Node.js Modules

Modules in Node.js are blocks of encapsulated code that can be reused throughout your application. These modules can include functions, objects, and variables that are exported from the code files.

What are Modules in Node.js?

Modules in Node.js are like JavaScript libraries — a set of related functions that you can include in your application. Every Node.js file can be considered a module that can export code for reuse in other parts of the application. This modular approach allows developers to separate concerns, reuse code, and maintain a clean architecture.

How Node.js Modules Work?

Each module in Node.js is executed within its own module scope. This means variables, functions, and classes defined in one module are private to that module unless explicitly exported for use by other modules. This behaviour avoids global namespace pollution and improves code maintainability.

At its core, a Node.js module is an object that contains the following key properties:

- **exports:** The object that a module can export for use in other modules.
- **require():** A function that is used to import modules into other modules.
- **module:** The object that represents the current module.

When a module is loaded, Node.js wraps the module code in a function to provide this module system.

Different types of Node.js Modules: Core Modules, Local Modules, Third-party modules

1. Core Modules

Node.js has many built-in modules that are part of the platform and come with Node.js installation. These modules can be loaded into the program by using the **require** function.

Syntax: const module = require('module_name');

The require() function will return a JavaScript type depending on what the particular module returns. The following example demonstrates how to use the Node.js http module to create a web server.

```
const http = require('http');
http.createServer(function (req, res) {
   res.writeHead(200, { 'Content-Type': 'text/html' });
   res.write('Welcome to this page!');
   res.end();
}).listen(3000);
```

In the above example, the require() function returns an object because the Http module returns its functionality as an object. The function http.createServer() method will be executed when someone tries to access the computer on port 3000. The res.writeHead() method is the status code where 200 means it is OK, while the second argument is an object containing the response headers. The following list contains some of the important core modules in Node.js:

Core Modules	**Description**
http	creates an HTTP server in Node.js.
assert	set of assertion functions useful for testing.
fs	used to handle file system.
path	includes methods to deal with file paths.
process	provides information and control about the current Node.js process.
os	provides information about the operating system.
querystring	utility used for parsing and formatting URL query strings.

Core Modules	Description
url	module provides utilit

2. Local Modules

Unlike built-in and external modules, local modules are created locally in your Node.js application. Let’s create a simple calculating module that calculates various operations. Create a calc.js file that has the following code:

```
// Filename: calc.js

exports.add = function (x, y) {

   return x + y;

};

exports.sub = function (x, y) {

   return x - y;

};

exports.mult = function (x, y) {

   return x * y;

};

exports.div = function (x, y) {

   return x / y;

};
```

Since this file provides attributes to the outer world via exports, another file can use its exported functionality using the require() function.

```
// Filename: index.js

const calculator = require('./calc');

let x = 50, y = 10;

console.log("Addition of 50 and 10 is "

            + calculator.add(x, y));

console.log("Subtraction of 50 and 10 is "
            + calculator.sub(x, y));
console.log("Multiplication of 50 and 10 is "
            + calculator.mult(x, y));
console.log("Division of 50 and 10 is "
            + calculator.div(x, y));
```

Step to run this program: Run the **index.js** file using the following command: node index.js

3. Third-party modules

Third-party modules are modules that are available online using the Node Package Manager(NPM). These modules can be installed in the project folder or globally. Some of the popular third-party modules are Mongoose, Express, Angular, and React.

Example:

- npm install express
- npm install mongoose

Create a Simple Express Server:

```
const express = require('express');
const app = express();
const port = 3000;
app.get('/', (req, res) => {
   res.send('Hello World!');
});
app.listen(port, () => {
   console.log(`Example app listening at http://localhost:${port}`);
});
```

Run the Server: Use this command to run the node application.

```
node server.js
```

When you navigate to http://localhost:3000 in your browser, you should see **Hello World!**.

Exporting and Importing Modules

Node.js allows developers to define the module's public API by exporting functions, objects, or classes using module.exports. The code that uses the module can then import these exported entities using require().

1. Default Export:

You can export a single function or object using module.exports:

```
// logger.js
module.exports = function log(message) {
  console.log(message);
};
```

2. Named Exports:

You can export multiple functions or objects by attaching them to the exports object:

```
// math.js
exports.add = function (a, b) {
  return a + b;
};
exports.multiply = function (a, b) {
  return a * b;
};
```

You can then import them as:

```
// app.js
const math = require('./math');
console.log(math.add(2, 3));  // Output: 5
console.log(math.multiply(2, 3));  // Output: 6
```

Core Modules:

1. **Fs Module:** The Node.js file system module allows you to work with the file system on your computer.

Common use for the File System module:

- Read files
- Create files
- Update files

- Delete files
- Rename files

2. **Path Module:** The Path module provides a way of working with directories and file paths.

Method	Description
basename()	Returns the last part of a path
delimiter	Returns the delimiter specified for the platform
dirname()	Returns the directories of a path
extname()	Returns the file extension of a path
format()	Formats a path object into a path string
isAbsolute()	Returns true if a path is an absolute path, otherwise false
join()	Joins the specified paths into one
normalize()	Normalizes the specified path
parse()	Formats a path string into a path object
posix	Returns an object containing POSIX specific properties and methods
relative()	Returns the relative path from one specified path to another specified path
resolve()	Resolves the specified paths into an absolute path
sep	Returns the segment separator specified for the platform

win32	Returns an object containing Windows specific properties and methods

3. **OS Module**: It provides functions to interact with the operating system. It provides the hostname of the operating system and returns the amount of free system memory in bytes.

- **os.arch():** Returns the CPU architecture of the operating system (e.g., ‘x64’, ‘arm’).
- **os.cpus():** Provides an array of objects describing each CPU/core installed.
- **os.freemem():** Returns the amount of free system memory in bytes.
- **os.homedir():** Returns the path to the current user’s home directory.
- **os.hostname():** Returns the hostname of the operating system.
- **os.networkInterfaces():** Returns a list of network interfaces and their details.
- **os.platform():** Returns the operating system platform (e.g., ‘linux’, ‘darwin’).
- **os.release():** Returns the operating system release.
- **os.totalmem():** Returns the total amount of system memory in bytes.
- **os.uptime():** Returns the system uptime in seconds.

4. **Assert Module:** The assert module provides a way of testing expressions. If the expression evaluates to 0, or false, an assertion failure is being caused, and the program is terminated.

Assert Methods

Method	**Description**
assert()	Checks if a value is true. Same as assert.ok()
deepEqual()	Checks if two values are equal

deepStrictEqual()	Checks if two values are equal, using the strict equal operator (===)
equal()	Checks if two values are equal, using the equal operator (==)
fail()	Throws an Assertion Error
ifError()	Throws a specified error if the specified error evaluates to true
notDeepEqual()	Checks if two values are not equal
notDeepStrictEqual()	Checks if two values are not equal, using the strict not equal operator (!==)
notEqual()	Checks if two values are not equal, using the not equal operator (!=)
notStrictEqual()	Checks if two values are not equal, using the strict not equal operator (!==)
ok()	Checks if a value is true
strictEqual()	Checks if two values are equal, using the strict equal operator (===)

NodeJS NPM

NPM (Node Package Manager) is a package manager for Node.js modules. It helps developers manage project dependencies, scripts, and third-party libraries. By installing Node.js on your system, NPM is automatically installed, and ready to use.

- It is primarily used to manage packages or modules—these are pre-built pieces of code that extend the functionality of your Node.js application.
- The NPM registry hosts millions of free packages that you can download and use in your project.
- NPM is installed automatically when you install Node.js, so you don't need to set it up manually.

How to Use NPM with Node.js?

To start using NPM in your project, follow these simple steps

Step 1: Install Node.js and NPM

First, you need to install Node.js. NPM is bundled with the Node.js installation. You can follow our article to Install the Node and NPM- How to install Node on your system

Step 2: Verify the Installation

After installation, verify Node.js and NPM are installed by running the following commands in your terminal:

```
node -v
```

```
npm -v
```

These commands will show the installed versions of Node.js and NPM.

Step 3: Initialize a New Node.js Project

In the terminal, navigate to your project directory and run:

```
npm init -y
```

This will create a package.json file, which stores metadata about your project, including dependencies and scripts.

Step 4: Install Packages with NPM

To install a package, use the following command

```
npm install <package-name>
```

For example, to install the Express.js framework

```
npm install express
```

This will add express to the node_modules folder and automatically update the package.json file with the installed package information.

Step 5: Install Packages Globally

To install packages that you want to use across multiple projects, use the -g flag:

```
npm install -g <package-name>
```

Step 6: Run Scripts

Using NPM Package in the project

Create a file named **app.js** in the project directory to use the package

```
//app.js


const express = require('express');//import the required package

const app = express();


app.get('/', (req, res) => {

  res.send('Hello, World!');

});


app.listen(3000, () => {

  console.log('Server running at http://localhost:3000');

});
```

- **express()** creates an instance of the Express app.
- **app.get()** defines a route handler for HTTP GET requests to the root (/) URL.
- **res.send()** sends the response “Hello, World!” to the client.
- **app.listen(3000)** starts the server on port 3000, and console.log() outputs the server URL.

Now run the application with

```
node app.js
```

Visit **http://localhost:3000** in your browser, and you should see the message: **Hello, World!**

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

console.log(colors.green('hello')); // outputs green text
console.log(colors.red.underline('i like cake and pies')) // outputs red underlined text
console.log(colors.inverse('inverse the color')); // inverses the color
console.log(colors.rainbow('OMG Rainbows!')); // rainbow
console.log(colors.trap('Run the trap')); // Drops the bass

colors.setTheme({
    custom: ['red', 'underline']
  });

  console.log('test'.custom);
```

Steps to Create Node Application (Web-Based)

Step 1: Import required modules

Load Node modules using the required directive. Load the http module and store the returned HTTP instance into a variable.

Syntax:

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

Step 2: Creating a server in Node

Create a server to listen to the client's requests. Create a server instance using the **createServer() method**. Bind the server to port 8080 using the listen method associated with the server instance.

Syntax:

```
http.createServer().listen(8080);
```

Step 3: Read request and return response in Node:

Read the client request made using the browser or console and return the response. A function with request and response parameters is used to read client requests and return responses.

Syntax:

```
http.createServer(function (request, response) {...}).listen(8080);
```

First Node Application

After combining all these techniques, you can create a Node application. This code below creates a **Hello World web-based application using Node.js.**

```
// Require http header

var http = require('http');

 // Create server

http.createServer(function (req, res) {

   // HTTP Status: 200 : OK

   // Content Type: text/html

   res.writeHead(200, {'Content-Type': 'text/html'});

    // Send the response body as &quot;Hello World!&quot;

   res.end('Hello World!');

}).listen(8080);
```

Step to Run Node Application:

Step 1: To run the program type the following command in terminal

```
node firstprogram.js
```

Step 2: Then type the following URL in the browser

http://127.0.0.1:8080/

Node.js file system

The fs (File System) module in Node.js provides an **API for interacting with the file system**. It allows you to perform operations such as reading, writing, updating, and deleting files and directories, which are essential for server-side applications and scripts.

To handle file operations like creating, reading, deleting, etc., Node.js provides an inbuilt module called FS (File System). All file system operations can have synchronous and asynchronous forms depending upon user requirements. To use this File System module, use the require() method:

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

Uses:

- Read Files
- Write Files
- Append Files
- Close Files
- Delete Files

Asynchronous approach:

They are called non-blocking functions as it never waits for each operation to complete, rather it executes all operations in the first go itself. The result of each operation will be handled once the result is available i.e. each command will be executed soon after the execution of the previous command. While the previous command runs in the background and loads the result once it is finished processing the data.

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

// Asynchronous read

fs.readFile("input.txt", function (err, data) {

  if (err) {

     return console.error(err);

  }

  console.log("Asynchronous read: " + data.toString());

});
```

Synchronous approach:

They are called blocking functions as it waits for each operation to complete, only after that, it executes the next operation, hence blocking the next command from execution i.e. a command will not be executed until & unless the query has finished executing to get all the result from previous commands.

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

// Synchronous read

const data = fs.readFileSync('input.txt');

console.log("Synchronous read: " + data.toString());
```

Open a File

The fs.open() method is used to create, read, or write a file. The fs.readFile() method is only for reading the file and fs.writeFile() method is only for writing to the file, whereas fs.open() method does several operations on a file. First, we need to load the fs class which is a module to access the physical file system.

Syntax:

```
fs.open(path, flags, mode, callback)
```

Parameters:

- **path:** It holds the name of the file to read or the entire path if stored at other locations.
- **flags:** Flags indicate the behavior of the file to be opened. All possible values are (r, r+, rs, rs+, w, wx, w+, wx+, a, ax, a+, ax+).
- **mode:** Sets the mode of file i.e. r-read, w-write, r+ -readwrite. It sets to default as readwrite.
- **err:** If any error occurs.
- **data:** Contents of the file. It is called after the open operation is executed.

Example: Let us create a js file named **main.js** having the following code to open a file **input.txt** for reading and writing.

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

// Asynchronous - Opening File

console.log("opening file!");

fs.open("input.txt", "r+", function (err, fd) {

  if (err) {

     return console.error(err);
  }
  console.log("File open successfully");
});
```

Output:

```
opening file!
File open successfully
```

Reading a File

The fs.read() method is used to read the file specified by fd. This method reads the entire file into the buffer.

Syntax:

```
fs.read(fd, buffer, offset, length, position, callback)
```

Parameters:

- **fd:** This is the file descriptor returned by fs.open() method.
- **buffer:** This is the buffer that the data will be written to.
- **offset:** This is the offset in the buffer to start writing at.
- **length:** This is an integer specifying the number of bytes to read.
- **position:** This is an integer specifying where to begin reading from in the file. If the position is null, data will be read from the current file position.
- **callback:** It is a callback function that is called after reading of the file. It takes two parameters:
    - **err:** If any error occurs.
    - **data:** Contents of the file.

Example: Let us create a js file named **main.js** having the following code:

```
const fs = require("fs");
const buf = new Buffer(1024);
console.log("opening an existing file");
fs.open("input.txt", "r+", function (err, fd) {
  if (err) {
    return console.error(err);
  }
  console.log("File opened successfully!");
  console.log("reading the file");
  fs.read(fd, buf, 0, buf.length, 0, function (err, bytes) {
    if (err) {
      console.log(err);
    }
    console.log(bytes + " bytes read");
    // Print only read bytes to avoid junk.
    if (bytes > 0) {
      console.log(buf.slice(0, bytes).toString());
    }
  });
});
```

Writing to a File

This method will overwrite the file if the file already exists. The fs.writeFile() method is used to asynchronously write the specified data to a file. By default, the file would be replaced if it exists. The ‘options’ parameter can be used to modify the functionality of the method.

Syntax:

fs.writeFile(path, data, options, callback)

Parameters:

- **path:** It is a string, Buffer, URL, or file description integer that denotes the path of the file where it has to be written. Using a file descriptor will make it behave similarly to fs.write() method.
- **data:** It is a string, Buffer, TypedArray, or DataView that will be written to the file.
- **options:** It is a string or object that can be used to specify optional parameters that will affect the output. It has three optional parameters:
    - **encoding:** It is a string value that specifies the encoding of the file. The default value is ‘utf8’.
    - **mode:** It is an integer value that specifies the file mode. The default value is 0o666.
    - **flag:** It is a string value that specifies the flag used while writing to the file. The default value is ‘w’.
- **callback:** It is the function that would be called when the method is executed.

- **err:** It is an error that would be thrown if the operation fails.

Example: Let us create a js file named **main.js** having the following code:

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

console.log("writing into existing file");

fs.writeFile("input.txt", "Hello all", function (err) {

  if (err) {

    return console.error(err);

  }

  console.log("Data written successfully!");

  console.log("Let's read newly written data");

  fs.readFile("input.txt", function (err, data) {

    if (err) {

      return console.error(err);

    }

    console.log("Asynchronous read: " + data.toString());

  });

});
```

Appending to a File

The fs.appendFile() method is used to synchronously append the data to the file.

Syntax:

```
fs.appendFile(filepath, data, options, callback);
// or
fs.appendFileSync(filepath, data, options);
```

Parameters:

- **filepath:** It is a String that specifies the file path.
- **data:** It is mandatory and it contains the data that you append to the file.
- **options:** It is an optional parameter that specifies the encoding/mode/flag.
- **Callback:** Function is mandatory and is called when appending data to file is completed.

Example 1: Let us create a js file named **main.js** having the following code:

```
const fs = require("fs");
let data = "\nLearn Node.js";
// Append data to file
fs.appendFile(
  "input.txt", data, "utf8",
  // Callback function
  function (err) {
    if (err) throw err;

    // If no error
    console.log("Data is appended to file successfully.");
  }
);
```

Example 1: For synchronously appending

```
const fs = require("fs");
const data = "\nLearn Node.js";
// Append data to file
fs.appendFileSync("input.txt", data, "utf8");
console.log("Data is appended to file successfully.");
```

Closing the File

The fs.close() method is used to asynchronously close the given file descriptor thereby clearing the file that is associated with it. This will allow the file descriptor to be reused for other files. Calling fs.close() on a file descriptor while some other operation is being performed on it may lead to undefined behavior.

Syntax:

```
fs.close(fd, callback)
```

Parameters:

- **fd:** It is an integer that denotes the file descriptor of the file for which to be closed.
- **callback:** It is a function that would be called when the method is executed.

    - **err:** It is an error that would be thrown if the method fails.

Example: Let us create a js file named **main.js** having the following code:

```
// Close the opened file.
fs.close(fd, function (err) {
  if (err) {
    console.log(err);
  }
  console.log("File closed successfully.");
});
```

Delete a File

The fs.unlink() method is used to remove a file or symbolic link from the filesystem. This function does not work on directories, therefore it is recommended to use fs.rmdir() to remove a directory.

Syntax:

```
fs.unlink(path, callback)
```

Parameters:

- **path:** It is a string, Buffer or URL which represents the file or symbolic link which has to be removed.
- **callback:** It is a function that would be called when the method is executed.
    - **err:** It is an error that would be thrown if the method fails.

Example: Let us create a js file named **main.js** having the following code:

```
const fs = require("fs");
console.log("deleting an existing file");
fs.unlink("input.txt", function (err) {
  if (err) {
    return console.error(err);
  }
  console.log("File deleted successfully!");
});
```

File- ReadStream, WriteStream

```
var fs = require('fs');
var grains = ['wheat', 'rice', 'oats'];
var options = { encoding: 'utf8', flag: 'w' };
var fileWriteStream = fs.createWriteStream("grains.txt", options);
fileWriteStream.on("close", function(){
console.log("File Closed.");
});
while (grains.length){
var data = grains.pop() + " ";
fileWriteStream.write(data);
console.log("Wrote: %s", data);
}
fileWriteStream.end();
var options = { encoding: 'utf8', flag: 'r' };
var fileReadStream = fs.createReadStream("grains.txt", options);
fileReadStream.on('data', function(txt) {
console.log('Grains: %s', txt);
console.log('Read %d bytes of data.', txt.length);
});
```

Node.js Events

Node.js is built on an event-driven architecture that allows you to build highly scalable applications. Understanding the event-driven nature of Node.js and how to work with events is important for building efficient and responsive applications.

What Are Events in Node.js?

In **Node.js**, an event is an action or occurrence that the program can detect and handle. The event-driven architecture allows asynchronous programming, and your application becomes able to perform non-blocking operations. This means that while waiting for an operation to complete (like reading a file or making a network request), the application can continue processing other tasks.

EventEmitter Class

At the core of the Node.js event system is the EventEmitter class. This class allows objects to emit named events that can be listened to by other parts of your application. It is included in the built-in events module.

Key Features of EventEmitter:

- **Event Registration:** You can register listeners for specific events using the on() method.
- **Event Emission:** Use the emit() method to trigger an event and call all registered listeners for that event.
- **Asynchronous Execution:** Listeners can execute asynchronously, allowing other operations to continue while waiting for events.

Syntax:

```
const EventEmitter=require('events');

var eventEmitter=new EventEmitter();
```

Working with Events in Node.js

Step 1: Importing the Events Module

To start using events in your application, you need to import the events module and create an instance of the EventEmitter class.

```
const EventEmitter = require('events');

const myEmitter = new EventEmitter();
```

Step 2: Registering Event Listeners

You can register listeners for specific events using the on() method. The first argument is the event name, and the second argument is the callback function to be executed when the event is emitted.

```
myEmitter.on('event', () => {
  console.log('An event occurred!');
});
```

Step 3: Emitting Events

To trigger an event, use the emit() method with the event name as the first argument.

```
myEmitter.emit('event');  // Output: An event occurred!
```

Listening events

Before emitting any event, it must register functions(callbacks) to listen to the events.

Syntax:

```
eventEmitter.addListener(event, listener)

eventEmitter.on(event, listener)

eventEmitter.once(event, listener)
```

Removing Listener

The **eventEmitter.removeListener()** takes two argument event and listener, and removes that listener from the listeners array that is subscribed to that event.
While **eventEmitter.removeAllListeners()** removes all the listener from the array which are subscribed to the mentioned event.

Syntax:

```
eventEmitter.removeListener(event, listener)

eventEmitter.removeAllListeners([event])
```

Note:

- Removing the listener from the array will change the sequence of the listener’s array, hence it must be carefully used.
- The **eventEmitter.removeListener()** will remove at most one instance of the listener which is in front of the queue.

Program

```
// Importing events

const EventEmitter = require('events');


// Initializing event emitter instances

var eventEmitter = new EventEmitter();


var fun1 = (msg) => {

   console.log("Message from fun1: " + msg);

};
```

```
var fun2 = (msg) => {
   console.log("Message from fun2: " + msg);
};

// Registering fun1 and fun2
//eventEmitter.on('myEvent', fun1);
//eventEmitter.on('myEvent', fun2);

// Listening to myEvent with fun1 and fun2
eventEmitter.addListener('myEvent', fun1);
// fun2 will be inserted in front of listeners array
eventEmitter.prependListener('myEvent', fun2);

console.log(eventEmitter.listeners('myEvent'))
console.log(eventEmitter.listenerCount('myEvent'))
 // Triggering myEvent
eventEmitter.emit('myEvent', "Event occurred");
// Removing listener fun1 that was
// registered on the line 13
eventEmitter.removeListener('myEvent', fun1);
// Triggering myEvent
eventEmitter.emit('myEvent', "Event occurred");

// Removing all the listeners to myEvent
eventEmitter.removeAllListeners('myEvent');

// Triggering myEvent
eventEmitter.emit('myEvent', "Event occurred");
```

Asynchronous events

The EventEmitter calls all listeners synchronously in order to which they were registered. However, we can perform asynchronous calls by using **setImmediate()**

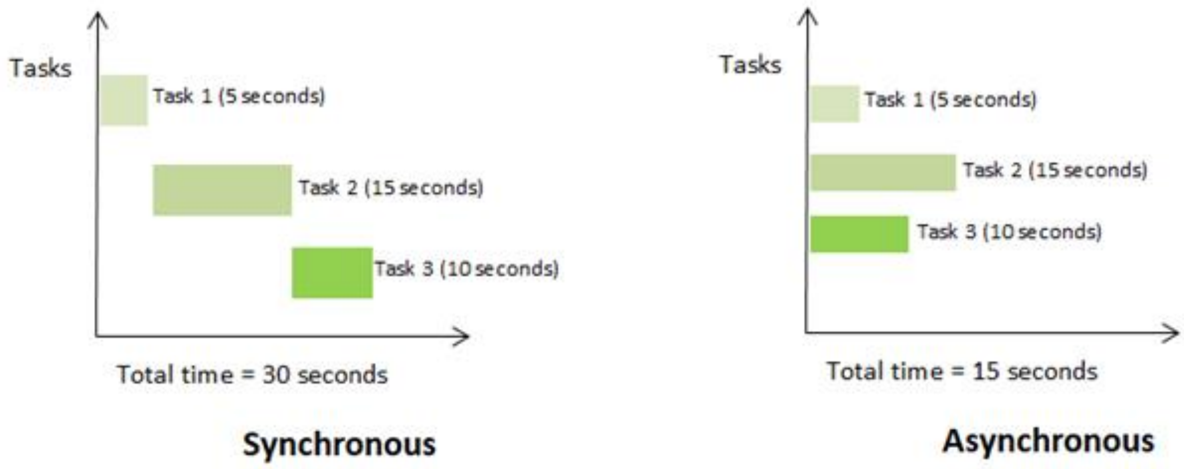
```
// Importing events
const EventEmitter = require('events');
// Initializing event emitter instances
var eventEmitter = new EventEmitter();
// Async function listening to myEvent
eventEmitter.on('myEvent', (msg) => {
    setImmediate( () => {
        console.log("Message from async1: " + msg);
    });
});
// Async function listening to myEvent
eventEmitter.on('myEvent', (msg) => {
    setImmediate( () => {
        console.log("Message from async2: " + msg);
    });
});

// Declaring listener fun to myEvent
var fun1 = (msg) => {
    console.log("Message from fun1: " + msg);
};
// Declaring listener fun to myEvent
var fun2 = (msg) => {
    console.log("Message from fun2: " + msg);
};
// Listening to myEvent with fun
eventEmitter.on('myEvent', fun1);
eventEmitter.on('myEvent', fun2);
// Triggering myEvent
eventEmitter.emit('myEvent', "Event occurred");
```

Synchronous and Asynchronous Programming in Node.js

Synchronous code is also called “blocking” as it halts the program until all the resources are available. Synchronous execution usually uses to code executing in sequence and the program is executed line by line, one line at a time. When a function is called, the program execution waits until that function returns before continuing to the next line of code.

Asynchronous code is also known as “non-blocking”. The program continues executing and doesn’t wait for external resources (I/O) to be available. Asynchronous execution applies to execution that doesn’t run in the sequence it appears in the code. The program doesn’t wait for the task to complete and can move on to the next task.



Synchronous

Asynchronous

Synchronous code wastes around 90% of CPU cycles waiting for the network or disk to get the data, but the Asynchronous code is much more performing.

Using Asynchronous code is a more efficient to have concurrency without dealing with multiple execution threads.

Example

File Handling Sync Async

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

console.log("Reading synchronously");

data = fs.readFileSync("sample.txt");

console.log(data.toString());

console.log("Reading asynchronously");

fs.readFile('sample.txt', function (err, data) {

  if (err) {    return console.error(err); }

    console.log("Asynchronous read: " + data.toString());

});

console.log('Read operation complete.');
```

How to Write Asynchronous Function for Node.js ?

The asynchronous function can be written in Node.js using ‘async’ preceding the function name. The asynchronous function returns an implicit Promise as a result. The async function helps to write promise-based code asynchronously via the event loop. Async functions will always return a value.

Await function can be used inside the asynchronous function to wait for the promise. This forces the code to wait until the promise returns a result.

Install async using the following command:

```
npm i async
```

A Node. js **Promise** is a placeholder for a value that will be available in the future, allowing us to handle the result of an asynchronous task once it has completed or encountered an error. Promises make writing asynchronous code easier. Promises and async/await both handle asynchronous code in Node.js.

Promise has 3 states – resolved, rejected and pending.

Examples:

1. **Creating async function to add two numbers**

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

function add(a, b) {

   return new Promise(resolve => {

      setTimeout(() => {

         resolve(a + b);

      }, 3000);

   });

}

async function output(a, b) {

   const ans = await add(a, b);

   console.log(ans);

}

output(10, 20);

console.log("async programming")
```

2. Create an asynchronous function to calculate the square of a number

```
const async = require("async");
function square(x) {
  return new Promise((resolve) => {
    setTimeout(() => {
      resolve(Math.pow(x, 2));
    }, 2000);
  });
}
async function output(x) {
  const ans = await square(x);
  console.log(ans);
}
output(10);
```