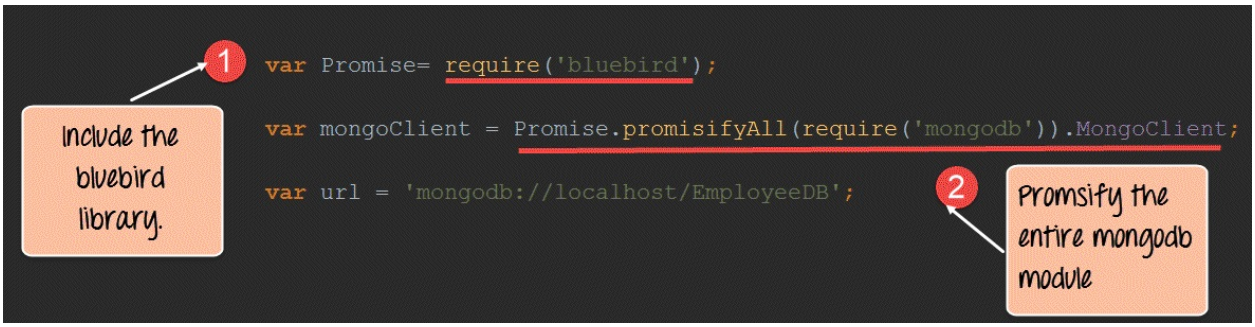
Our example will first establish a connection to the "Employee collection" in the "EmployeeDB" database. If "then" connection is established, then it will get all of the records in the collection and display them in the console accordingly.

Step 1) Installing the NPM Modules

To use Bluebird from within a Node application, the Bluebird module is required. To install the Bluebird module, run the below command **npm install bluebird**

Step 2) The next step is to include the bluebird module in your code and promisify the entire MongoDB module. By promisify, we mean that bluebird

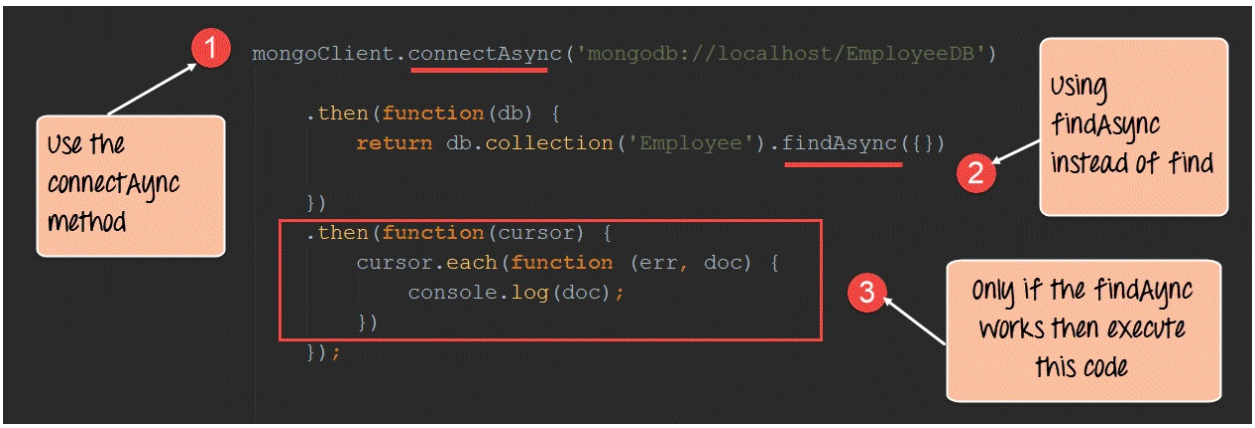
will ensure that each and every method defined in the MongoDB library returns a promise.



Code Explanation:-

1. The require command is used to include the Bluebird library.
2. Use Bluebird's .promisifyAll() method to create an async version of every method the MongoDB module provides. This ensures that each method of the MongoDB module will run in the background and ensure that a promise is returned for each method call in the MongoDB library.

Step 3) The final step is to connect to our database, retrieve all the records in our collection and display them in our console log.



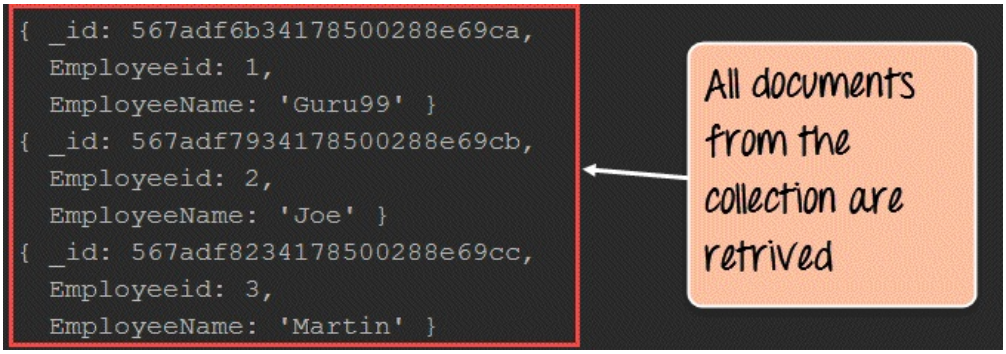
Code Explanation:-

1. You will notice that we are using the "connectAsync" method instead of the normal connection method for connecting to the database. Bluebird actually adds the Async keyword to each method in the MongoDB library

to distinguish those calls which return promises and those which don't. So there is no guarantee that methods without the Async word will return a value.

2. Similar to the connectAsync method, we are now using the findAsync method to return all of the records in the mongoDB 'Employee' collection.
3. Finally, if the findAsync returns a successful promise we then define a block of code to iterate through each record in the collection and display them in the console log.

If the above steps are carried out properly, all of the documents in the Employee collection will be displayed in the console as shown in the output below.



Here is the code for your reference

```
var Promise = require('bluebird');

var mongoClient =
Promise.promisifyAll(require('mongodb')).MongoClient;

var url = 'mongodb://localhost/EmployeeDB';
mongoClient.connectAsync('mongodb://localhost/EmployeeDB')

.then(function(db) {
        return db.collection('Employee').findAsync({})

    })
    .then(function(cursor) {
        cursor.each(function(err, doc) {
            console.log(doc);
        })
    });
```

Creating a custom promise

A custom promise can be created by using a node module called 'q.' The 'q' library needs to be downloaded and installed using the node package manager. After using the 'q' library, the method "denodeify" can be called which will cause any function to become a function which returns a promise.

In the example below, we will create a simple function called "Add" which will add 2 numbers. We will convert this function into a function to return a promise.

Once that is done, we will use the promise returned by the Add function to display a message in the console.log.

Let's follow the below steps to creating our custom function to return a promise.

Step 1) Installing the NPM Modules

To use 'q' from within a Node JS application, the 'q' module is required. To install the 'q' module, run the below command **npm install q**

Step 2) Define the following code which will be used to create the custom promise.

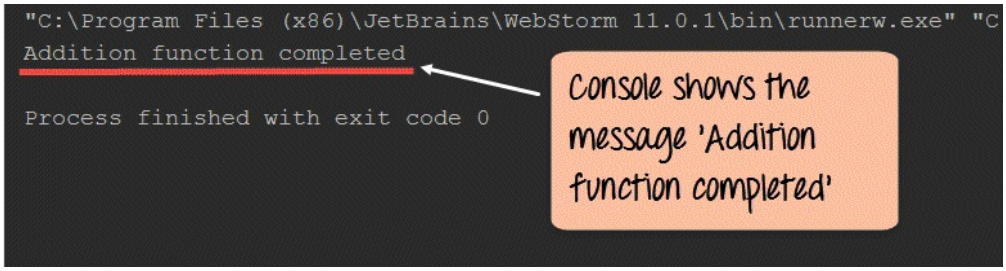
```
var Q= require('q');

function Add() {
        var a, b, c;
        a=5;b=6;
        c=a+b;

}

        var Display_promise= Q.denodeify(Add);

var promise=Add;
```

```
promise.then
{console.log("Addition function complete");}
```

Code Explanation:-

1. The first bit is to include the 'q' library by using the require keyword. By using this library, we will be able to define any function to return a callback.
2. We are creating a function called Add which will add 2 numbers defined in variables a and b. The sum of these values will be stored in variable c.
3. We are then using the q library to denodeify (the method used to convert any function into a function that would return a promise) our Add function or in otherwise convert our Add function to a function which returns a promise.
4. We now call our "Add" function and are able to get a return promise value because of the prior step we performed of denodeify the Add function.
5. The 'then' keyword is used specify that if the function is executed successfully then display the string "Addition function completed" in the console.log.

When the above code is run, the output "Addition function completed" will be displayed in the console.log as shown below.



What are generators

Generators have become quite famous in Node.js in recent times and that probably because of what they are capable of doing.

- Generators are function executions that can be suspended and resumed at a later point.
- Generators are useful when carrying out concepts such as 'lazy execution'. This basically means that by suspending execution and resuming at will, we are able to pull values only when we need to.

Generators have the below 2 key methods

1. Yield method – The yield method is called in a function to halt the execution of the function at the specific line where the yield method is called.
2. Next method – This method is called from the main application to resume the execution of a function which has a yield method. The execution of the function will continue till the next yield method or till the end of the method.

Let's look at an example of how generators can be used.

In our example, we are going to have a simple Add function which will add 2 numbers, but we will keep on halting the method execution at different points to showcase how generators can be used.

```
function* Add(x) {
   yield x + 1;
   var y = yield(null);
   y = 6
   return x + y;
```

```
}

var gen = Add(5);

gen.next();

gen.next();
```

Code Explanation:-

1. The first step is to define our generator "function". Note that this is done by adding a "*" to the function keyword. We are then defining a function called Add which takes a parameter of x.
2. The yield keyword is a specific to generators. This makes it a powerful construct for pausing a function in the middle of anything. So here, the function execution will be halted till we invoke the next() function, which will be done in Step4. At this point, the value of x will become 6 and the execution of the function will be stopped.
3. This is where we first call the generator function and send the value of 5 to our Add function. This value will be substituted in the x parameter of our Add function.
4. Once we call the next() function, the Add() function will resume the execution. When the next statement var y= yield(null) will be executed, the Add() function will again stop executing.
5. Now after calling the next() function again, the next statements will run, and the combined value of x=6 and y=6 will be added and returned.

Callbacks vs. generators

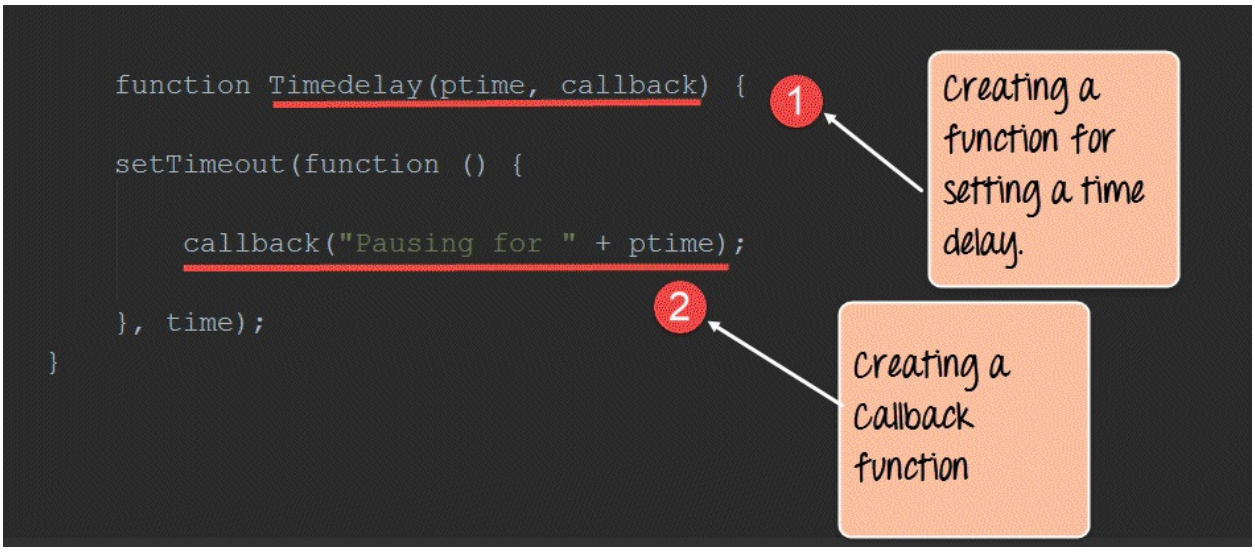
Generators are used to solve the problem of what is known as callback hell. Sometimes callback functions become so nested during the development of a Node.js application that it just becomes too complicated to use callback functions.

This is where generators are useful. One of the most common examples of this is when creating timer functions.

Let's see the below example of how generators can prove to be useful over callbacks.

Our example will just create a simple time delay function. We would then want to call this function incorporating a delay of 1000, 2000 and 3000 ms.

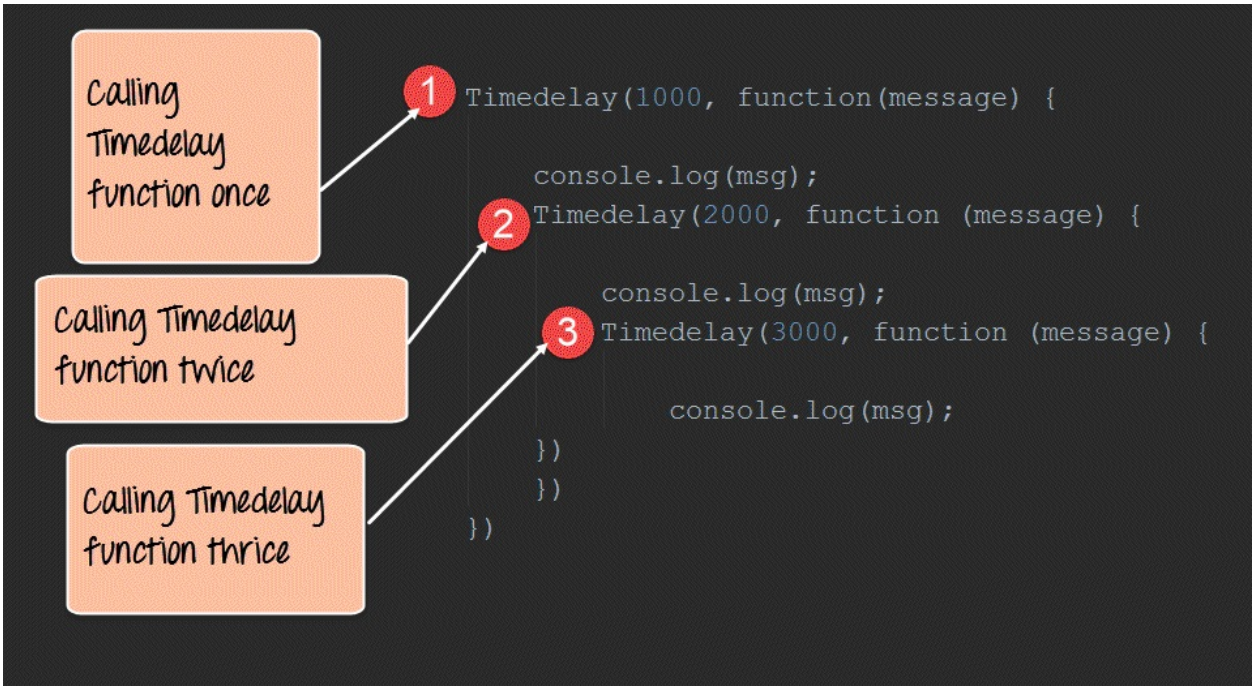
Step 1) Define our callback function with the necessary time delay code.



Code Explanation:-

1. Here we are creating a function called Timedelay with a parameter called ptime. This will take in the necessary time delay we want to introduce in our application.
2. The next step is to just create a message, which will be displayed to the user saying that the application is going to be pause for these many numbers of milliseconds.

Step 2) Now let's look at the code if we were incorporating callbacks. Suppose we wanted to incorporate callbacks based on the value of 1000, 2000 and 3000 milliseconds, the below code shows how we would need to implement these using callbacks.

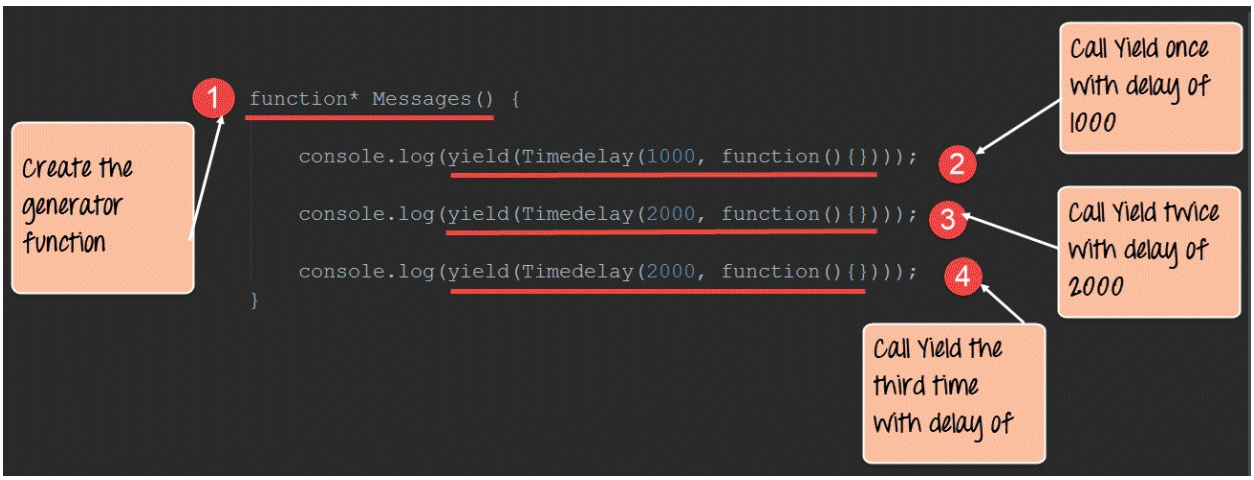


Code Explanation:-

1. We are calling the Timedelay as a callback with 1000 as the value.
2. Next we want to call the Timedelay function again with 2000 as the value.
3. Finally, we want to call the Timedelay function again with 3000 as the value.

From the above code, you can see that it becomes messier as we want to start calling the function multiple times.

Step 3) Now let's see how to implement the same code using generators. From the below code you can now see how simple it has become to implement the Timedelay function using generators.



Code Explanation:-

1. We are first defining a generator function which will be used to call our Timedelay function.
2. We are calling the Yield function along with the Timedelay function with 1000 as the parameter value.
3. We are then calling the Yield function along with the Timedelay function with 2000 as the parameter value.
4. Finally, we are calling the Yield function along with the Timedelay function with 3000 as the parameter value.

Filestream in Node.js

Node makes extensive use of streams as a data transfer mechanism.

For example, when you output anything to the console using the console.log function, you are actually using a stream to send the data to the console.

Node.js also has the ability to stream data from files so that they can be read and written appropriately. We will now look at an example of how we can use streams to read and write from files. We need to follow the below-mentioned steps for this example **Step 1)** Create a file called data.txt which has the below data. Let assume this file is stored on the D drive of our local machine.

Tutorial on Node.js

Introduction

Events

Generators

Data Connectivity

Using Jasmine

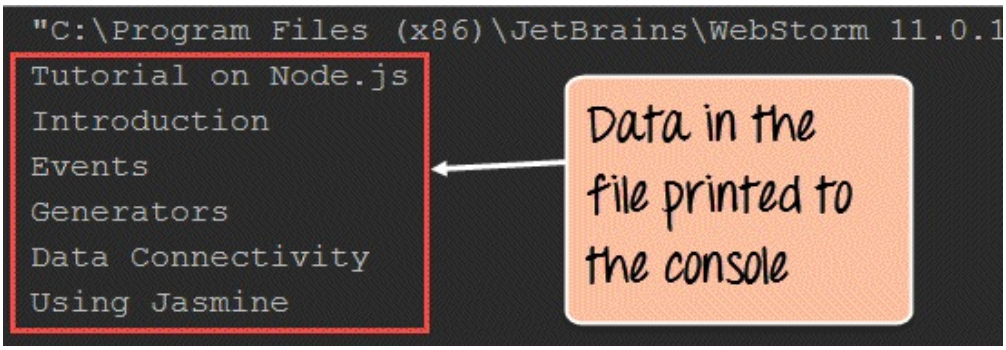
Step 2) Write the relevant code which will make use of streams to read data from the file.

```
var fs = require("fs");
var stream;
stream = fs.createReadStream("D://data.txt");

stream.on("data", function(data) {
    var chunk = data.toString();
    console.log(chunk);
});
```

Code Explanation:-

1. We first need to include the 'fs' modules which contain all the functionality required to create streams.
2. Next we create a readable stream by using the method – createReadStream. As an input, we give the location of our data.txt file.
3. The steam.on function is an event handler and in it, we are specifying the first parameter as 'data.' This means that whenever data comes in the stream from the file, then execute a callback function. In our case, we are defining a callback function which will carry out 2 basic steps. The first is to convert the data read from the file as a string. The second would be to send the converted string as an output to the console.
4. We are taking each chunk of data which is read from the data stream and converting it to a string.
5. Finally, we are sending the output of each string converted chunk to the console.

Output:



- If the code is executed properly, you will see the above output in the console. This output will be the same as that in the data.txt file.

Writing to a file

In the same way, that we create a read stream, we can also create a write stream to write data to a file. Let's first create an empty file with no contents called data.txt. Let's assume this file is placed in the D drive of our computer.

The below code shows how we can write data to the file.

```
var fs = require("fs");
var stream;
stream = fs.createWriteStream("D://data.txt");

stream.write("Tutorial on Node.js")
stream.write("Introduction")
stream.write("Events")
stream.write("Generators")
stream.write("Data Connectivity")
stream.write("Using Jasmine")
```

Code Explanation:-

1. We are creating a writable stream by using the method – createWriteStream. As an input, we give the location of our data.txt file.
2. Next we used the stream.write a method to write the different lines of text to our text file. The stream will take care of writing this data to the data.txt file.

If you open the data.txt file, you will now see the following data in the file

Tutorial on Node.js

Introduction

Events

Generators

Data Connectivity

Using Jasmine

Pipes in Node.js

Within Node applications, streams can be piped together using the pipe() method, which takes two arguments:

- A Required writable stream that acts as the destination for the data and
- An optional object used to pass in options.

A typical example of using pipes, if you want to transfer data from one file to the other.

So let's see an example of how we can transfer data from one file to the other using pipes.

Step 1) Create a file called datainput.txt which has the below data. Let assume this file is stored on the D drive of our local machine.

Tutorial on Node.js

Introduction

Events

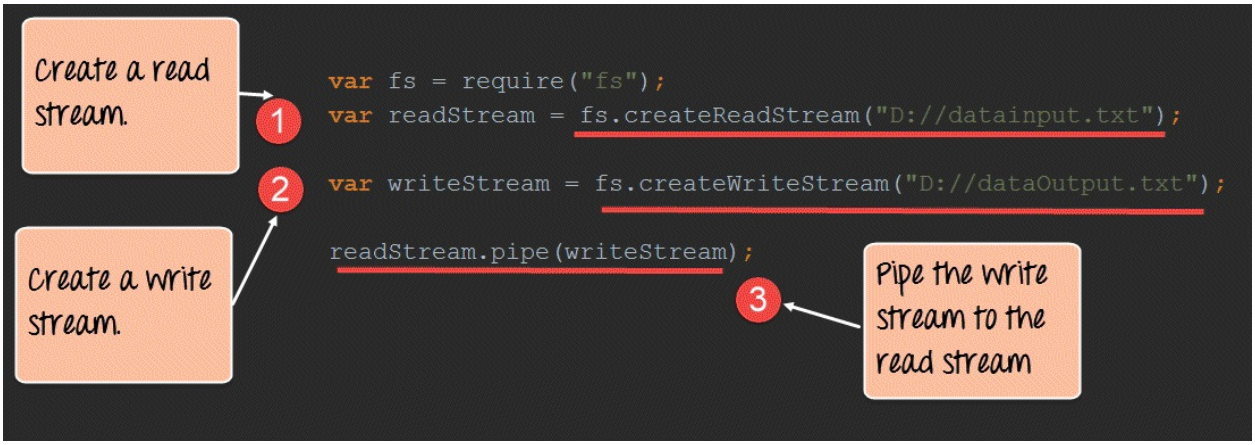
Generators

Data Connectivity

Using Jasmine

Step 2) Create a blank empty file called dataOutput.txt and placed it on the D drive of your local machine.

Step 3) Write the below code to carry out the transfer of data from the datainput.txt file to the dataOutput.txt file.



Code Explanation:-

1. We are first creating a "readstream" to our datainput.txt file which contains all our data which needs to be transferred to the new file.
2. We then need to create a "writestream" to our dataOutput.txt file, which is our empty file and is the destination for the transfer of data from the datainput.txt file.
3. We then use the pipe command to transfer the data from the readstream to the write stream. The pipe command will take all the data which comes into the readstream, and push it to the writestream.

If you now open the dataOutput.txt file, you will see all the data which was present in the datainput.txt file.

Events in Node.js

Events are one of the key concepts in Node.js and sometimes Node.js is referred to as an Event-driven framework.

Basically, an event is something that happens. For example, if a connection is established to a database, then the database connection event is triggered. Event driven programming is to create functions that will be triggered when specific events are triggered.

Let's look at a basic example of defining an event in Node.js.

We are going to create an event called 'data_received'. When this event is triggered, the text "data received" will be sent to the console.

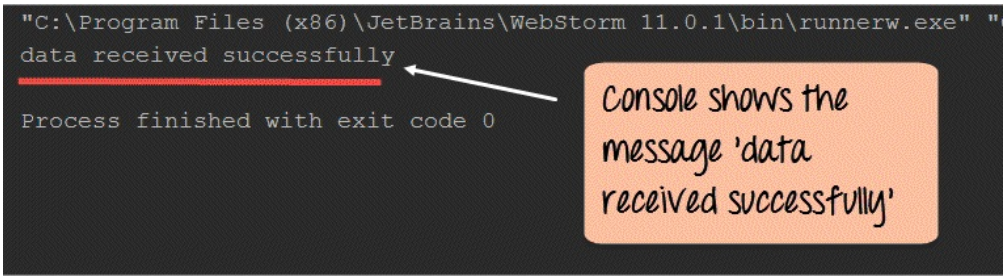
```
var events = require('events');
var eventEmitter = new events.EventEmitter();
eventEmitter.on('data_received', function() {
    console.log('data received succesfully.');
});

eventEmitter.emit('data_received');
```

Code Explanation:-

1. Use the require function to include the 'events' module. With this module, you will be able to create events in Node.js.
2. Create a new events emitter. This is used to bind the event, which in our case is "data_received" to a callback function which is defined in step3.
3. We define an event-driven function which says that if in case the "data_received" event is triggered then we should output the text "data_received" to the console.

4. Finally, we do have a manual trigger of our event using the eventEmiter.emit function. This will trigger the data_received event.

When the program is run, the text "data received" will be sent to the console as shown below.



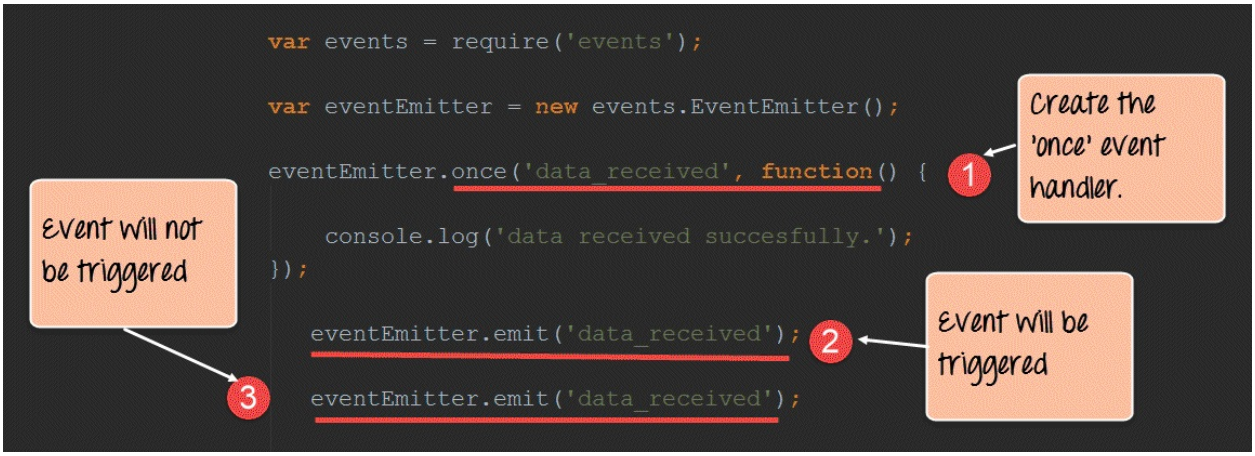
Emitting Events

When defining events, there are different methods for events which can be invoked. This topic focuses on looking at each one of them in detail.

1. **One time event handlers**

Sometimes you may be interested in reacting to an event only the first time it occurs. In these situations, you can use the once() method.

Let's see how we can make use of the once method for event handlers.



Code Explanation:-

1. Here we are using the 'once' method to say that for the event 'data_received,' the callback function should only be executed once.
2. Here we are manually triggering the 'data_received' event.
3. When the 'data_received' event is triggered again, this time, nothing will happen. This is because of the first step where we said that the event could only be triggered once.

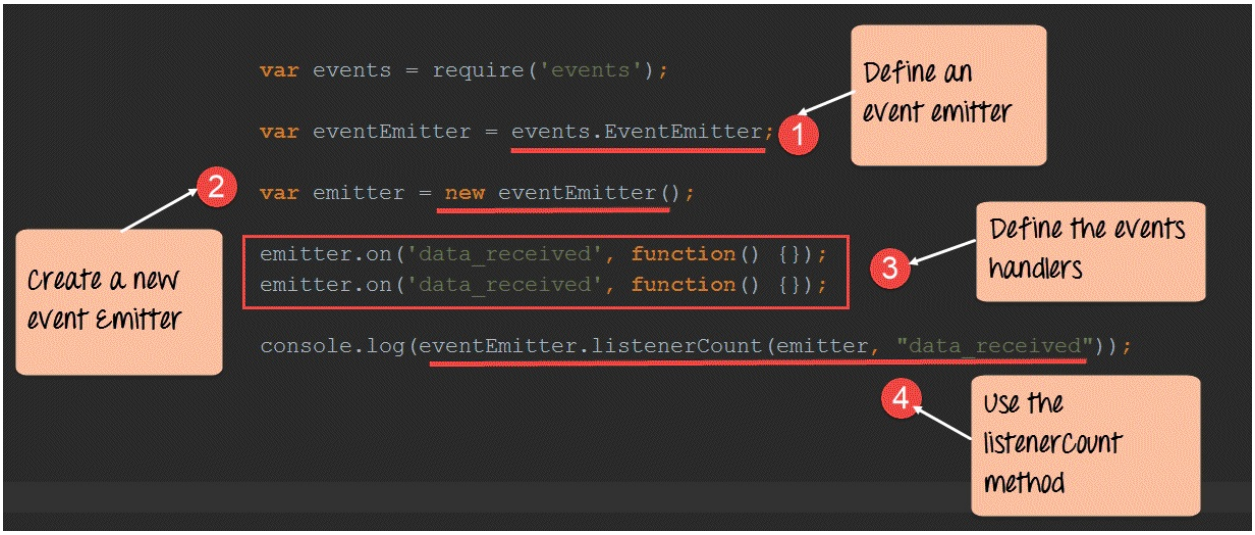
If the code is executed properly, the output in the log will be 'data_received successfully'. This message will only appear once in the console.

2. **Inspecting Event Listeners**

At any point in its lifetime, an event emitter can have zero or more listeners attached to it. The listeners for each event type can be inspected in several ways.

If you are interested in only determining the number of attached listeners, then look no further than the EventEmitter.listenerCount() method.

(**Note:** Listeners are important because the main program should know if listeners are being added on the fly to an event, else the program will malfunction because additional listeners will get called.)



Code Explanation:-

1. We are defining an eventEmitter type which is required for using the event-related methods.
2. We are then defining an object called emitter which will be used to define our event handlers.
3. We are creating 2 events handlers which basically do nothing. This is kept simple for our example just to show how the listenerCount method works.

4. Now when you invoke the listenerCount method on our data_received event, it will send the number of event listeners attached to this event in the console log.

If the code is executed properly, the value of 2 will be shown in the console log.

3. **The newListener Event**

Each time a new event handler is registered, the event emitter emits a newListener event. This event is used to detect new event handlers. You typically use newListener event when you need to allocate resources or perform some action for each new event handler.

```
var events = require('events');
var eventEmitter = events.EventEmitter;
var emitter = new eventEmitter();
emitter.on("newListener", function(eventName, listener) {
    console.log("Added listener for " + eventName + " events");
});
emitter.on('data_received', function() {});
emitter.on('data_received', function() {});
```

Code Explanation:-

1. We are creating a new event handler for the 'newListener' event. So whenever a new event handler is registered, the text "Added listener for" + the event name will be displayed in the console.
2. Here we are writing to the console the text "Added listener for" + the event name for each event registered.
3. We are defining 2 event handlers for our event 'data_received'.

If the above code is executed properly, the below text will be shown in the console. It just shows that the 'newListener' event handler was triggered twice.

Added listener for data_received events

Added listener for data_received events

Summary

- Using callback functions in Node.js does have its disadvantages. Sometimes during the process of development, the nested use of callback functions can make the code messier and difficult to maintain.
- Most of the issues with nested callback functions can be mitigated with the use of promises and generators in node.js
- A Promise is a value returned by an asynchronous function to indicate the completion of the processing carried out by the asynchronous function.
- Promises can be nested within each other to make code look better and easier to maintain when many asynchronous function need to be called at the same time.
- Generators can also be used to alleviate the problems with nested callbacks and assist in removing what is known as the callback hell. Generators are used to halt the processing of a function. This is accomplished by usage of the 'yield' method in the asynchronous function.
- Streams are used in Node.js to read and write data from Input-Output devices. Node.js makes use of the 'fs' library to create readable and writable streams to files. These streams can be used to read and write data from files.
- Pipes can be used to connect multiple streams together. One of the most common example is to pipe the read and write stream together for the transfer of data from one file to the other.
- Node.js is often also tagged as an event driven framework, and it's very easy to define events in Node.js. Functions can be defined which respond to these events.
- Events also expose methods for responding to key events. For example, we have seen the once() event handler which can be used to make sure that a callback function is only executed once when an event is triggered.

Chapter 8: Testing with Jasmine

Testing is a key element to any application. For Node.js, the framework available for testing is called Jasmine. In early 2000, there was a framework for testing javascript applications called JsUnit. Later this framework got upgraded and is now known as jasmine.

Jasmine helps in automated unit testing, something which has become quite a key practice when developing and deploying modern day web applications.

In this tutorial, you will learn how to get your environment setup with jasmine and how you can start testing your first Node.js application with jasmine.

Overview of Jasmine for testing Node.js applications

Jasmine is a **Behavior Driven Development(BDD)** testing framework for JavaScript. It does **not** rely on browsers, DOM, or any JavaScript framework. Thus, it's suited for websites, Node.js projects, or anywhere that JavaScript can run. To start using Jasmine, you need to first download and install the necessary Jasmine modules.

Next you would need to initialize your environment and inspect the jasmine configuration file. The below steps shows how to setup Jasmine in your environment

Step 1) Installing the NPM Modules

To use the jasmine framework from within a Node application, the jasmine module needs to be installed first. To install the jasmine-node module, run the below command.

npm install jasmine-node

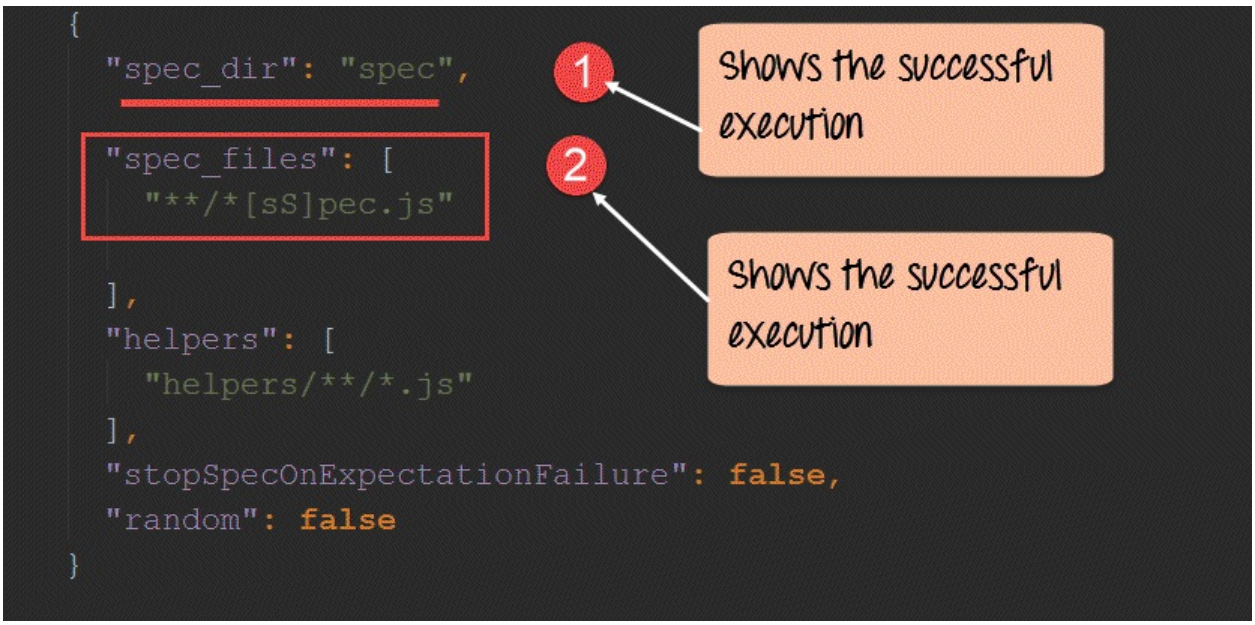
Step 2) Initializing the project – By doing this, jasmine creates a spec directory and configuration json for you. The spec directory is used to store all your test files. By doing this, jasmine will know where all your tests are, and then can execute them accordingly. The JSON file is used to store specific configuration information about jasmine.

To initialize the jasmine environment, run the below command

jasmine init

Step 3) Inspect your configuration file. The configuration file will be stored in the spec/support folder as jasmine.json. This file enumerates the source files and spec files you would like the Jasmine runner to include.

The below screenshot shows a typical example of the package.json file for jasmine.



1. Note that the spec directory is specified here. As noted earlier, when jasmine runs it searches for all tests in this directory.
2. The next thing to note is the spec_files parameter – This denotes that whatever test files are created they should be appended with the 'spec' keyword.

How to use Jasmine to test Node.js applications

In order to use Jasmine to test Node.js applications, a series of steps needs to be followed.

In our example below, we are going to define a module which add 2 numbers which need to be tested. We will then define a separate code file with the test code and then use jasmine to test the Add function accordingly.

Step 1) Define the code which needs to be tested. We are going to define a function which will add 2 numbers and return the result. This code is going to be written in a file called "Add.js."

```
var exports=module.exports={};
exports.AddNumber=function(a,b)
{
return a+b;
};
```

Code Explanation:

1. The "exports" keyword is used to ensure that the functionality defined in this file can actually be accessed by other files.
2. We are then defining a function called 'AddNumber.' This function is defined to take 2 parameters, a and b. The function is added to the module "exports" to make the function as a public function that can be accessed by other application modules.
3. We are finally making our function return the added value of the parameters.

Step 2) Next we need to define our jasmine test code which will be used to test our "Add" function In the Add.js file. The below code needs to put in a file called **add-spec.js.**

Note: - The word 'spec' needs to be added to the test file so that it can be detected by jasmine.

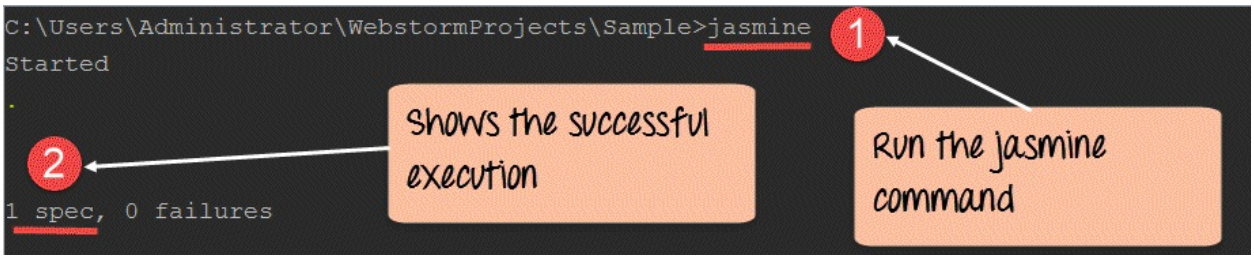
```
var app=require("../Add.js");
describe("Addition",function(){
it("The function should add 2 numbers",function() {
var value=app.AddNumber(5,6);
expect(value).toBe(11);
});
});
```

Code Explanation:

1. We need to first include our Add.js file so that we can test the 'AddNumber' function in this file.
2. We are now creating our test module. The first part of the test module is to describe a method which basically gives a name for our test. In this case, the name of our test is "Addition".
3. The next bit is to give a description for our test using the 'it' method.
4. We now invoke our Addnumber method and send in 2 parameters 5 and 6. This will be passed to our Addnumber method in the App.js file. The return value is then stored in a variable called value.
5. The final step is to do the comparison or our actual test. Since we expect the value returned by the Addnumber function to be 11, we define this using the method expect(value).toBe(the expected value).

Output

1. In order to run the test, one needs to run the command jasmine.
2. The below screenshot shows that after the jasmine command is run , it will detect that there is a test called add-spec.js and execute that test accordingly. If there are any errors in the test, it will be shown accordingly.



Summary

- In order to test a Node.js application, the jasmine framework needs to be installed first. This is done by using the Node package manager.
- The test code needs to be written in a separate file, and the word 'spec' should be appended to the file name. Only if this is done will jasmine be able to detect that a file needs to be run.
- To run the test, you need to execute the jasmine command. This will find all files which have the 'spec' word attached to it and run the file accordingly.

One Last Thing….

DID YOU ENJOY THE BOOK?

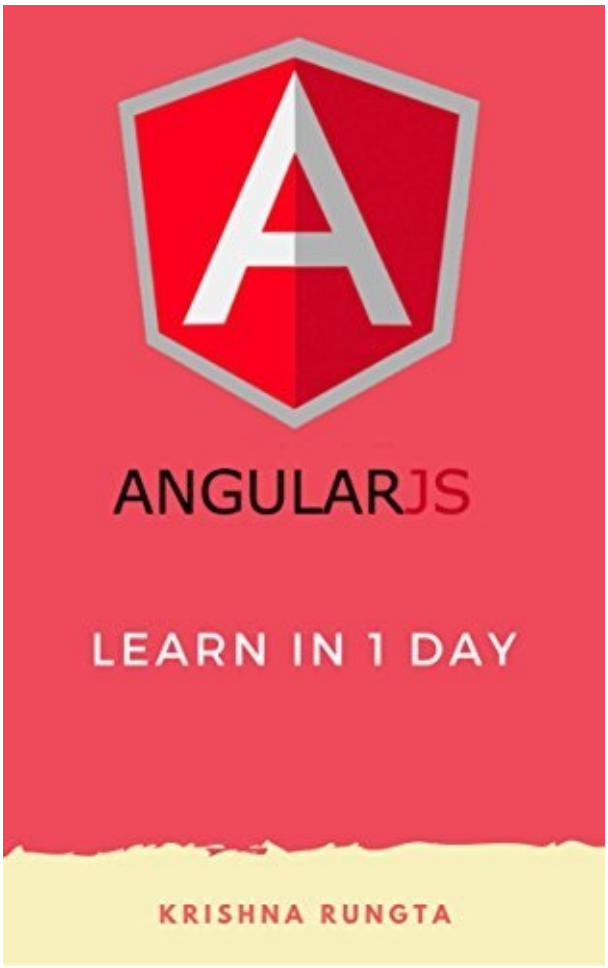
IF SO, THEN LET ME KNOW LEAVING A REVIEW ON AMAZON! Reviews are lifeblood of independent authors. I would appreciate even a few

words and rating if that's all you have time for

IF YOU DID NOT LIKE THIS BOOK, THEN PLEASE TELL ME! EMAIL me and Let me know what you didn't like! Perphase I can change it. In today's world a book doesn't have to be stagnant, it can improve with time and feedback from readers like you. You can impact this book, and I welcome your feedback. Help make this book better for everyone!

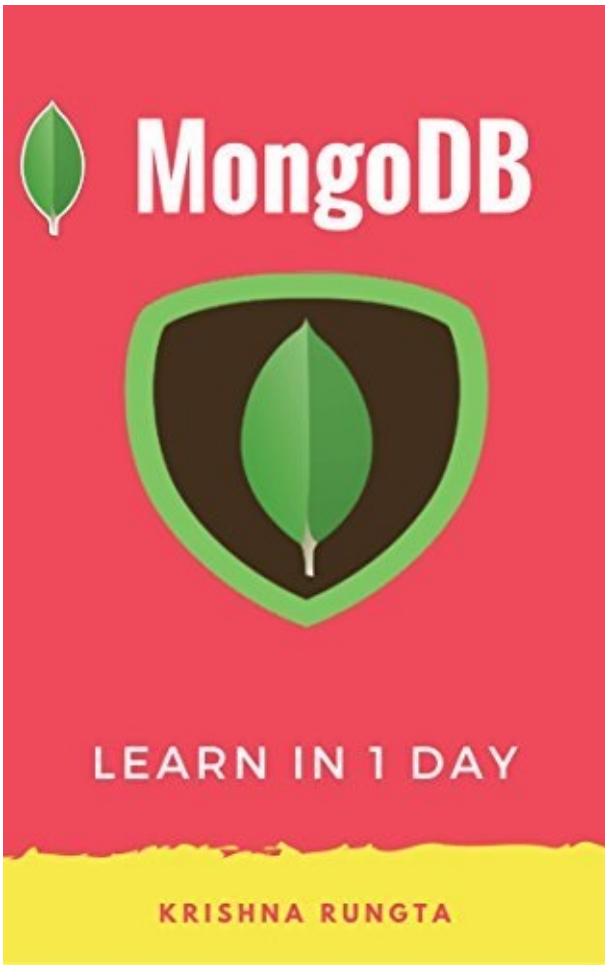
More Books -

Learn AngularJS in 1 Day: Complete Angular JS Guide with Examples



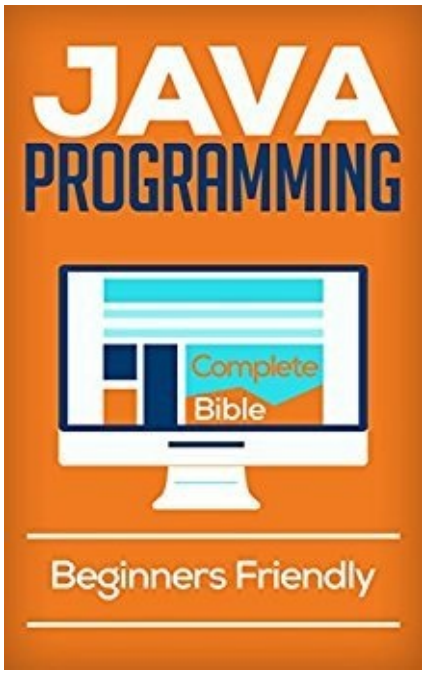
BUY NOW

Learn MongoDB in 1 Day: Definitive Guide to Master Mongo DB



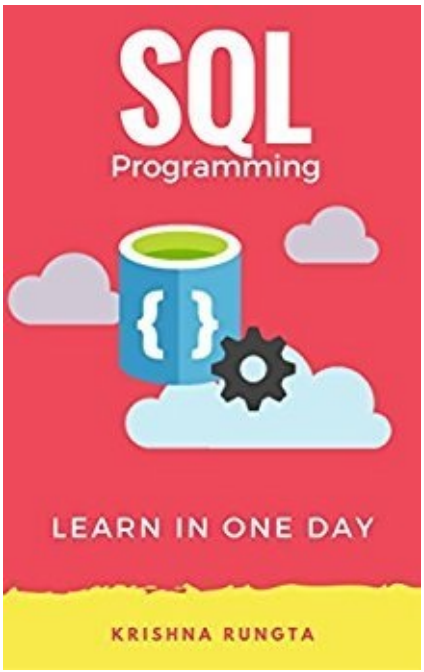
BUY NOW

Learn Java in 1 Day: Complete Beginners Guide



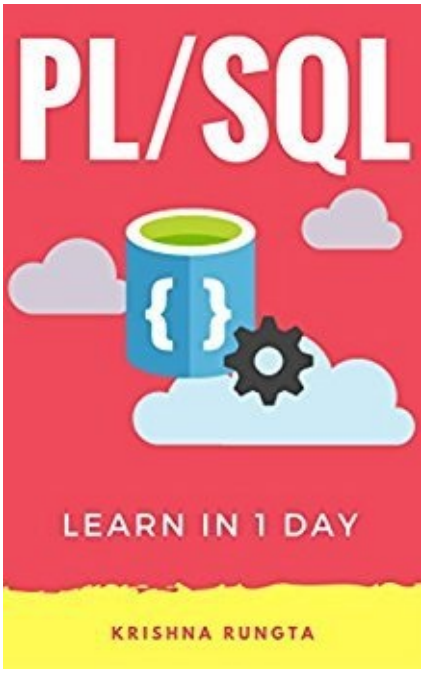
BUY NOW

Learn SQL in 1 Day: Definitive Guide to Learn SQL for Beginners



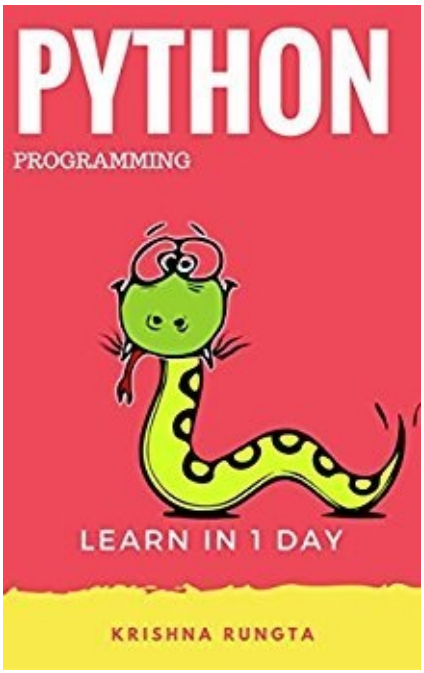
BUY NOW

Learn PL/SQL in 1 Day: Definitive Guide to Learn PL/SQL for Beginners



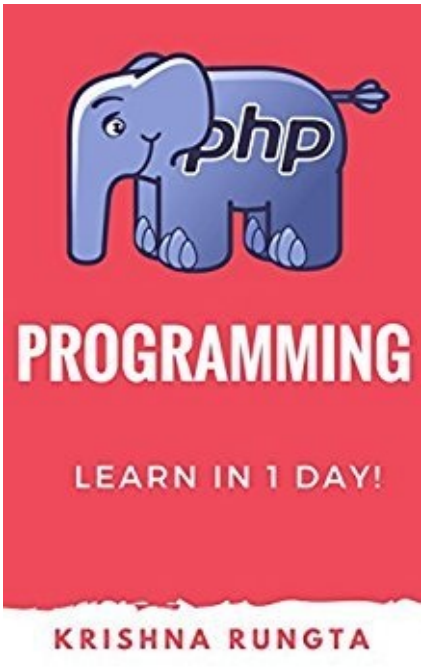
BUY NOW

Learn Python in 1 Day: Complete Python Guide with Examples



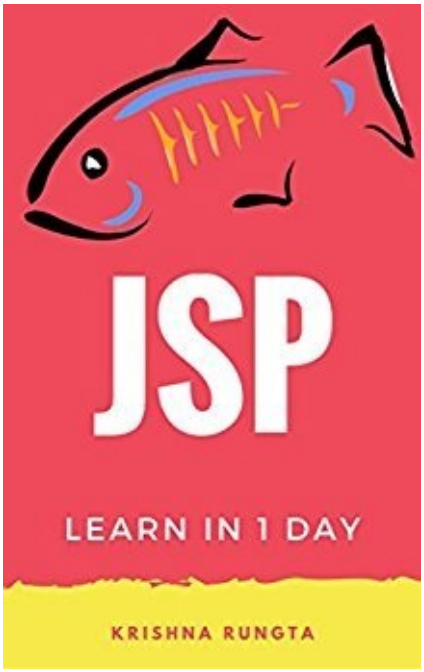
BUY NOW

Learn PHP in 1 Day: Definitive Guide to Learn & Master PHP programming



BUY NOW

Learn JSP in 1 Day: Definitive Guide to Learn JSP for Beginners

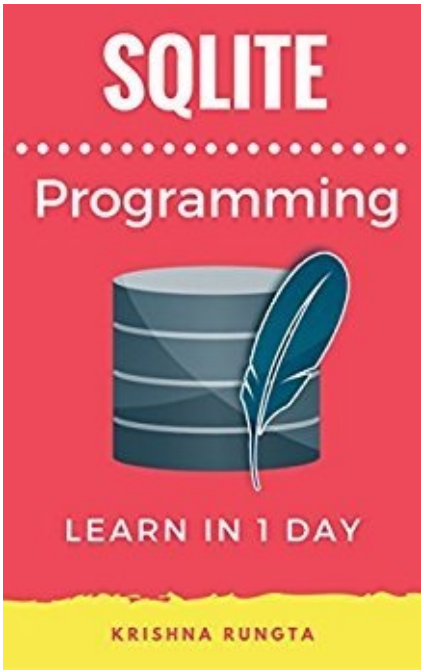


BUY NOW

Learn ASP.Net in 1 Day: Definitive Guide to Learn ASP.Net for Beginners

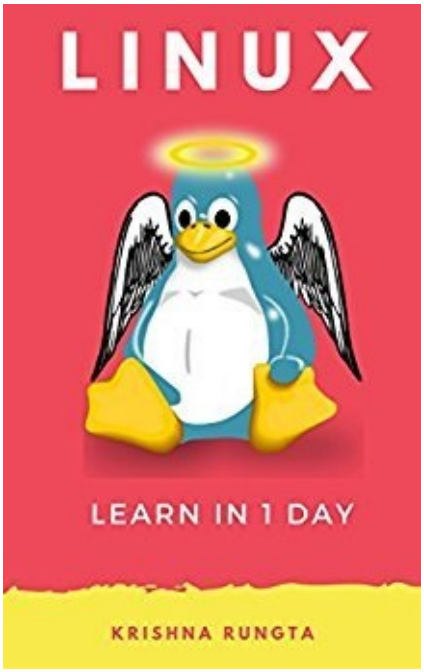
BUY NOW

Learn SQLite in 1 Day: Definitive Guide to Learn SQLite for Beginners



BUY NOW

Learn Linux in 1 Day: Complete Linux Guide with Examples



BUY NOW